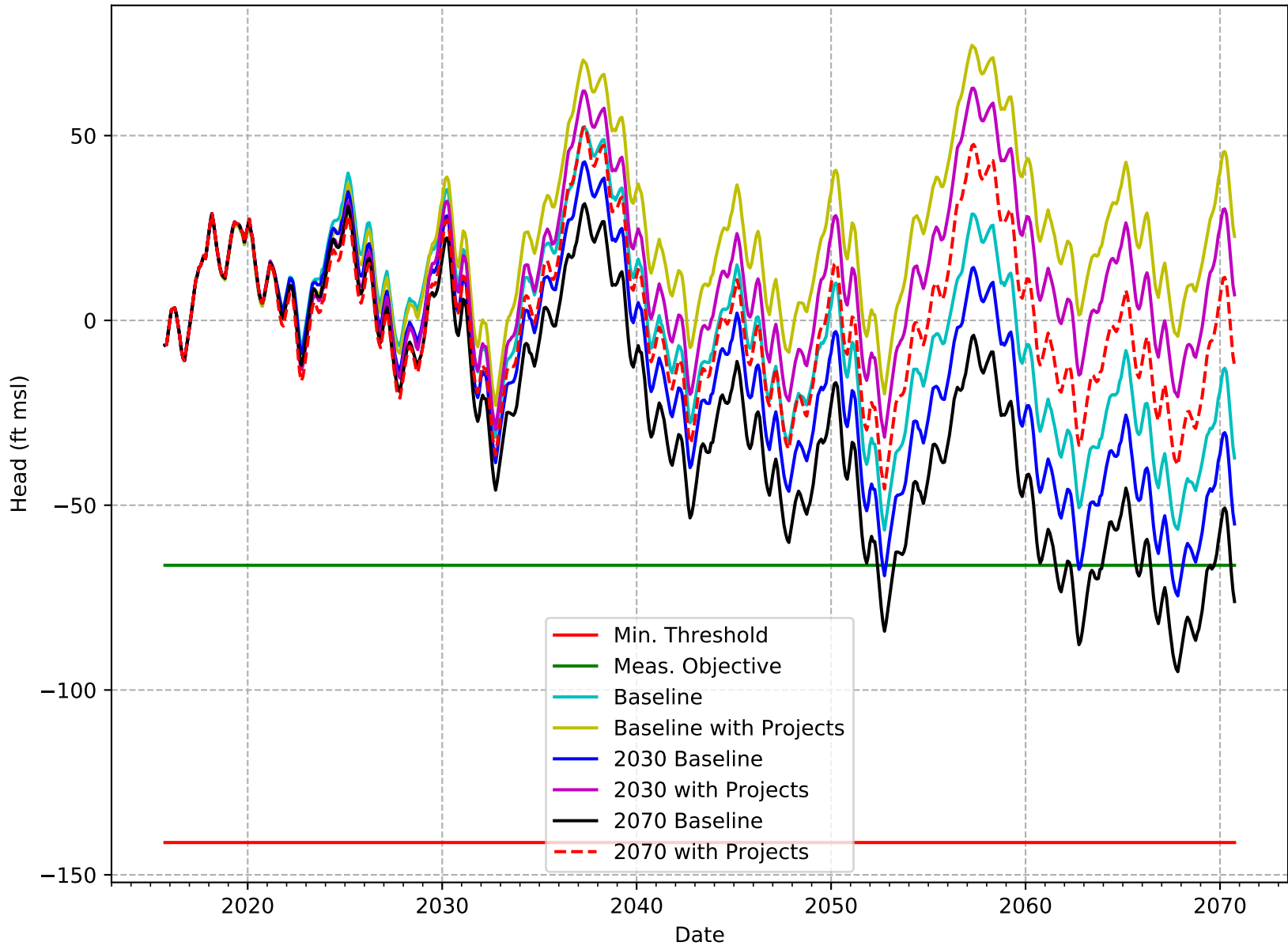
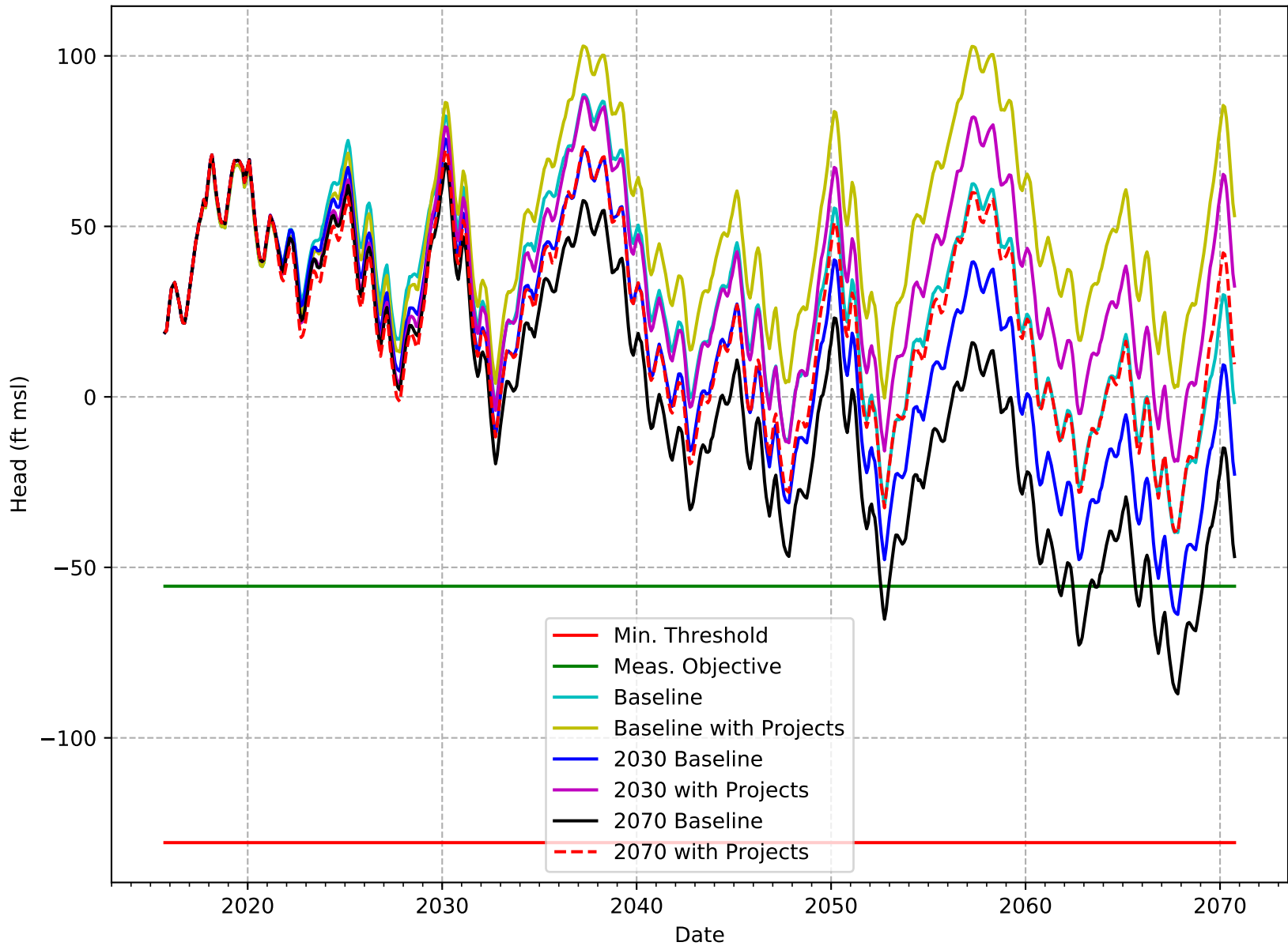


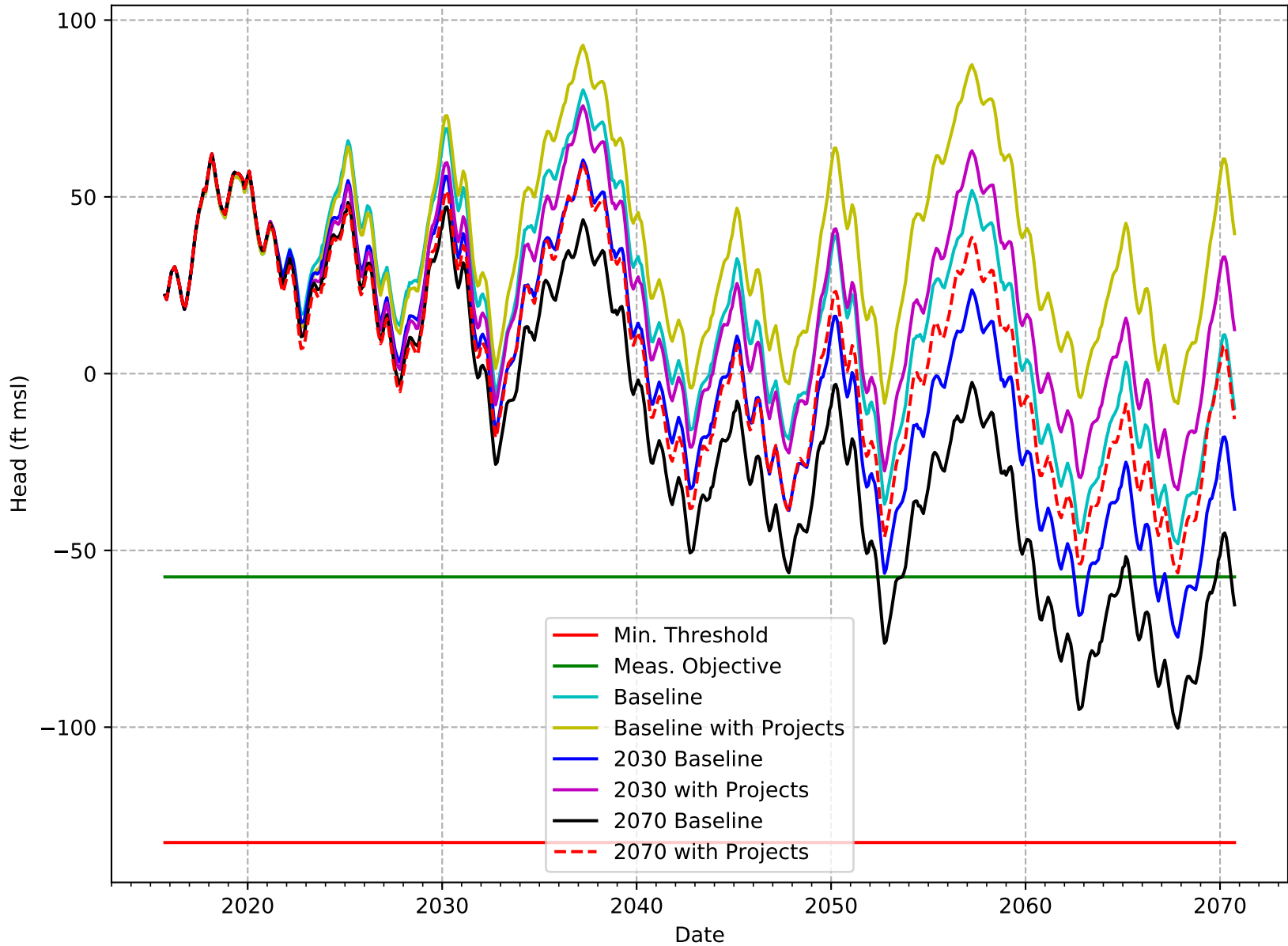
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-146-NKWSD



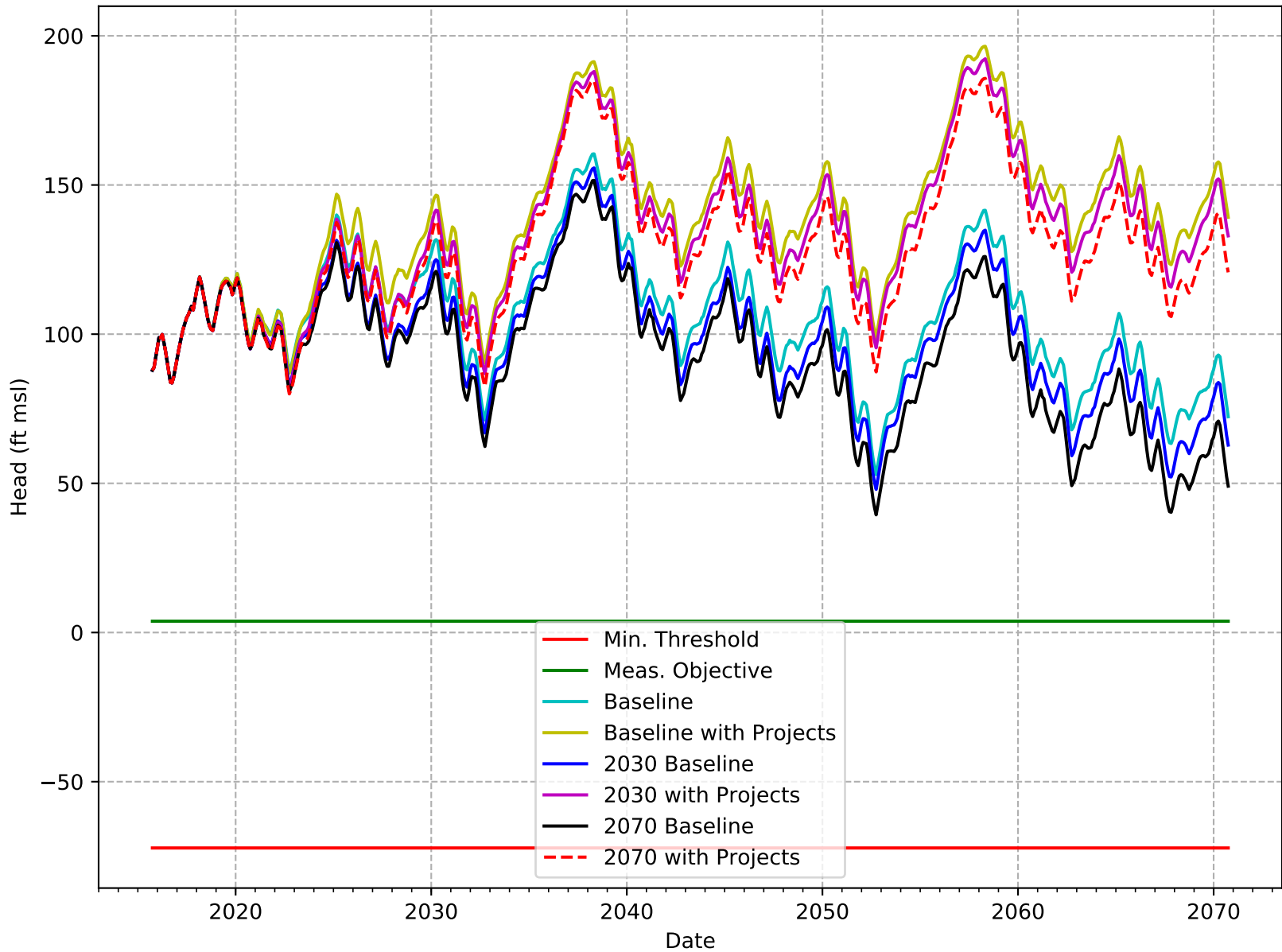
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-147-NKWS



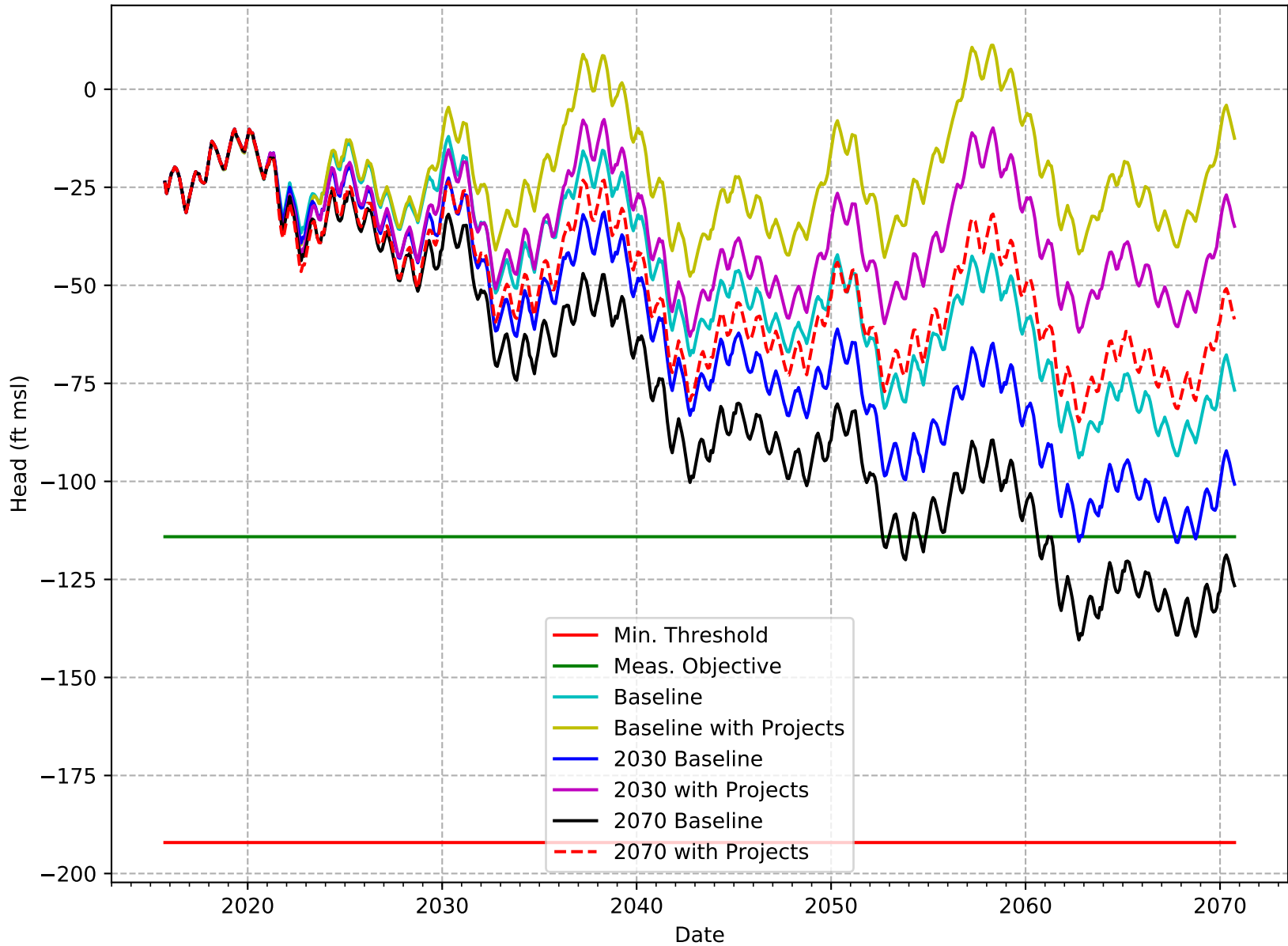
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-148-NKWSD



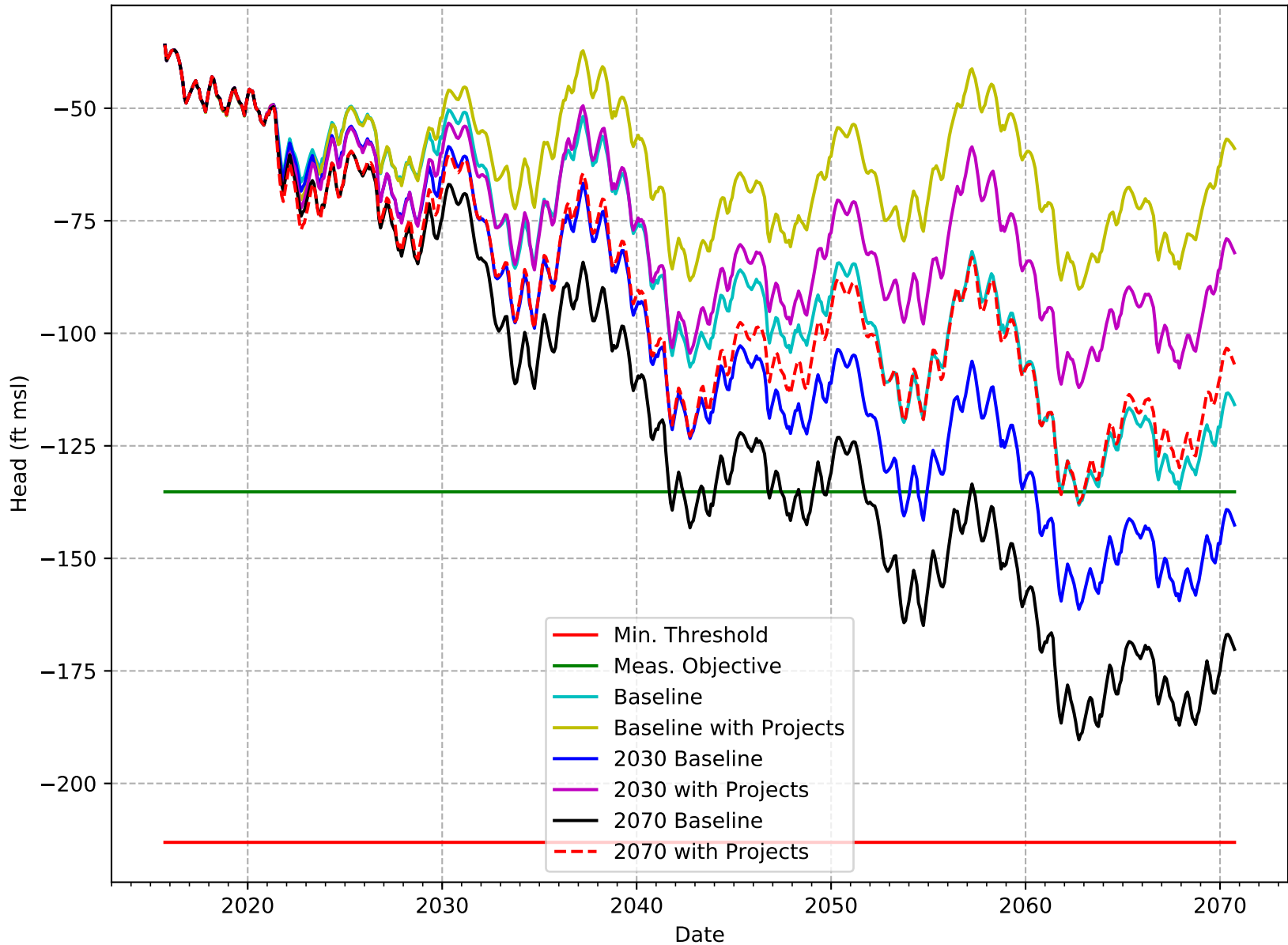
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-149-NKWS



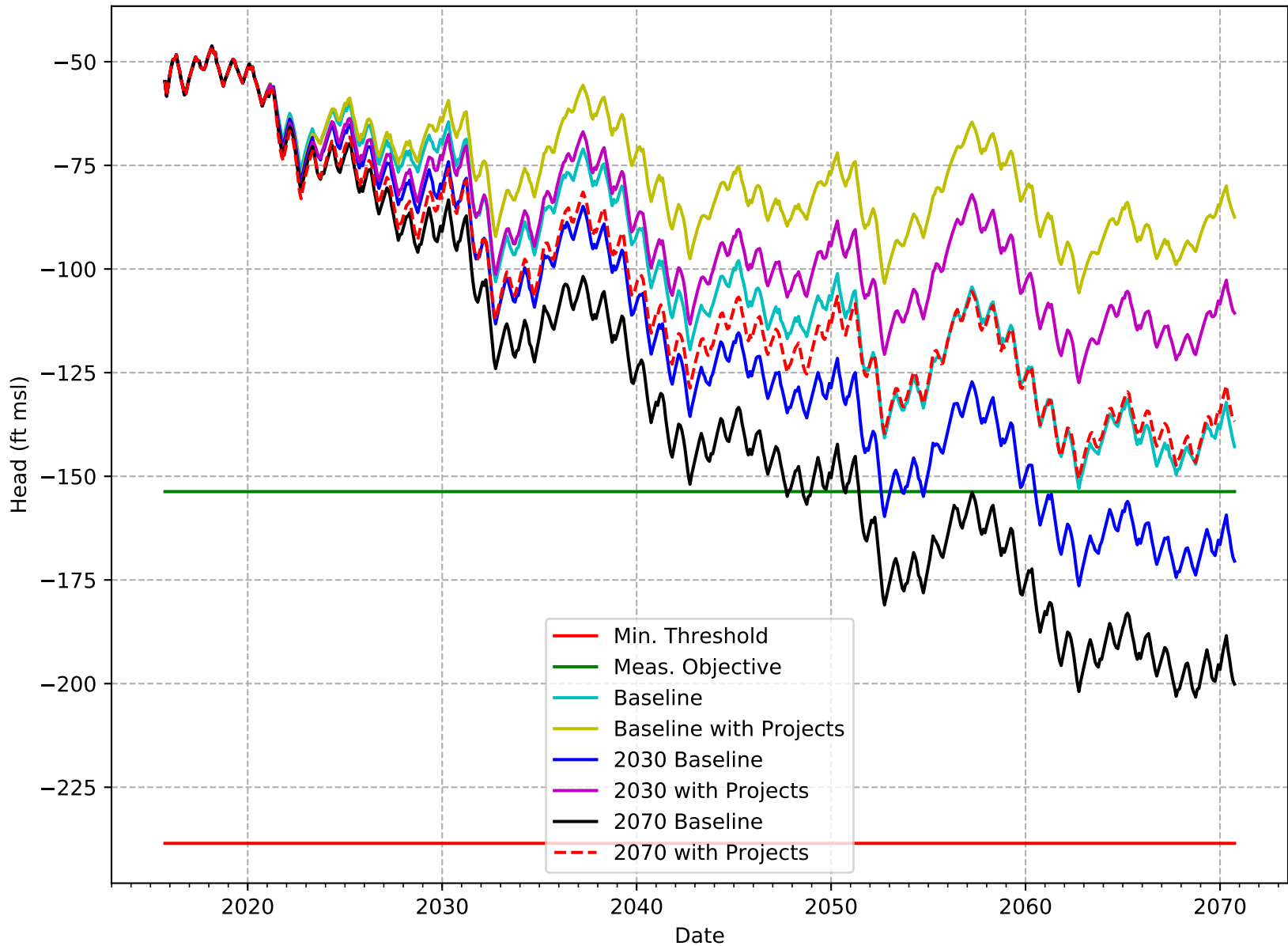
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-150-NKWSD



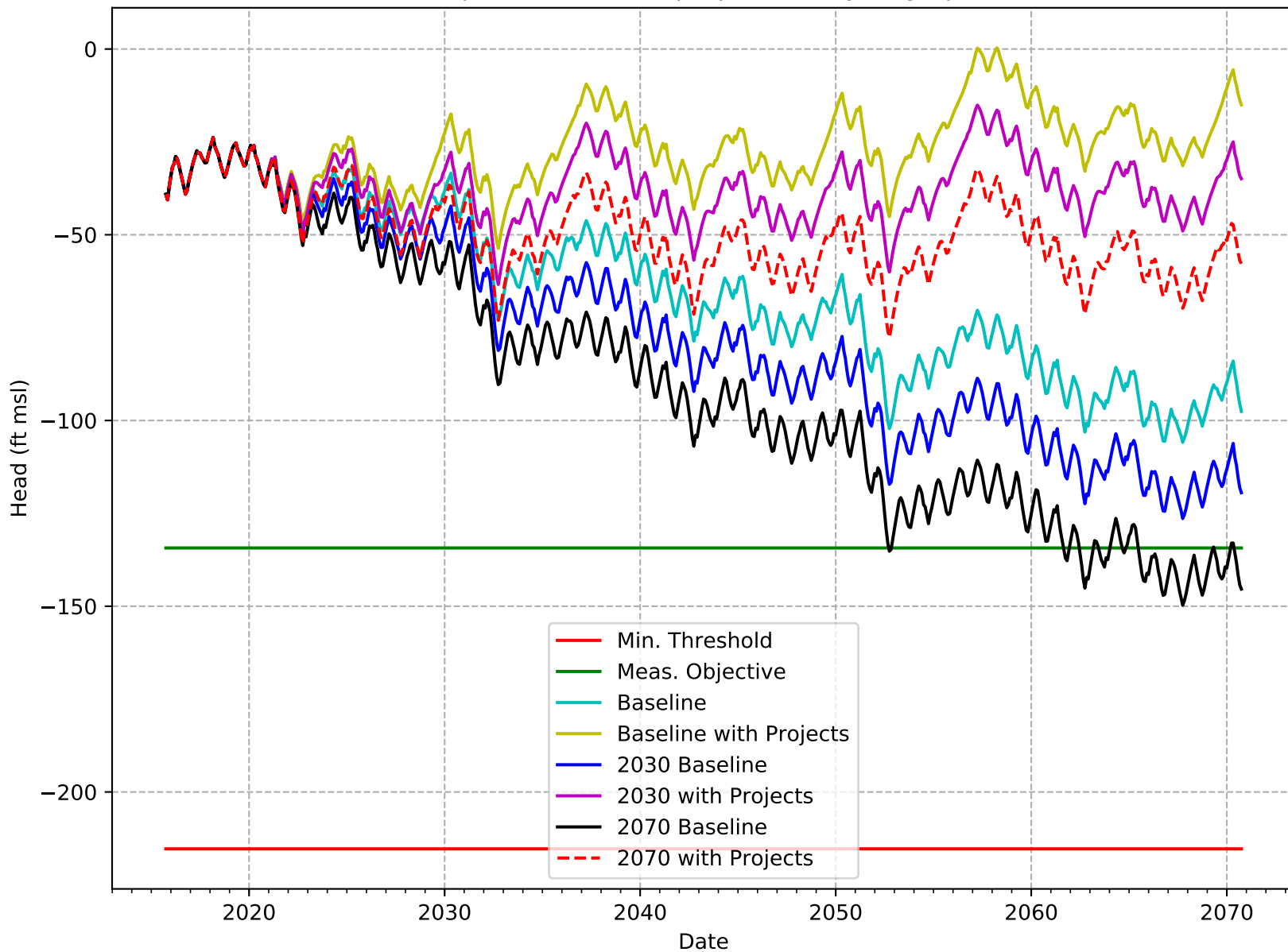
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-151-NKWSD



C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-152-NKWS

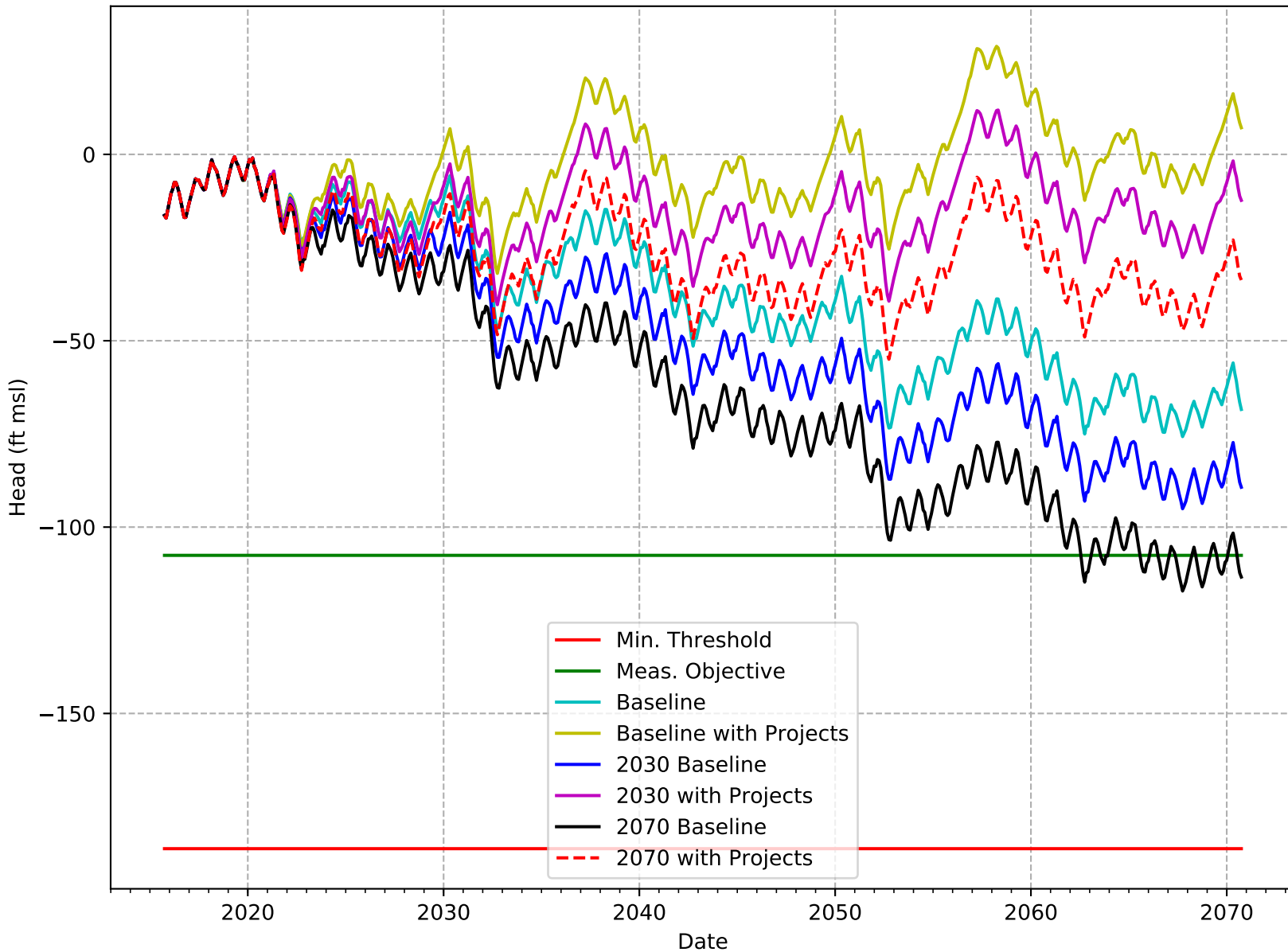


C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-153-SWID

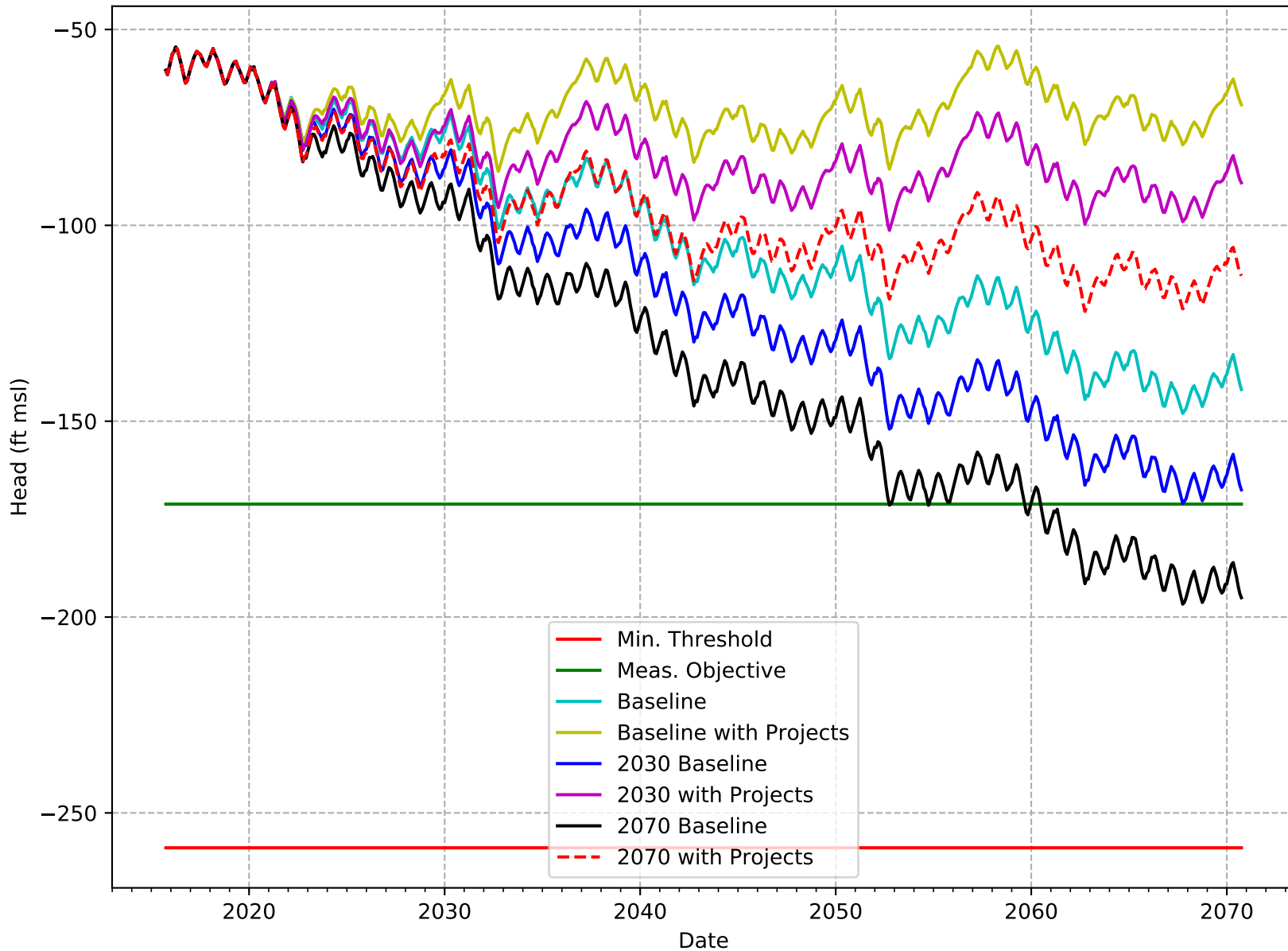




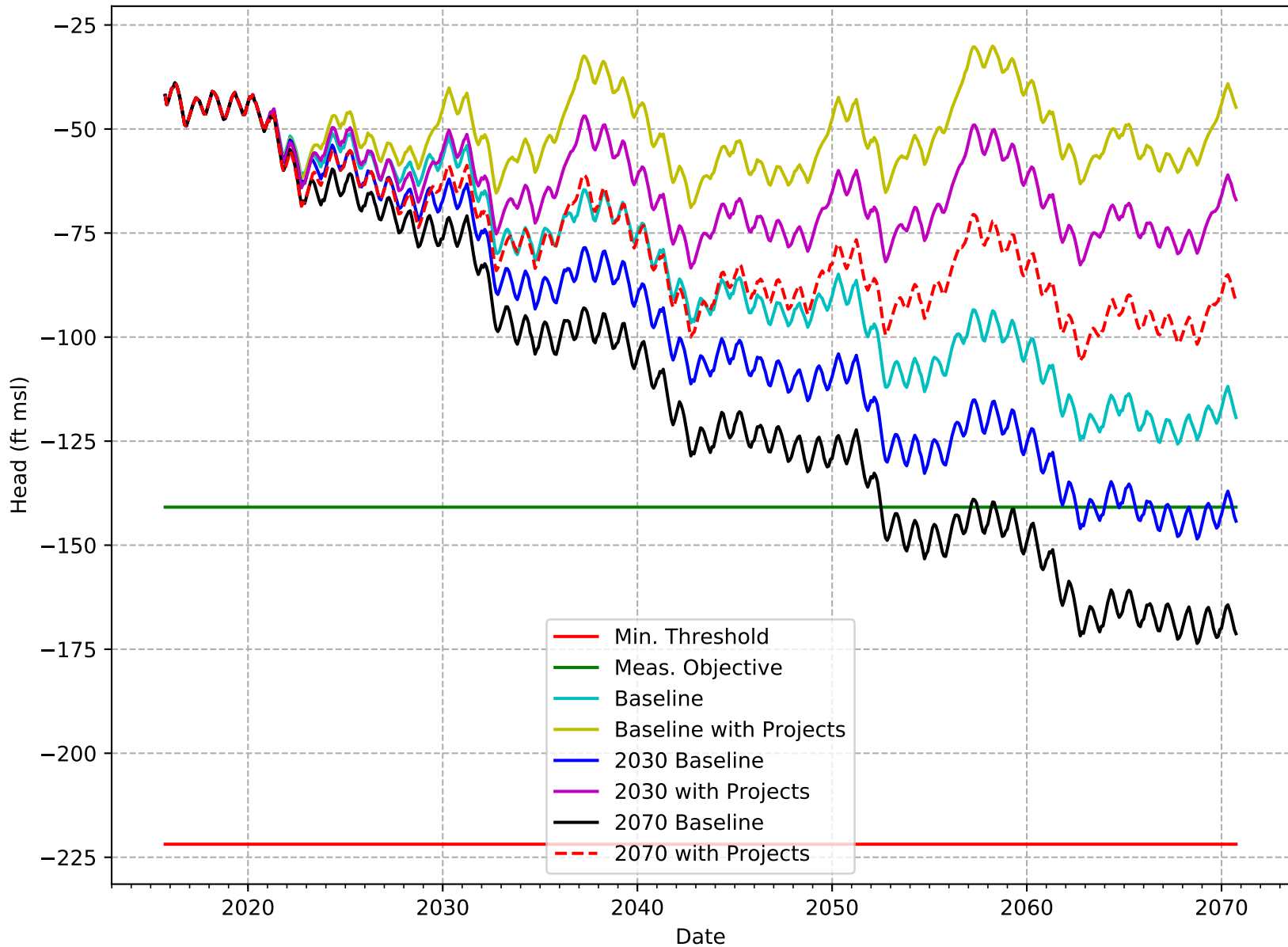
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-154-SWID



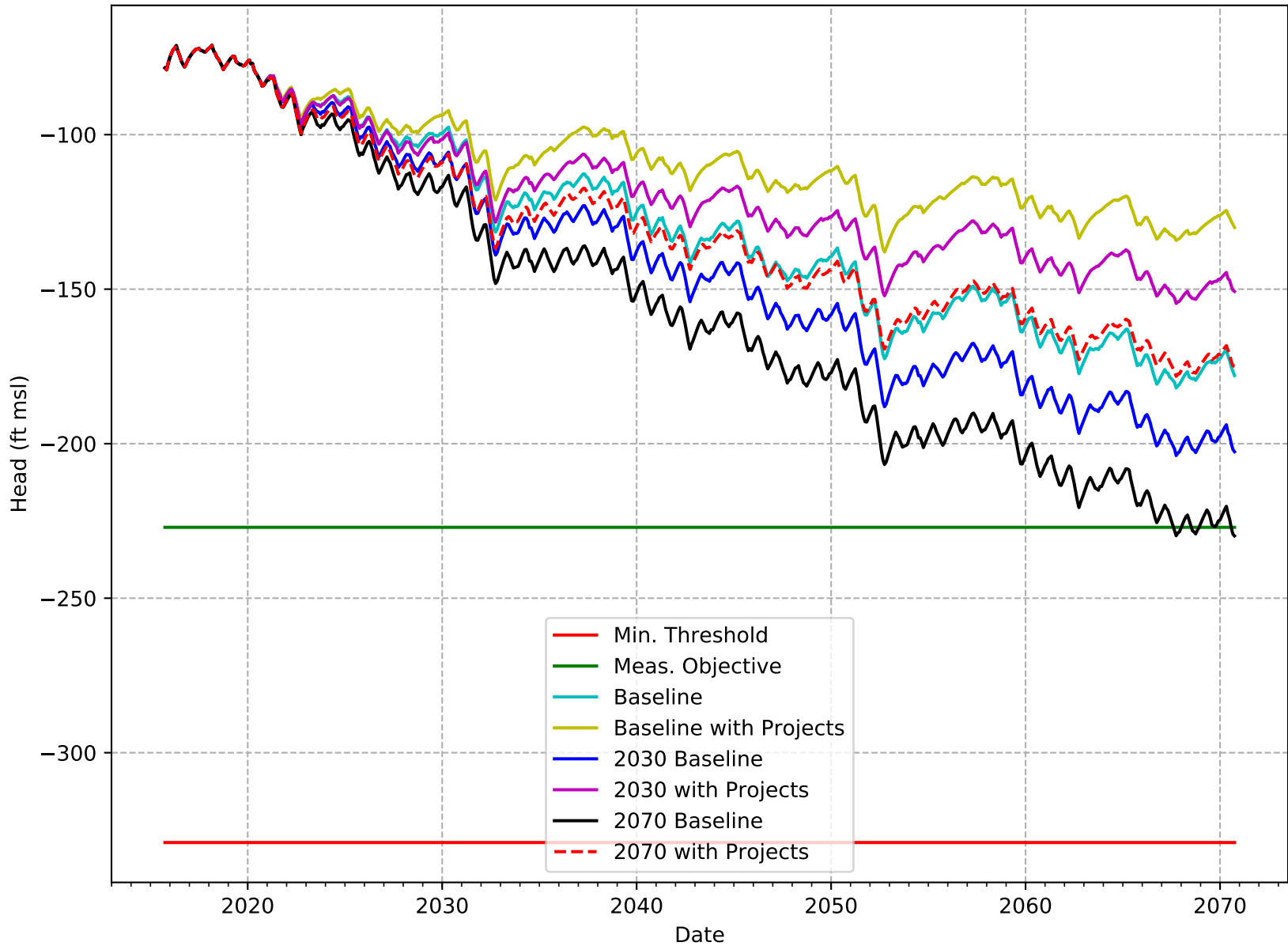
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-155-SWID



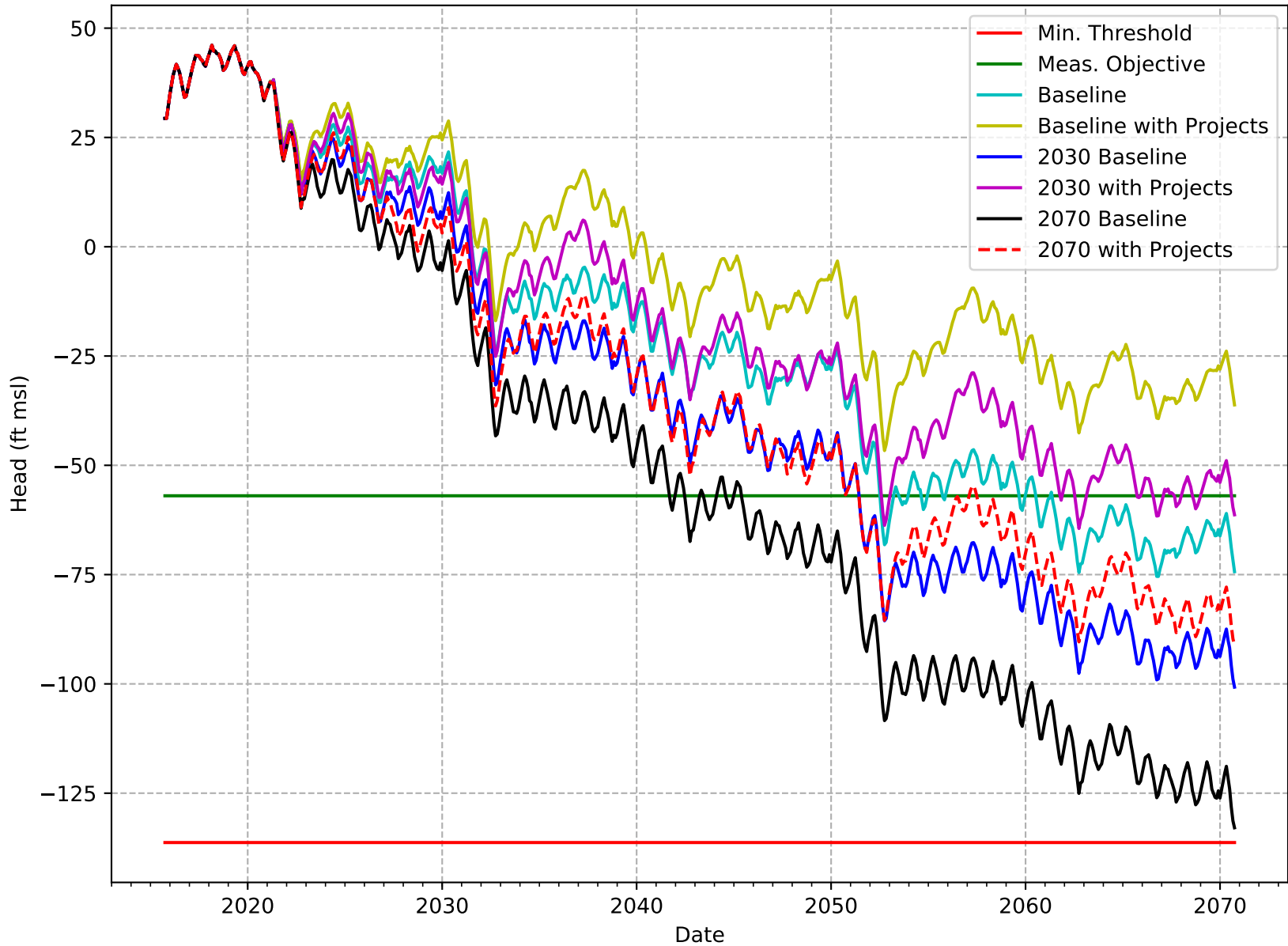
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-156-SWID



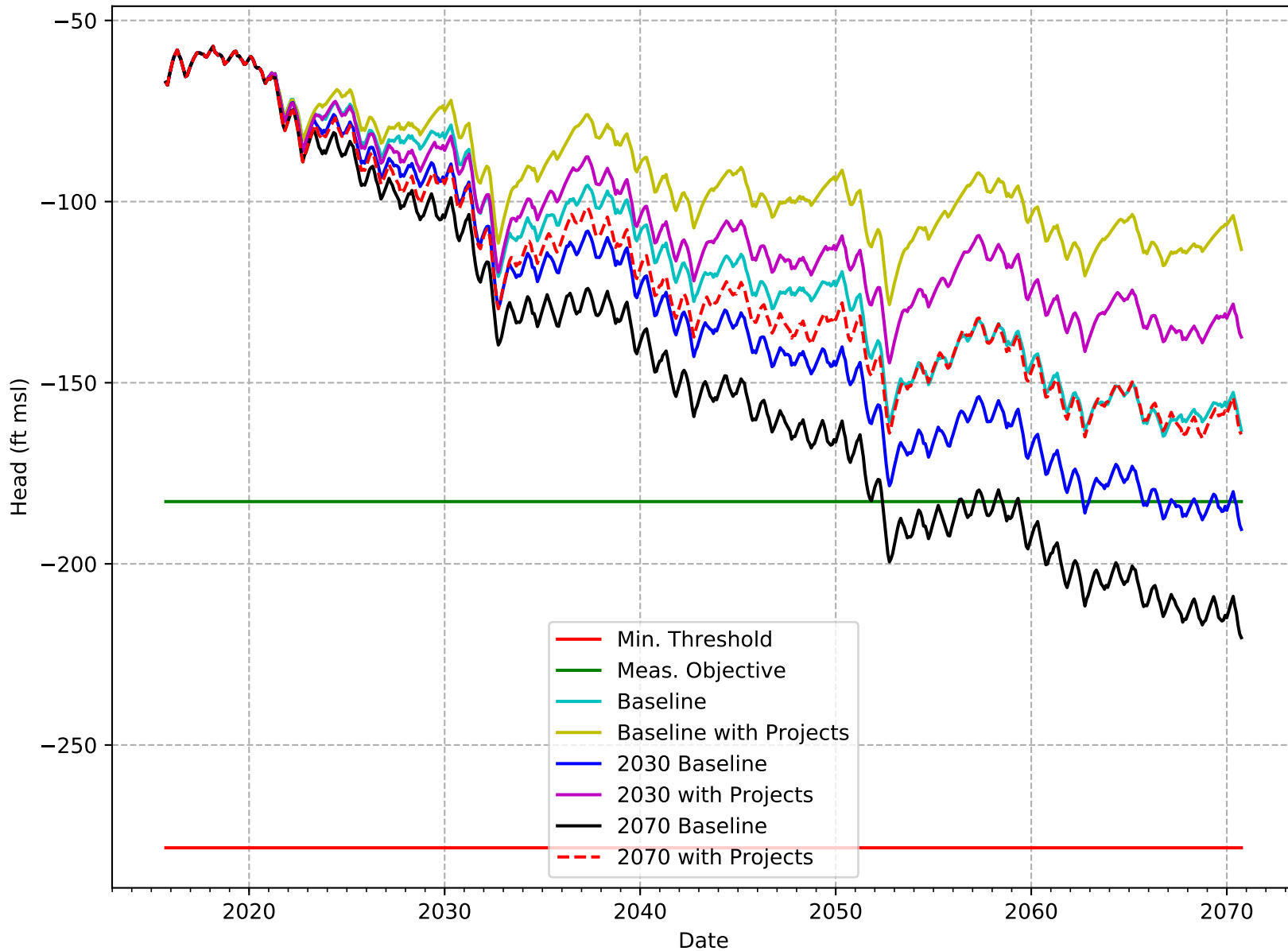
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-157-SSJMUD



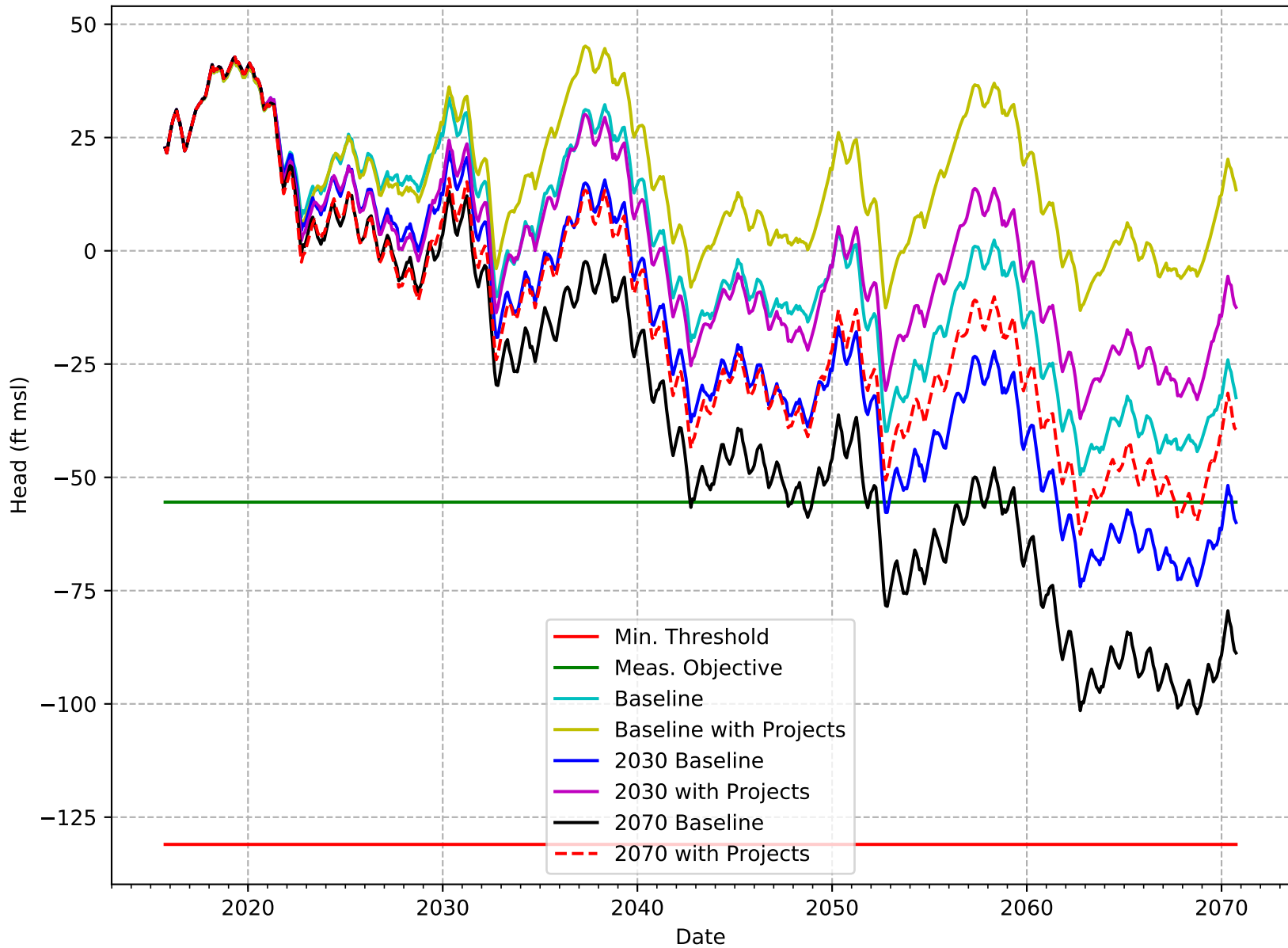
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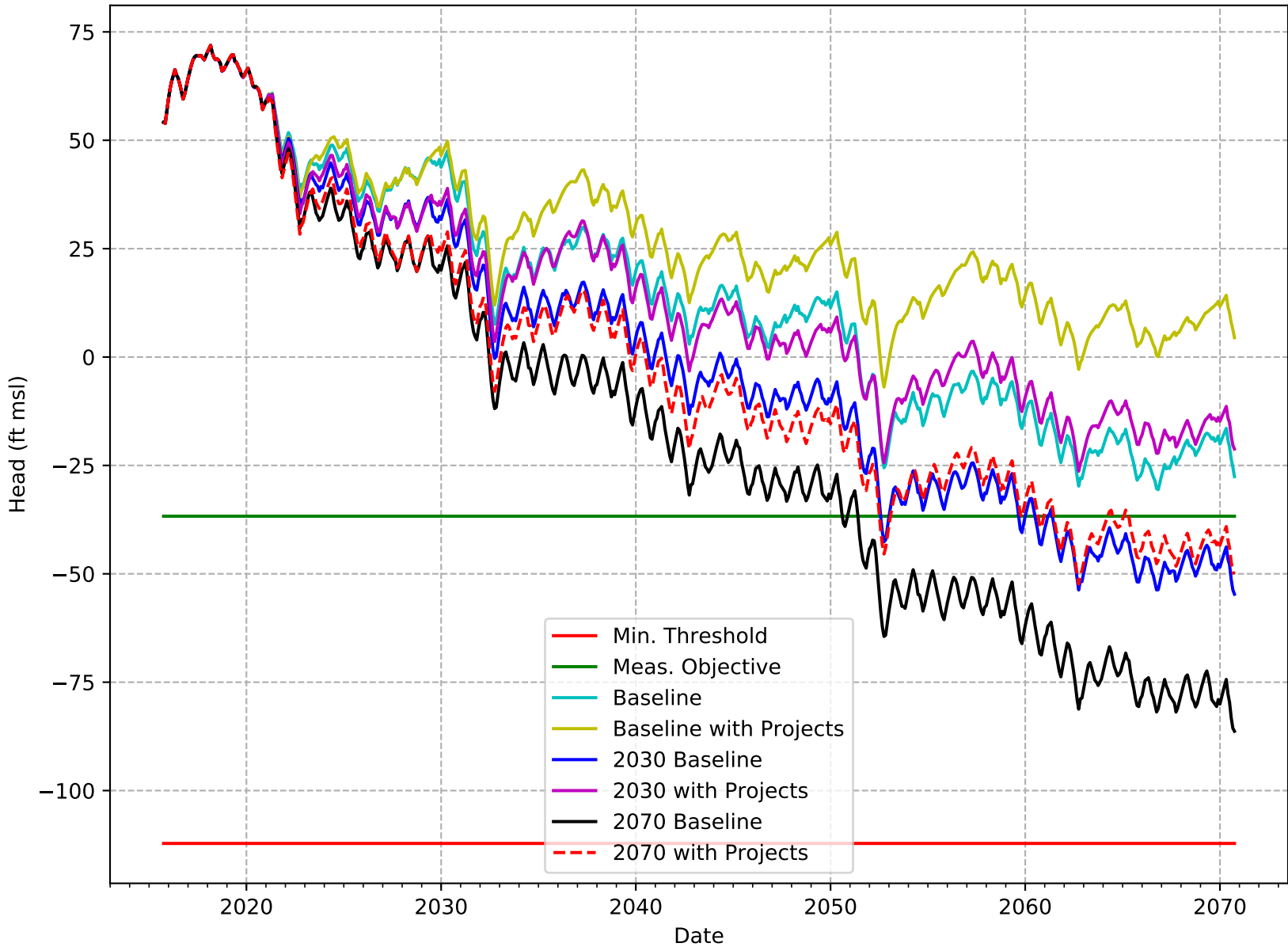
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-159-SSJMUD



C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-160-SSJMUD

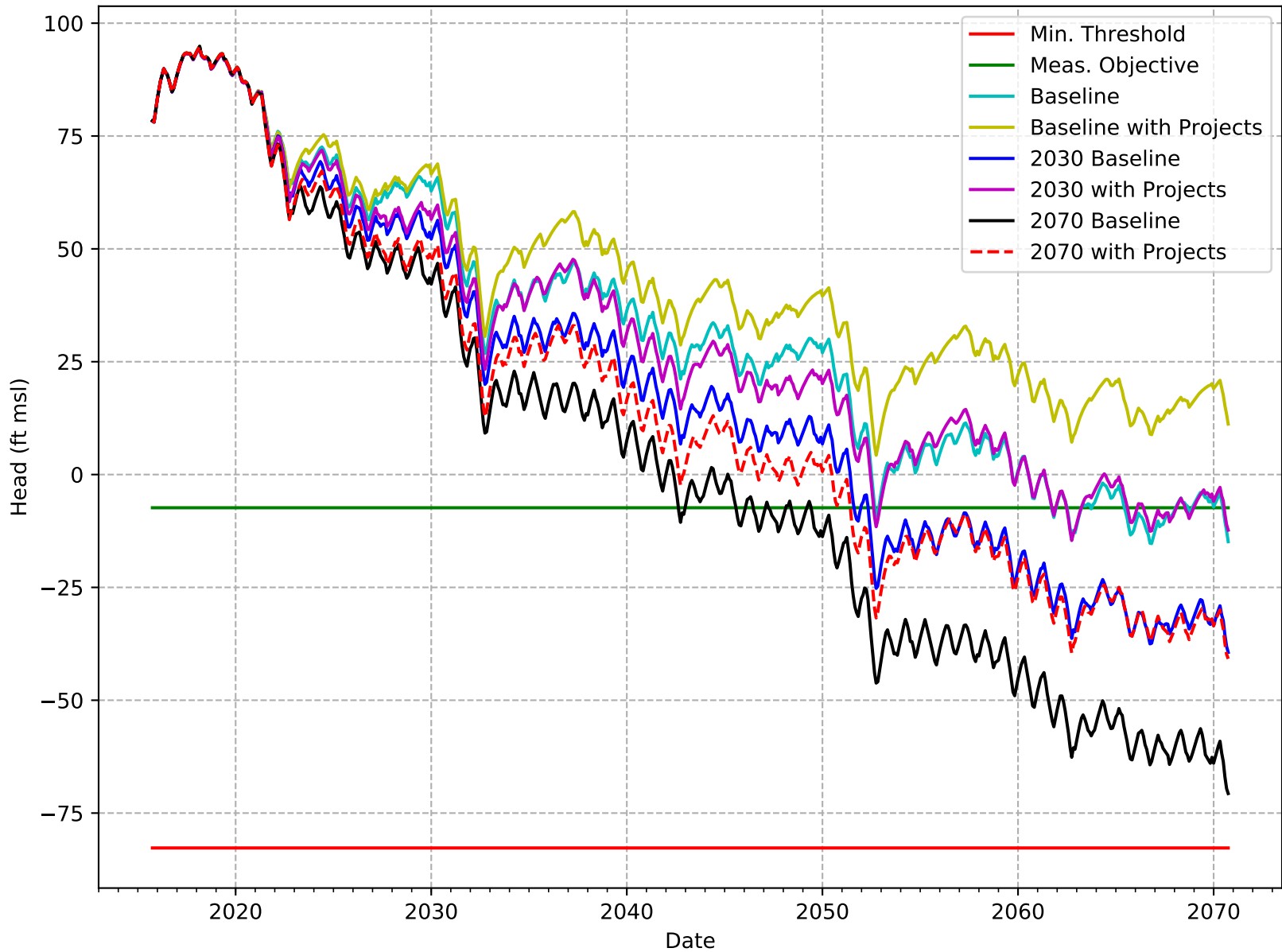


C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-161-SSJMUD

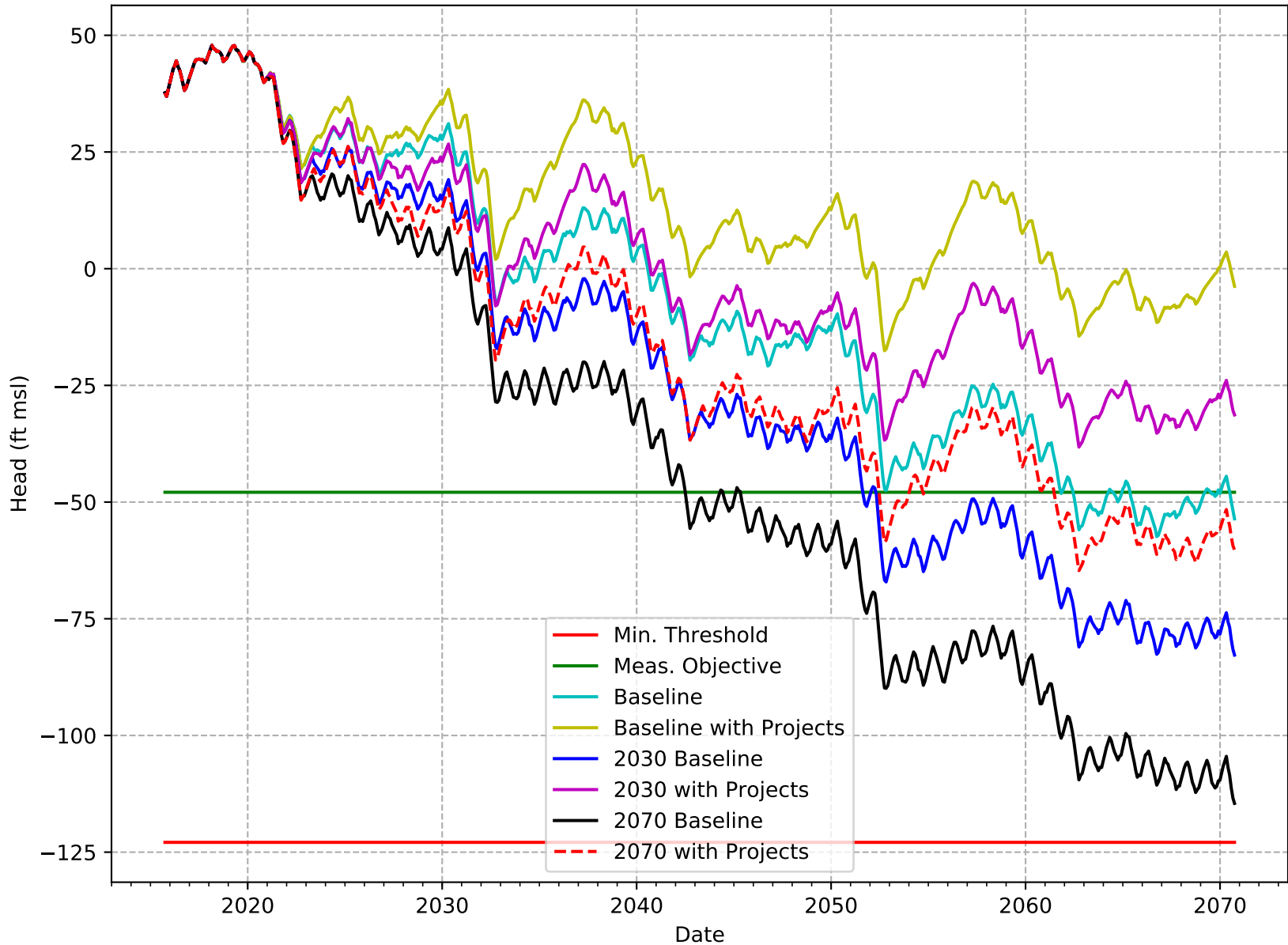




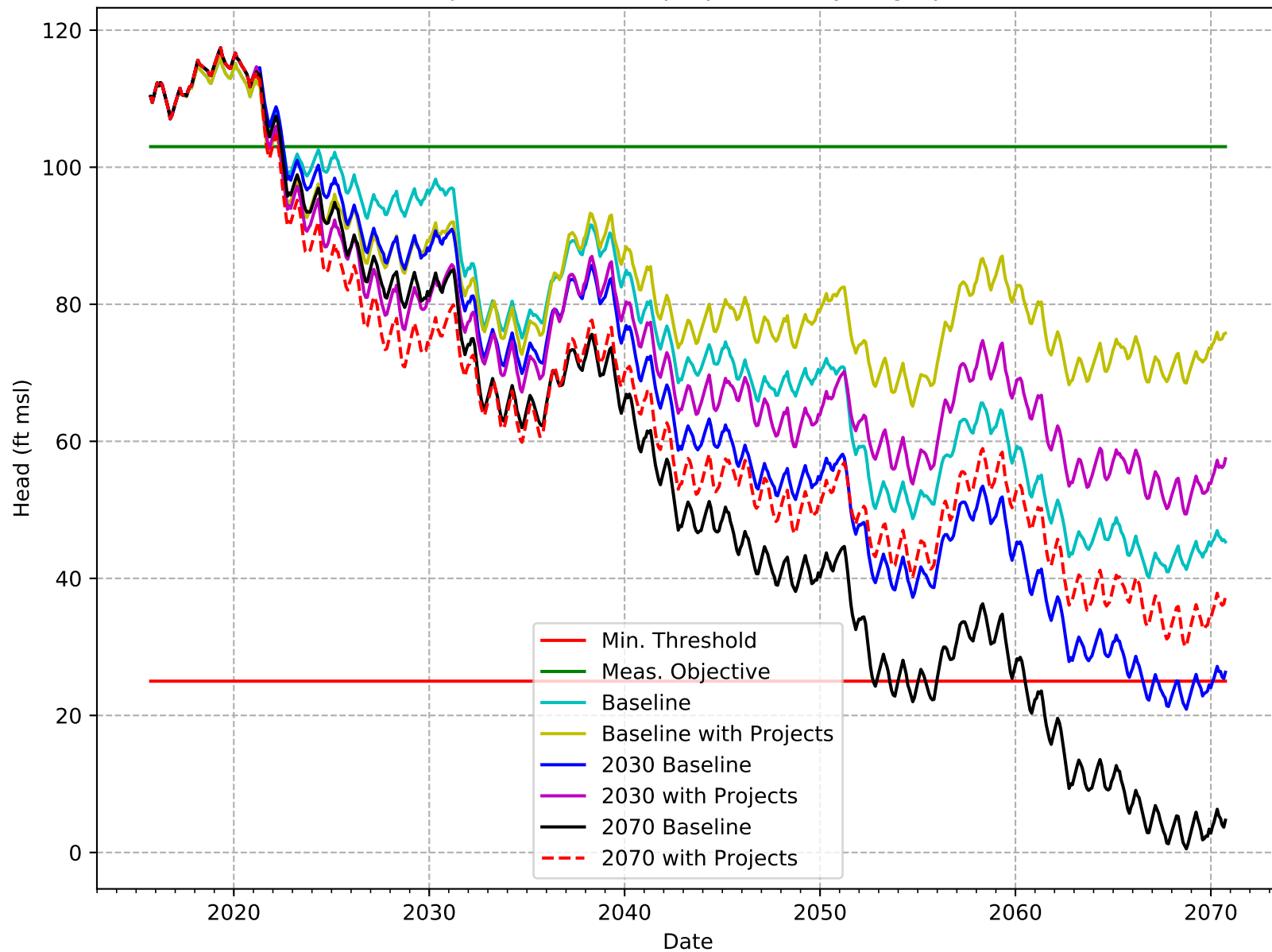
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-162-SSJMUD



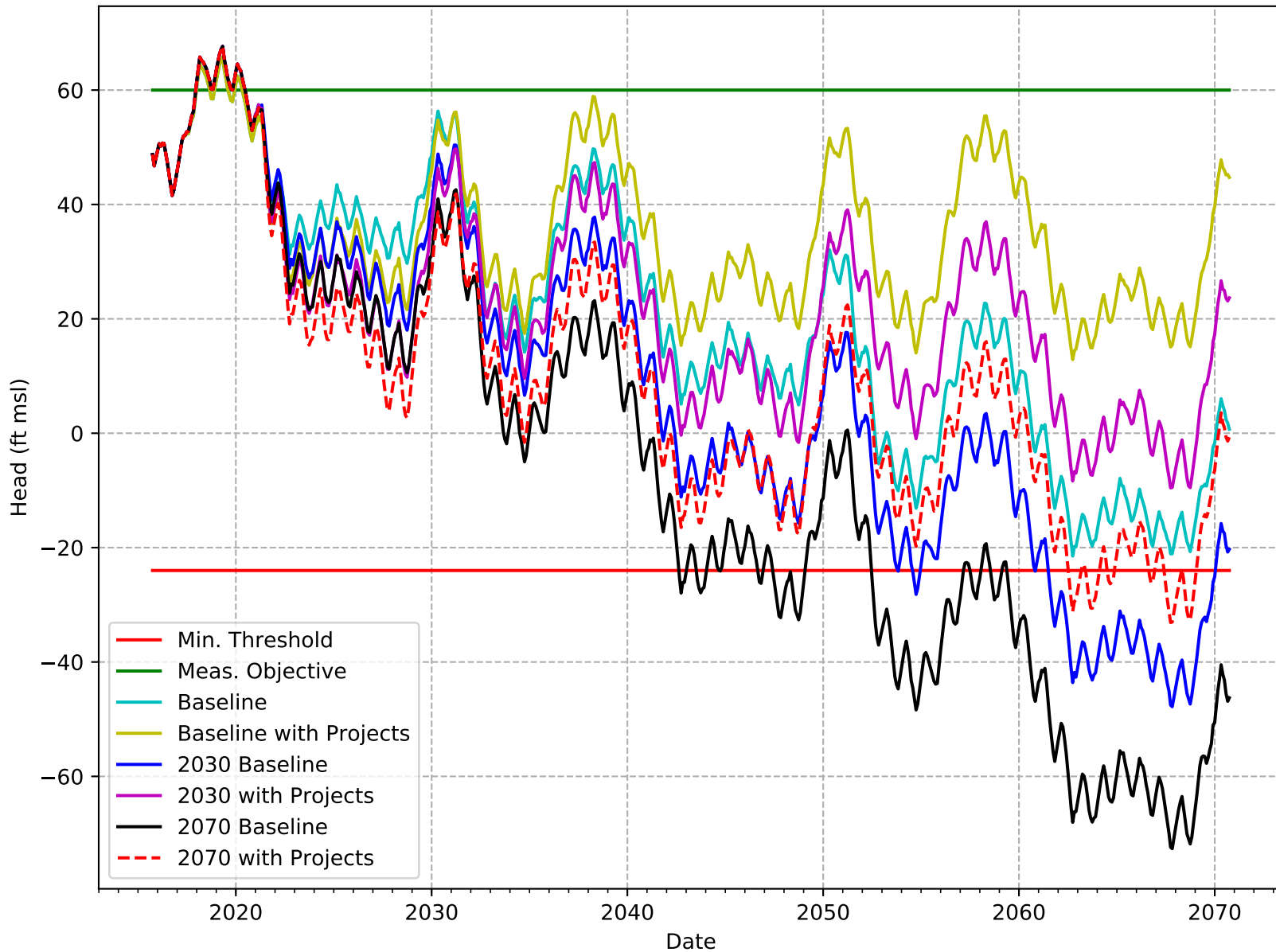
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-163-SSJMUD



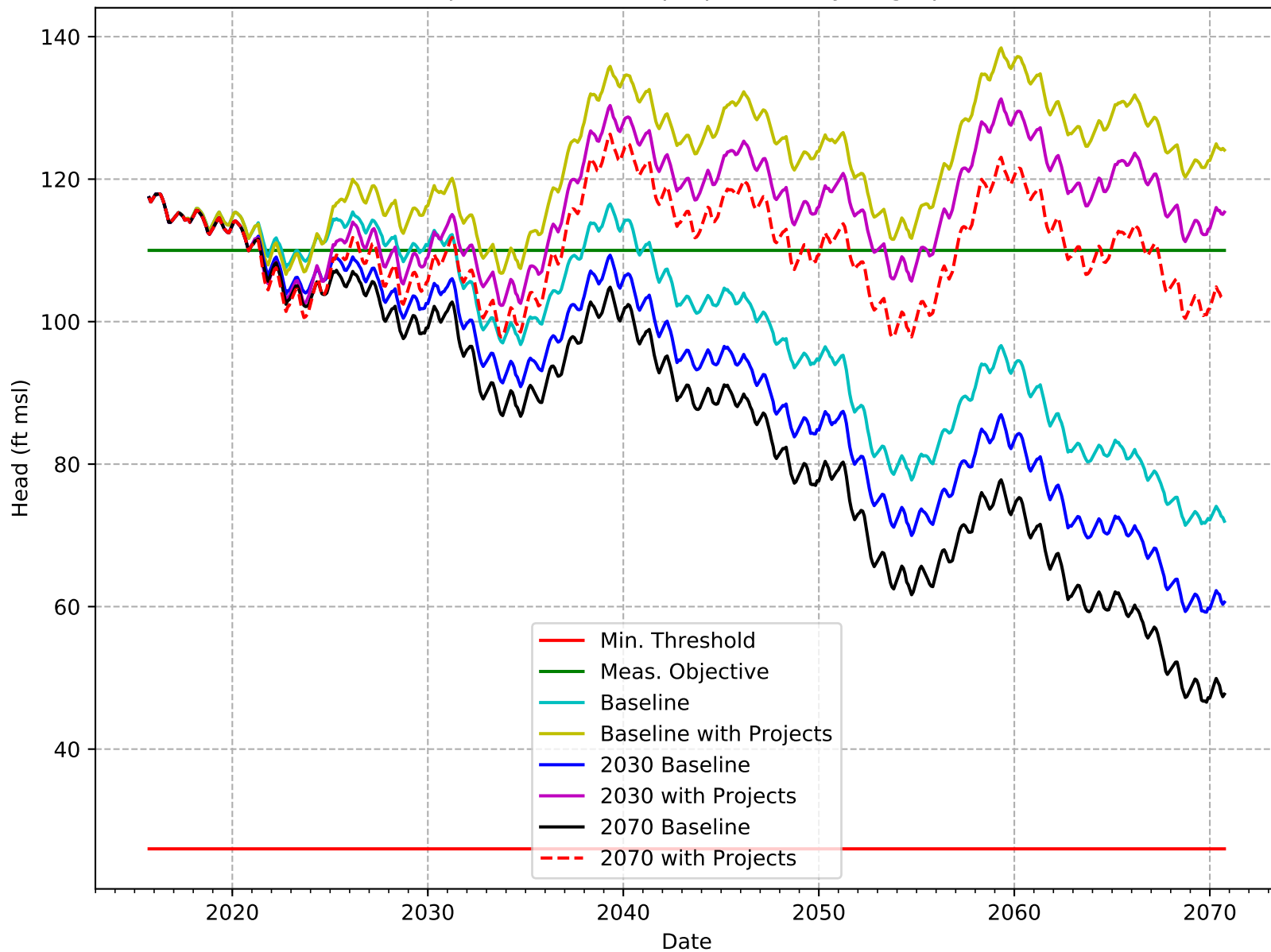
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-167-CWD



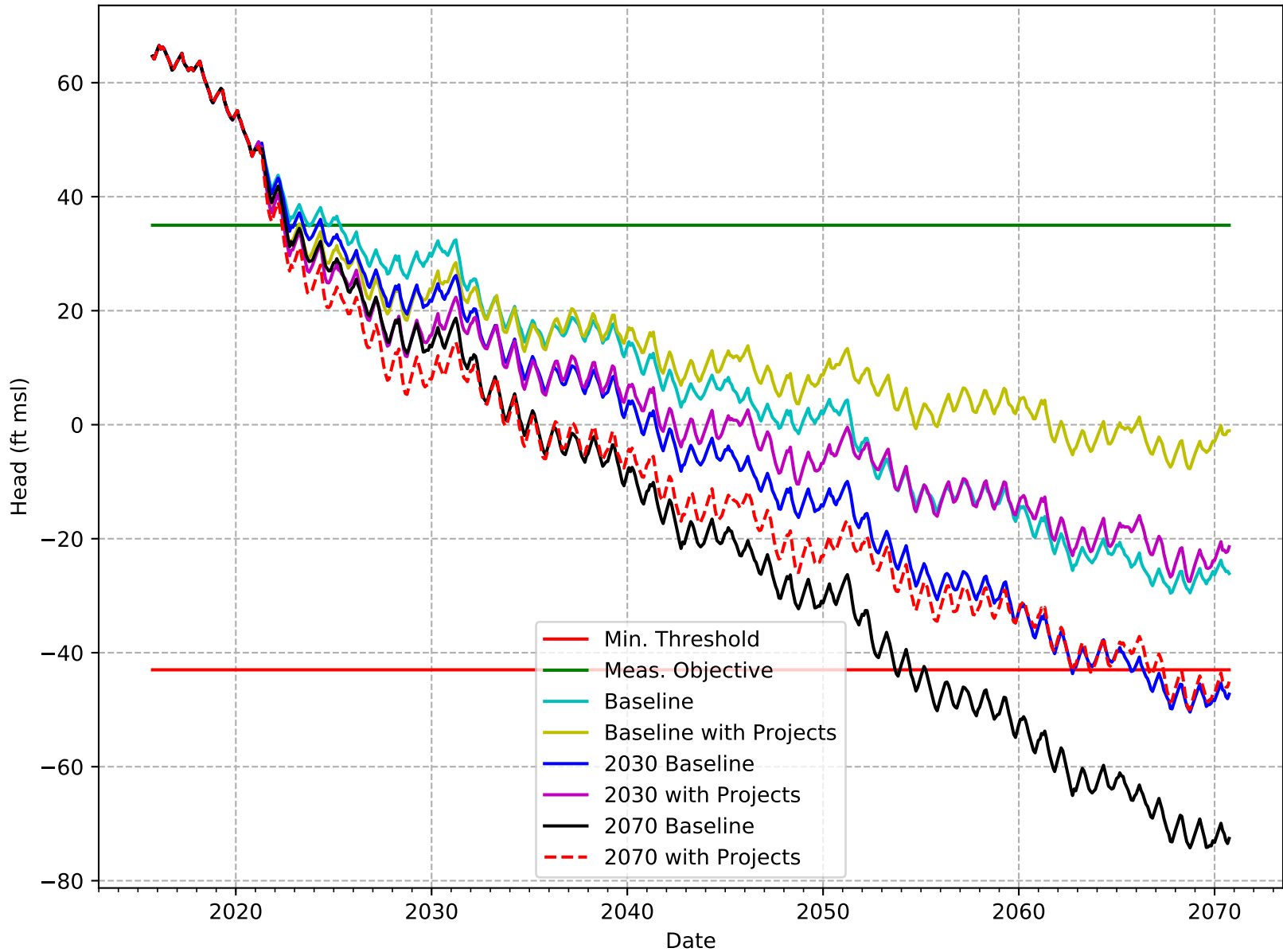
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-168-CWD



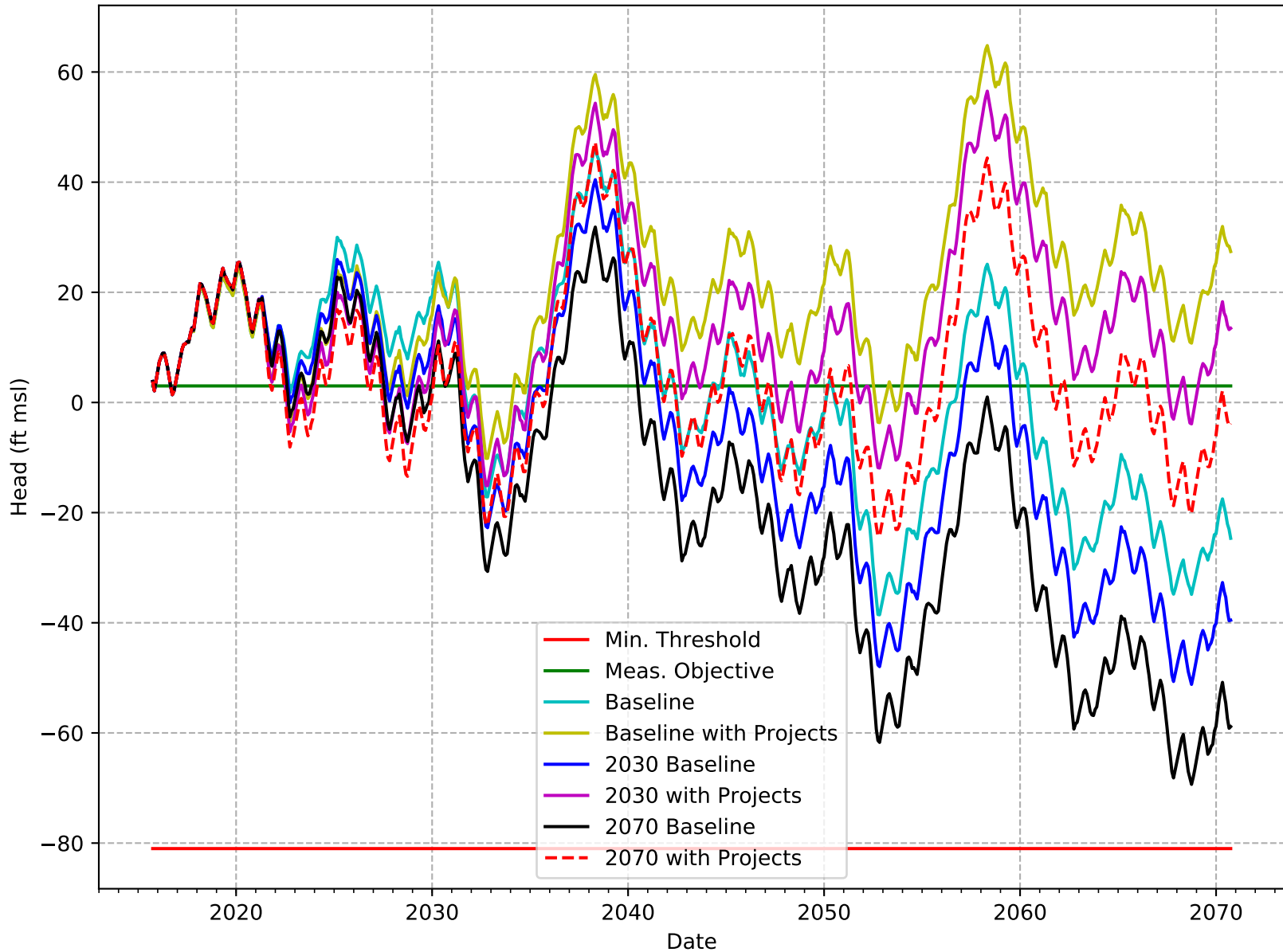
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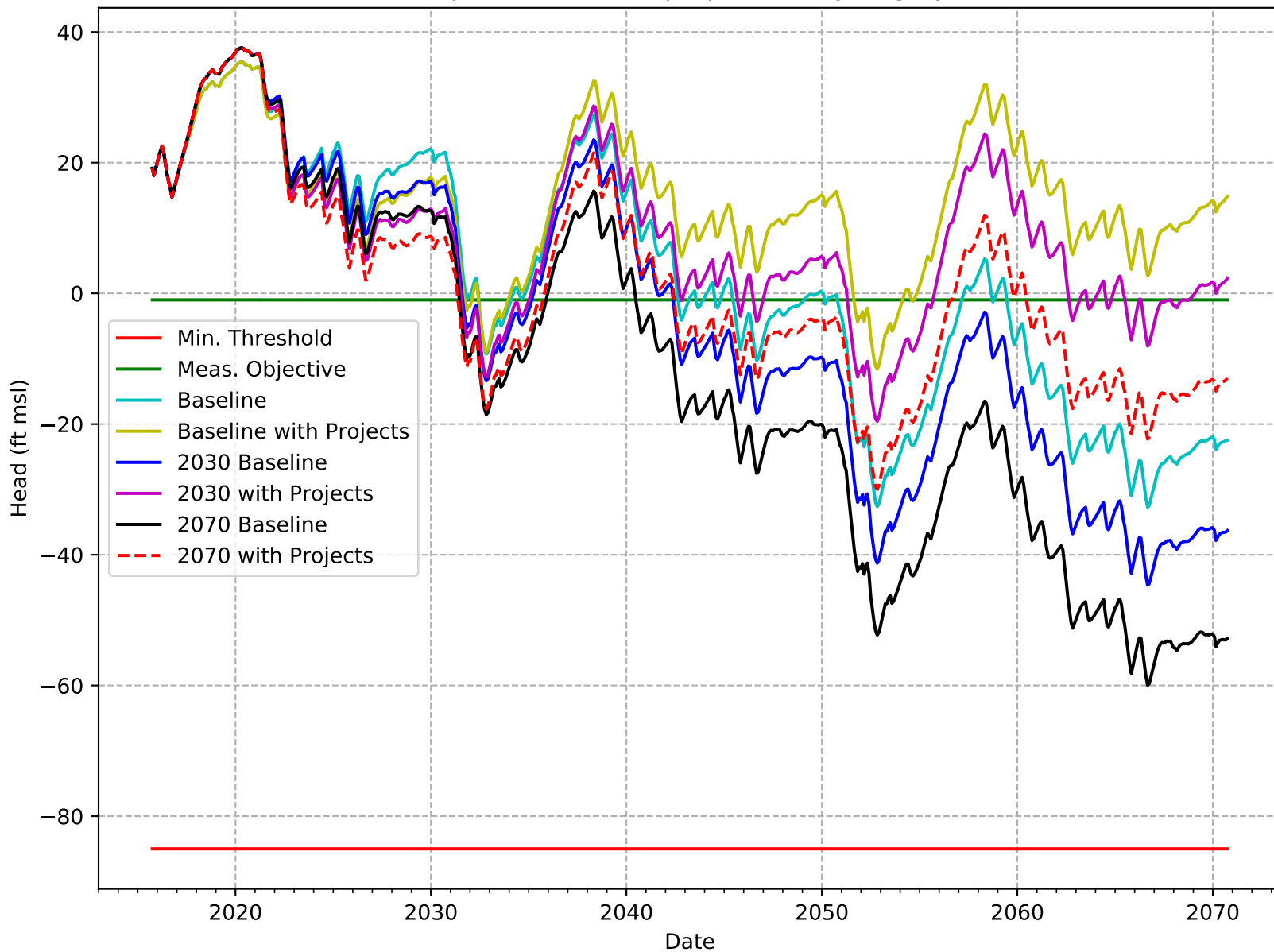
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-170-CWD



C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-171-CWD

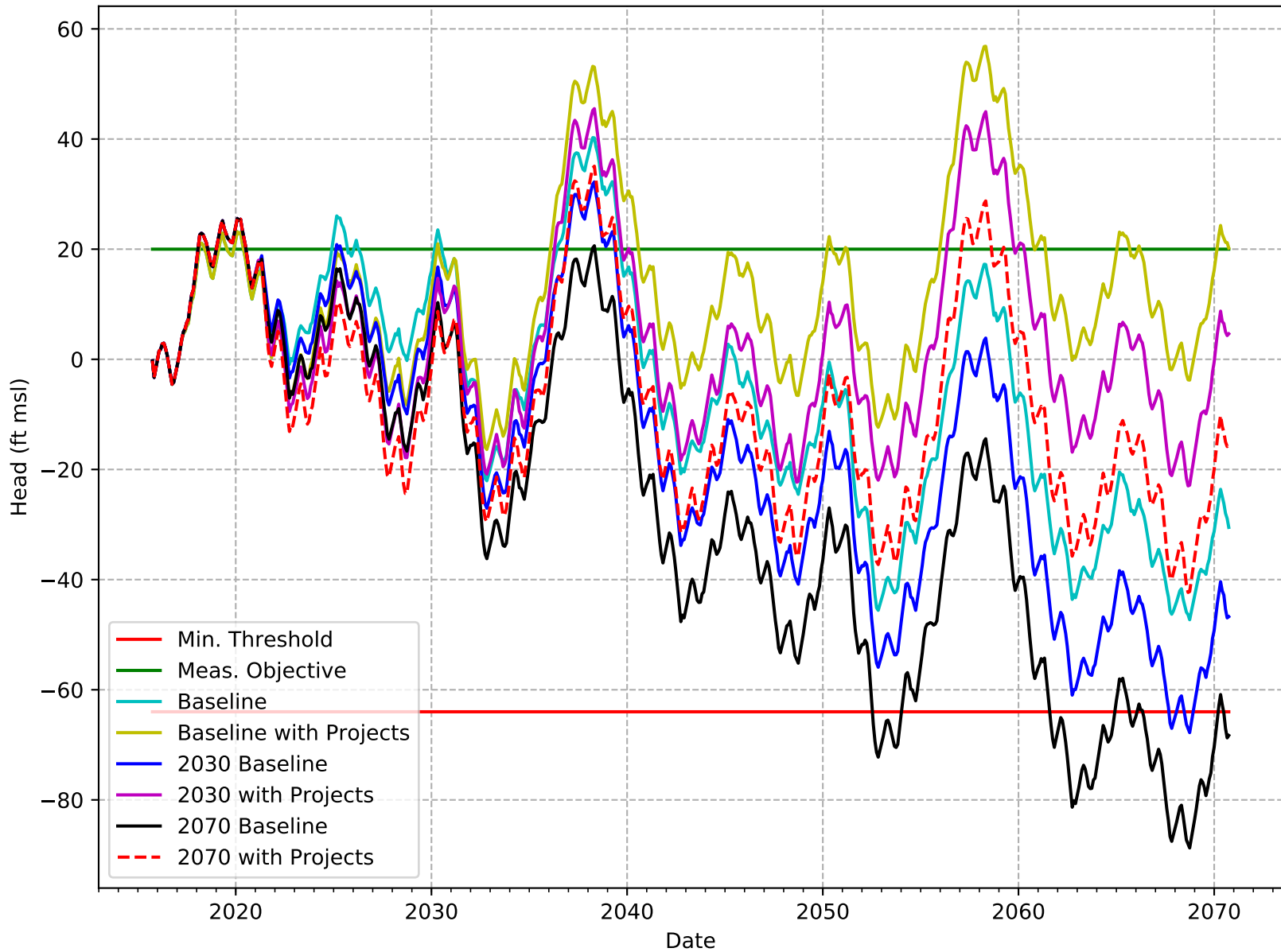


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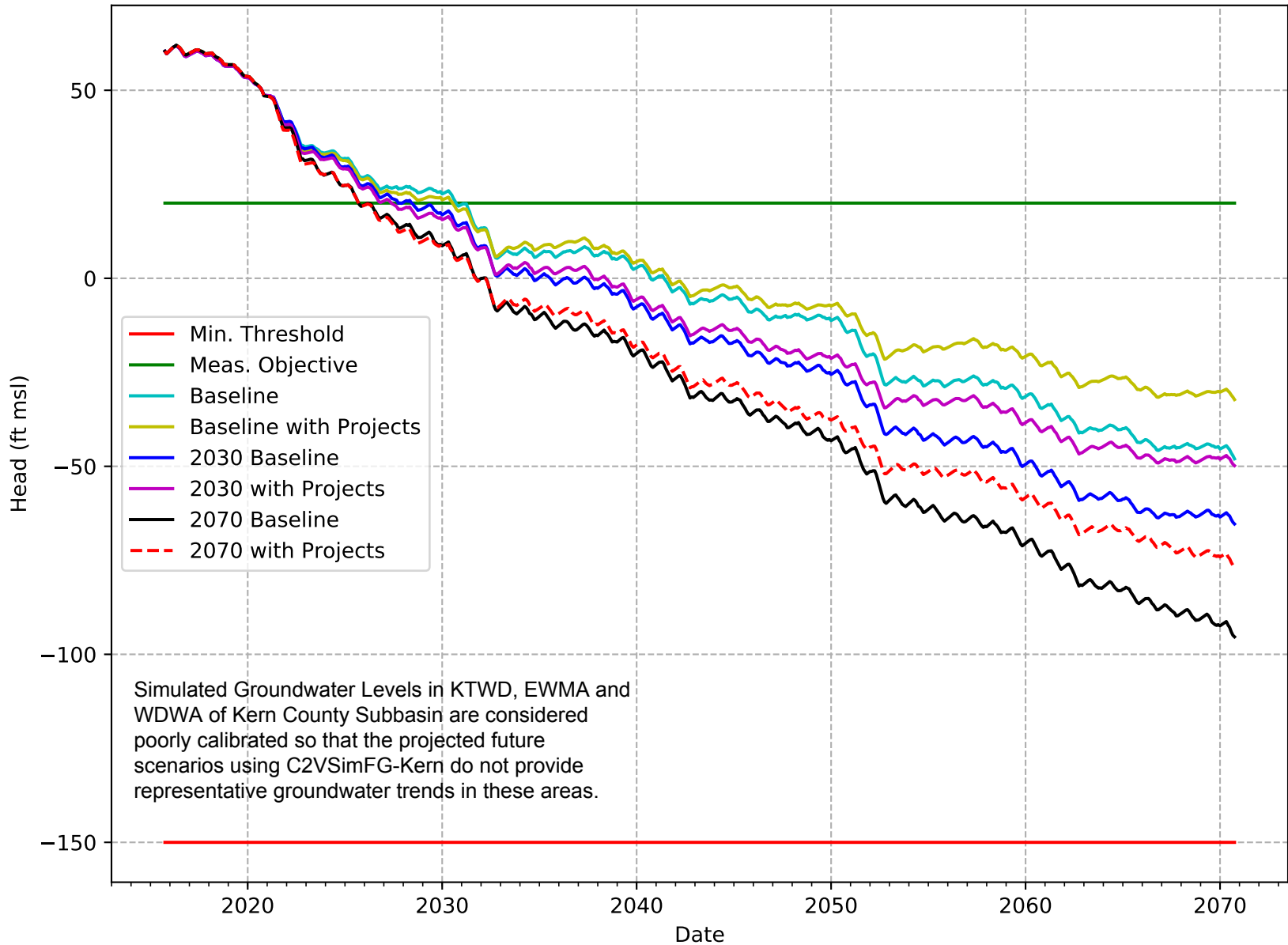




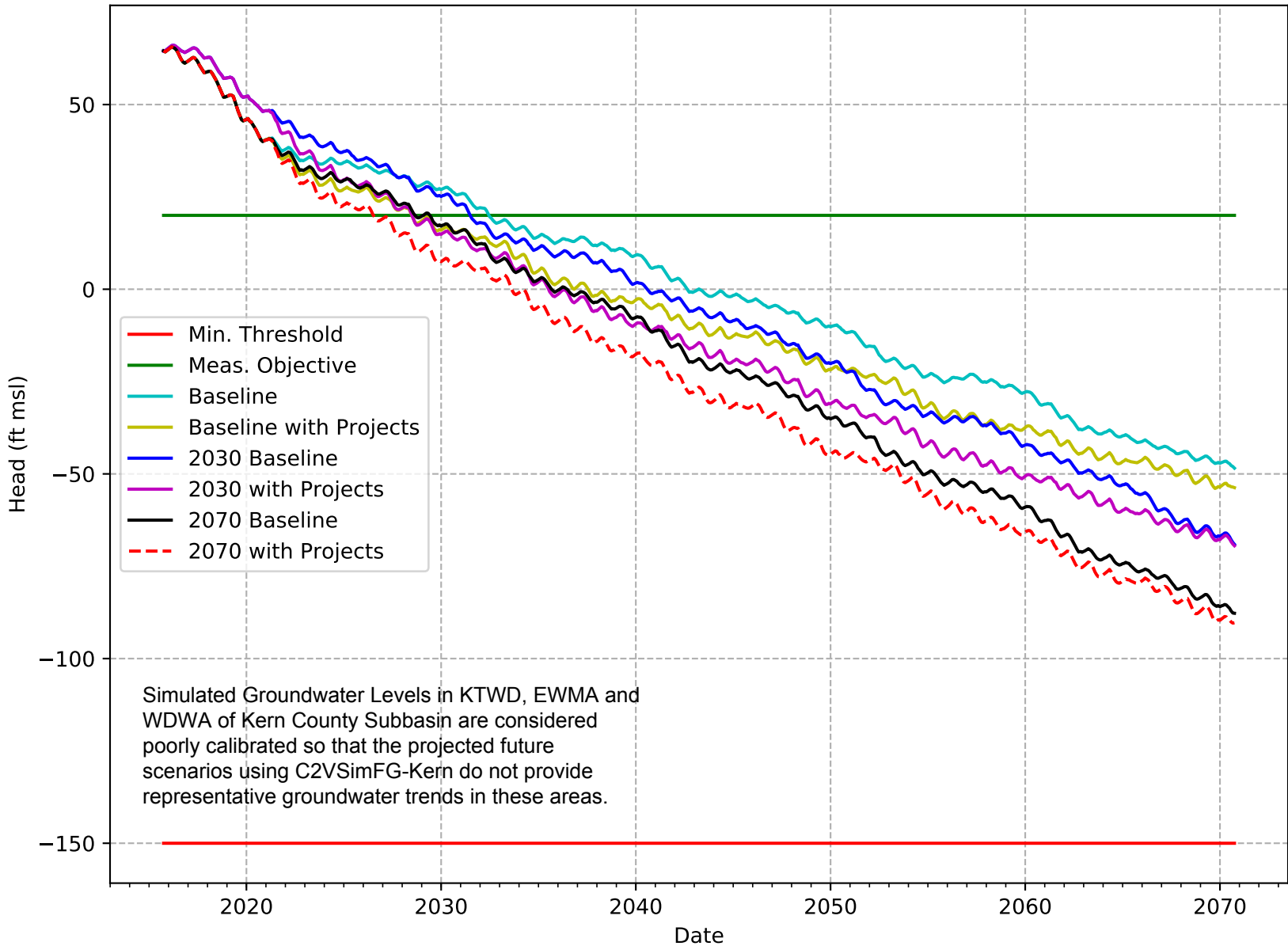
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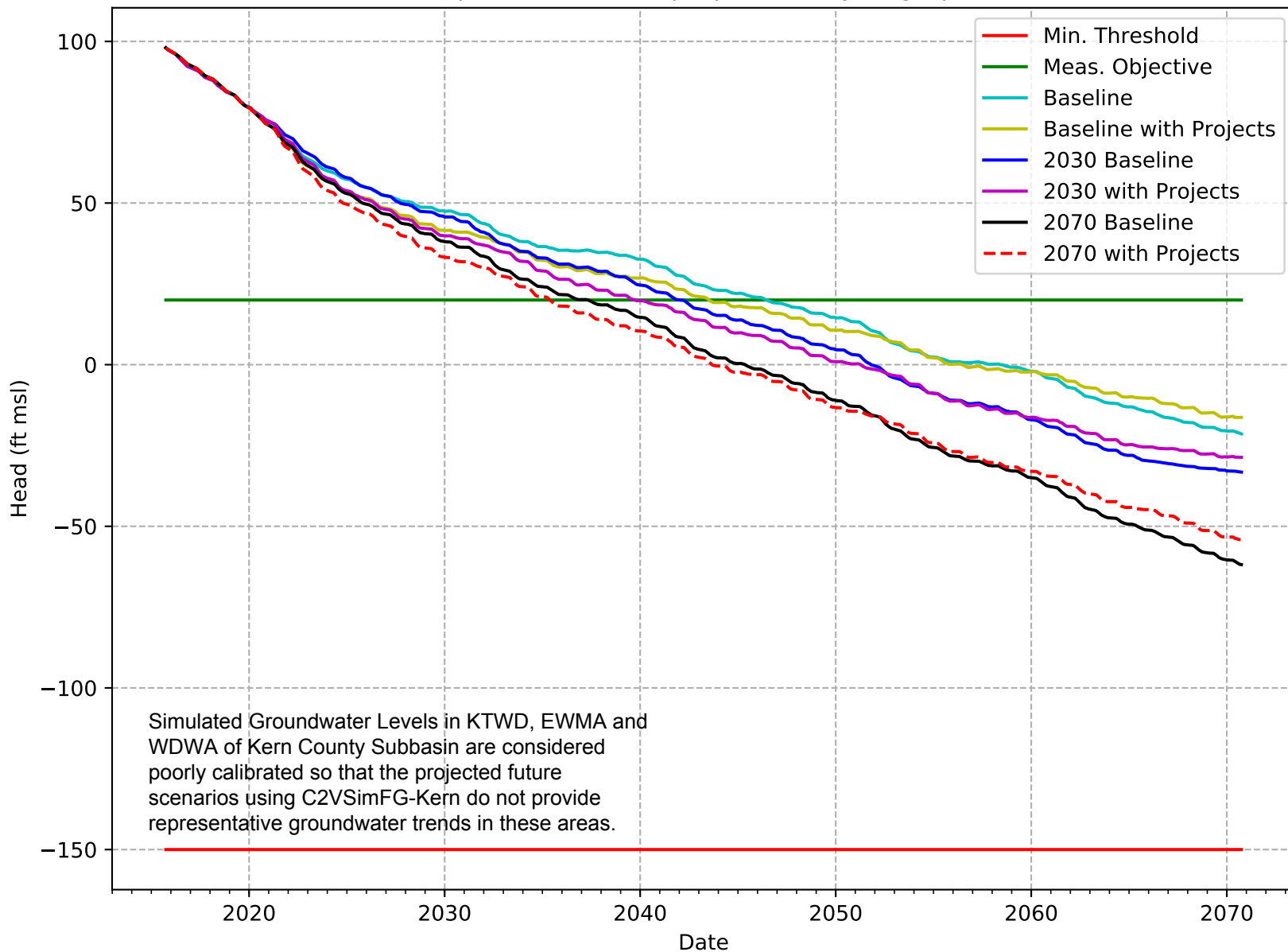
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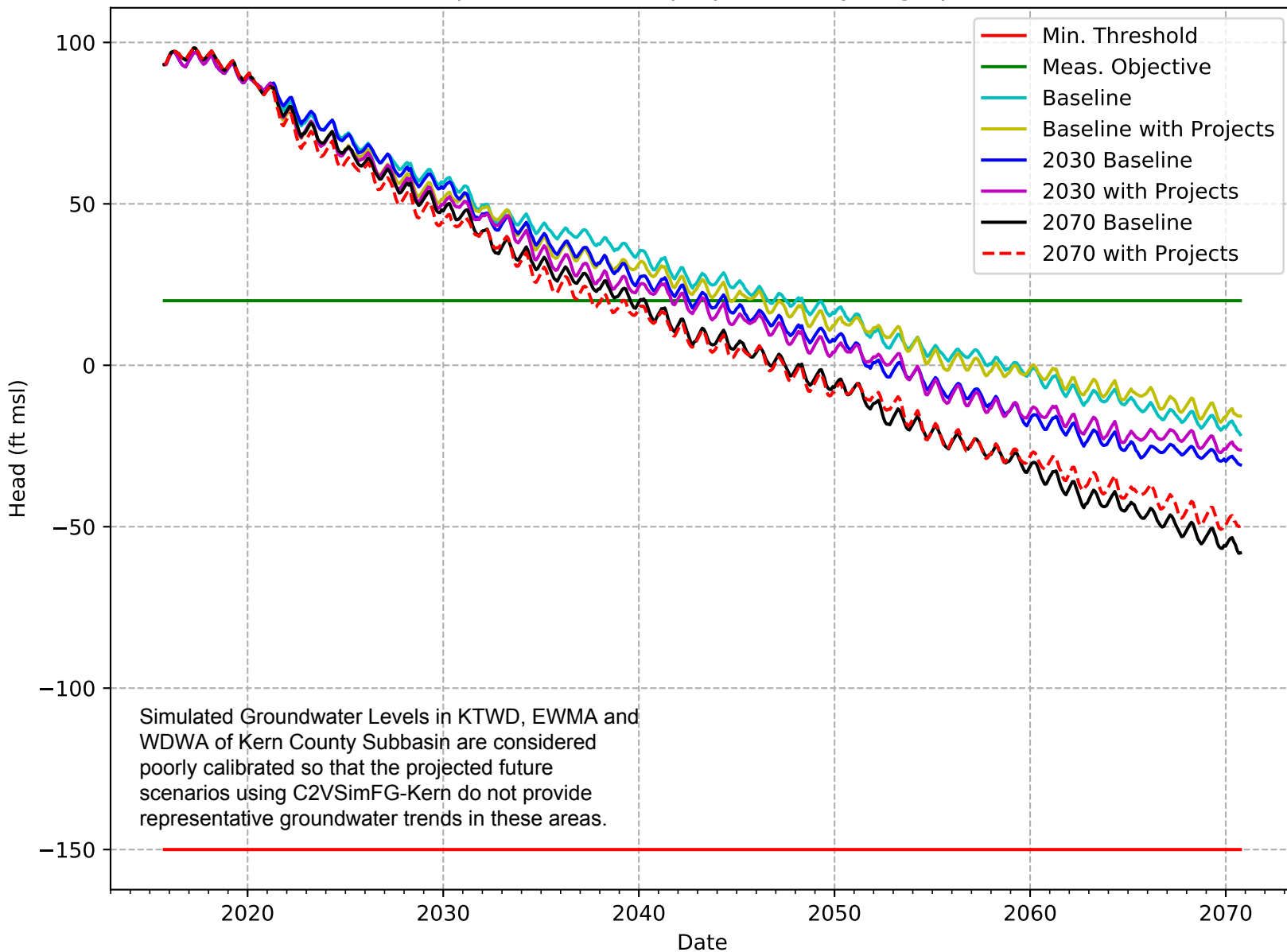
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-175-KTWD



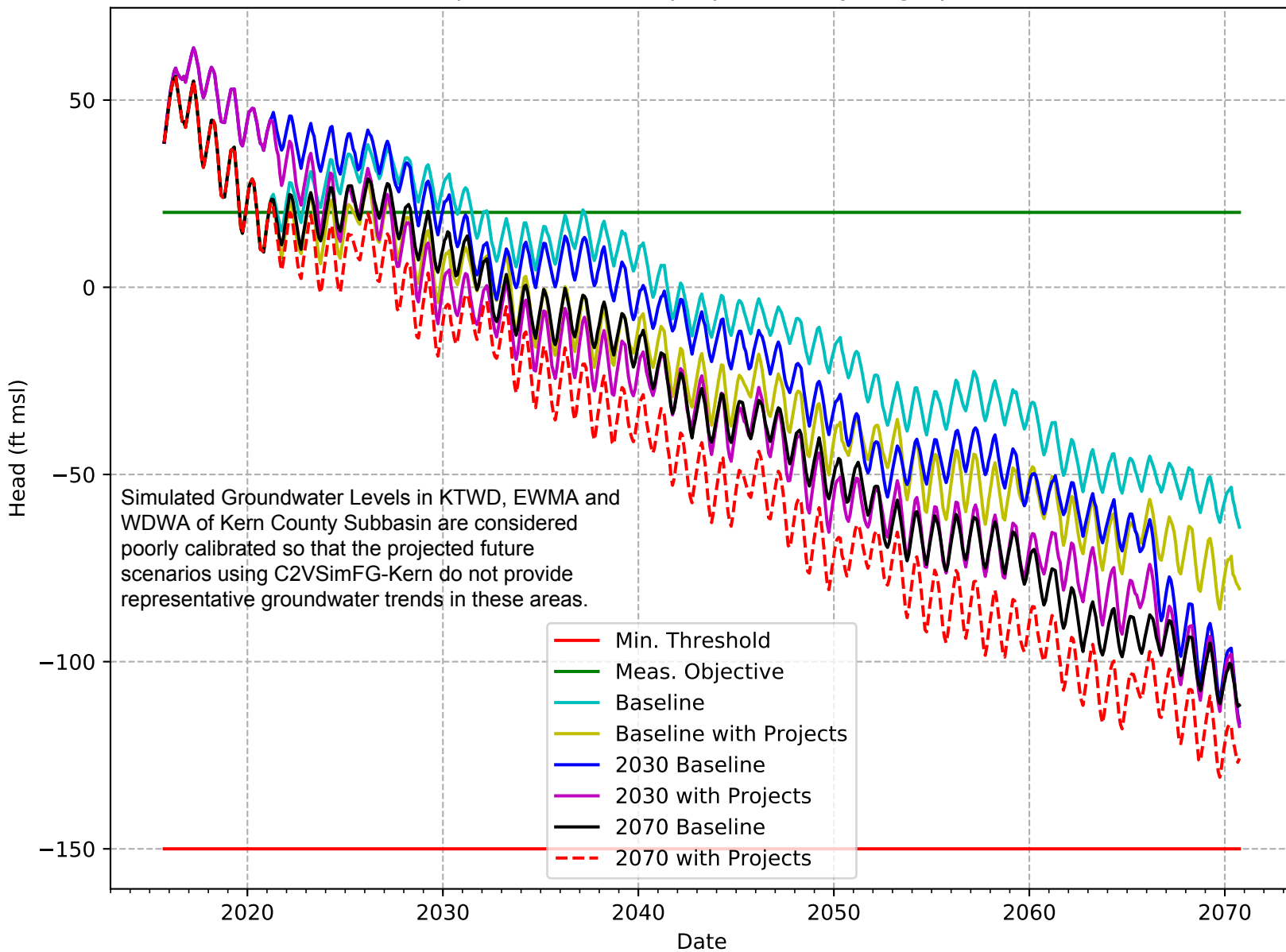
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-176-KTWD



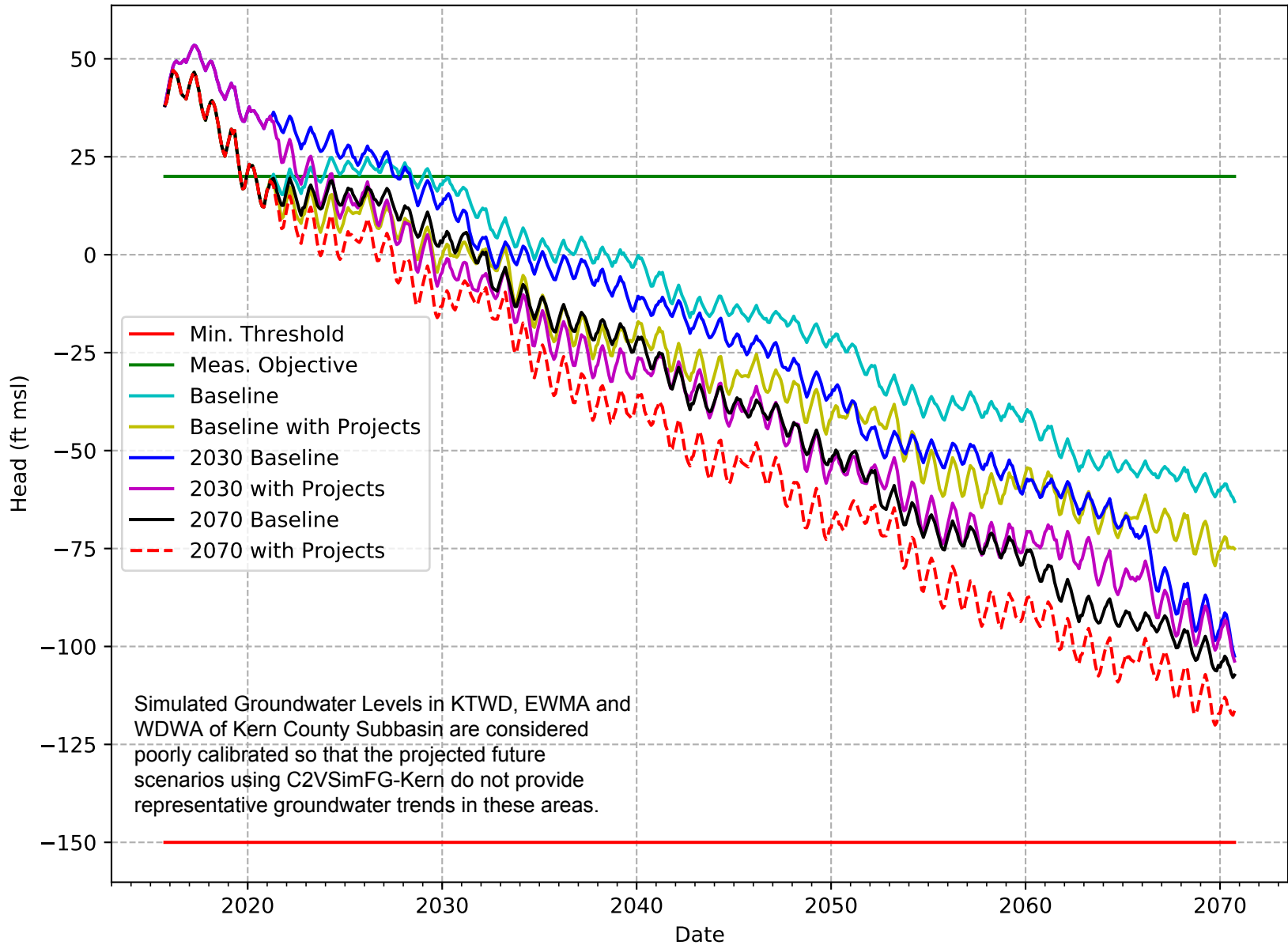
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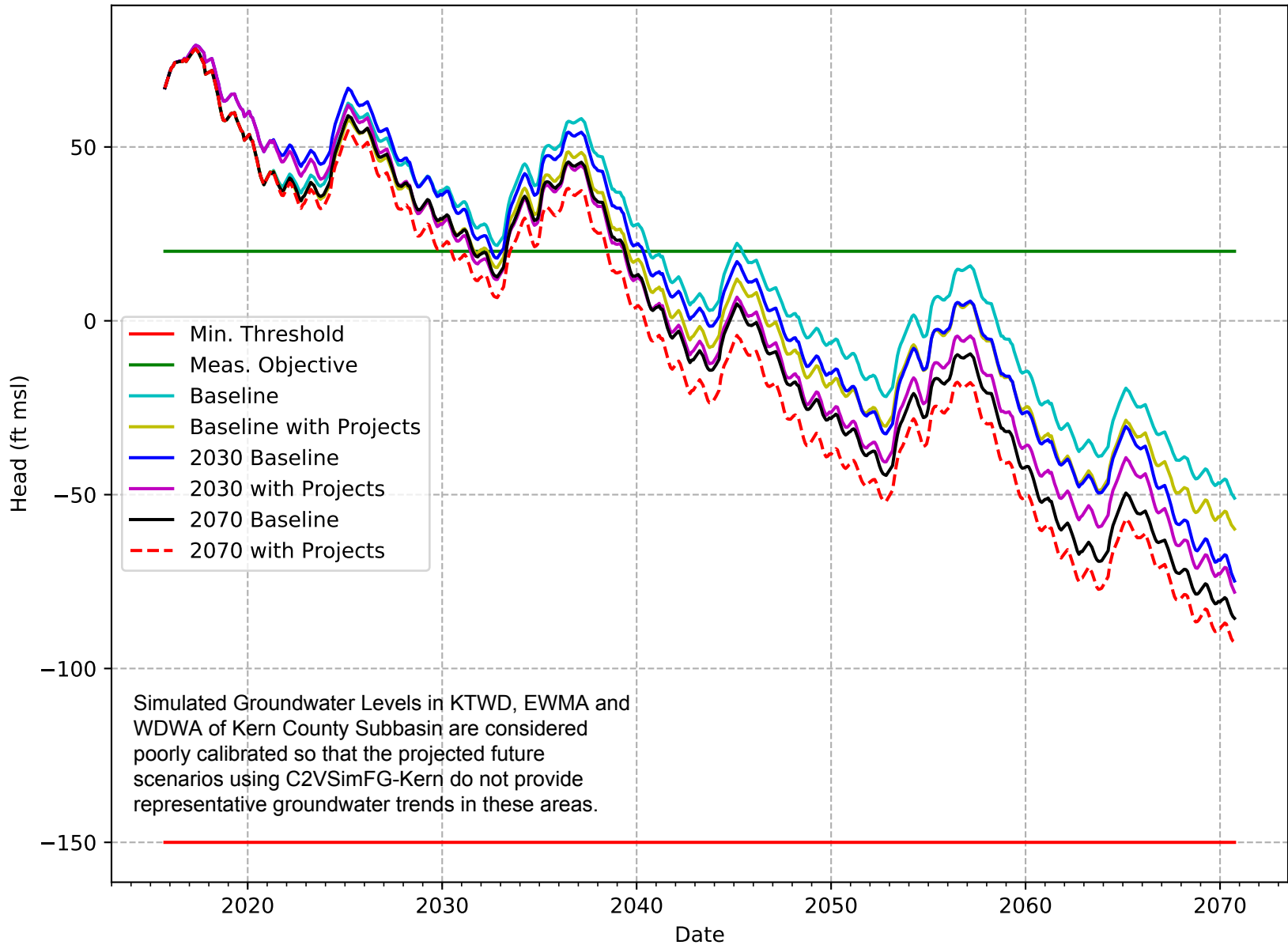
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-178-KTWD



C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-179-KTWD

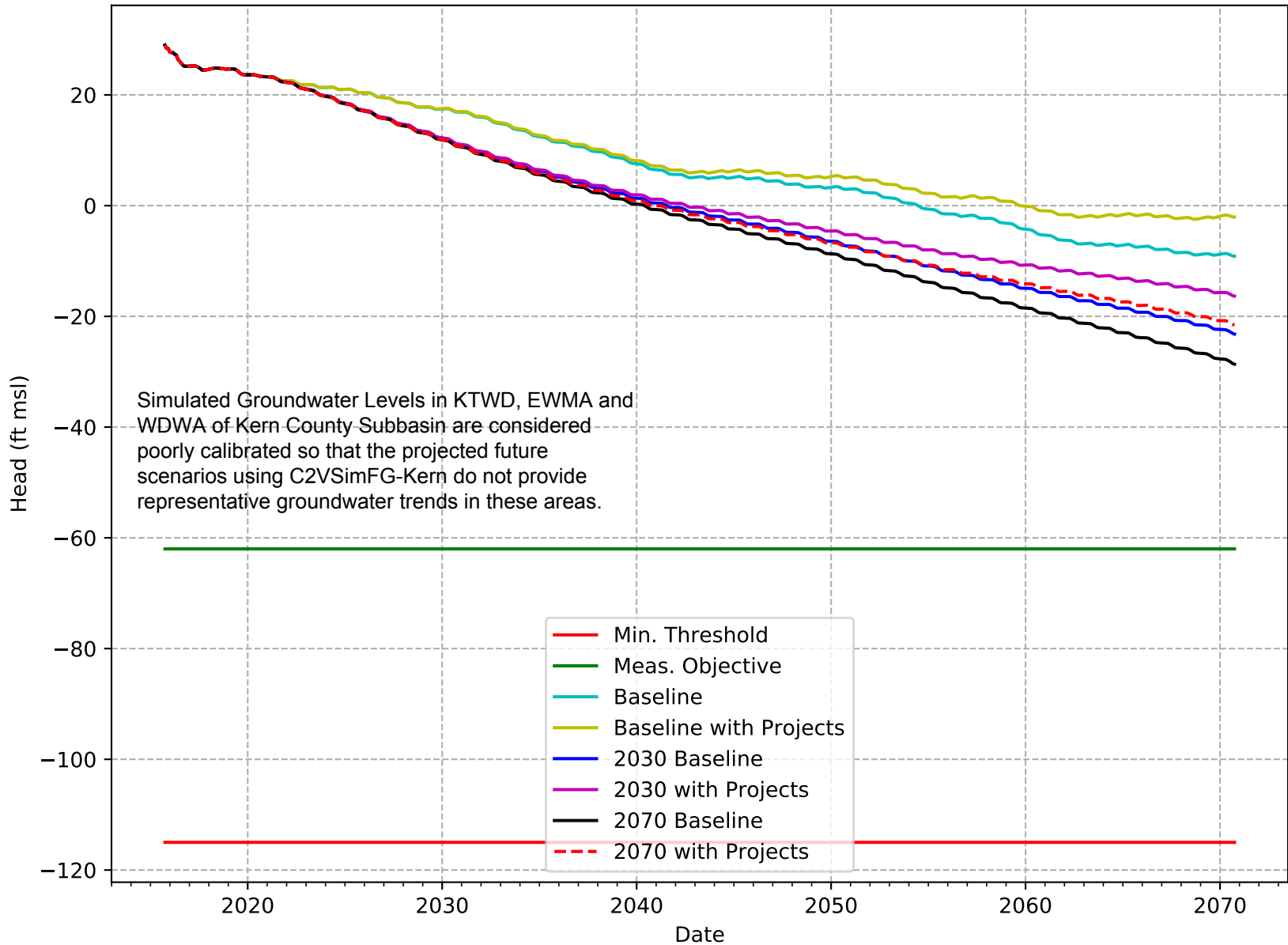


C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-180-KTWD

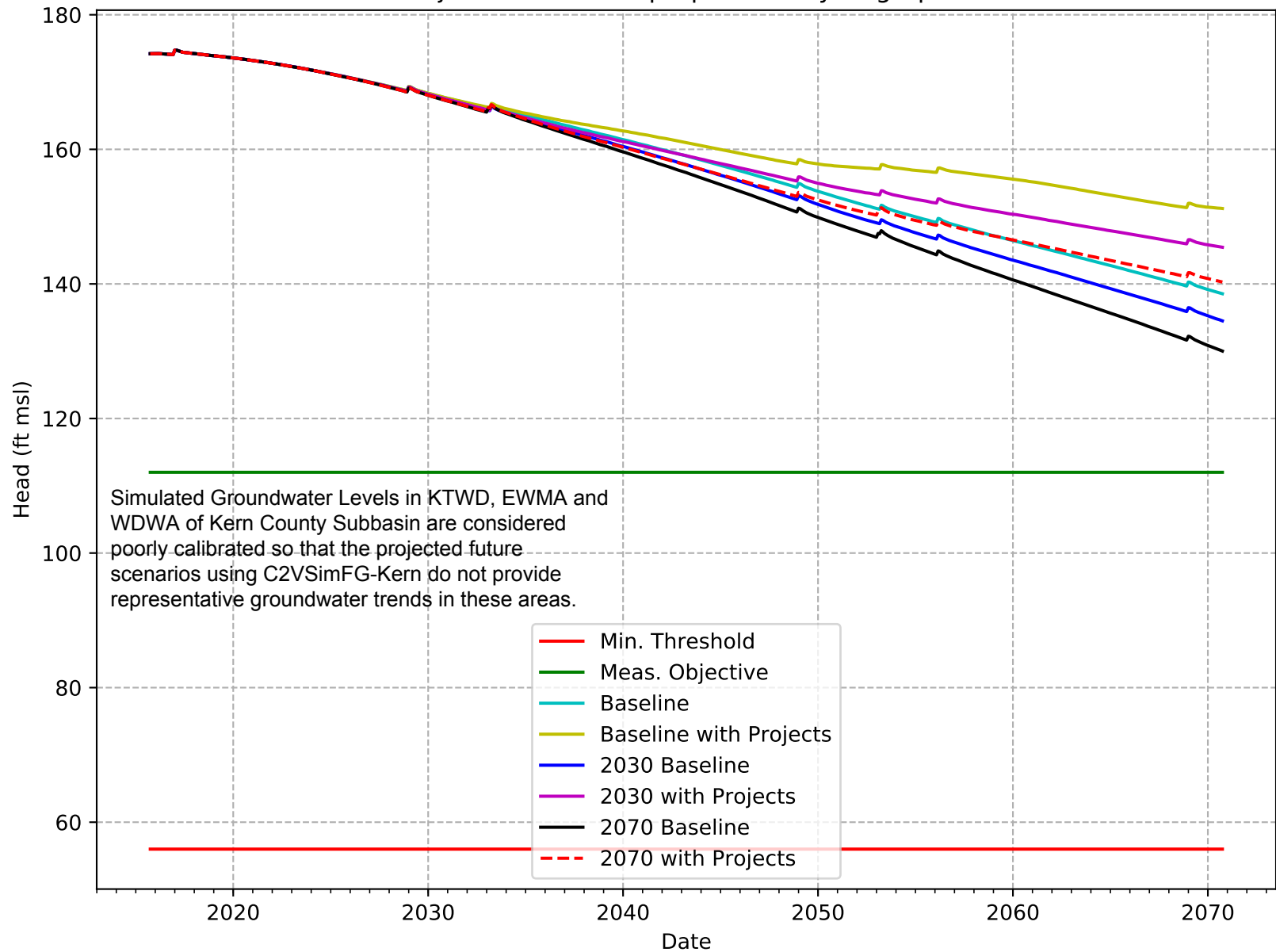




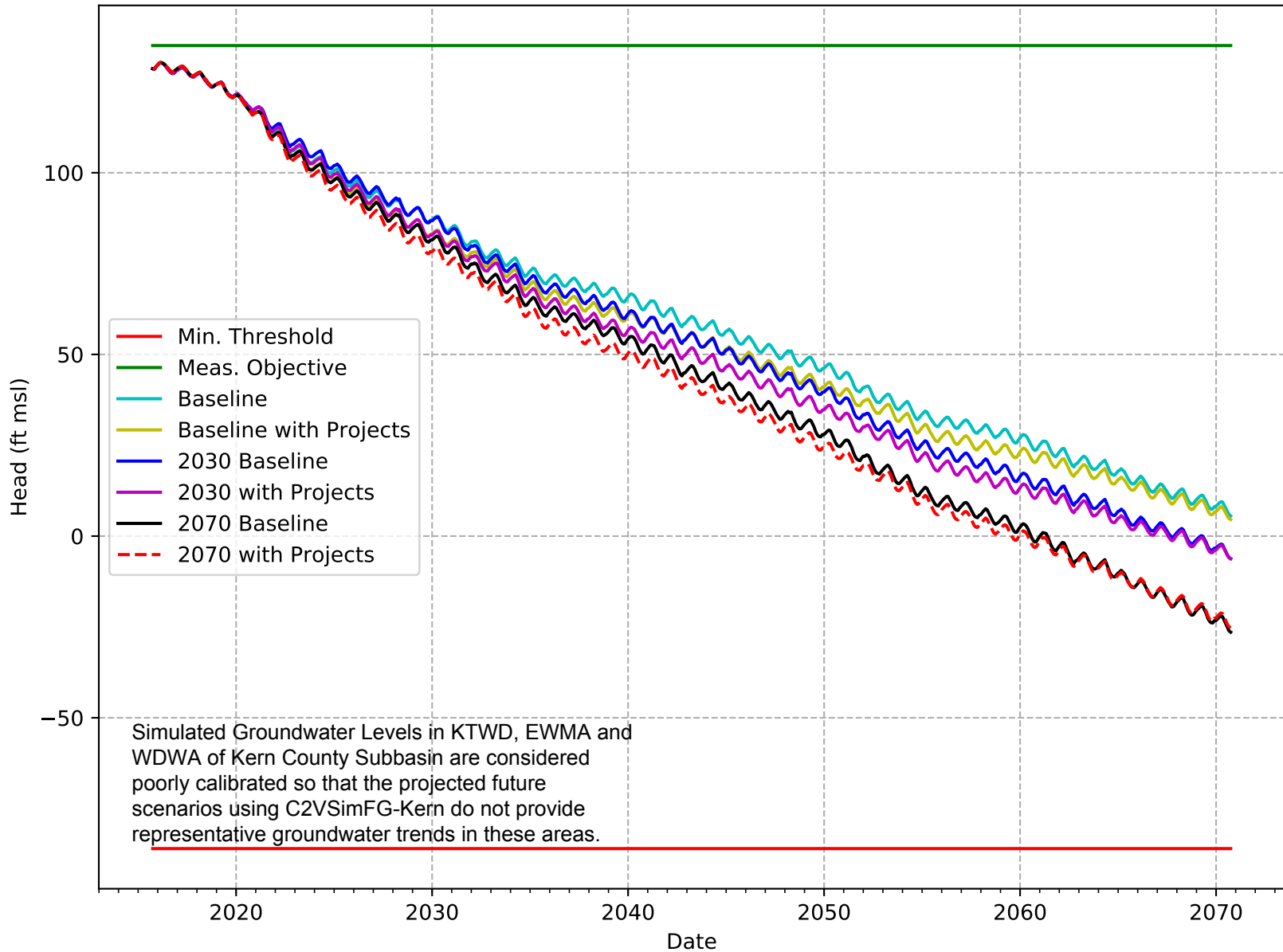
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-181-WDWA



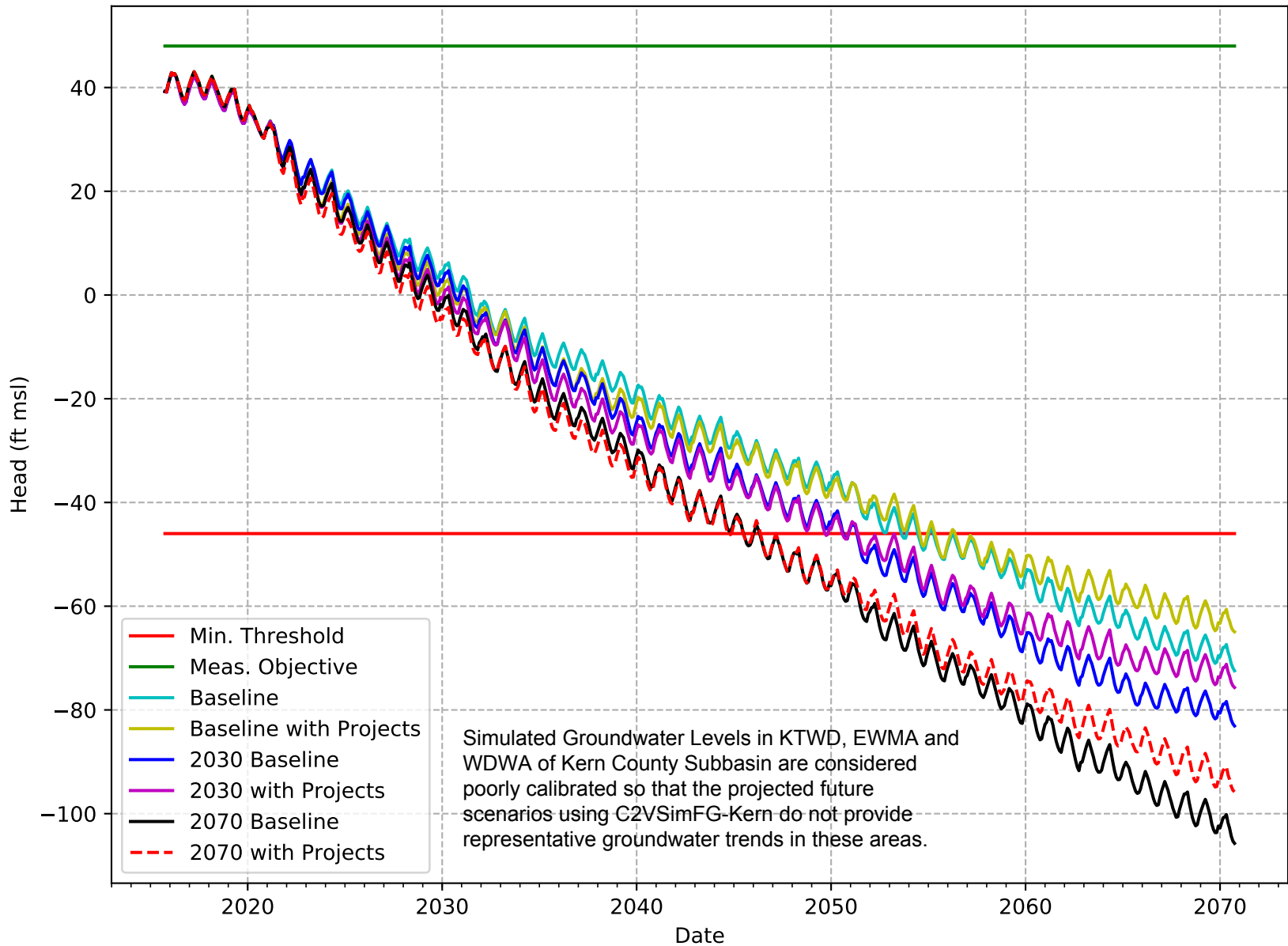
# C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-182-WDWA



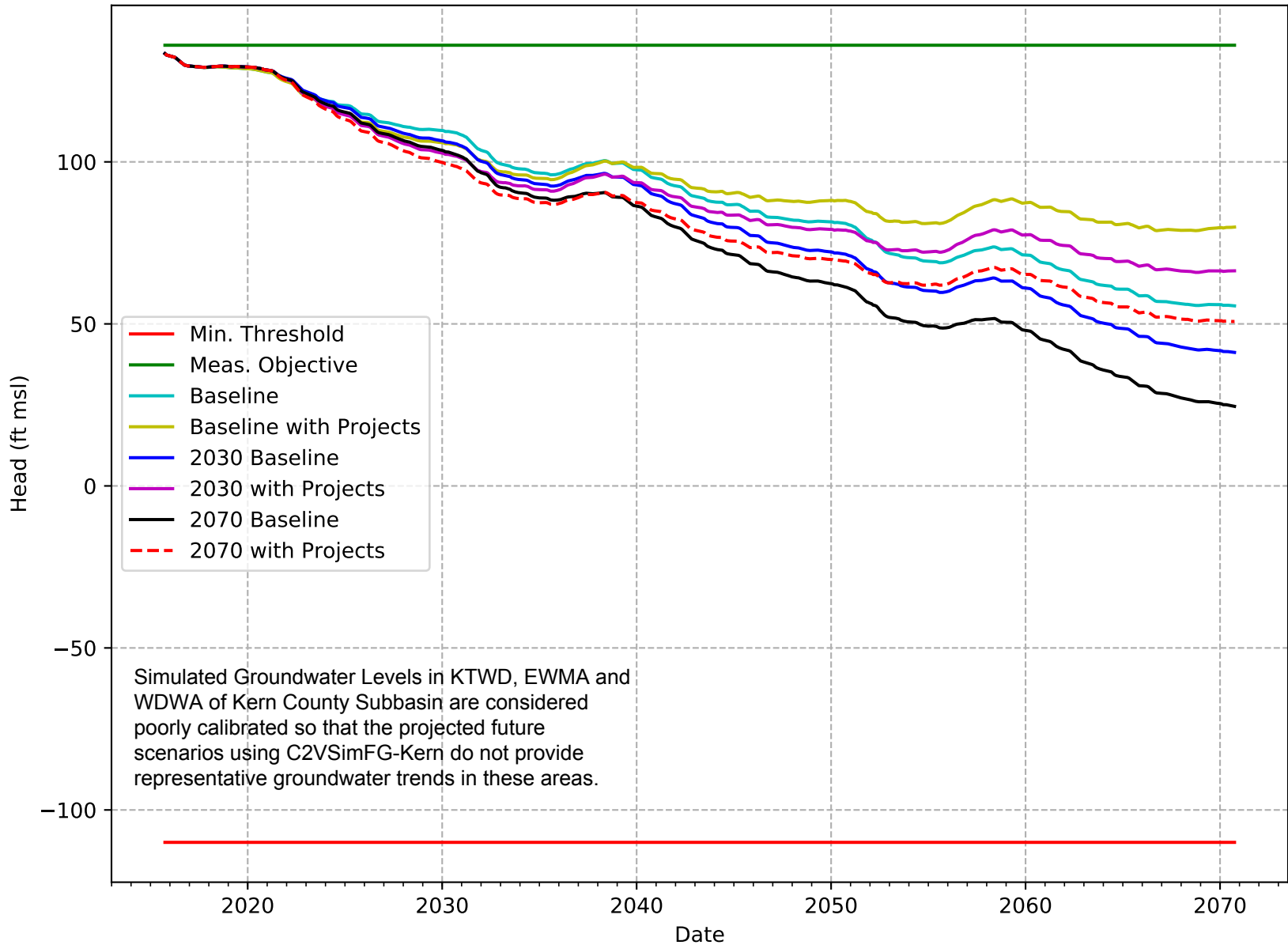
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-183-EWMA



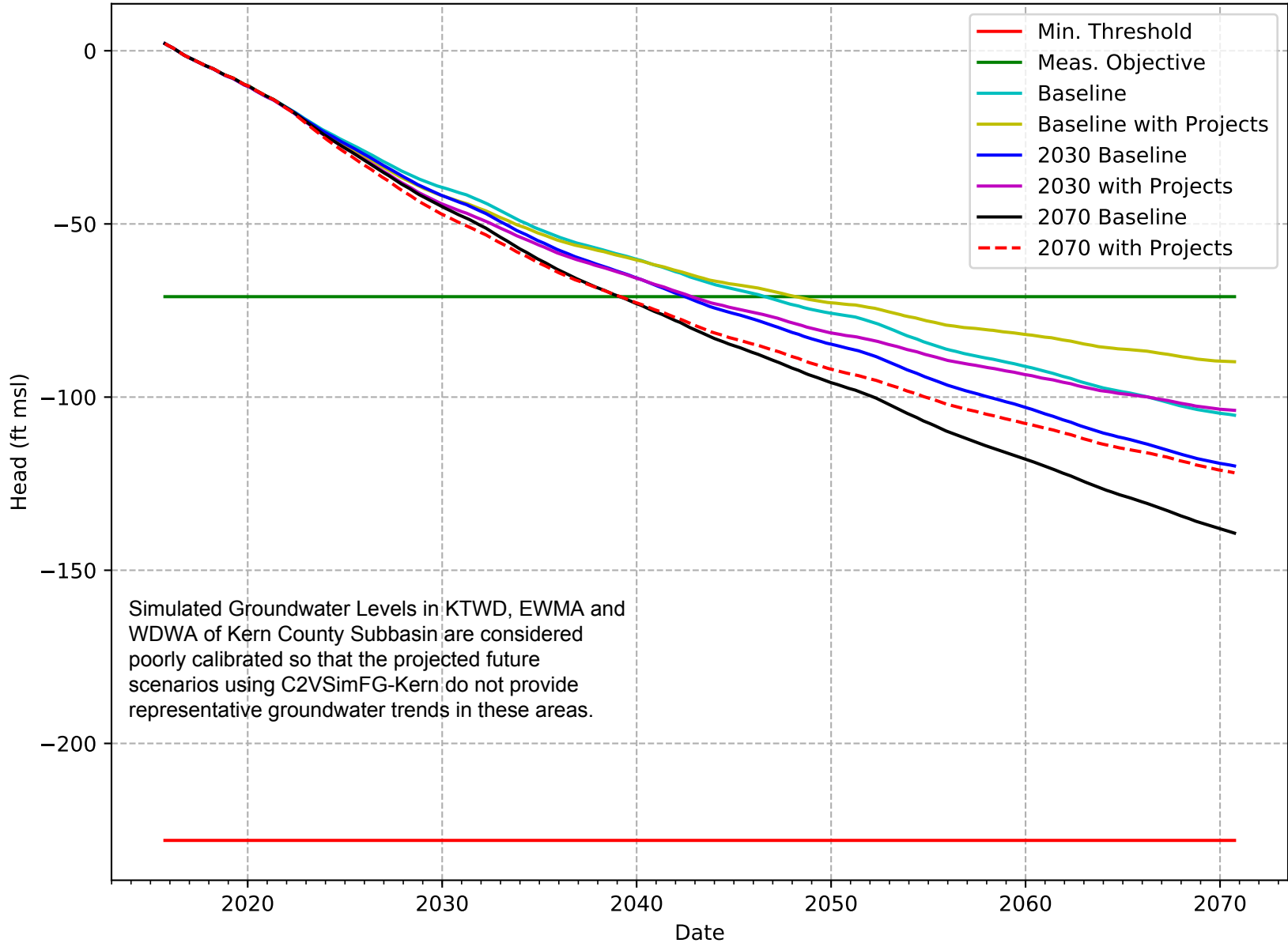
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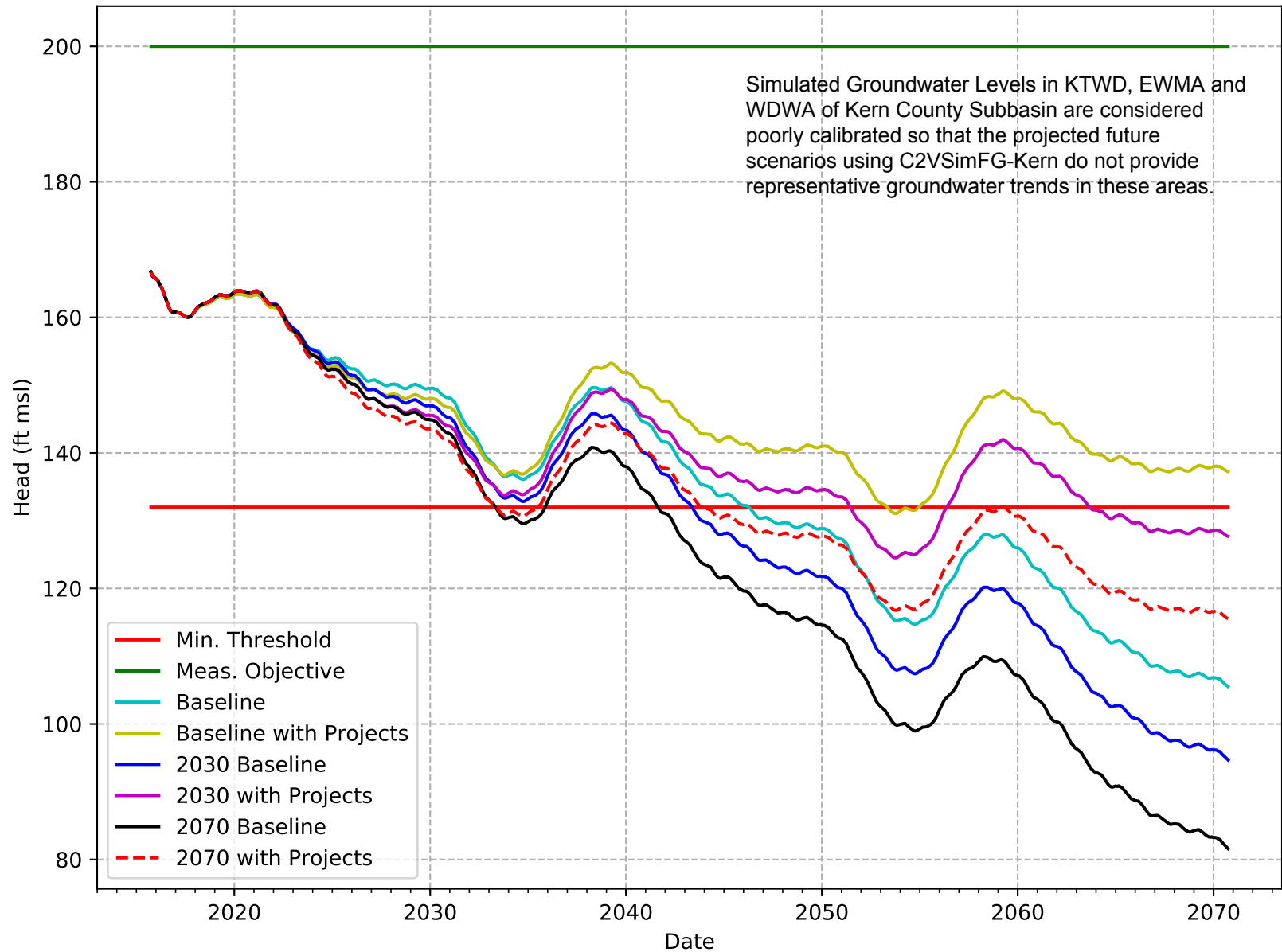
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-185-EWMA



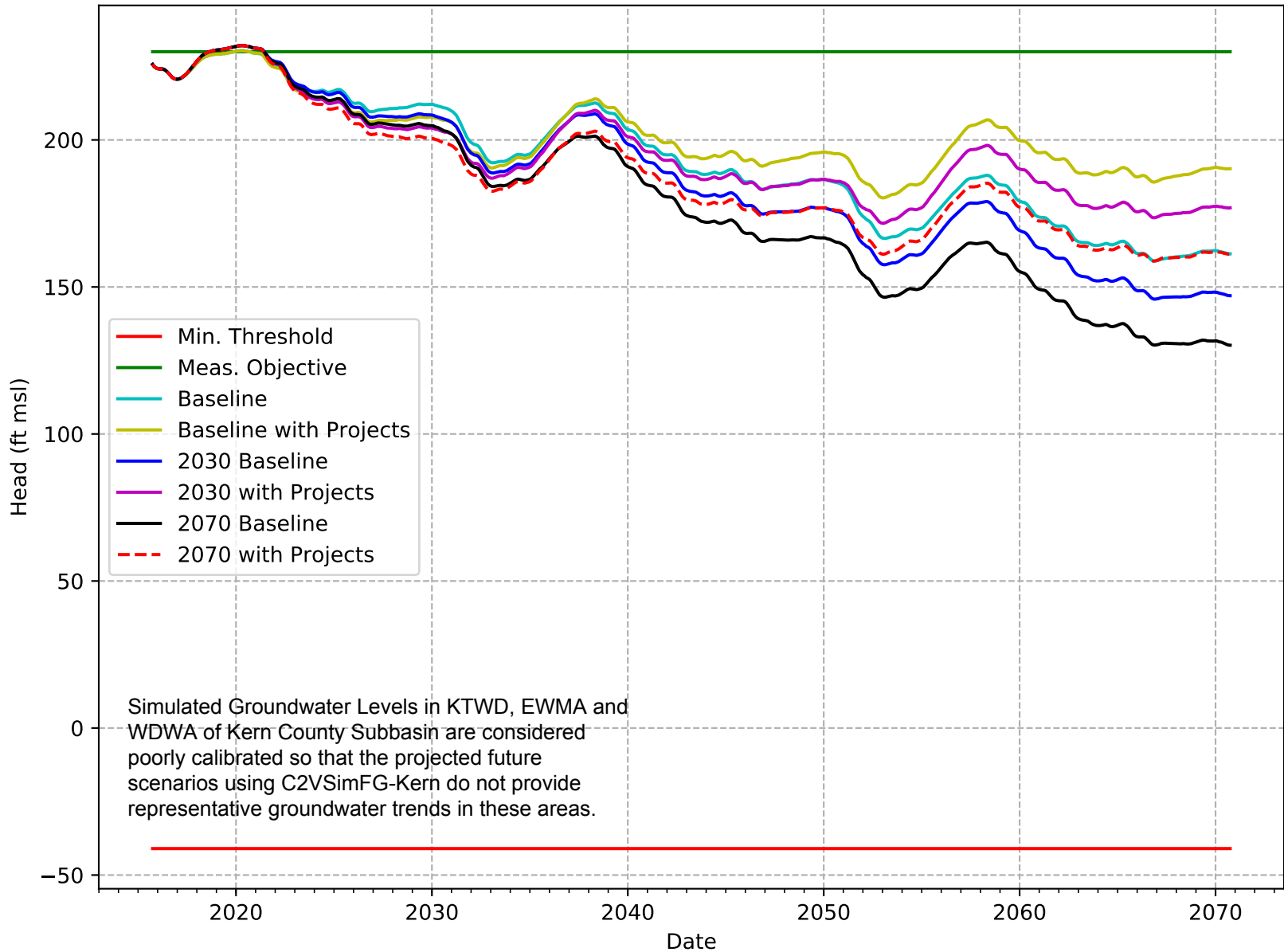
# C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-187-EWMA



# C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-188-EWMA

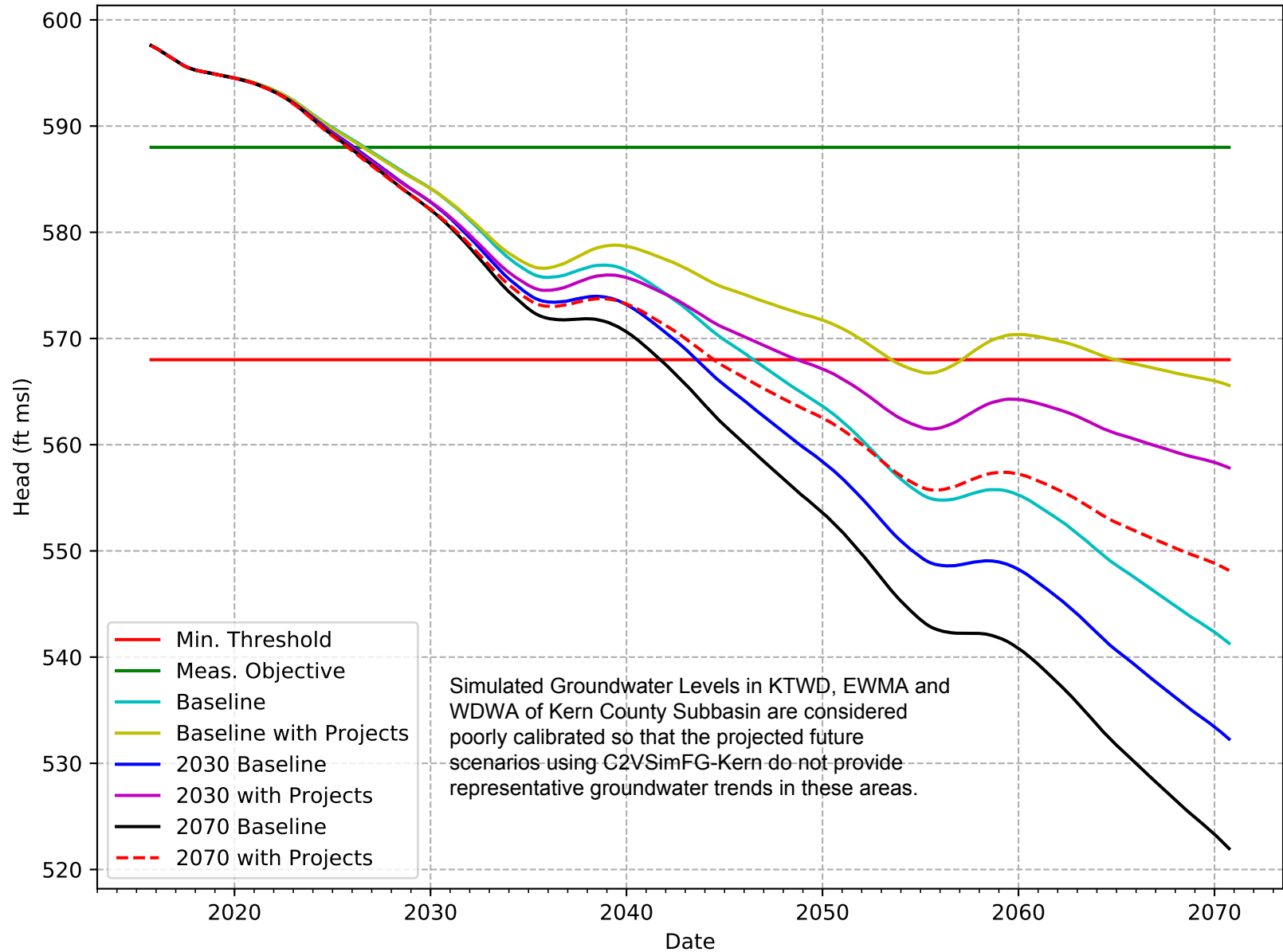


### C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-189-EWMA

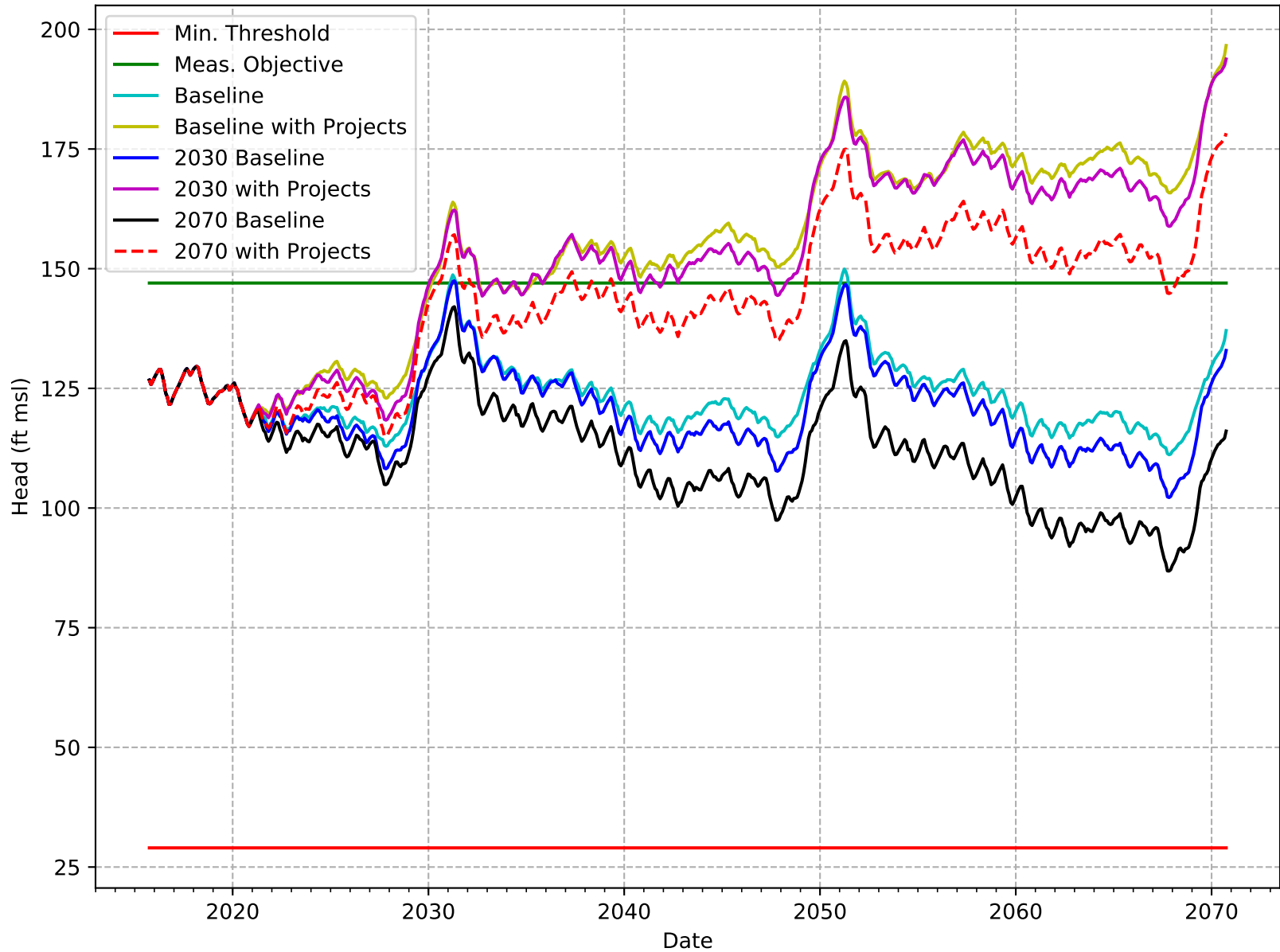




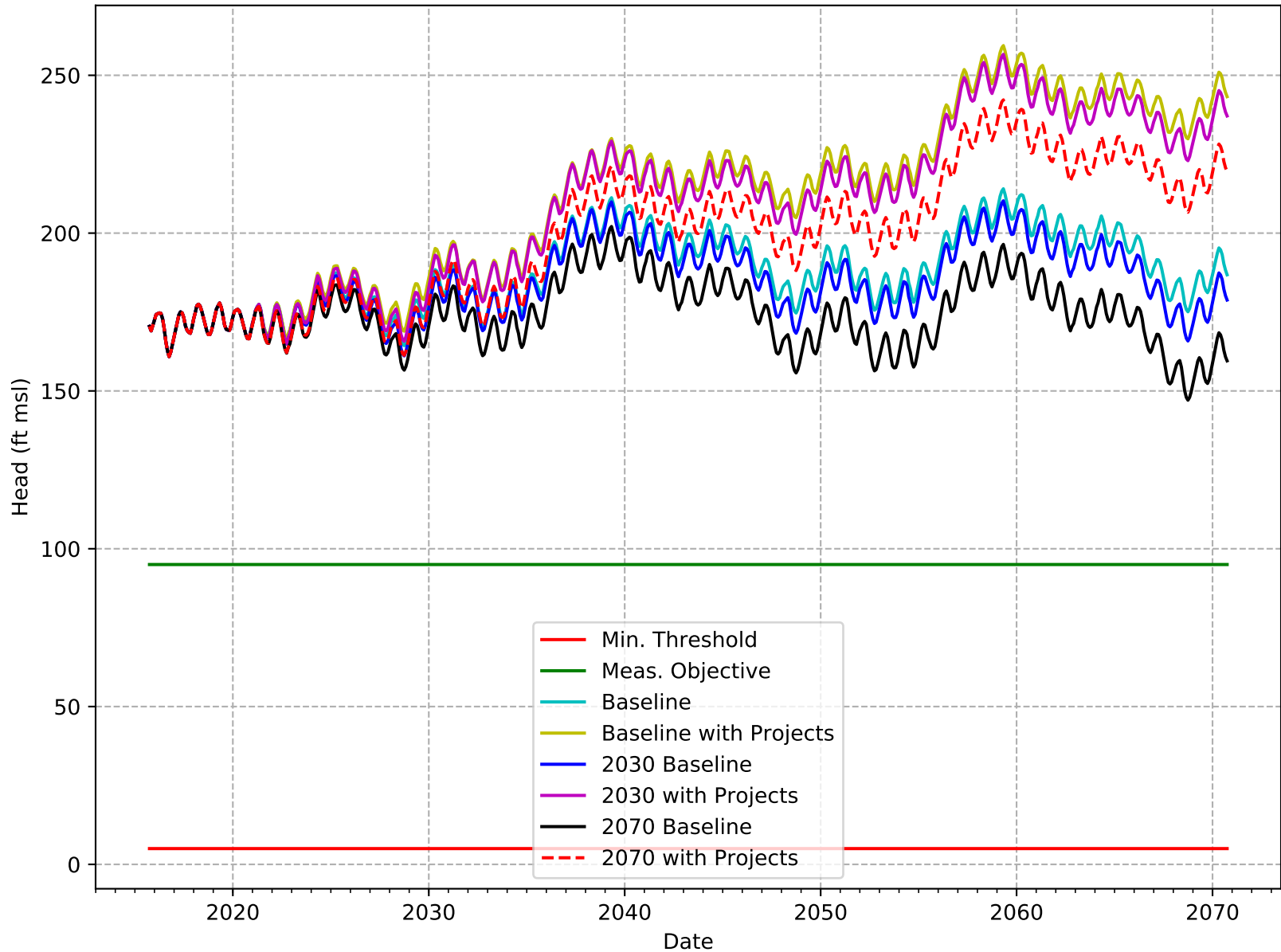
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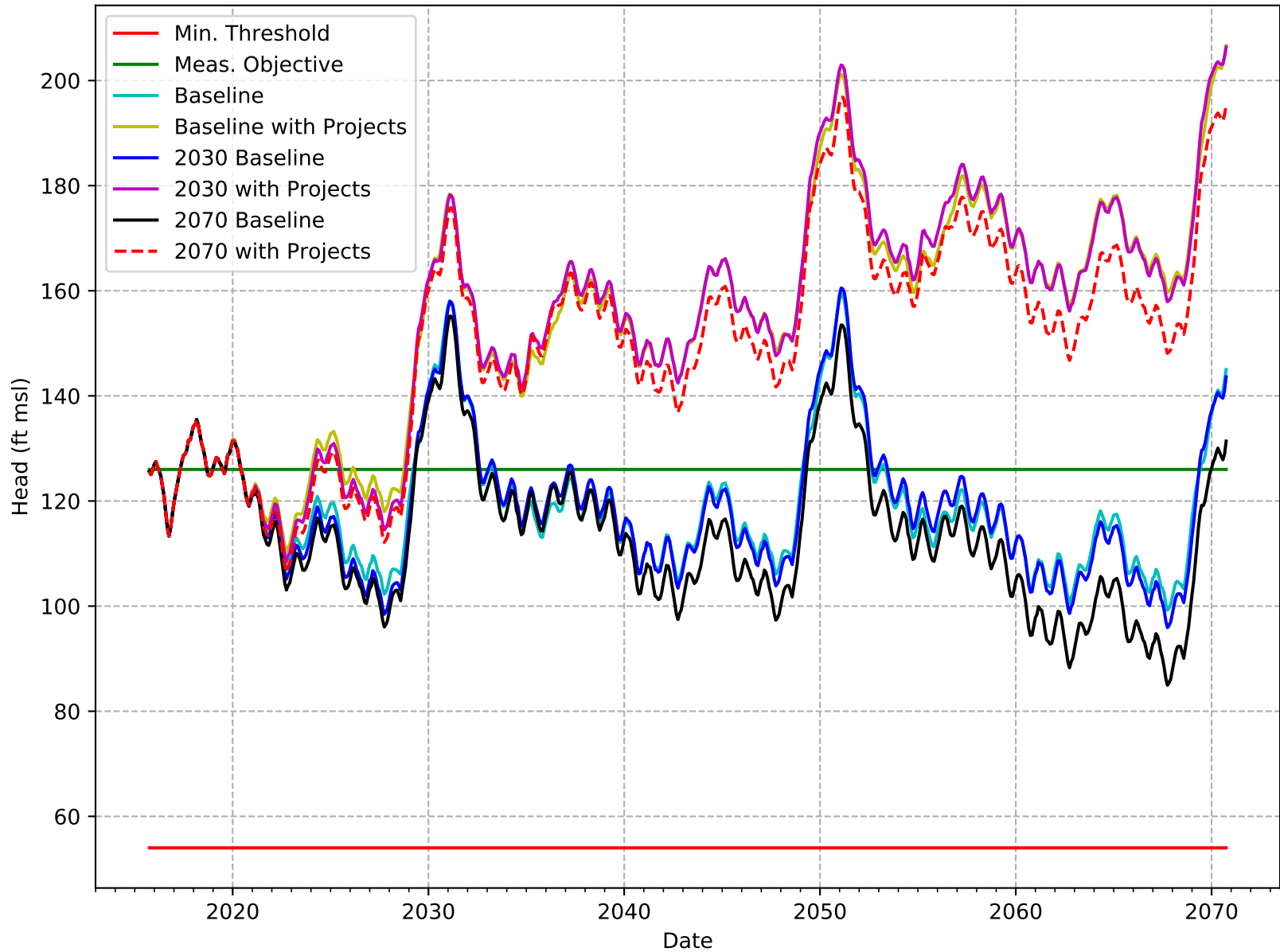
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-192-KRGSA



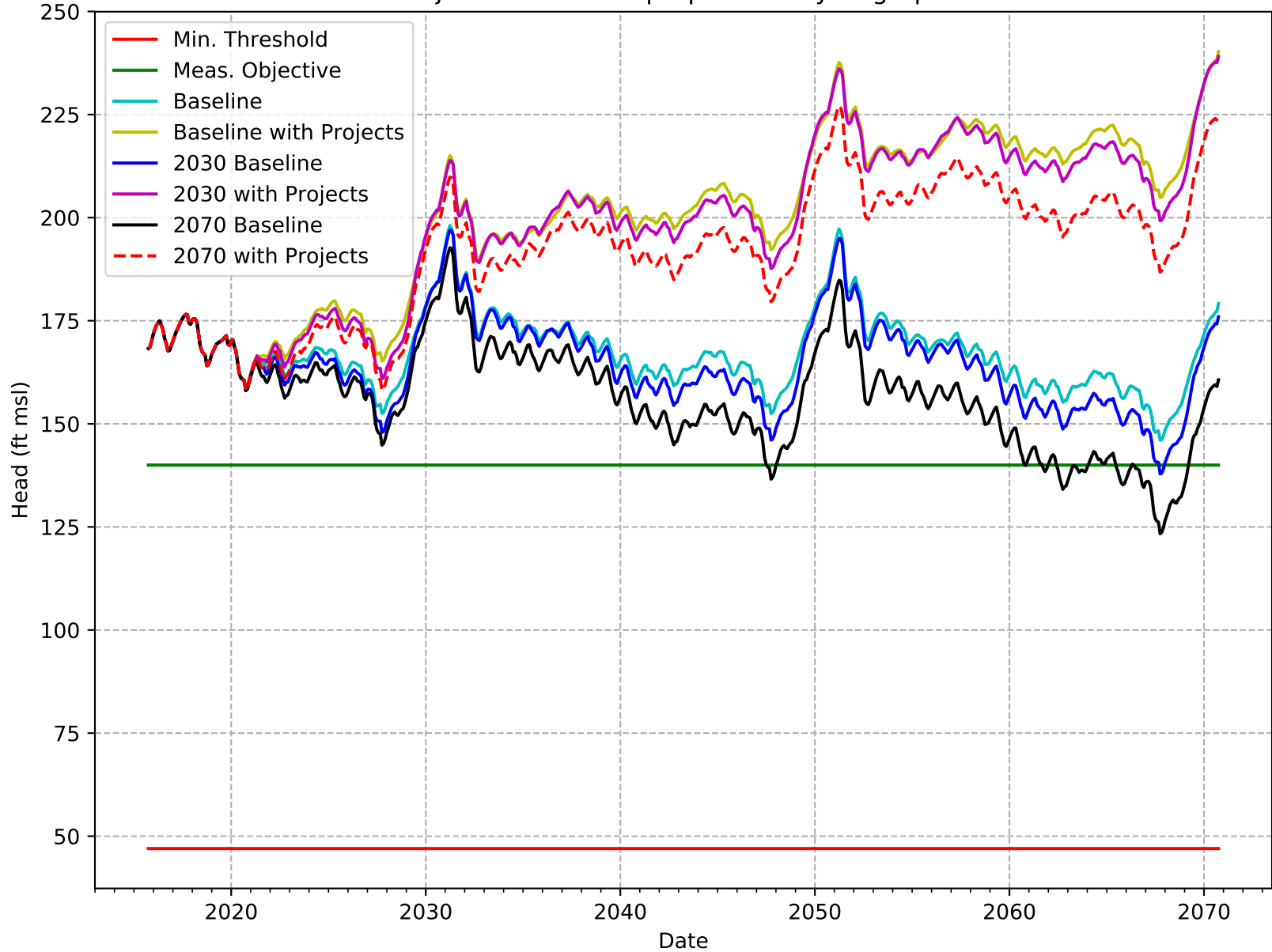
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-193-KRGSA



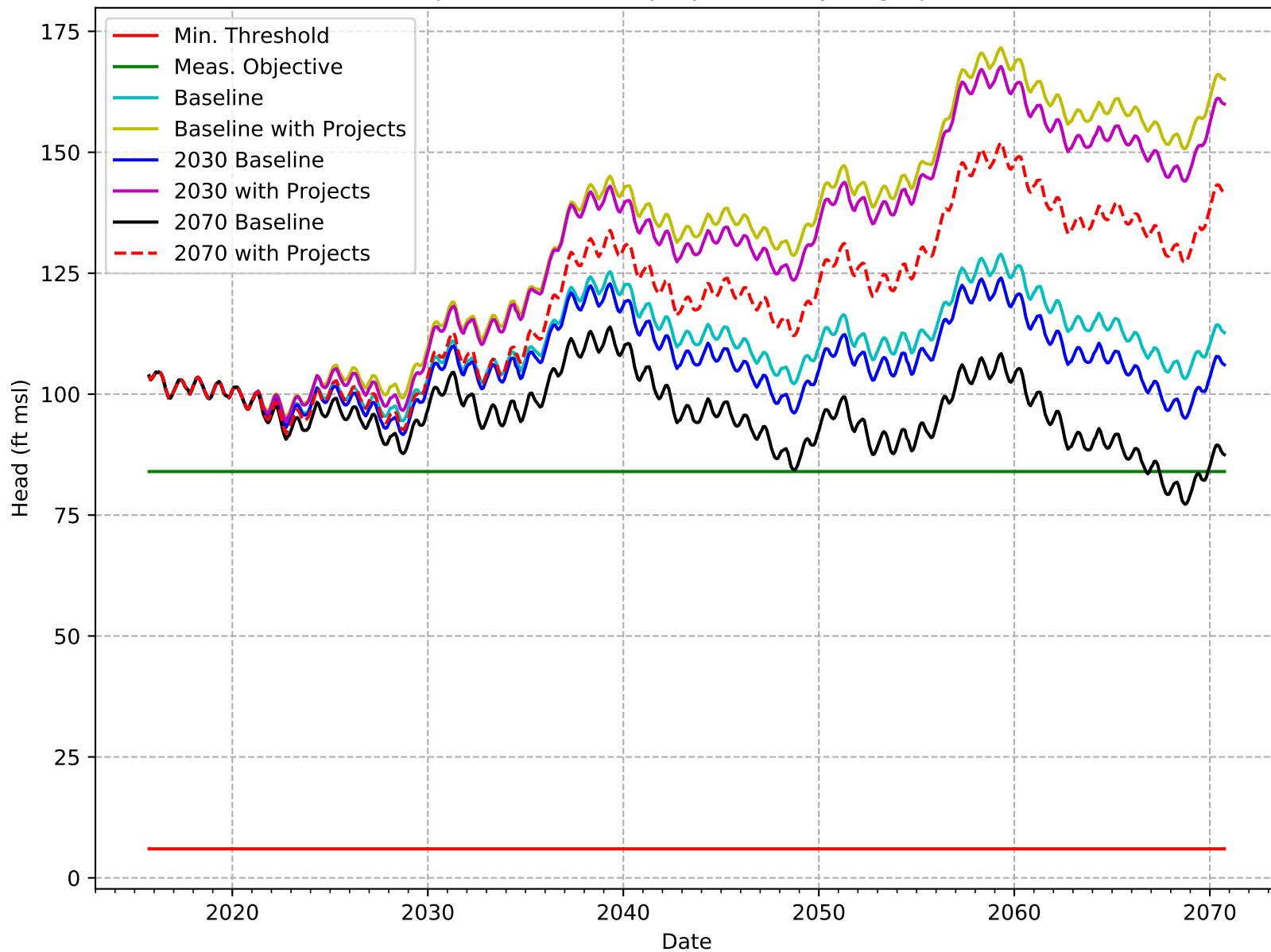
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-195-KRGSA



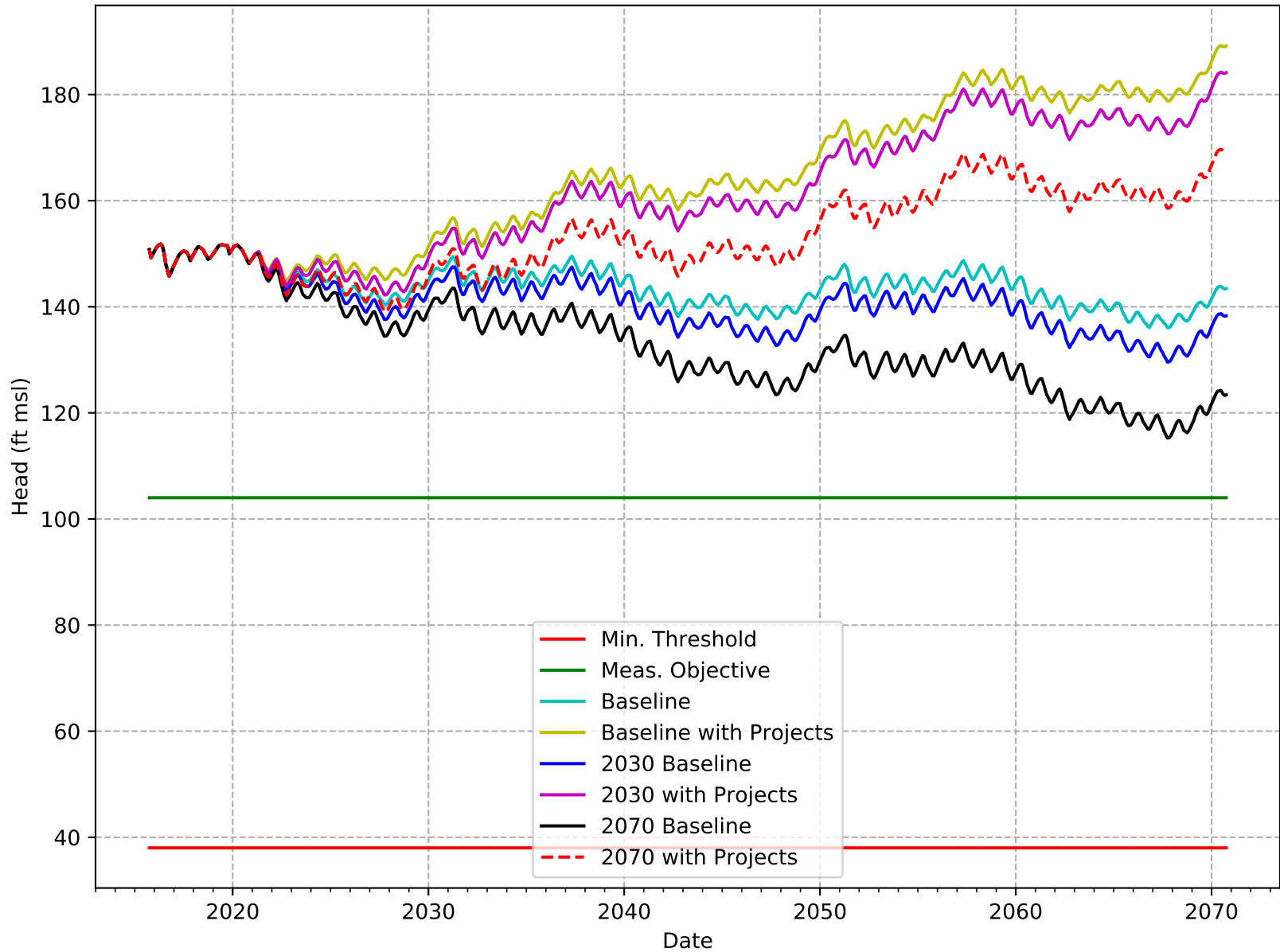
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-196-KRGSA



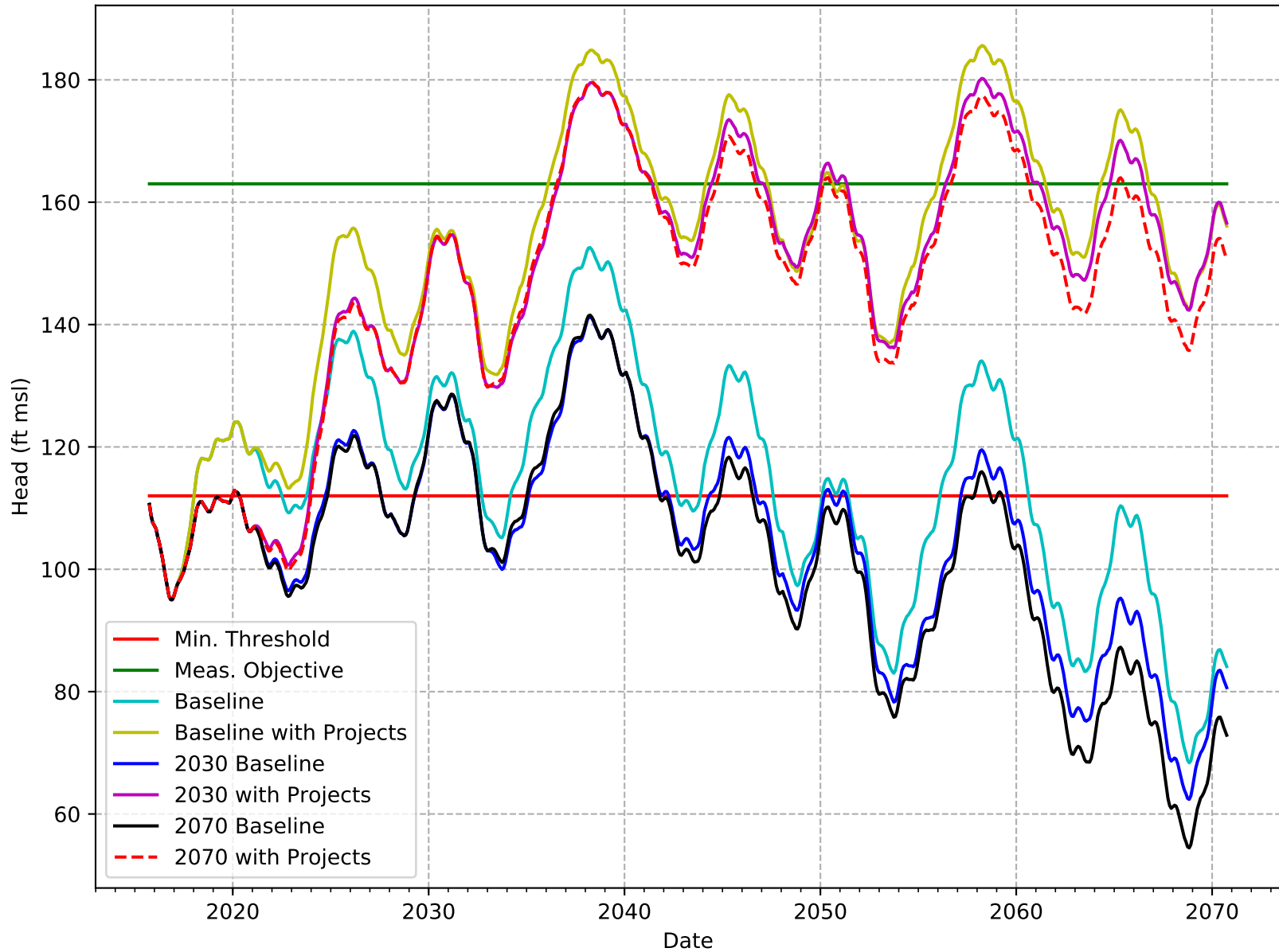
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-197-KRGSA



C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-200-KRGSA

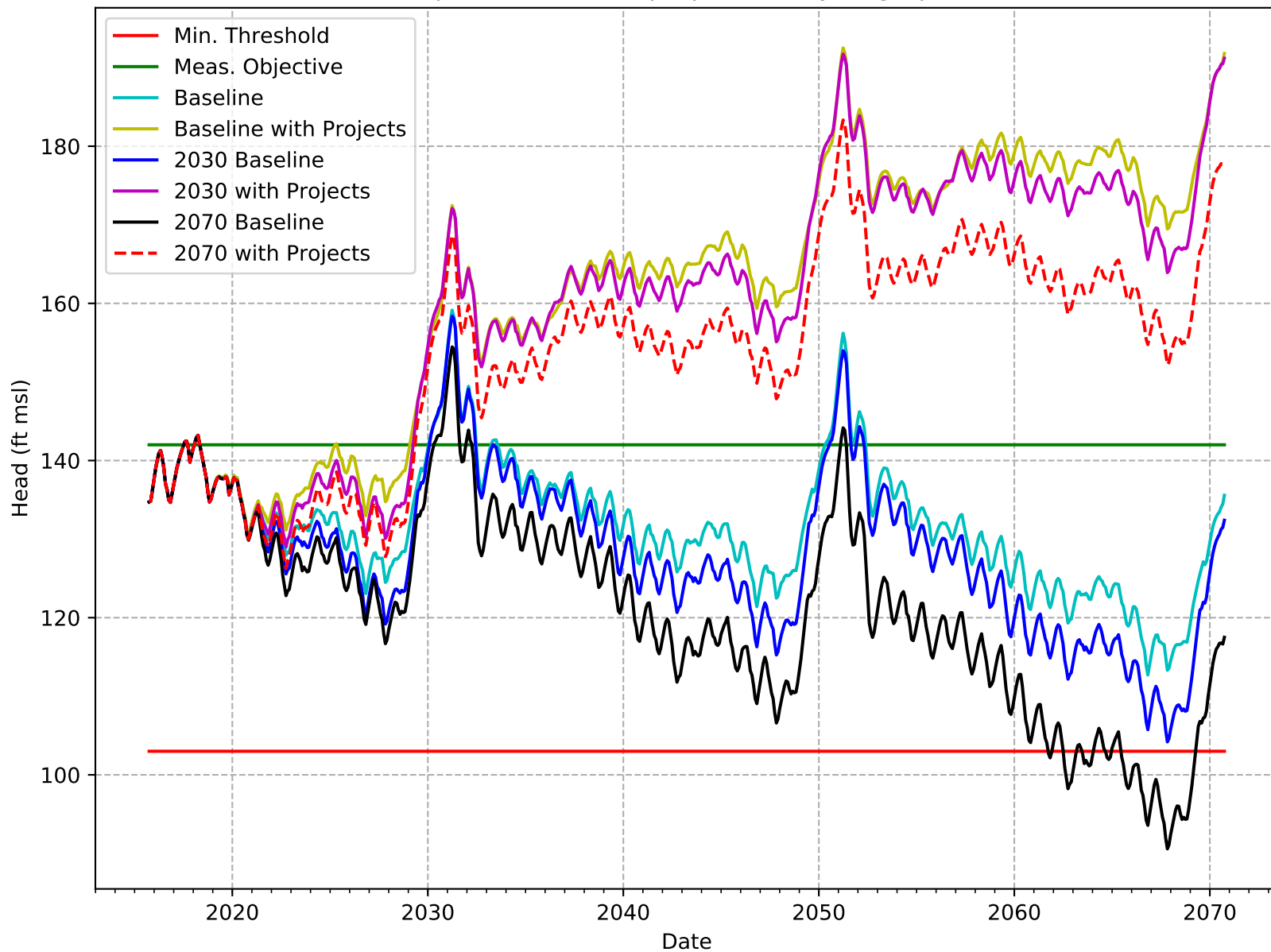


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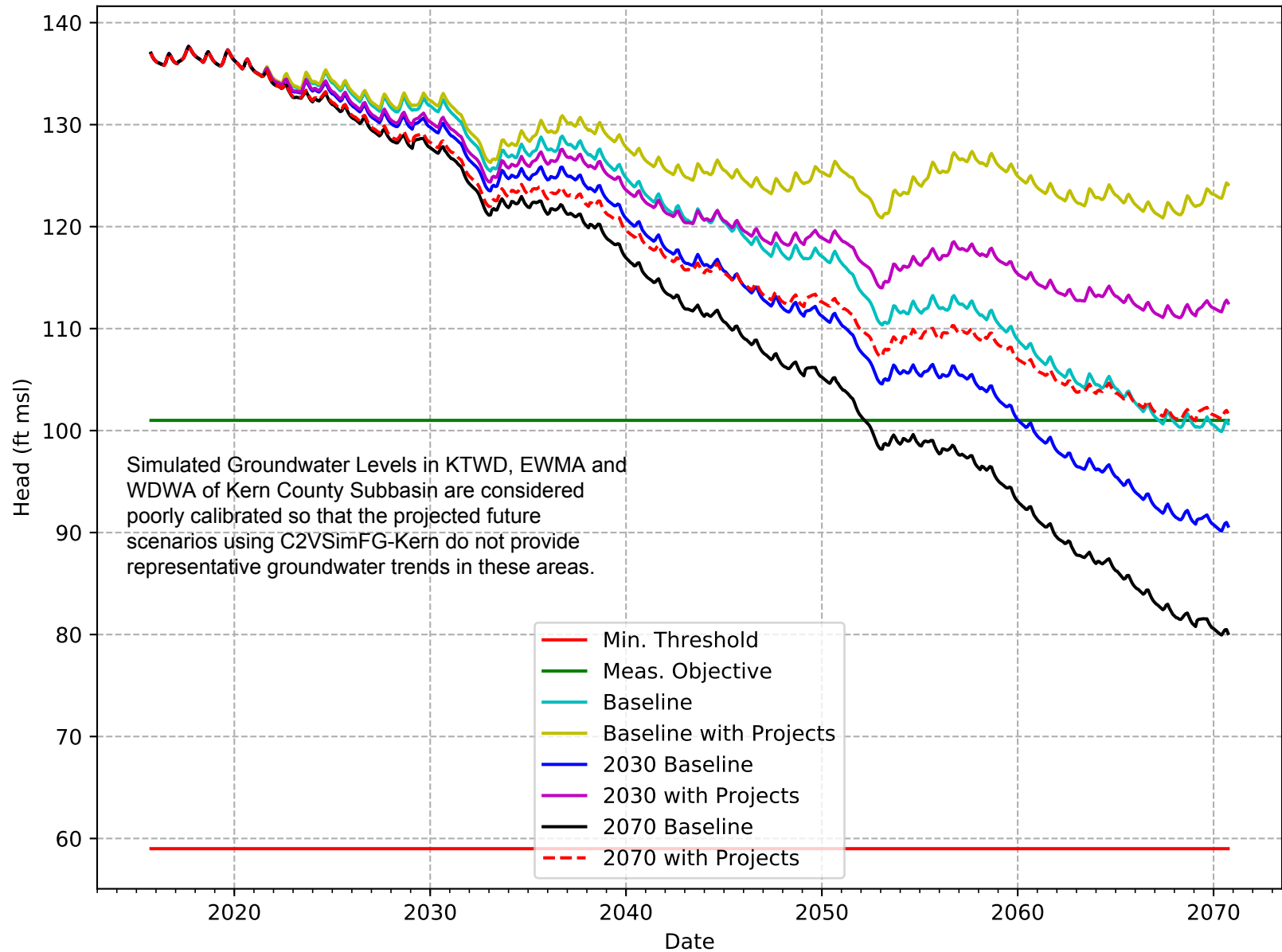




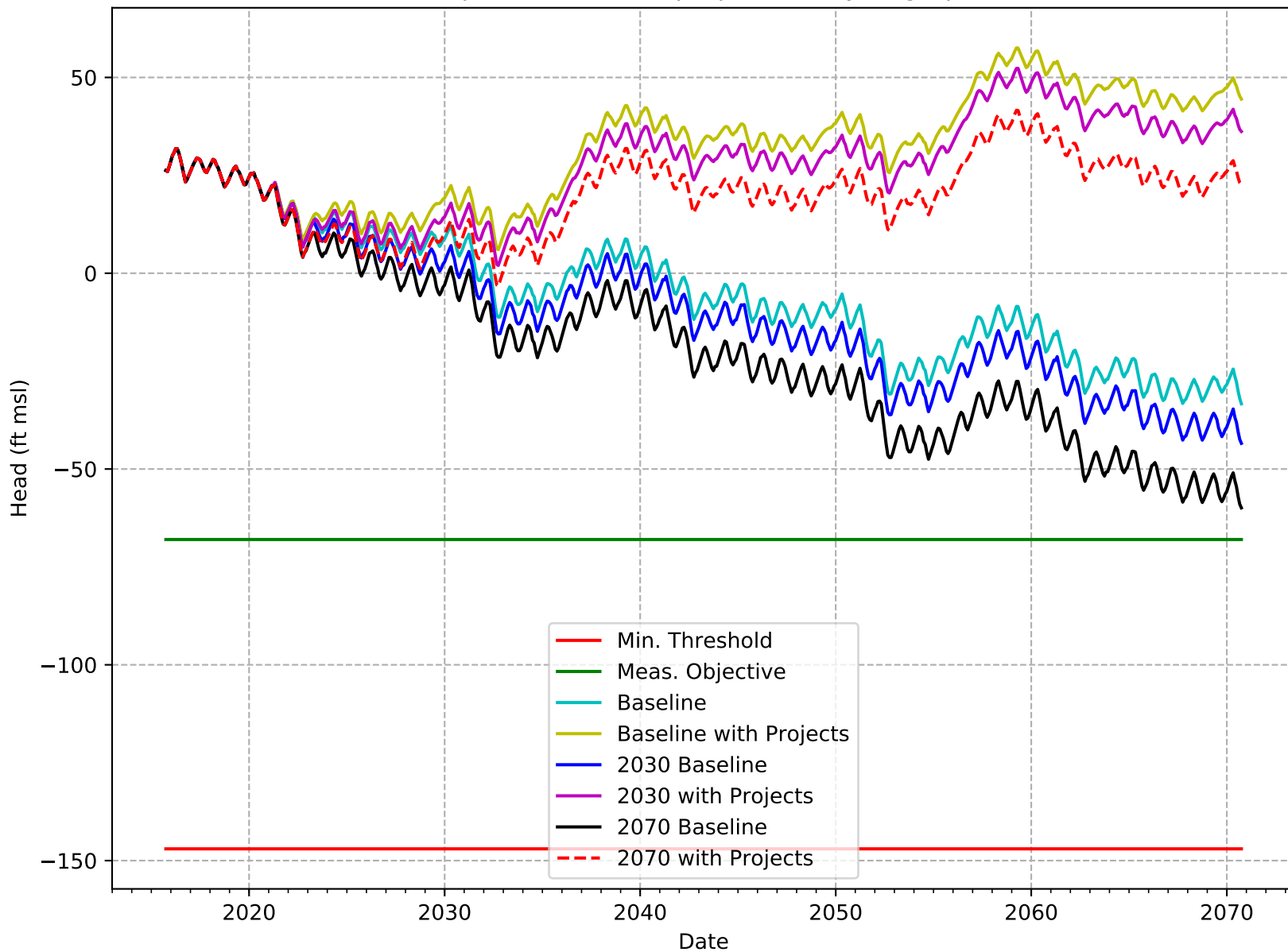
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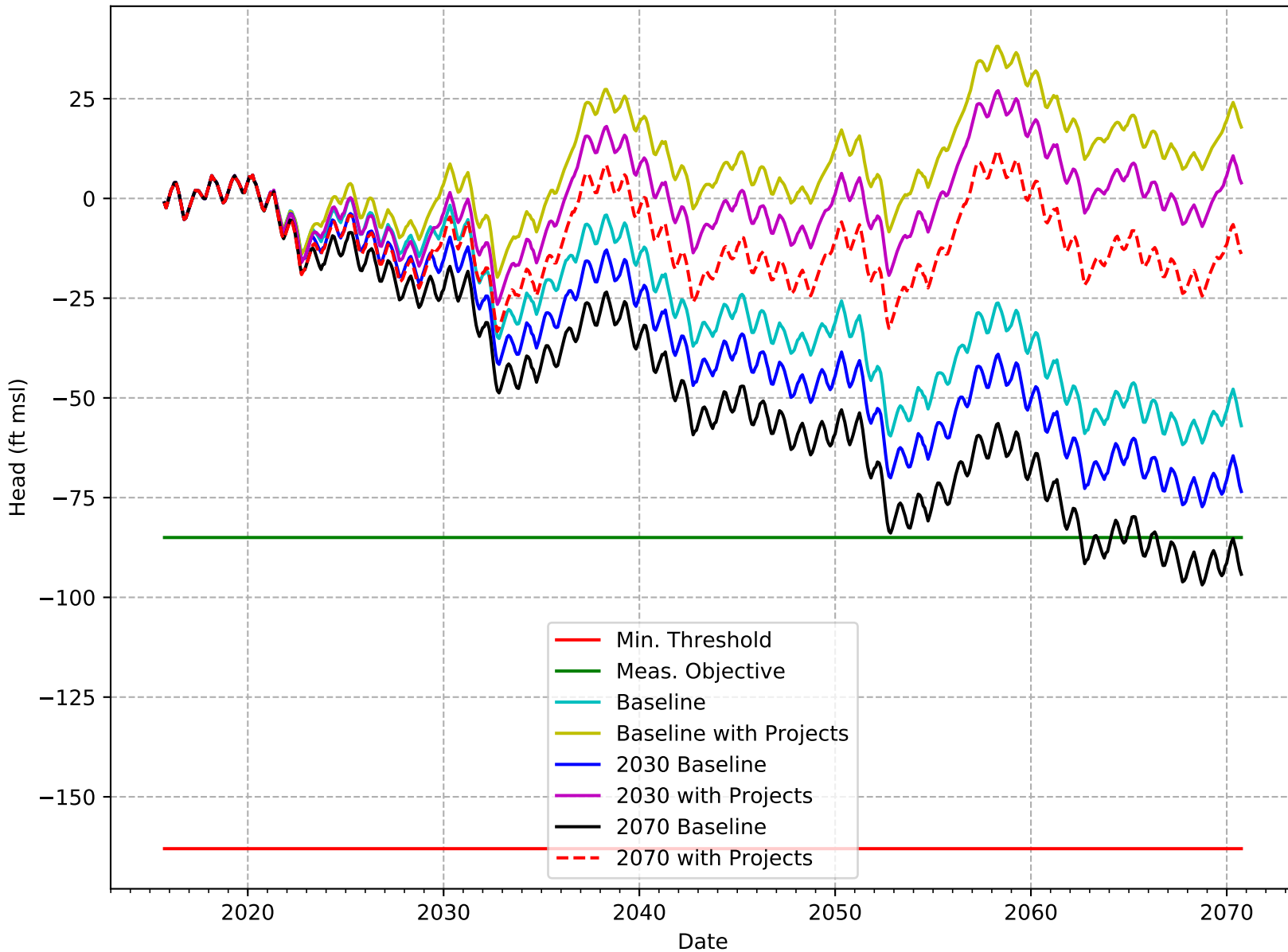
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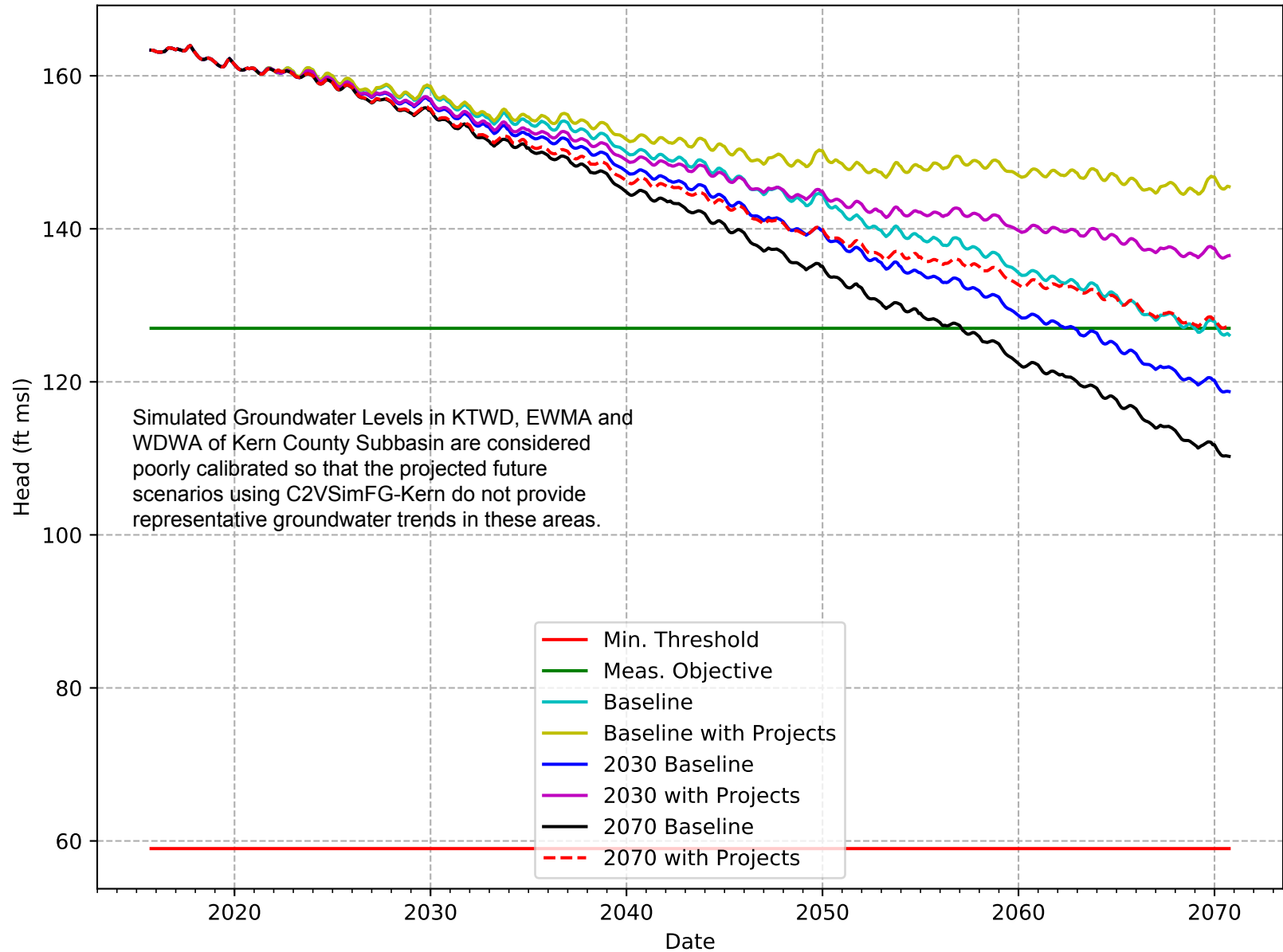
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-204-SWID



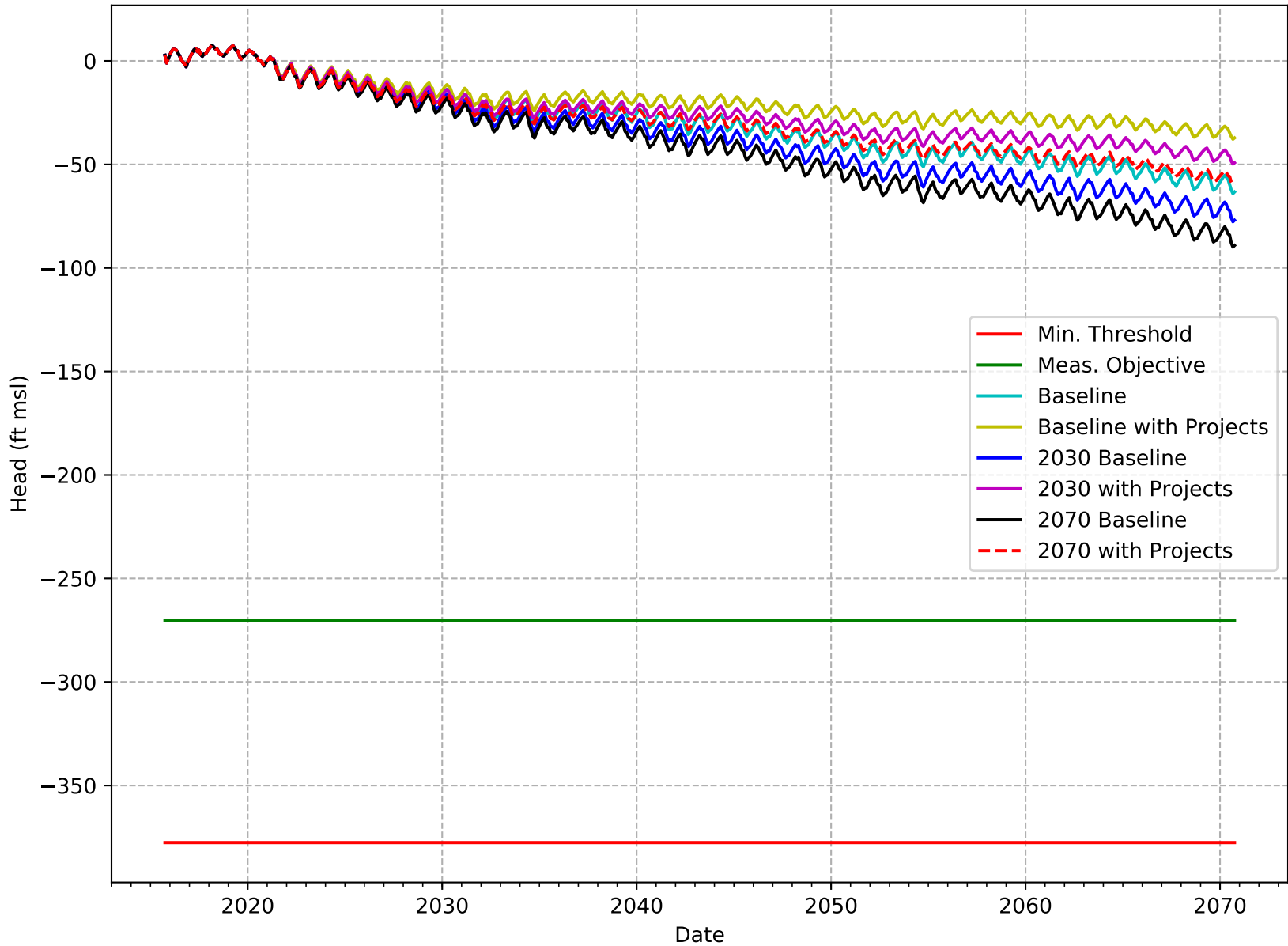
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-205-SWID



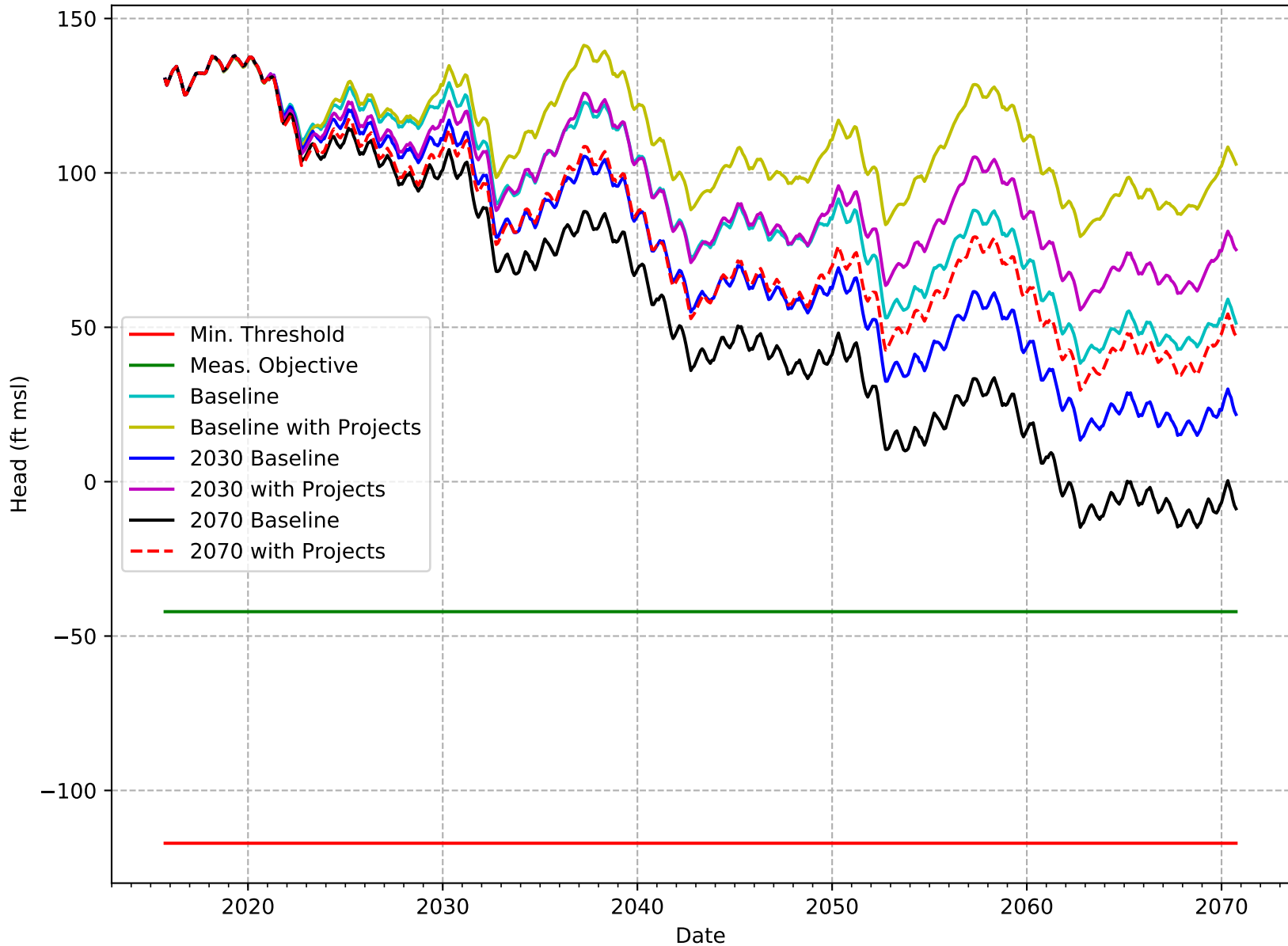
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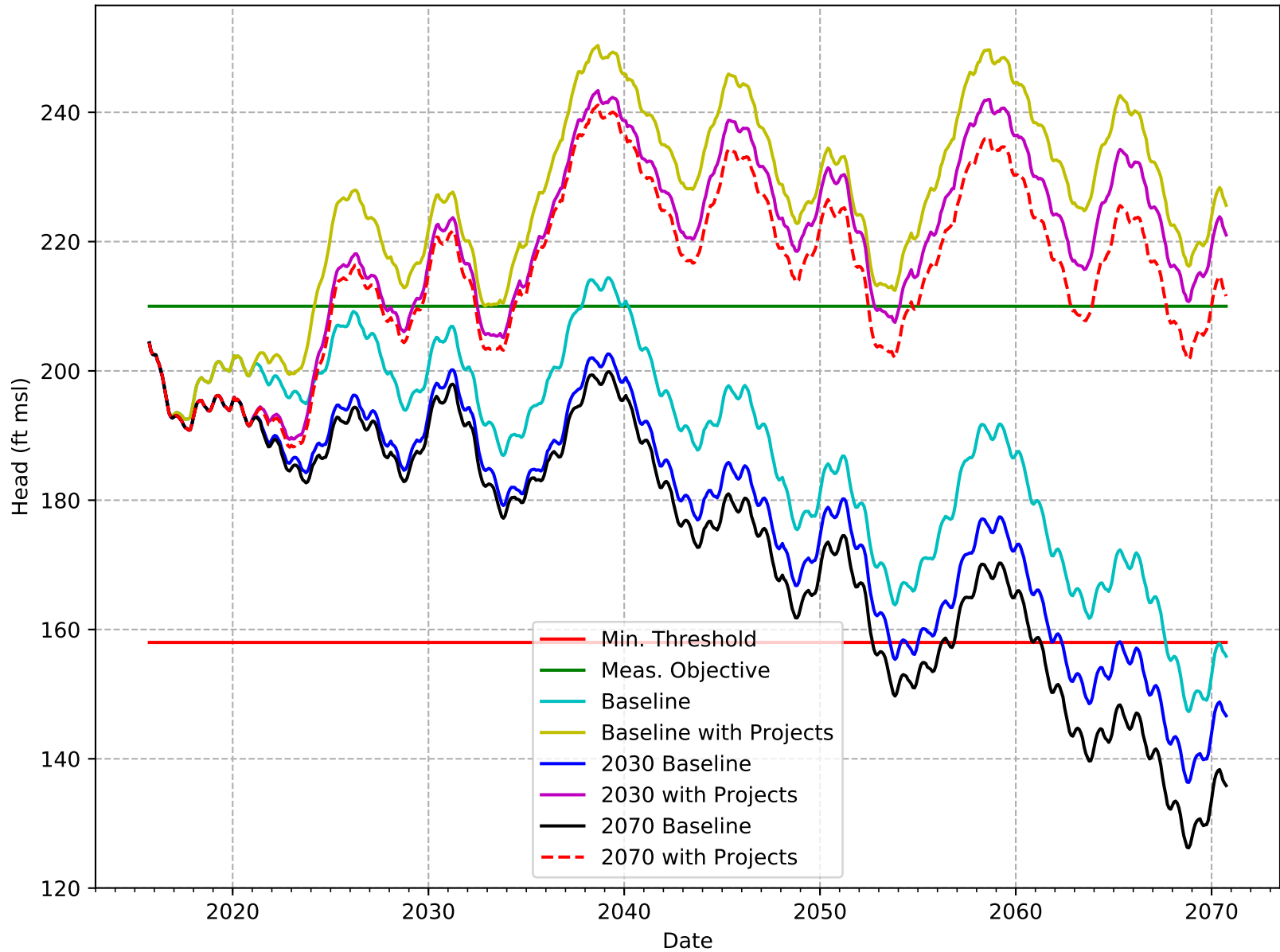
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-207-SWSD



C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-208-SSJMUD

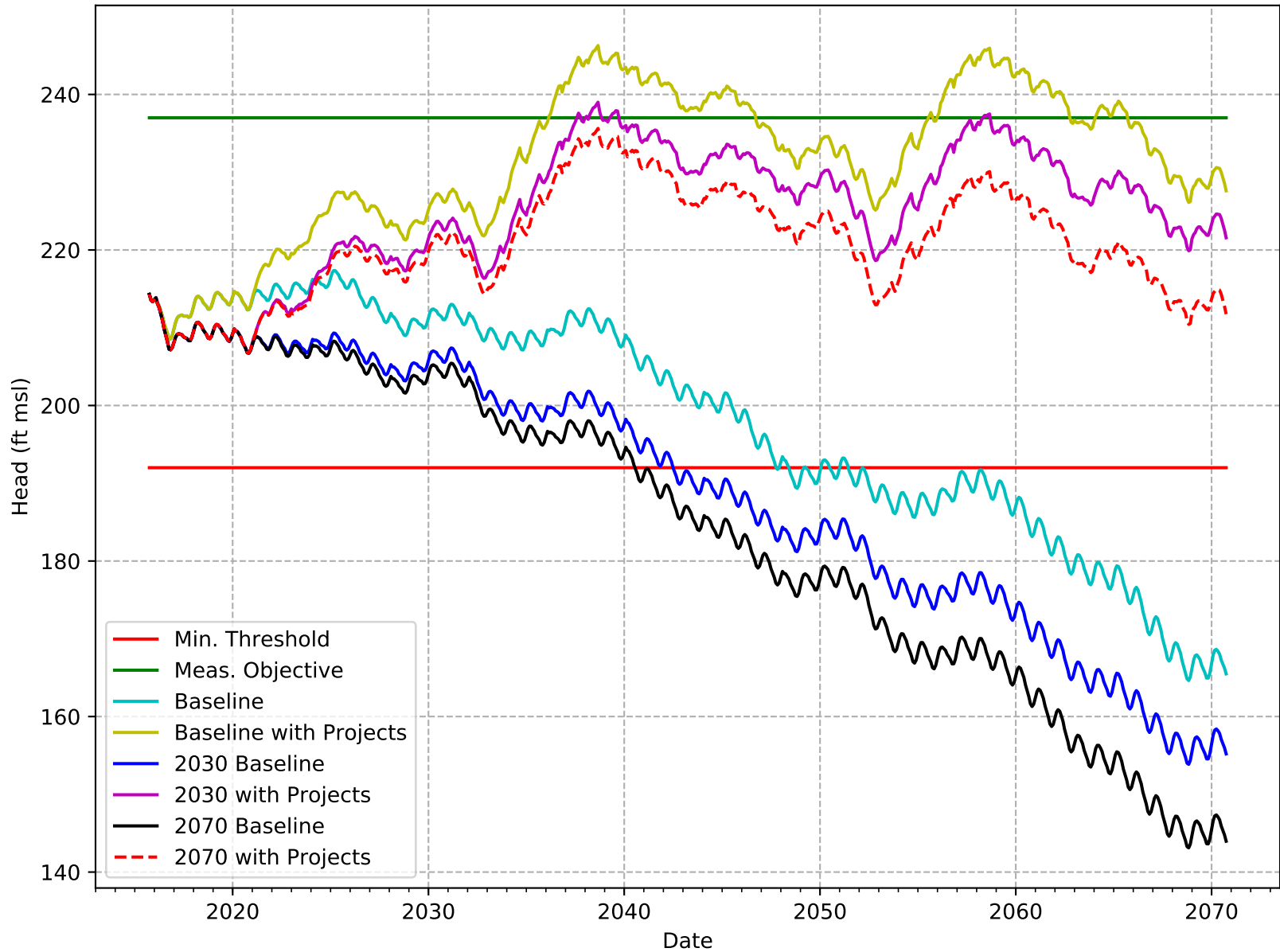


C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-209-KRGSA

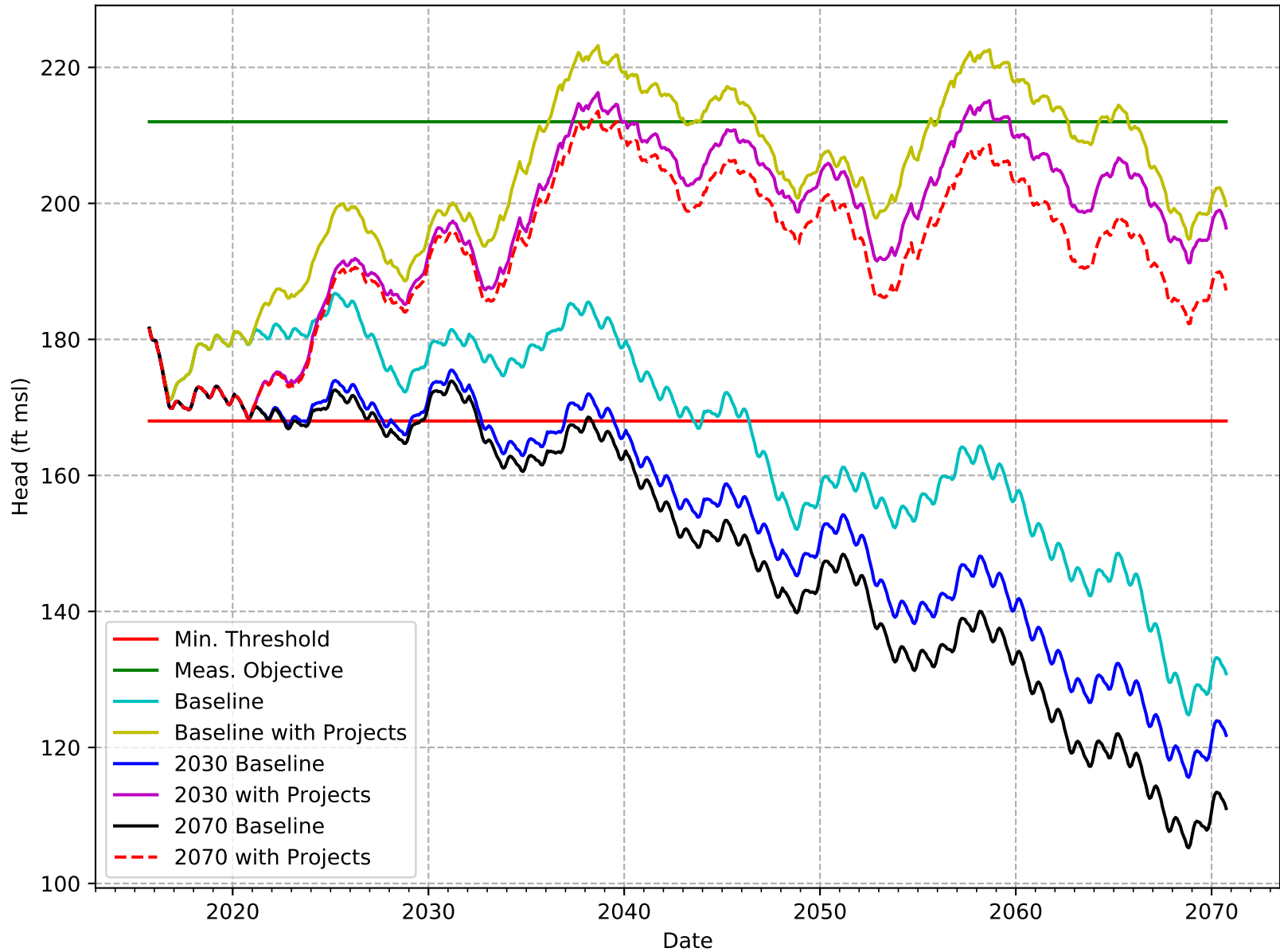




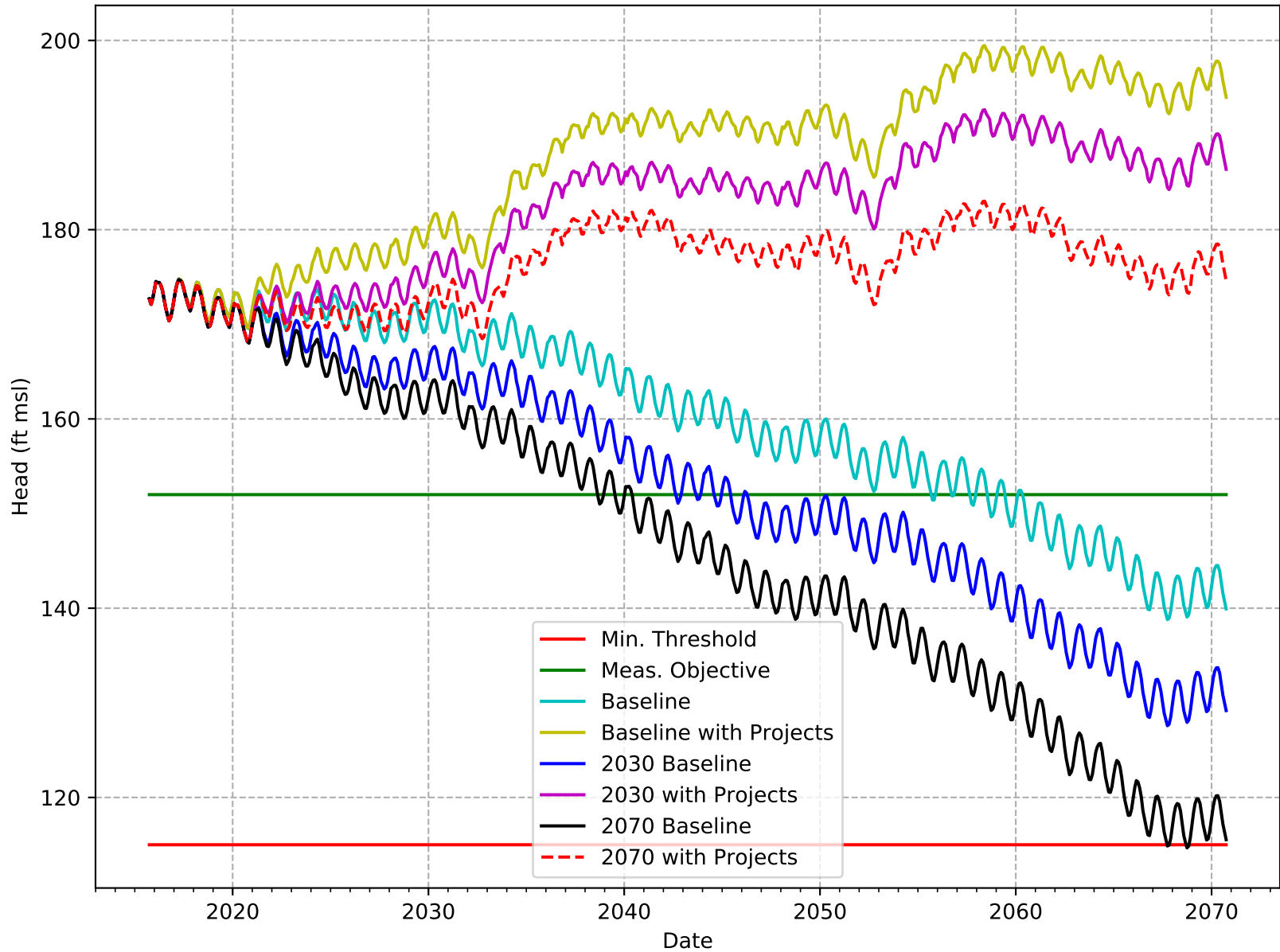
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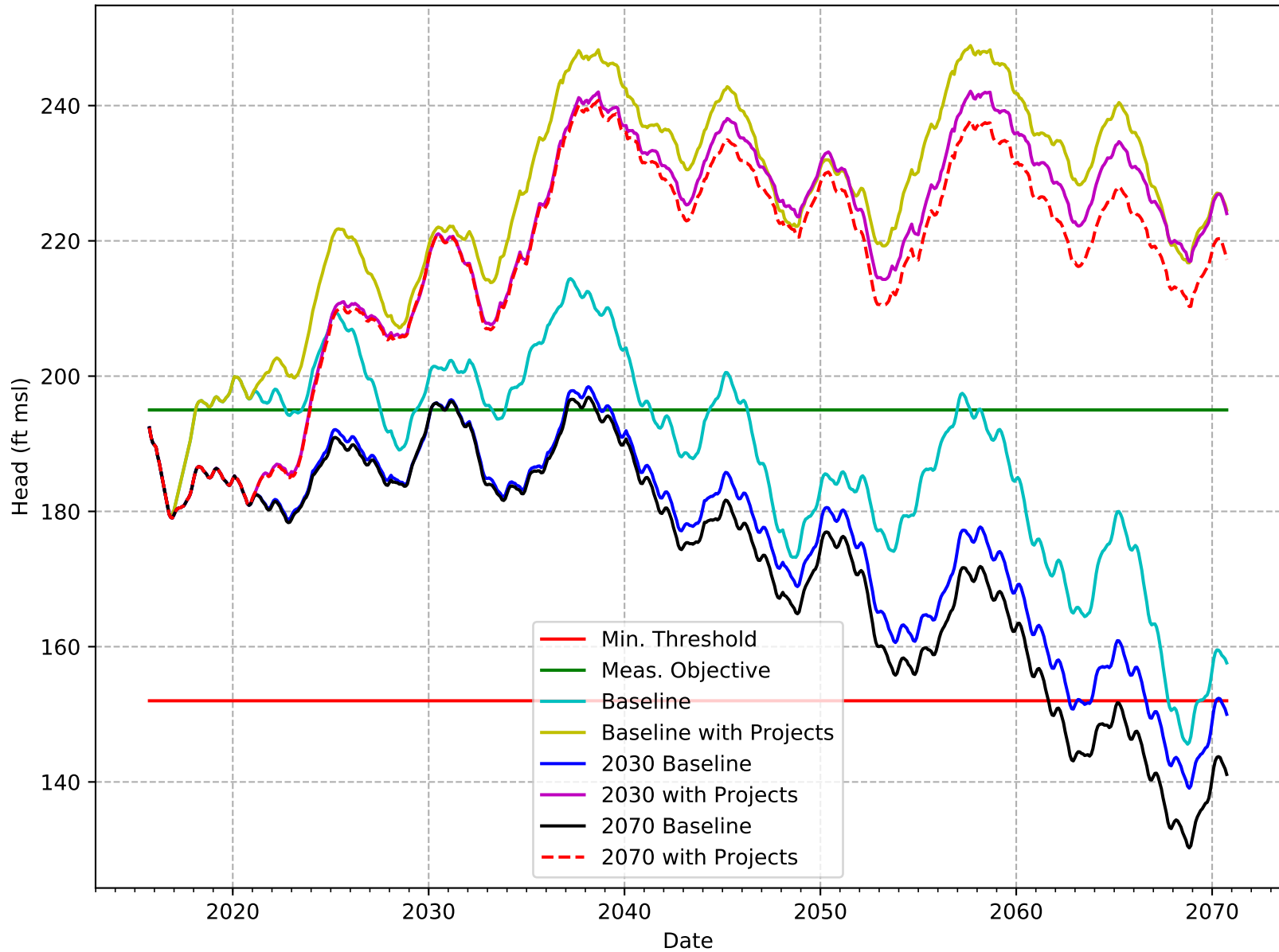
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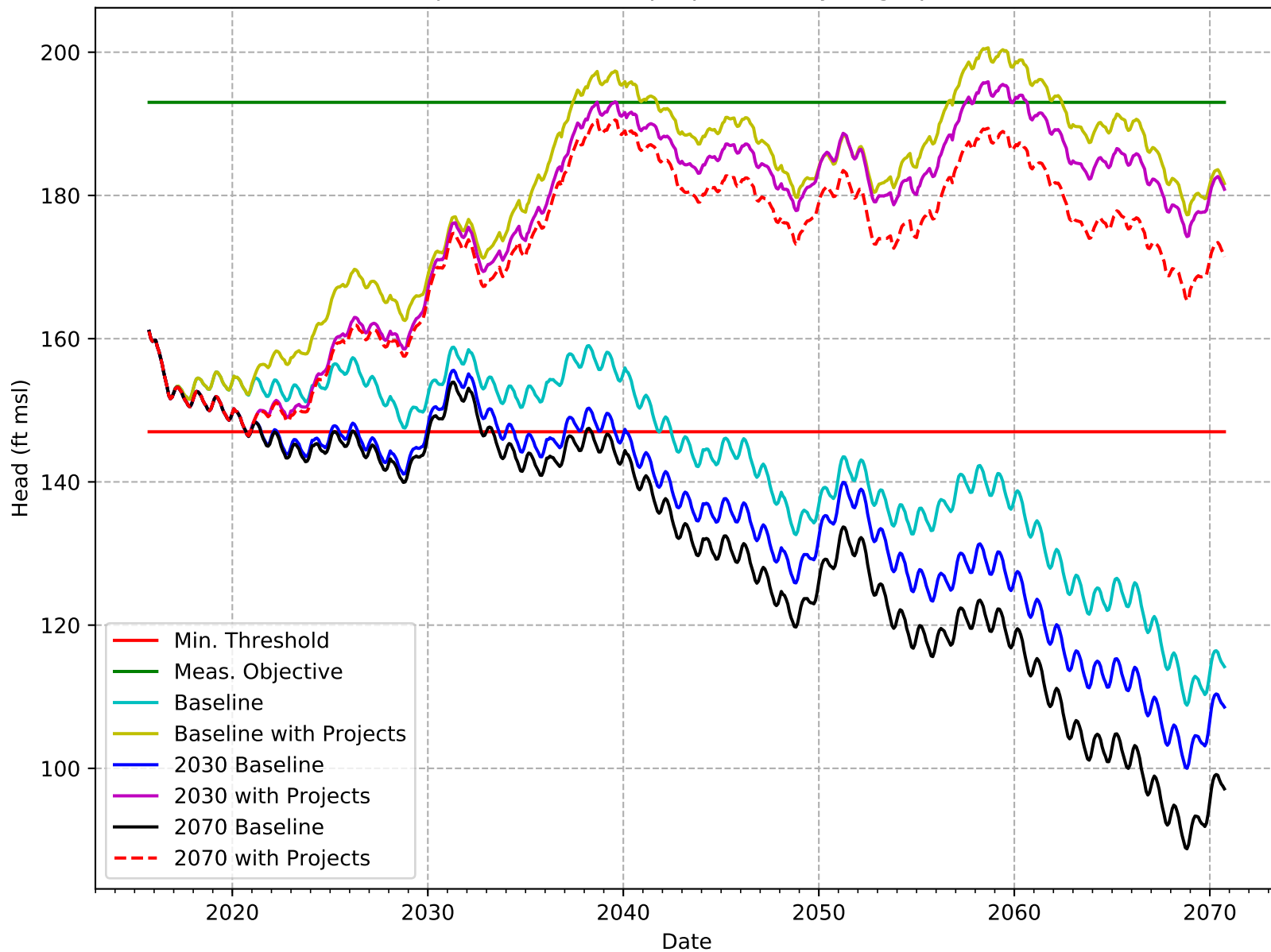
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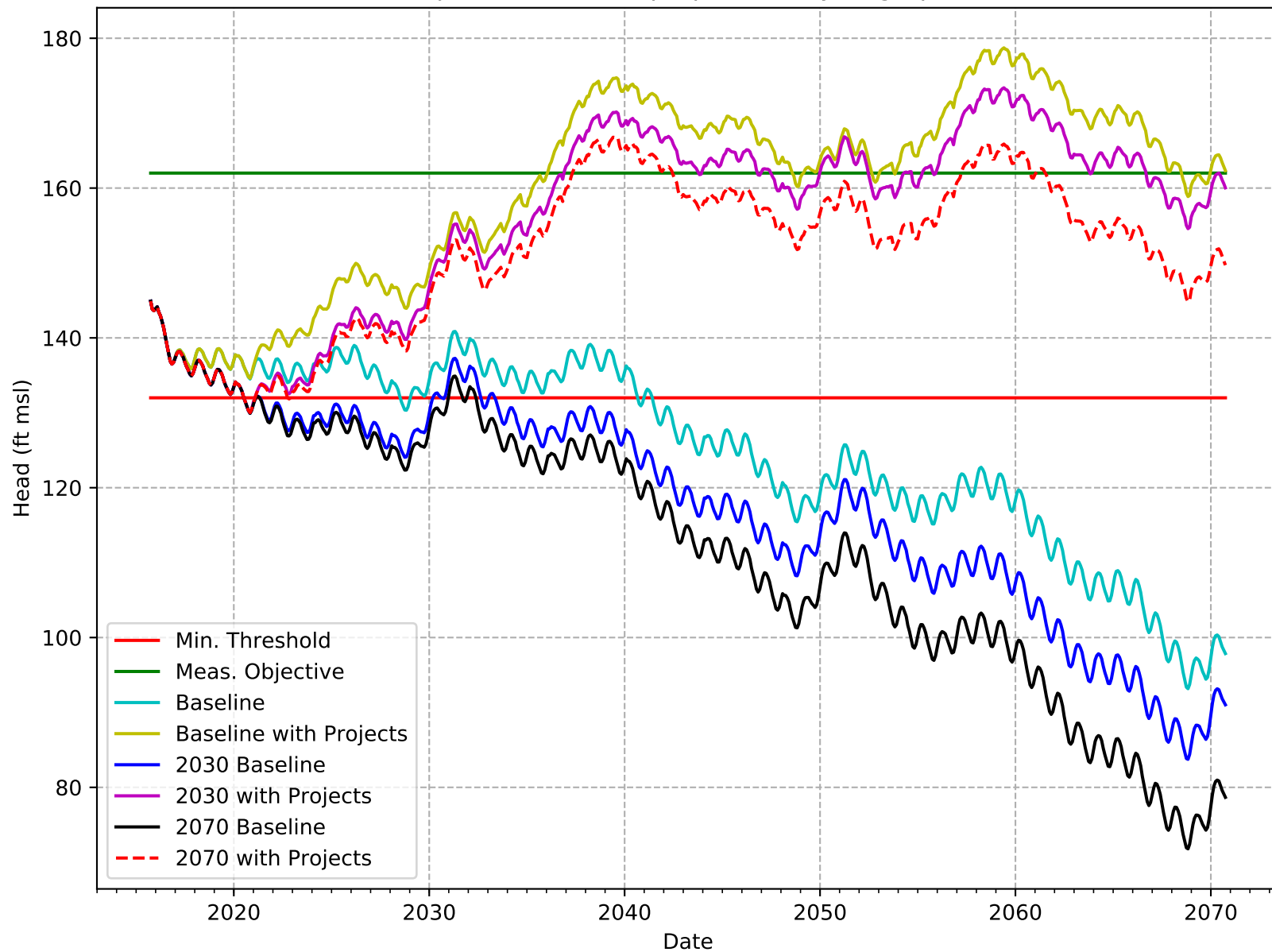
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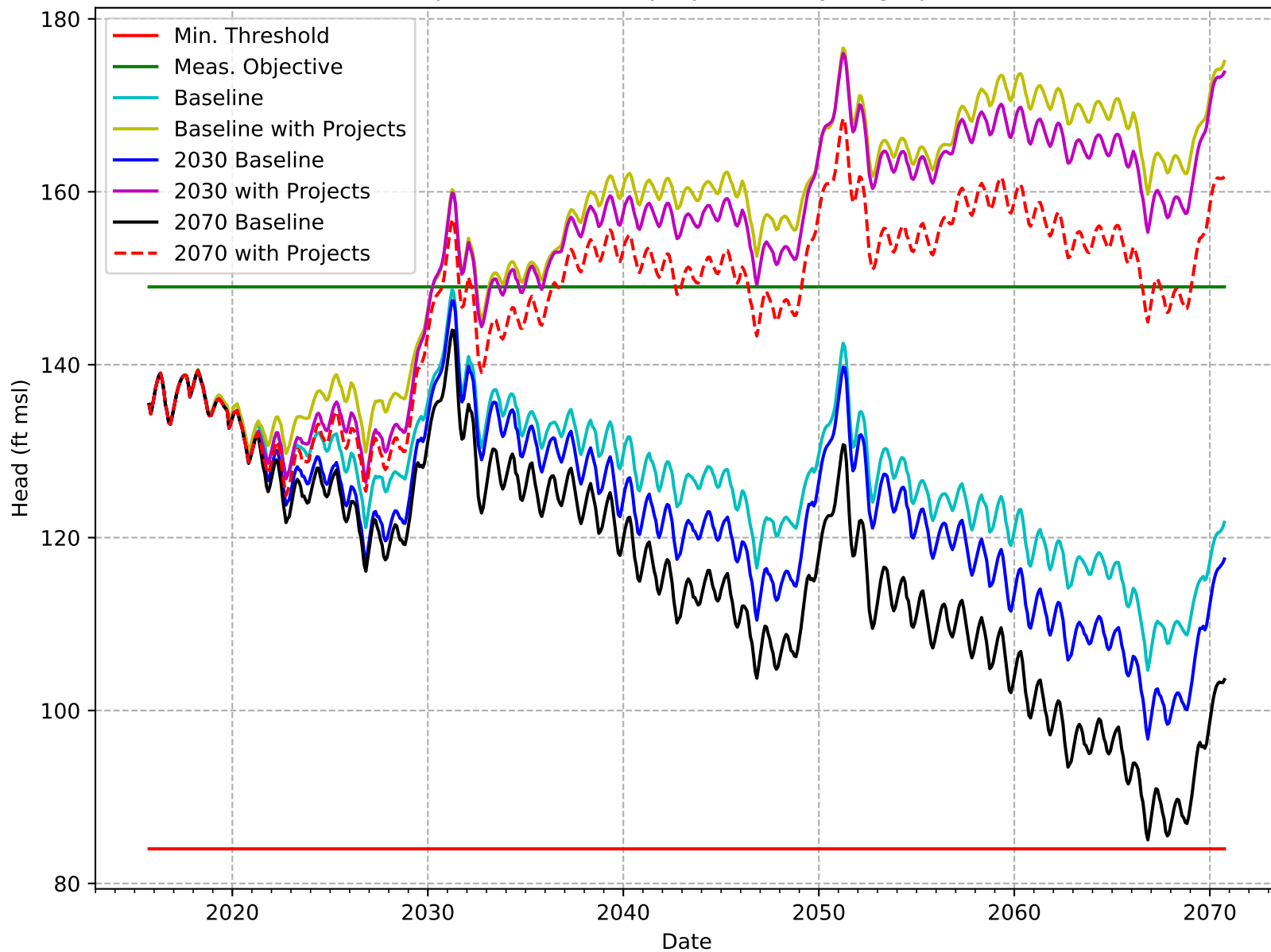
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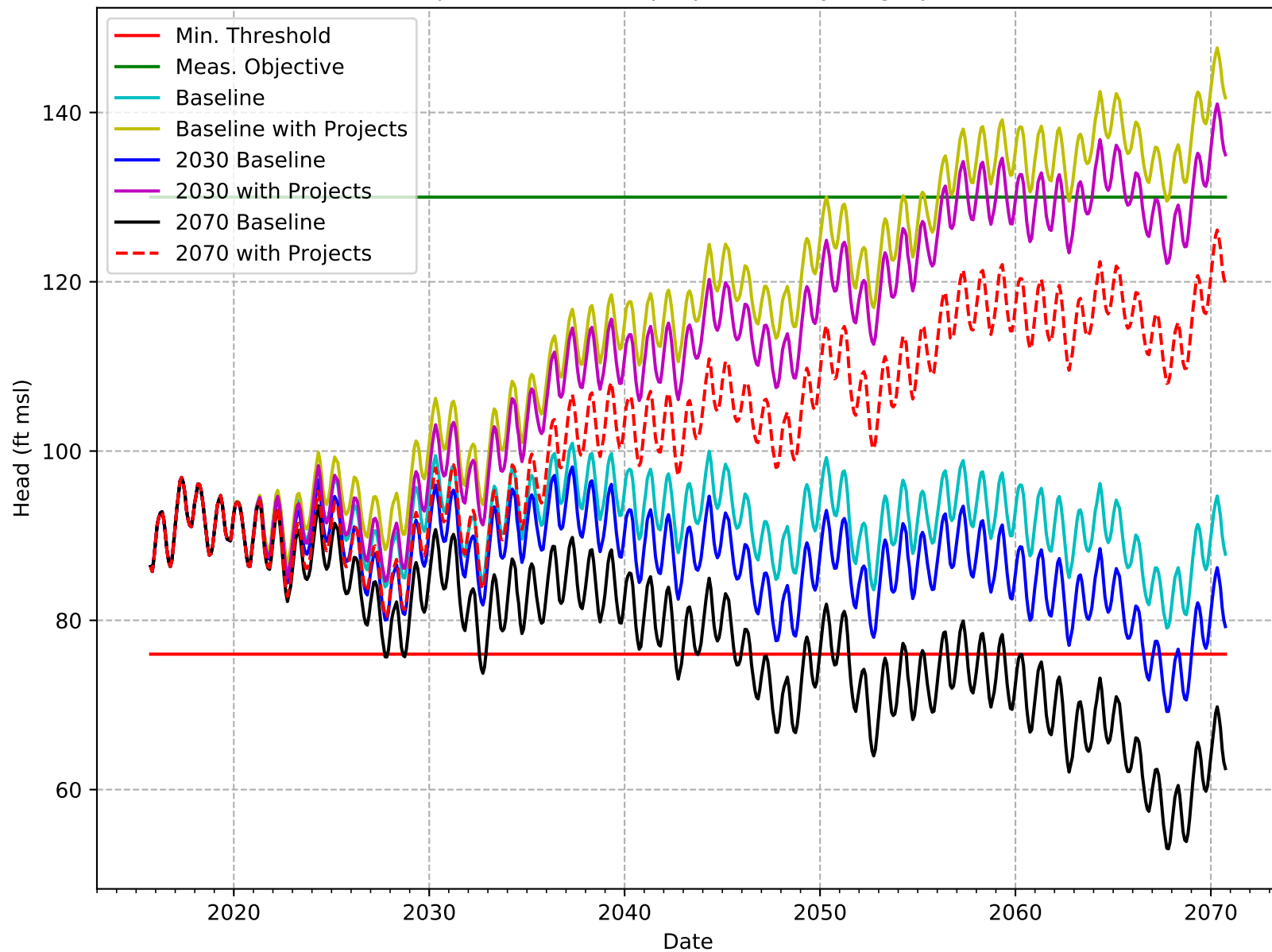
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-215-KRGSA



C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-216-KRGSA

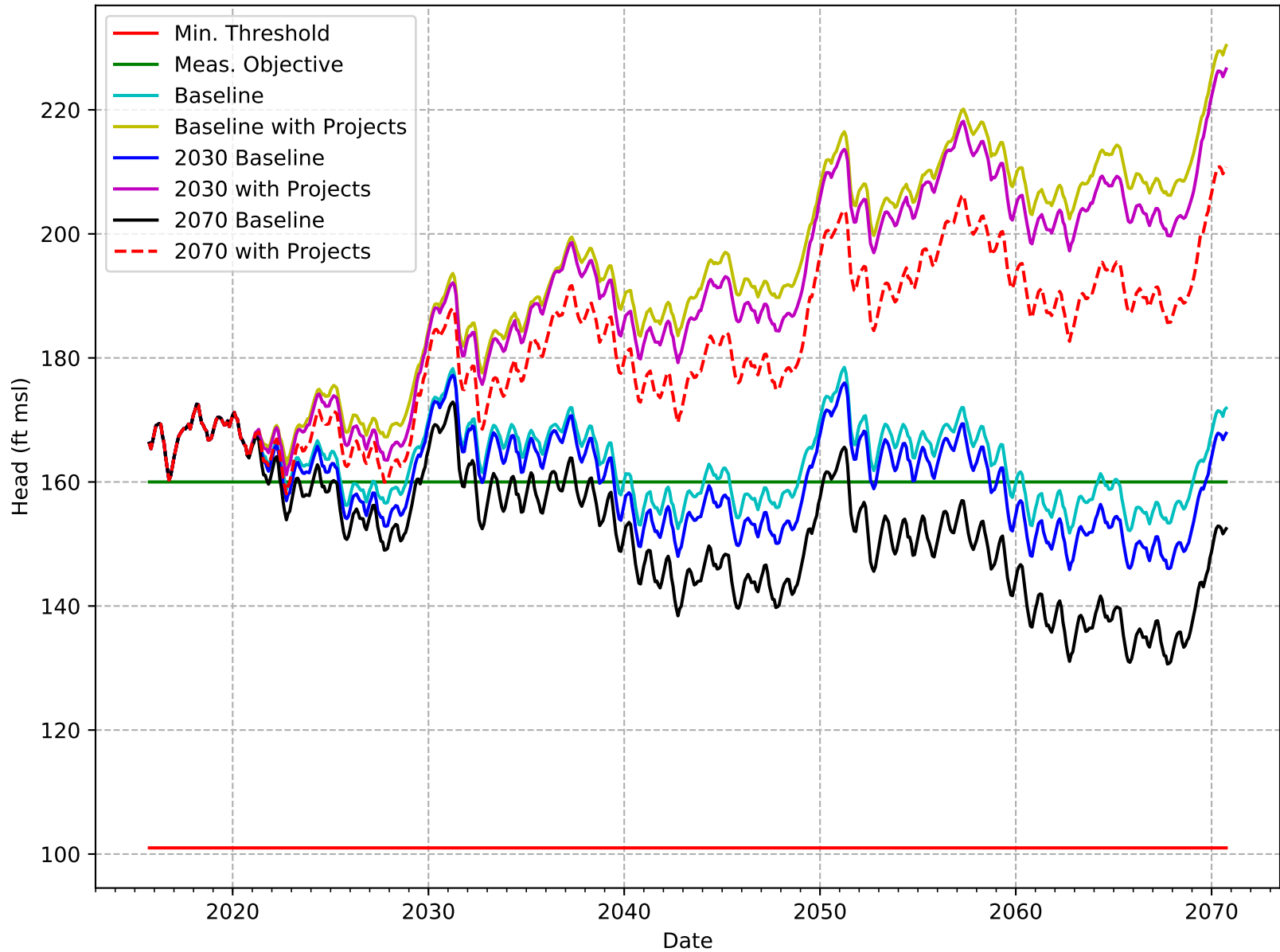


C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-217-KRGSA

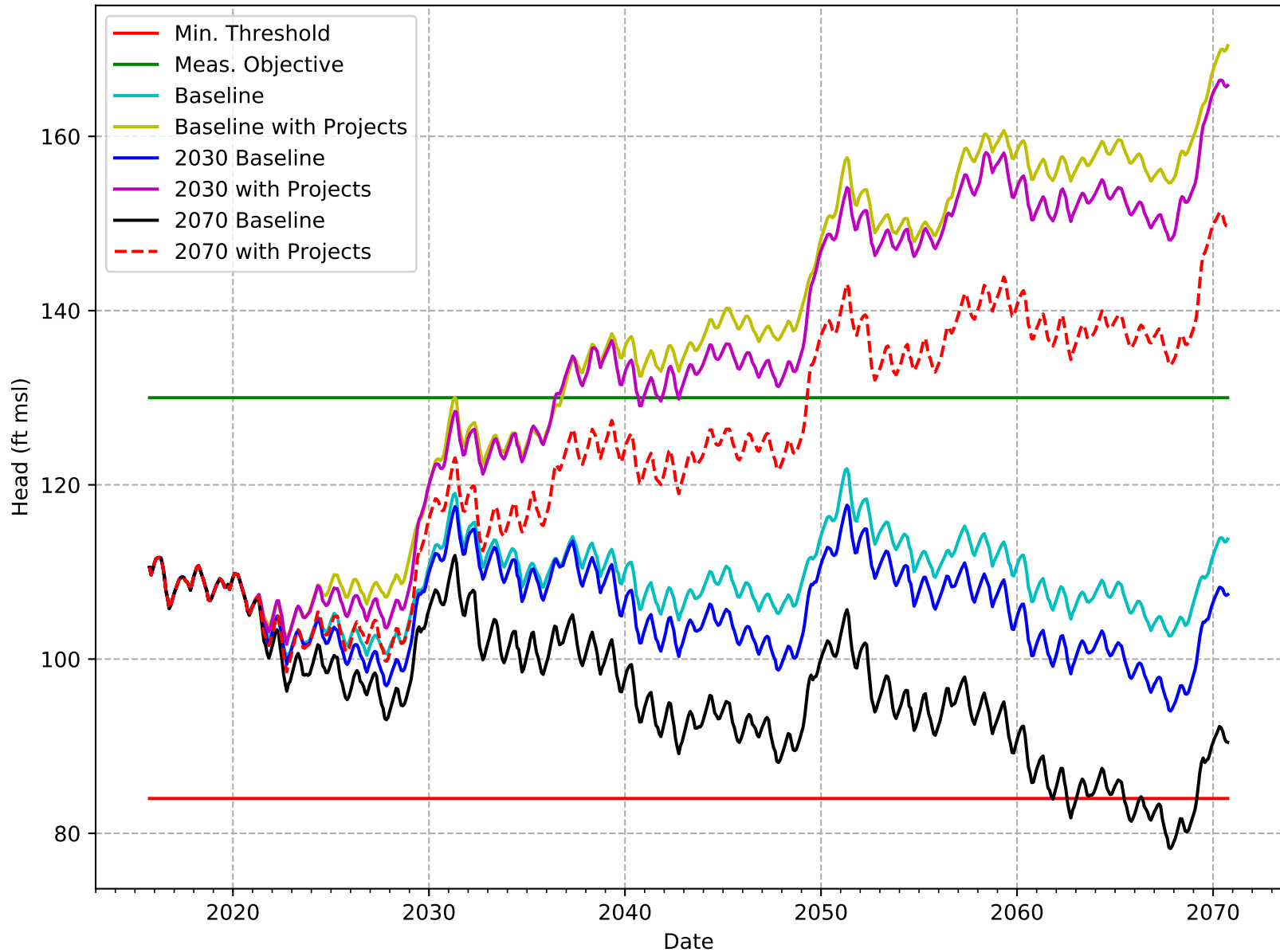




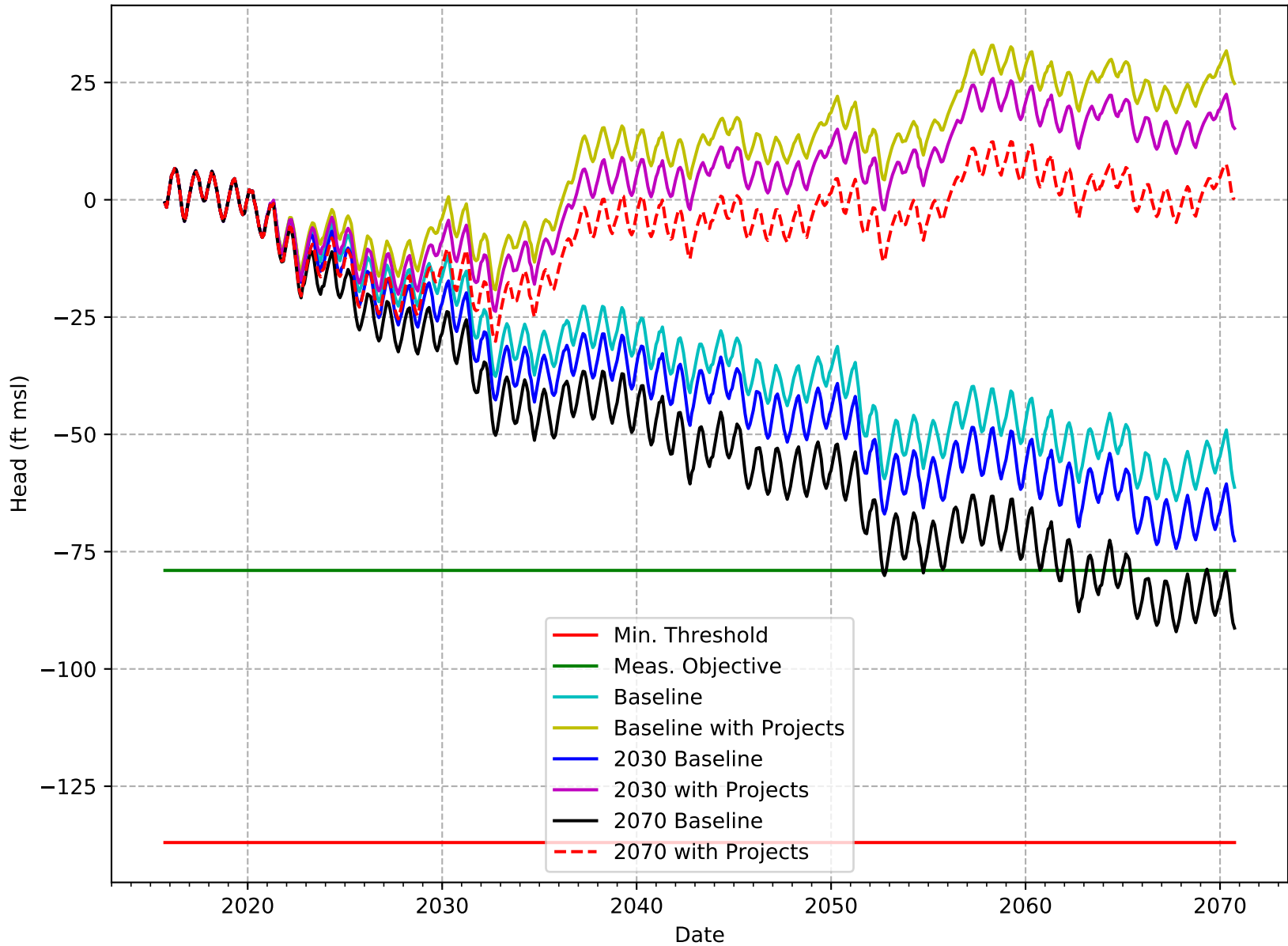
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-218-KRGSA



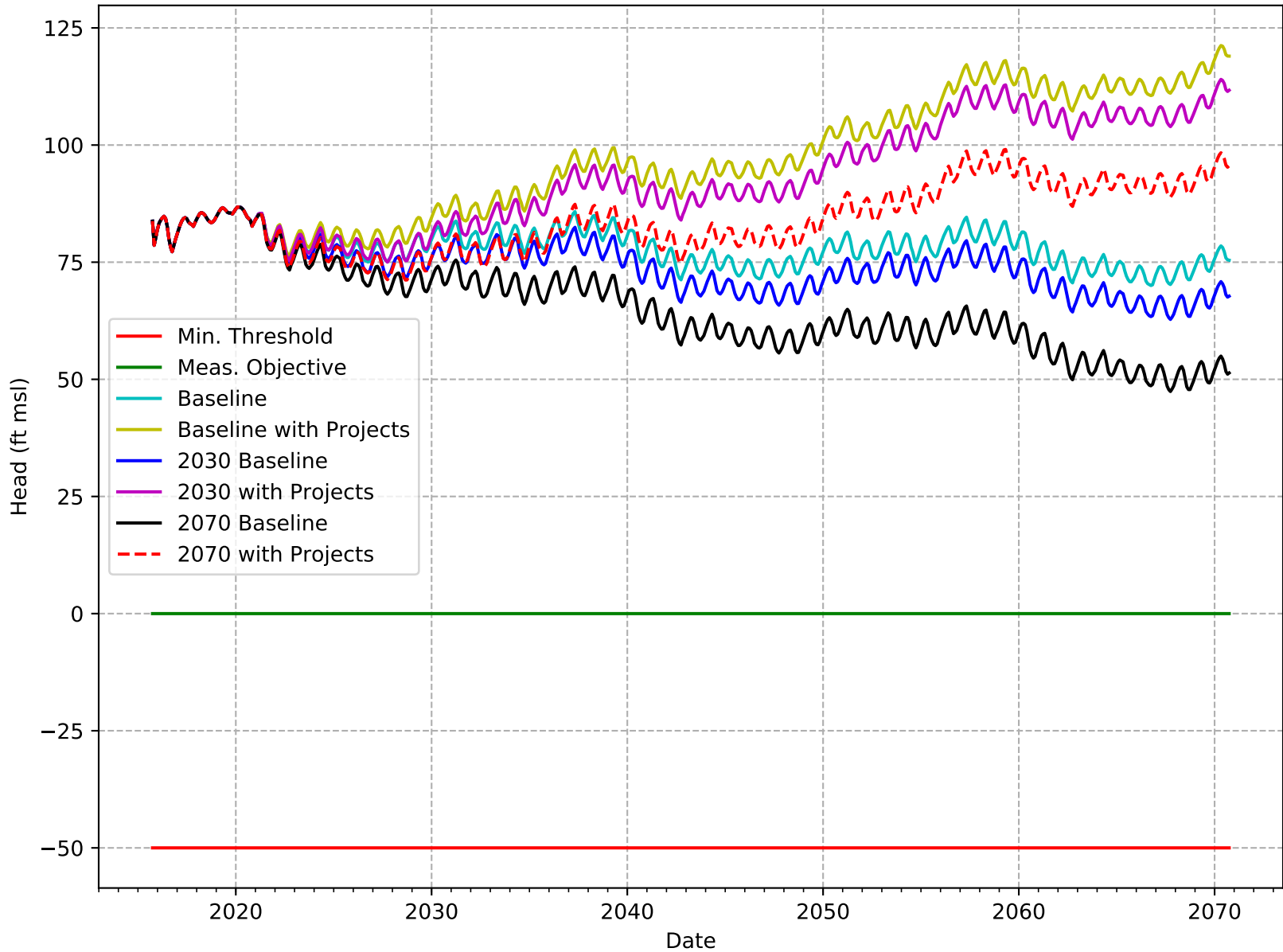
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-219-KRGSA



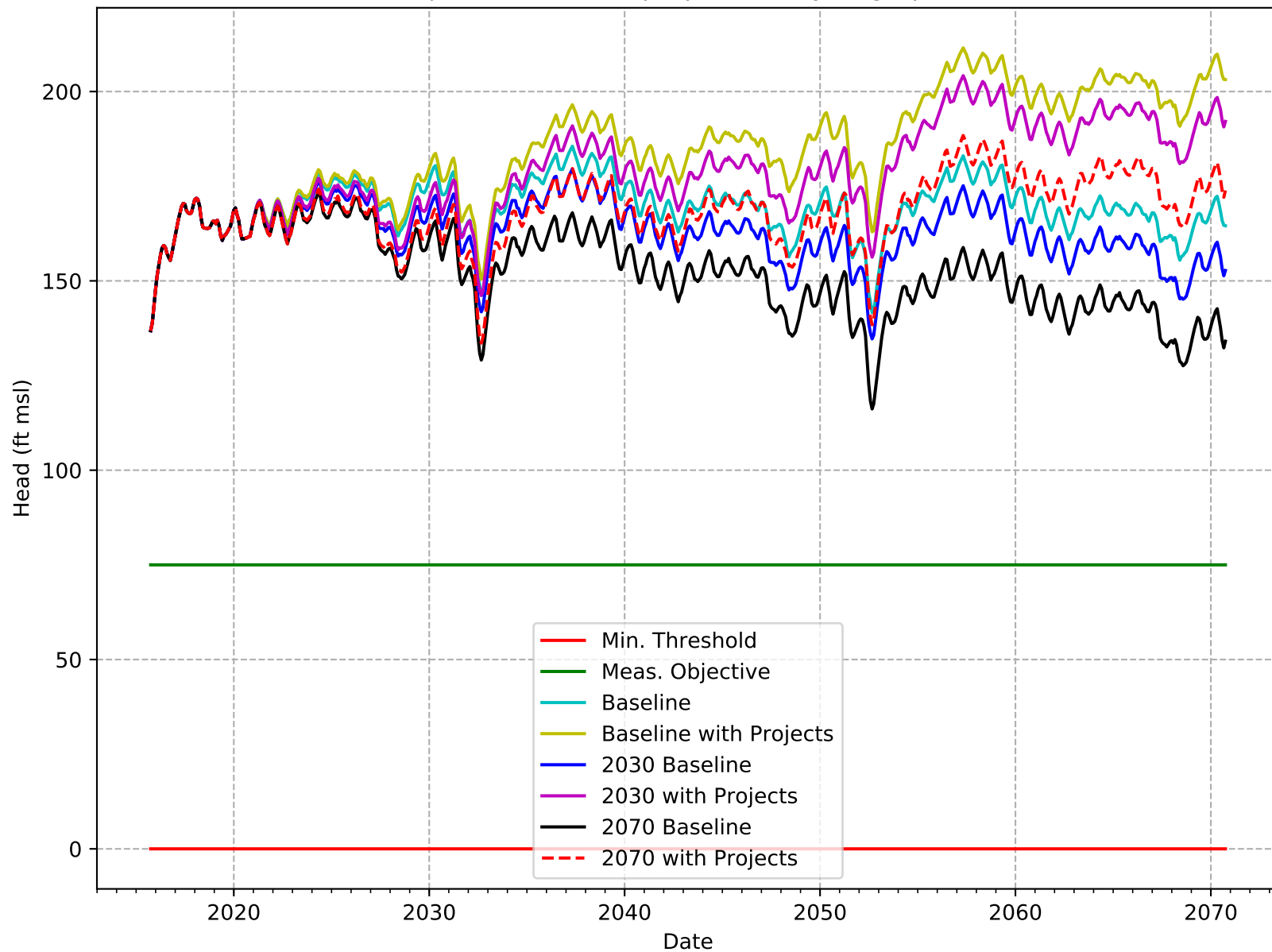
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-230-7TH-STD



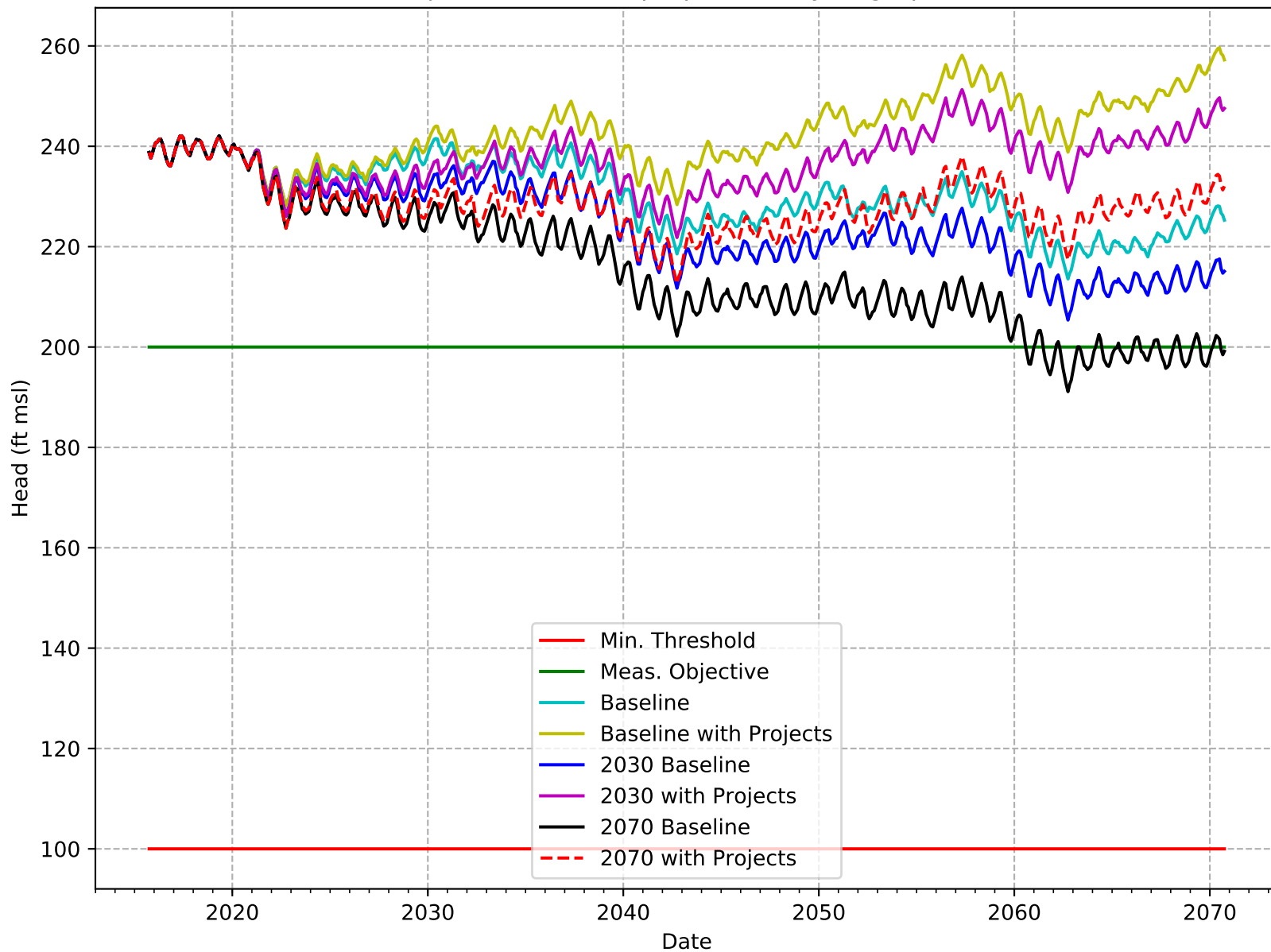
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-231-WRWSD



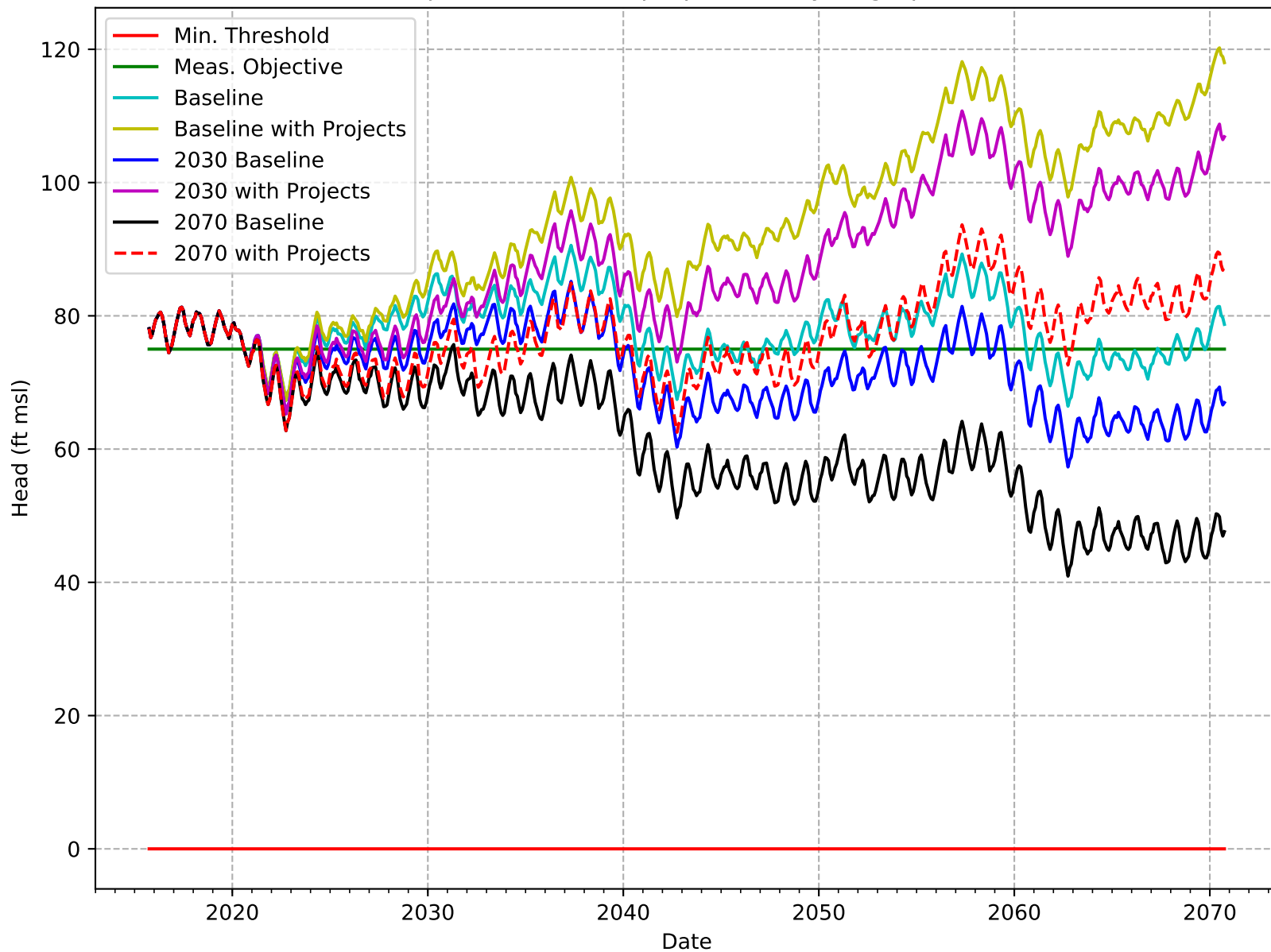
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-232-WRWSD



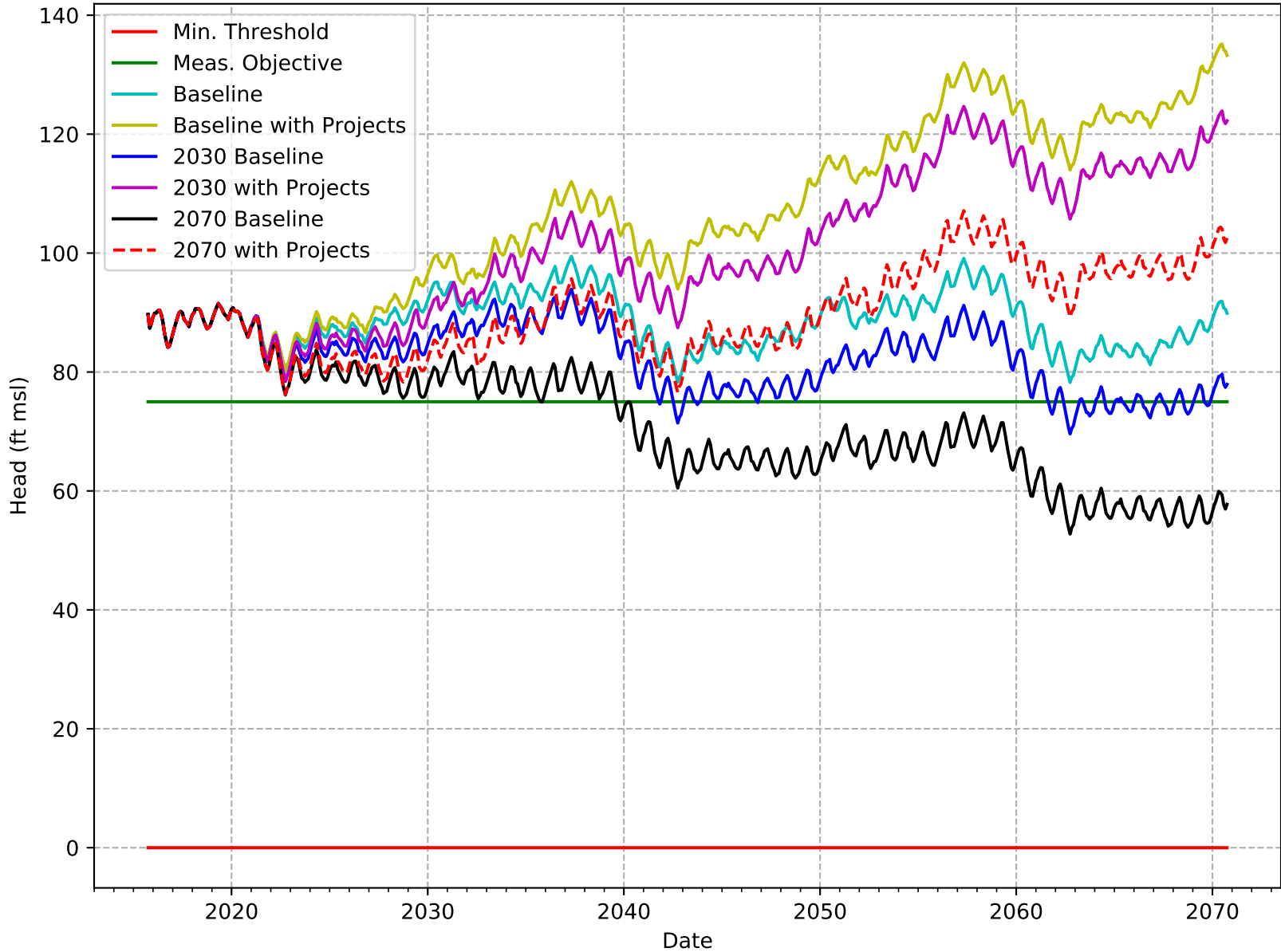
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-233-WRWSD



C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-234-WRWSD

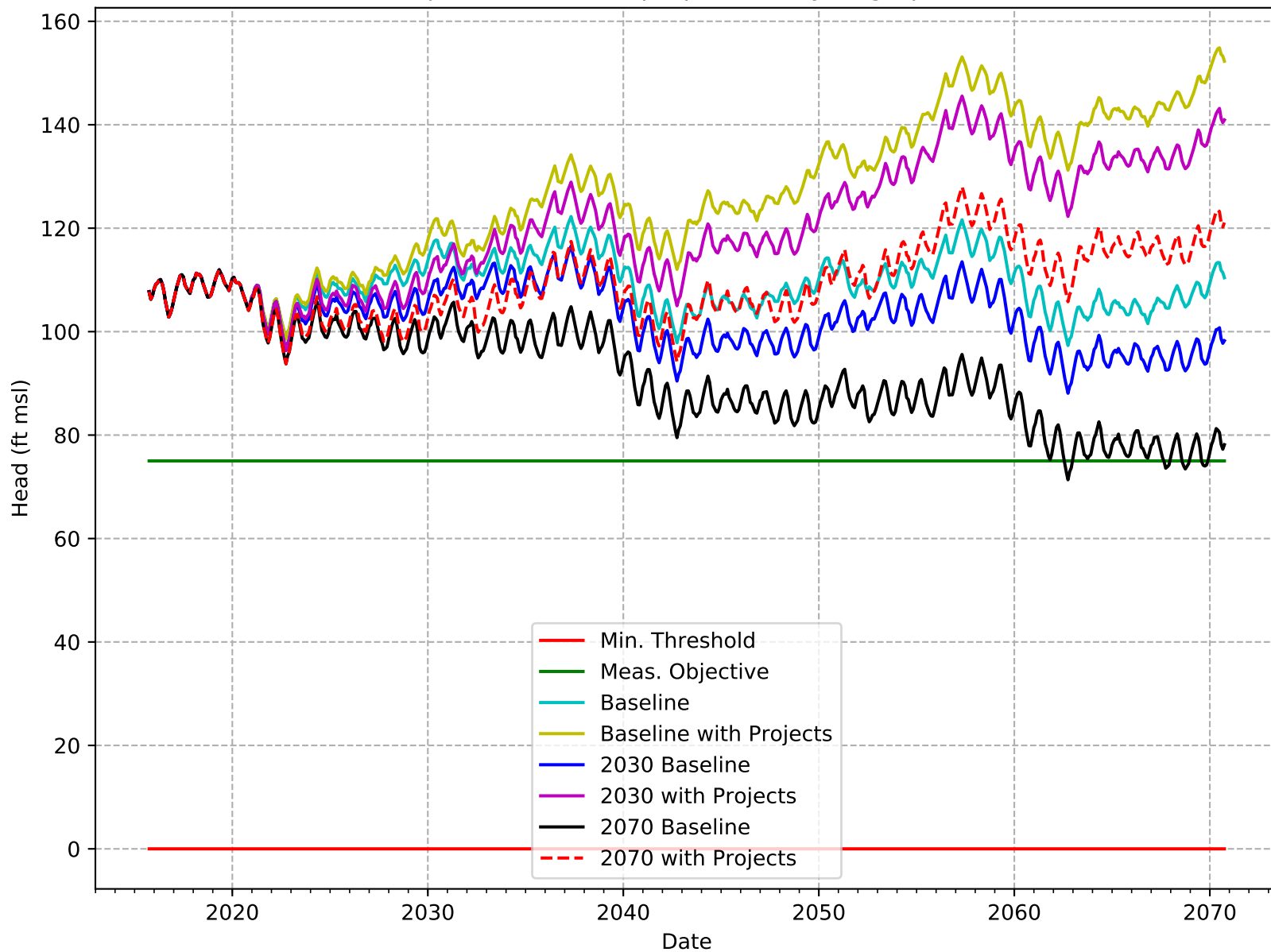


C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-235-WRWSD

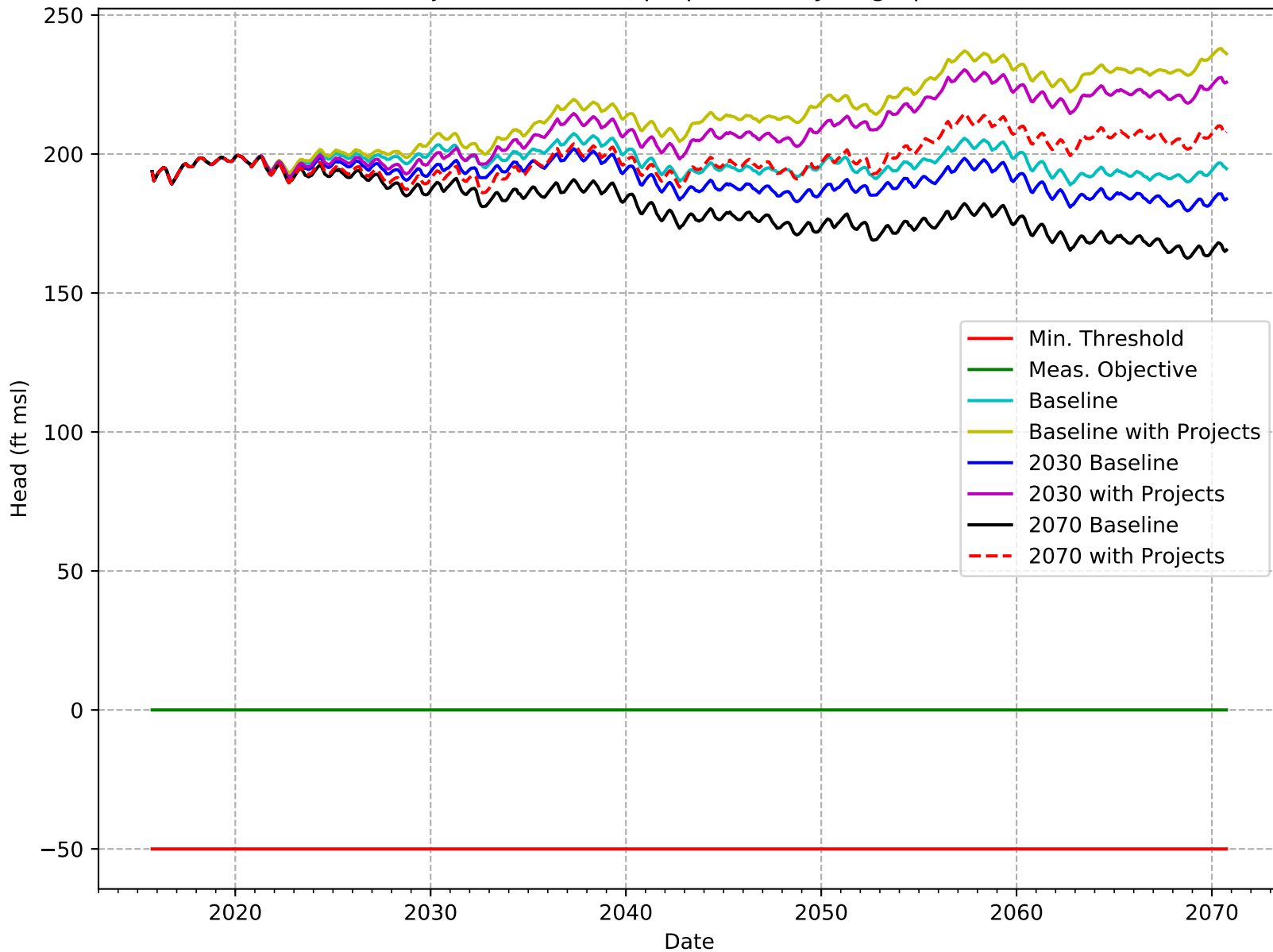




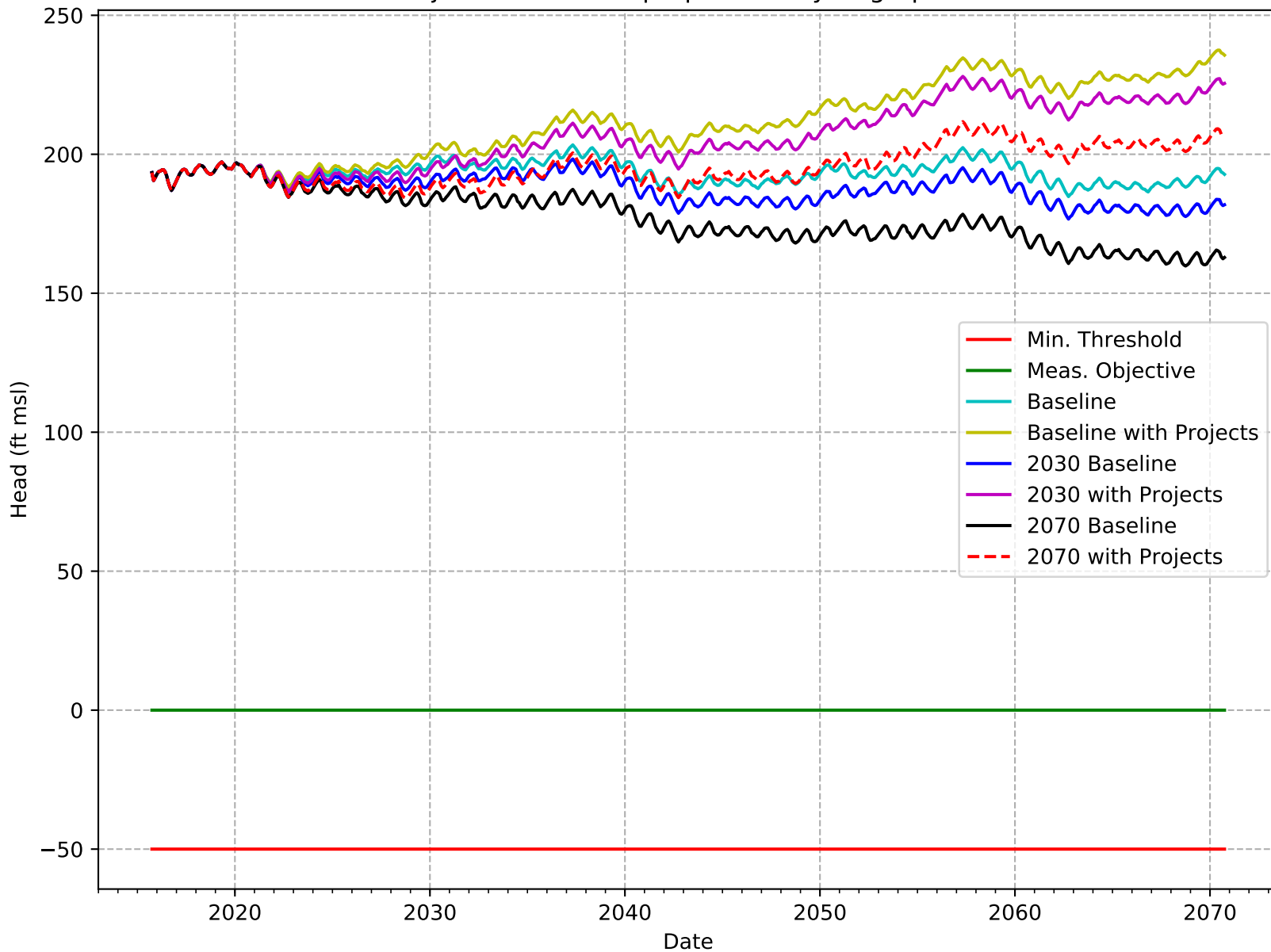
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-236-WRWSD



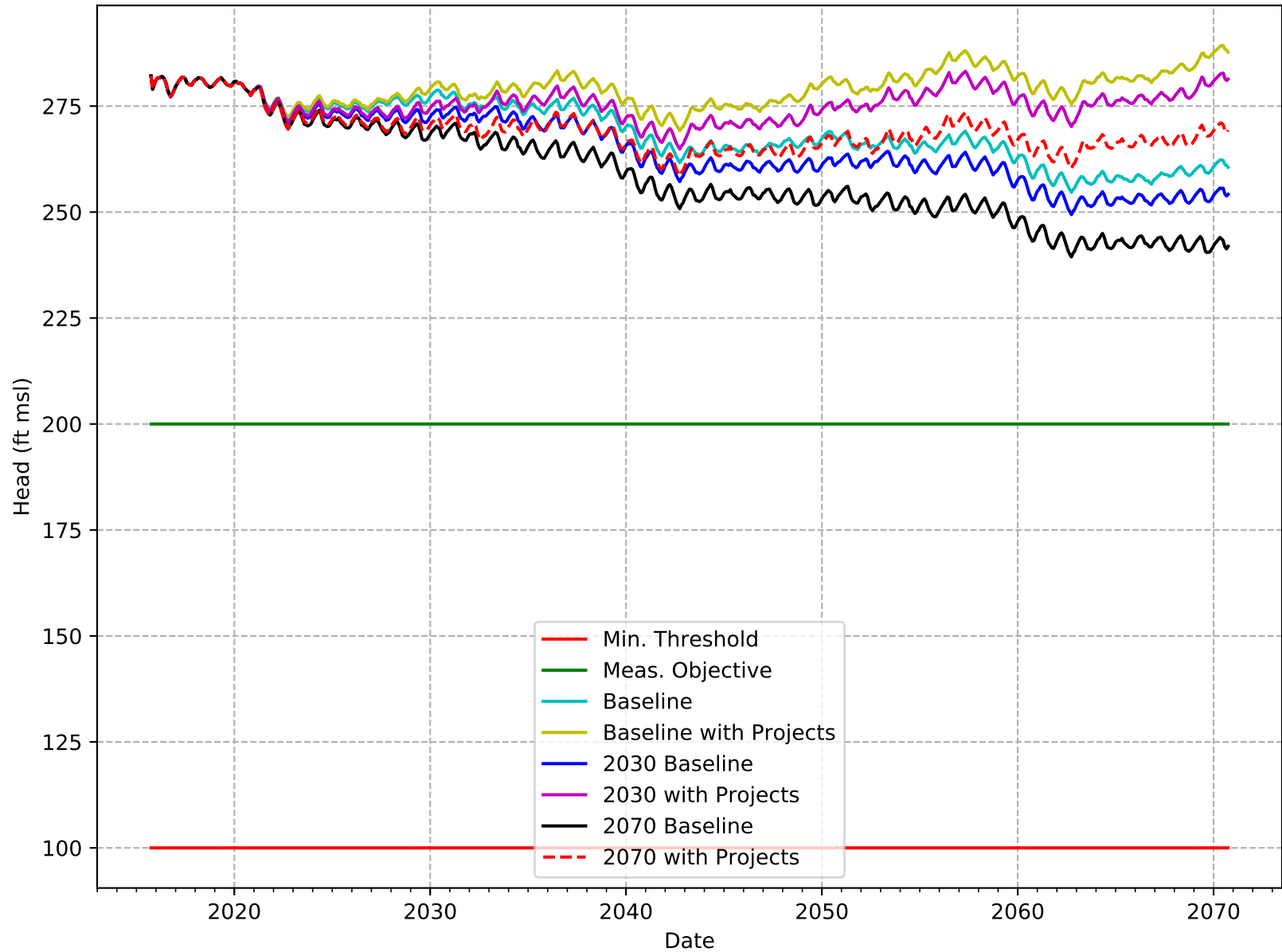
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-237-WRWS



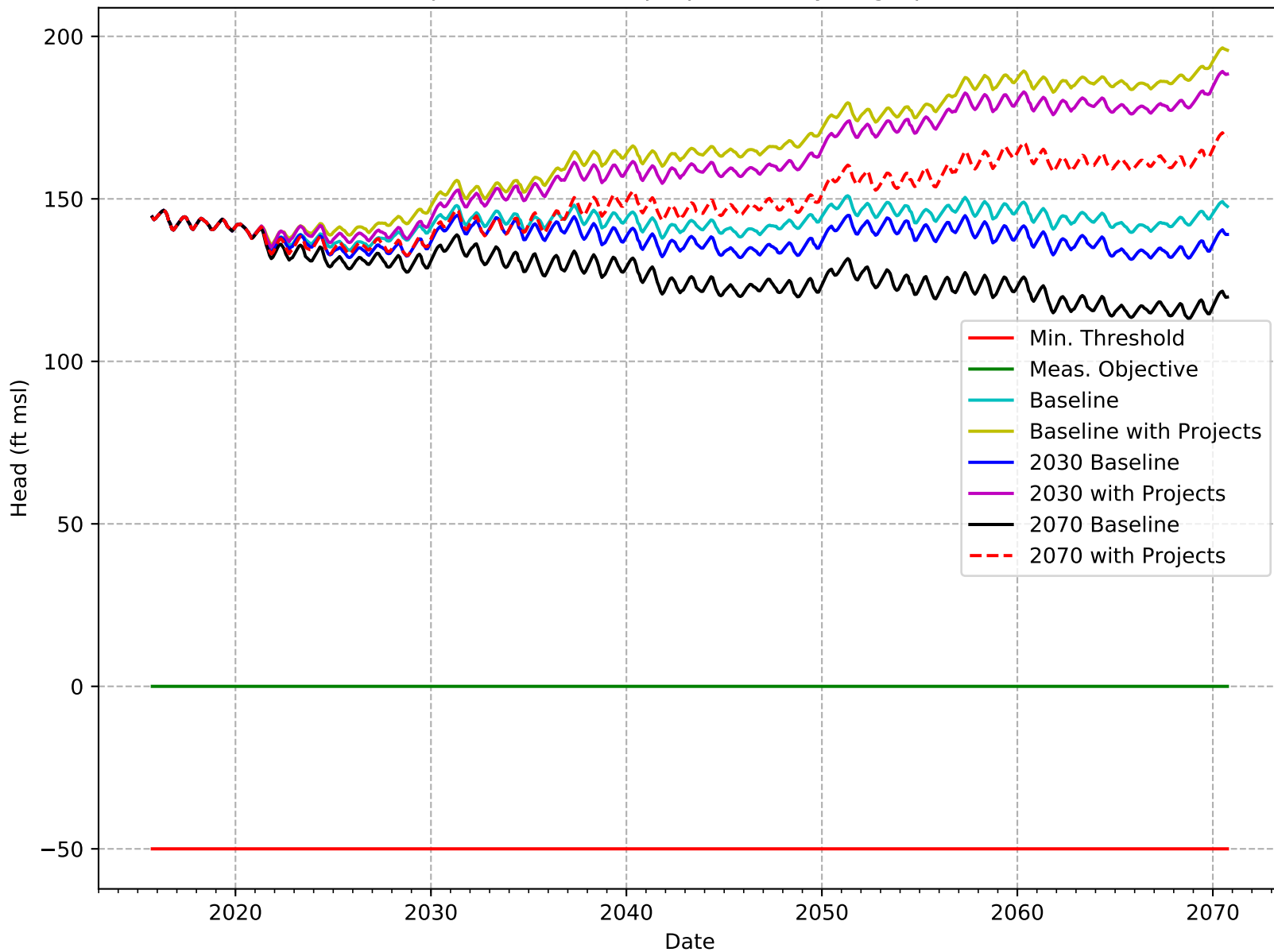
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-238-WRWS



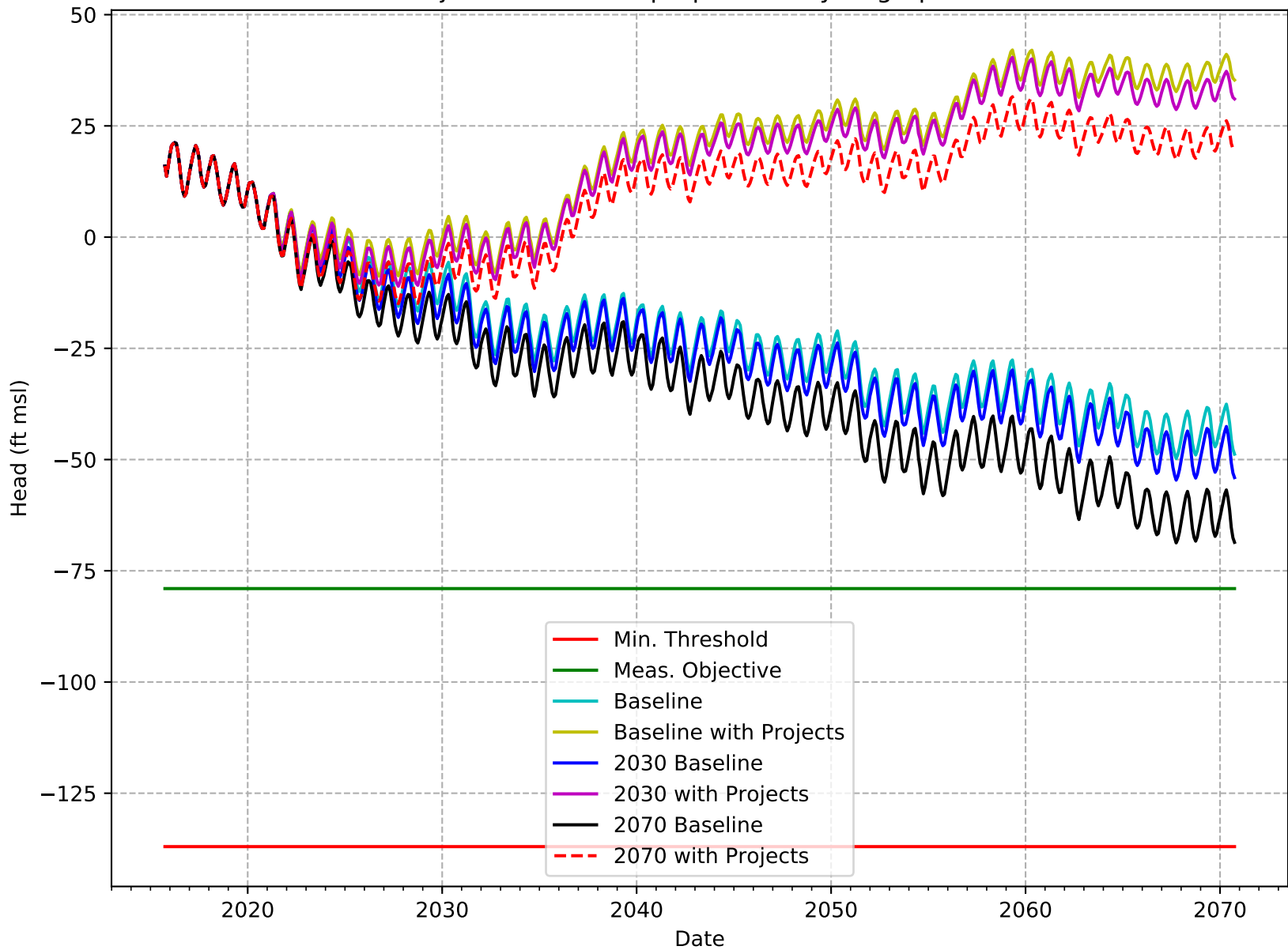
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-239-WRWSD



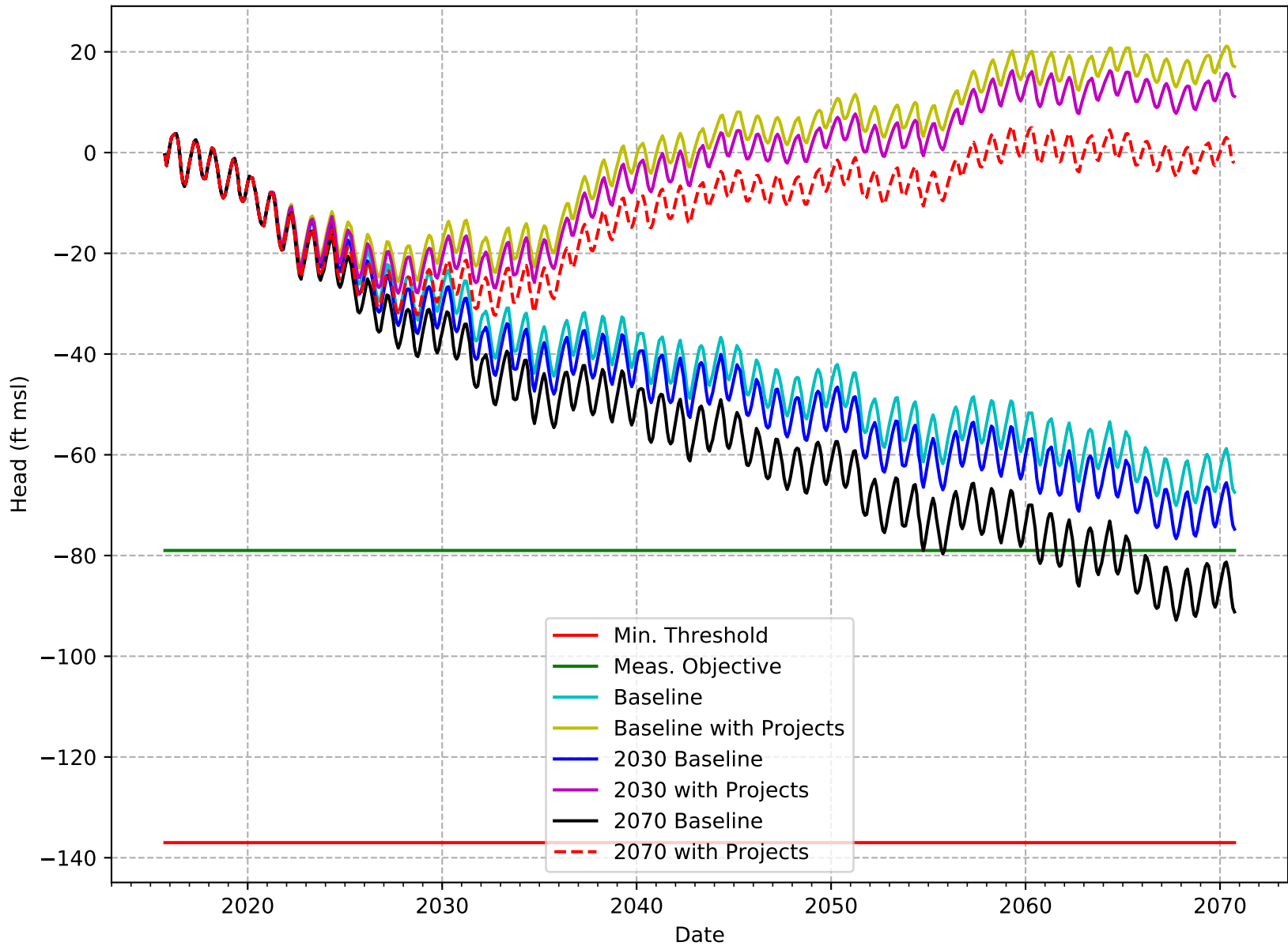
C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-240-WRWSD



C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-248-7TH-STD



C2VSimFG-Kern Projected-Future Superposition Hydrograph: RMW-249-7TH-STD



## BASELINE CONDITIONS

ENTITY	TOTAL DEMAND	TOTAL WATER SUPPLY	NET WATER BUDGET
<b>Kern Groundwater Authority</b>	1,939,409	1,683,128	-256,281
<b>Henry Miller GSA</b>	40,884	35,791	-5,093
<b>Olcese Water District GSA</b>	2,650	3,202	552
<b>Kern River GSA</b>	305,310	276,157	-29,153
<b>Kern River GSA - App. K Properties</b>	1,308		-1,308
<b>Buena Vista GSA</b>	103,950	126,936	22,986
<b>Non-districted lands*</b>	18,013		-18,013
<b>Totals</b>	<b>2,411,524</b>	<b>2,125,214</b>	<b>-286,310</b>

**Todd Groundwater Modeling Result for Baseline Condition:** **-324,326**  
**Todd Groundwater Modeling Result for Historical Change in Groundwater in Storage:** **-277,114**

**\*Most of the irrigated non-districted lands are now being managed/covered under SGMA by the GSAs**

The Kern County Subbasin GSAs have collaboratively developed the above water budget table to present an inventory of supply and demand using a "checkbook approach". The checkbook approach provides a mechanism for coordinated water accounting among the GSAs and does not include subsurface flows. The table was used to examine local water budget conditions and to prevent double-counting of water supplies. Although developed separately from the C2VSimFG-Kern model, the sum of the water budget deficits compares relatively well with model results; model deficits shown at the bottom of the table are larger due to inclusion of Subbasin subsurface outflows, which are not included in the checkbook approach.



# APPENDIX 3

## Undesirable Results Definitions

### Introduction:

- Management areas shall be identified by the basin and shown on exhibit "A".
- Representative Monitoring Locations shall mean the locations within the basin which are identified and designated by the GSA's for purposes of monitoring sustainability indicators.
- Critical Infrastructure shall mean facilities which are utilized to provide public services such as water, utilities, and or transportation service for a region.
- Prolonged Drought – The undesirable results herein take into account the accommodation of a prolonged drought as defined in DWR's BMP.

### *Chronic Lowering of Water Levels –*

The point at which significant and unreasonable impacts over the planning and implementation horizon, as determined by depth/elevation of water, affect the reasonable and beneficial use of, and access to, groundwater by overlying users.

This is determined when the minimum threshold for groundwater levels are exceeded in at least three(3) adjacent management areas that represent at least 15% of the subbasin or greater than 30% of the subbasin (as measured by each Management Area). Minimum thresholds shall be set by each of the management areas through their respective Groundwater Sustainability Plans.

### *Groundwater Storage –*

The point at which significant and unreasonable impacts, as determined by the amount of groundwater in the basin, affect the reasonable and beneficial use of, and access to, groundwater by overlying users over an extended drought period. (10-years?)

This is determined when the volume of storage (above the groundwater level minimum thresholds) is depleted to an elevation lower than the groundwater level minimum threshold in at least three(3) adjacent management areas that represent at least 15% of the subbasin or greater than 30% of the subbasin (as measured by the acreage of each Management Area).

Minimum thresholds shall be set by each of the management areas through their respective Groundwater Sustainability Plans.

**Degraded Water Quality Trends –**

The point at which significant and unreasonable impacts over the planning and implementation horizon, as caused by water management actions, that affect the reasonable and beneficial use of, and access to, groundwater by overlying users.

This is determined when the minimum threshold for a groundwater quality constituent of concern is exceeded in at least three(3) adjacent management areas that represent at least 15% of the subbasin or greater than 30% of the designated monitoring points within the basin. Minimum thresholds shall be set by each of the management areas through their respective Groundwater Sustainability Plans.

**Land Subsidence Trends –**

The point at which significant and unreasonable impacts, as determined by a subsidence rate and extent in the basin, that affects the surface land uses or critical infrastructure.

This is determined when subsidence results in significant and unreasonable impacts to critical infrastructure as indicated by monitoring points established by a basin wide coordinated GSP subsidence monitoring plan.

## Monitoring Network & Protocols

Monitoring Network shall be developed to be capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and yield representative information about groundwater conditions as necessary to evaluate Plan implementation. The monitoring network objectives shall be implemented to accomplish the following:

- 1) Demonstrate progress toward achieving measurable objectives described in the Plan
- 2) Monitor impacts to the beneficial uses and users of groundwater
- 3) Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds
- 4) Quantify annual changes in water budget components

Monitoring Network shall be designed to ensure adequate coverage of sustainability indicators. If management areas are established, the quantity and density of monitoring sites in those areas shall be sufficient to evaluate conditions of the basin setting and sustainable management criteria specific to that area. To the extent possible, the use of existing monitoring data and infrastructure should be utilized to meet the needs for characterization, historical record documentation and continued monitoring requirements.

Monitoring Network shall describe the scientific rationale for the monitoring site selection and for each sustainability indicator, the quantitative values for the minimum threshold, measurable objective and interim milestones shall be indicated at each monitoring site.

Monitoring Protocols developed shall include a description of technical standards, data collection methods, and other procedures or protocols for monitoring sites or other data collection facilities to ensure that the monitoring network utilizes comparable data and methodologies. There is no definitive rule for the density of groundwater monitoring points needed in a basin. The table below provides guidance for the density of monitoring wells per hundred square miles. One important item to consider is how the definitions of undesirable results will be impacted to provide the necessary information to indicate compliance.

Reference	Monitoring Well Density (wells per 100 miles <sup>2</sup> )
Heath (1976)	0.2 - 10
Sophocleous (1983)	6.3
Basins pumping more than 10,000 acrefeet/year per 100 miles	4.0
Basins pumping between 1,000 and 10,000 acre-feet/year per 100 miles	2.0
Basins pumping between 250 and 1,000 acre-feet/year per 100 miles	1.0
Basins pumping between 100 and 250 acre-feet/year per 100 miles	0.7

## Measuring Groundwater Levels

Given the significant variations in groundwater elevations throughout the Kern subbasin which are due to variations in hydrologic conditions, no single groundwater elevation surface should be considered a representation of groundwater flow directions in this basin.

Requirements for well selections:

- A long-term access agreement that includes year-round site access to allow for increased monitoring frequency
- A unique identifier that includes a general written description of the site location, date established, access instructions and point of contact, type of information to be collected, latitude, longitude and elevation
- Monitoring location should also track all modifications to the site in a modification log

The following data collection protocols are to be followed within the Kern subbasin:

- Groundwater level data shall be sufficient to produce seasonal maps of potentiometric surfaces or water table surfaces throughout the basin that clearly identify changes in groundwater flow direction and gradient.
- Use the Well Data form provided (see attached)
- Groundwater level data shall be collected from each principal aquifer in the basin
- Collection of data between the approved time frames only
  - January 15<sup>th</sup> to March 30<sup>th</sup>
  - September 15<sup>th</sup> to November 15<sup>th</sup>
- A weighted water level meter or other CASGEM approved measuring device will be used to measure the depth to groundwater
- Depth to groundwater must be measured relative to an established Reference Point on the well casing. If no mark or reference point is apparent, the person performing the measurement should measure the depth to groundwater from the north side of the top of the well casing
- The elevation of the Reference Point of the well must be referenced to the North American Vertical Datum of 1988. The accuracy of the reference point should be consistent with CASGEM established guidelines.
- Each well's Reference Point will be cataloged to ensure identical procedures are followed for subsequent measurements.
- The data collector should remove the appropriate cap, lid or plug that covers the monitoring access point listening for pressure release. If a release is observed, the measurement should follow a period of time to allow the water level to equilibrate.
- Depth to groundwater must be measured to the accuracy associated with the approved monitoring method or device.
- The water level meter shall be decontaminated after measuring each well.
- The data collector shall calculate the groundwater elevation as:
  - $GWE = RPE - DTW$
  - GWE = Groundwater Elevation

- RPE = Reference Point Elevation
- DTW = Depth to Water
- The data collector must ensure that all measurements are consistent units of feet, tenths of feet or hundredths of feet. Measurements and Reference Point Elevations should not be recorded in feet and inches.

## Groundwater Quality

Groundwater quality monitoring networks shall be designed to demonstrate that the degraded water quality sustainability indicator is being observed for the purpose of meeting the definition of the sustainability goal.

Requirements for well selections:

- A long-term access agreement that includes year-round site access to allow for increased monitoring frequency
- A unique identifier that includes a general written description of the site location, date established, access instructions and point of contact, type of information to be collected, latitude, longitude and elevation
- Monitoring location should also track all modifications to the site in a modification log
- The use of existing water quality data within the basin should be done to the greatest extent possible
- Monitoring network should consist largely as a supplemental monitoring locations where known groundwater contamination plumes are under existing regulatory management

The following data collection protocols are to be followed within the Kern subbasin:

- Monitor groundwater quality data from each principal aquifer in the basin
- Data should be sufficient for mapping movement of degraded water quality
- Data should be sufficient to assess groundwater quality impacts to beneficial uses and users
- Data should be sufficient to evaluate whether management activities are contributing to water quality degradation.
- All analyses should be performed by a laboratory certified under the State Environmental Laboratory Accreditation Program
- Samples will be collected according to the standards listed in the Standard Methods for the Examination of Water and Wastewater, USGS National Field Manual for the Collection of Water Quality Data
- Prior to sampling, the sampler must contact the laboratory to schedule laboratory time, obtain appropriate sampler containers, and clarify any sample holding times or sample preservation requirements
- Each well used for groundwater quality monitoring must have a unique identifier. This identifier must appear on the well housing or the well casing to avoid confusion
- In the case of wells with dedicated pumps, samples should be collected at or near the wellhead. Samples are not to be taken/collected from storage tanks, at the end of long pipe runs or after any water treatment infrastructure

- Samples will be taken/collected only after the appropriate volume of water has been purged from the casing and field parameters have stabilized
- Sampler will clean the sampling port and/or sampling equipment. The sampling port and/or sampling equipment must be free of any contaminants
- Groundwater elevation in the well should be measured following the protocols described in the groundwater level measuring protocols
- Field parameters of pH, electrical conductivity and temperature should be collected for each sample. Lab pH analysis are typically unachievable due to short hold times.
- All field instruments should be calibrated daily and evaluated for drift throughout the day
- Sample containers should be labeled prior to sample collection. The sample label must include:
  - Sample ID (well ID)
  - Sample date and time
  - Sample personnel
  - Sample location
  - Preservative used
  - Analytes and analytical method
- Samples shall be collected under laminar flow conditions. This may require reducing pumping rates prior to sample collection
- Samples requiring preservation must be preserved as soon as practically possible
- Samples to be analyzed for metals should be field-filtered prior to preservation. Do not collect an unfiltered sample in a preserved container
- Samples will be chilled and maintained at 4 C to prevent degradation of the sample
- Samples will be shipped under a chain of custody documentation to the appropriate laboratory promptly to avoid violating holding time restrictions
- Custody Seal will be used by the field technician if a third-party transportation service is used
- A Field Sampling Log will include:
  - Sampler's identification
  - Well identification
  - Climatic conditions
  - Depth to water prior to purging
  - Type of purging and sampling device
  - Purging rate and volume
  - Relative well yield volume
  - Field parameter measurements (pH, temperature, EC, DO)
  - Type and number of samples collected
  - Date and time collected

## Change in Groundwater Storage

Since the groundwater storage is not a directly measurable condition, it does rely heavily on the collection of accurate groundwater levels. The changes in groundwater levels reflect changes in storage and can thus be estimated with assumptions of thickness of units, porosity, and connectivity. These observations will be essential for use in calculating the water budget.

A water budget is a foundational tool used to compile water flows (supplies) and outflows (demands). It is an accounting of the total groundwater and surface water entering and leaving a basin or user-defined area. The difference between flows and outflows is a change in the amount of water stored.

Coordination of Water Budget Data to comply with groundwater storage:

- Surface water supply
- Total water use
- Water budget
- Sustainable yield

The change in the annual volume of groundwater storage between seasonal high conditions shall be quantified in the water budget.



## Land Subsidence

Land subsidence protocols are to be set up to identify the rate and extent of land subsidence, which maybe measured by extensometers, surveying, remote sensing technology, or other appropriate method. To the extent possible, the use of existing data should be utilized.

Prior to development of a specific subsidence monitoring network a screening level analysis should be conducted. The screening of subsidence occurrence should include:

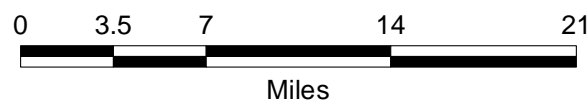
- Review of the HCM and understanding of grain-size distributions and potential for subsidence to occur
- Review of any known regional or correlative geologic conditions where subsidence has been observed.
- Review of historic range of groundwater levels in the principal aquifers of the basin
- Review of historic records of infrastructure impacts, including but not limited to damage to pipelines, canals, roadways or bridges or well collapse potentially associated with land surface elevation changes
- Review of remote sending results such as InSAR or other land surface monitoring data
- Review of existing CGPS surveys

This basin has decided to work together on this protocol with a consultant to obtain the required data.

See the attached for the coordinated effort by all the GSAs in the Kern Subbasin pertaining to Land Subsidence.



- Kern Subbasin Boundary
- MTMO Groundwater Level Monitoring Network
- KWB Monitoring Well (No MO/MT data)
- Kern Groundwater Authority GSA
- KERN RIVER GSA
- BELRIDGE W.S.D.
- BERRENDA MESA W.D.
- BUENA VISTA W.S.D.
- CAWELO W.D.
- DEVILS DEN W.D.
- DUDLEY RIDGE W.D.
- HENRY MILLER W.D.
- LOST HILLS W.D.
- SEMITROPIC W.S.D.
- WHEELER RIDGE-MARICOPA W.S.D.
- ARVIN-EDISON W.S.D.
- DELANO-EARLIMART I.D.
- SHAFTER-WASCO I.D.
- KERN-TULARE W.D.
- SOUTHERN SAN JOAQUIN M.U.D.
- TEJON CASTAIC W.D.
- NORTH KERN W.S.D.
- SHAFTER-WASCO I.D. additional M.A.
- ROSEDALE RIO BRAVO W.S.D.
- WEST KERN W.D.
- KERN WATER BANK AUTHORITY
- OIL AND GAS LANDS
- EASTSIDE WATER MANAGEMENT AREA
- SEMITROPIC W.S.D. additional M.A.
- ROSEDALE RIO BRAVO W.S.D. additional M.A.
- ARVIN-EDISON W.S.D. additional M.A.
- BELRIDGE W.S.D. additional M.A.
- BERRANDA MESA W.D. additional M.A.



Kern Groundwater Authority  
Basin Setting

Kern County, California

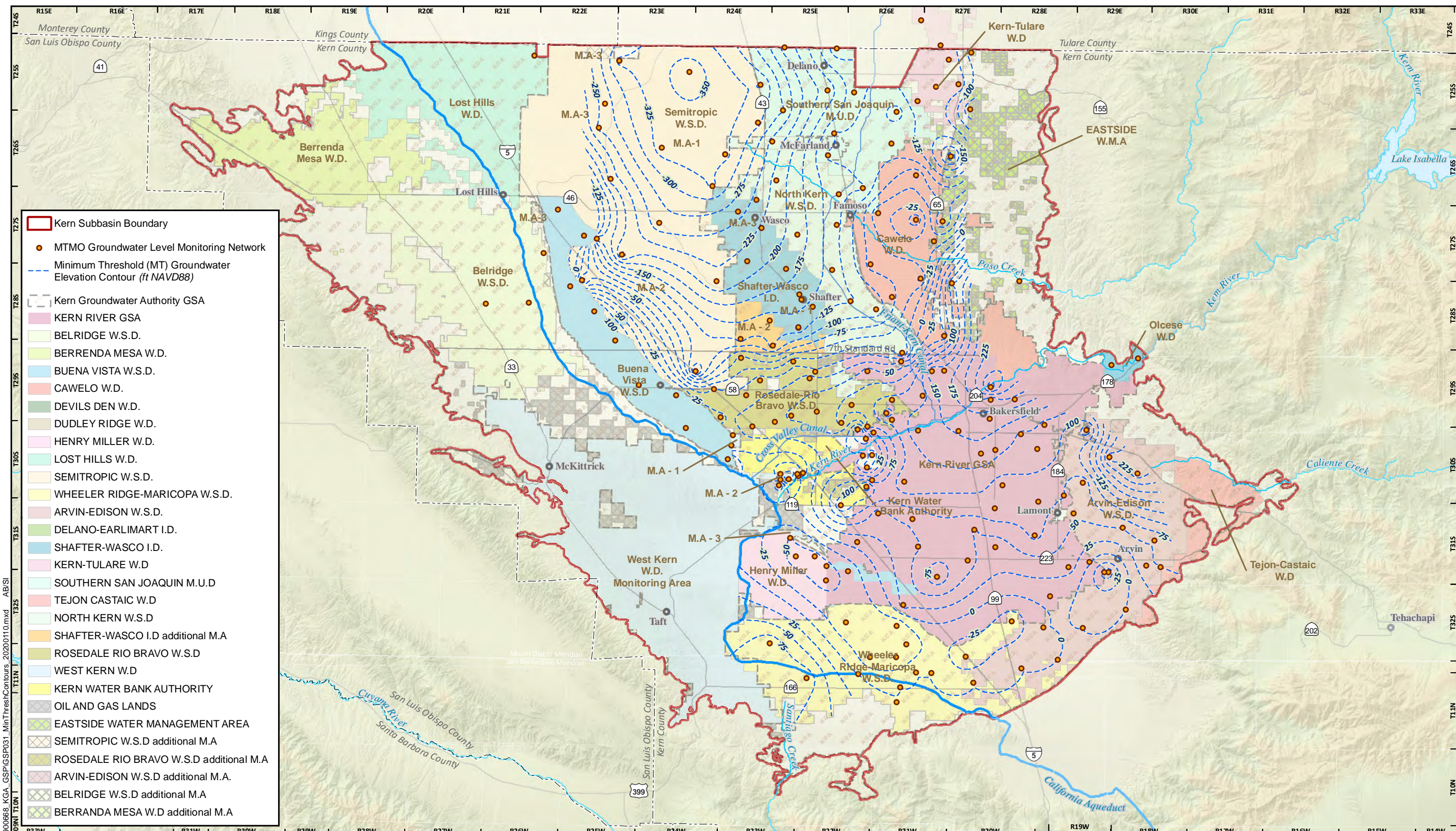


REGIONAL GROUNDWATER LEVEL  
MONITORING NETWORK

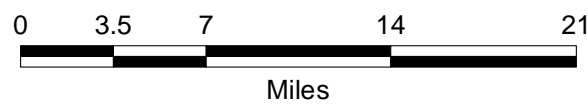
DECEMBER 2019

FIGURE 3-1

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Kern Groundwater Authority  
Basin Setting

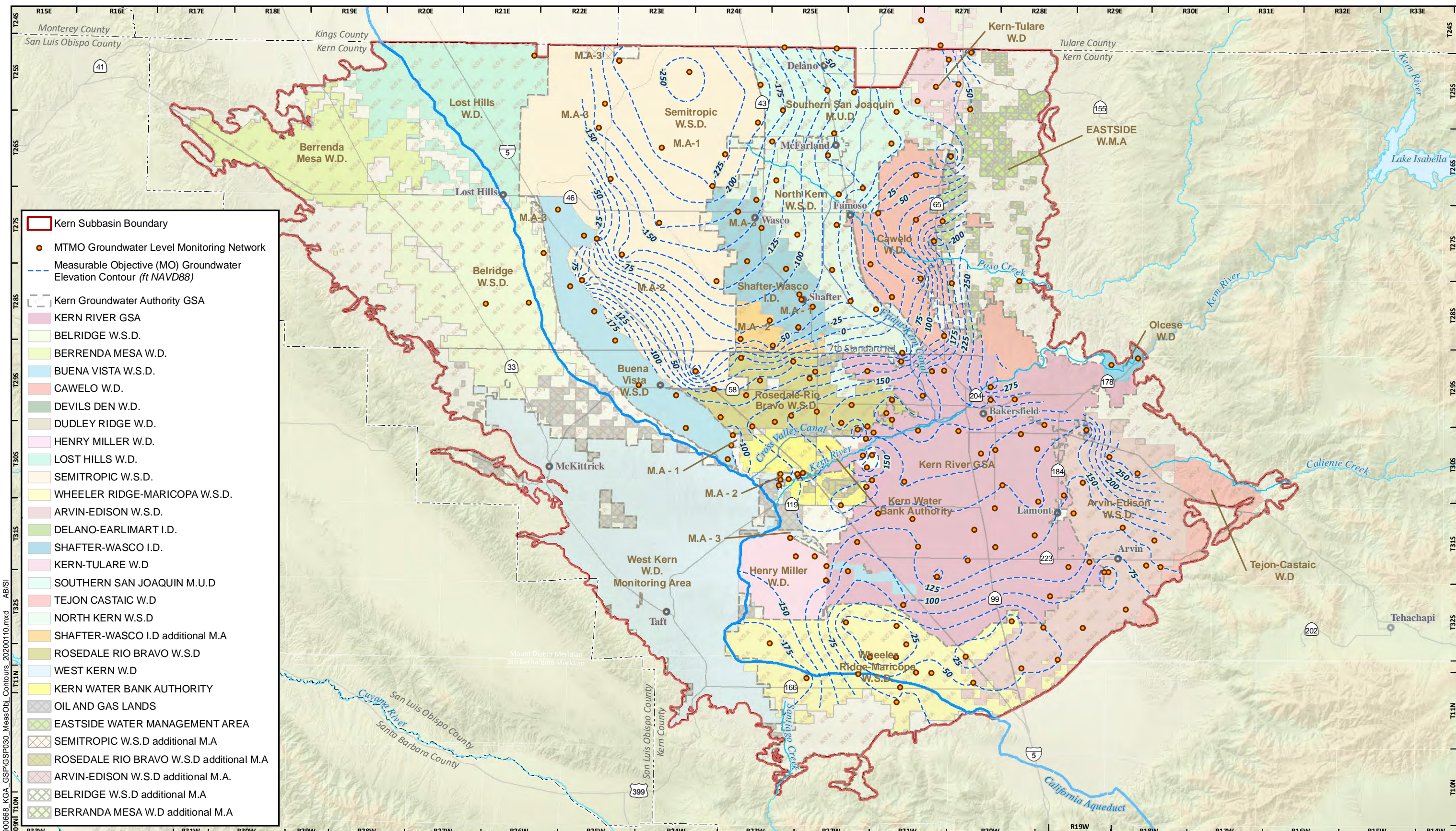
Kern County, California



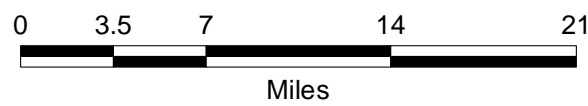
REGIONAL MINIMUM THRESHOLD  
GROUNDWATER ELEVATION CONTOURS

DECEMBER 2019

FIGURE 3-2



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Kern Groundwater Authority  
Basin Setting

Kern County, California



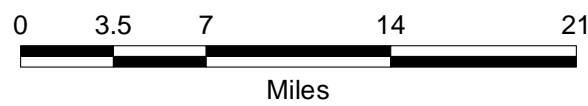
REGIONAL MEASURABLE OBJECTIVE  
GROUNDWATER ELEVATION CONTOURS

DECEMBER 2019

FIGURE 3-3



- Kern Subbasin Boundary
- Monitored for Water Quality Only
- Monitored for Water Quality and GWE
- Kern Groundwater Authority GSA
- KERN RIVER GSA
- BELTRIDGE W.S.D.
- BERRENDAS MESA W.D.
- BUENA VISTA W.S.D.
- CAWELO W.D.
- DEVILS DEN W.D.
- DUDLEY RIDGE W.D.
- HENRY MILLER W.D.
- LOST HILLS W.D.
- SEMITROPIC W.S.D.
- WHEELER RIDGE-MARICOPA W.S.D.
- ARVIN-EDISON W.S.D.
- DELANO-EARLIMART I.D.
- SHAFTER-WASCO I.D.
- KERN-TULARE W.D.
- SOUTHERN SAN JOAQUIN M.U.D.
- TEJON CASTAIC W.D.
- NORTH KERN W.S.D.
- SHAFTER-WASCO I.D. additional M.A.
- ROSEDALE RIO BRAVO W.S.D.
- WEST KERN W.D.
- KERN WATER BANK AUTHORITY
- OIL AND GAS LANDS
- EASTSIDE WATER MANAGEMENT AREA
- SEMITROPIC W.S.D. additional M.A.
- ROSEDALE RIO BRAVO W.S.D. additional M.A.
- ARVIN-EDISON W.S.D. additional M.A.
- BELTRIDGE W.S.D. additional M.A.
- BERRENDAS MESA W.D. additional M.A.



Kern Groundwater Authority  
Basin Setting

Kern County, California



REGIONAL GROUNDWATER QUALITY  
MONITORING NETWORK

DECEMBER 2019

FIGURE 3-4

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# TECHNICAL MEMORANDUM

**TO:** Kern County Subbasin GSAs

**FROM:** GEI Consultants, Inc.

**DATE:** October 25, 2019

**RE:** IMPROVEMENTS TO REGIONAL SUBSIDENCE MONITORING IN THE  
KERN COUNTY SUBBASIN

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This memorandum was prepared, in coordination with the Kern County Subbasin GSAs, to fill data gaps in the Kern County Subbasin subsidence monitoring network. It prioritizes areas of interest, at a subbasin-level, that require additional subsidence monitoring. It also includes the design approach and parameters to be monitored, and references DWR guidelines regarding subsidence monitoring design.

## Background and Purpose

The development of a network to monitor sustainability indicators, including subsidence, is one of the requirements of the Groundwater Sustainability Plans (GSPs) to be submitted to the Department of Water Resources (DWR) for compliance with the Sustainable Groundwater Management Act (SGMA).

To achieve and comply with the requirements of SGMA as it pertains to subsidence and knowing that in the Kern County Subbasin there lacks sufficient data, this memo was generated for the benefit of the entire Kern Subbasin GSAs as a coordinated effort. In each individual GSPs of the Kern Subbasin, existing land surface elevation and land subsidence monitoring is identified, along with data gaps within the existing network. This memo describes the process and rationale for identifying subsidence areas of interest (AOIs) to address data gaps, the current monitoring network, and the location of future monitoring points. The memo includes the following objectives for monitoring, which are applicable to land subsidence:

1. Demonstrate progress toward achieving measurable objectives described in the management area and throughout the Subbasin;
2. Monitor impacts to the beneficial uses and users of groundwater, surface land uses, and critical infrastructure; and
3. Monitor changes in groundwater conditions (or land subsidence) relative to measurable objectives and minimum thresholds.

The monitoring network is designed to monitor impacts to surface land uses or critical infrastructure as stated in the Subbasin-wide definition of undesirable results for land subsidence (KGA, 2019 emphasis added):

*The point at which significant and unreasonable impacts, as determined by a subsidence rate and extent in the basin, that affects the surface land uses or critical infrastructure.*

*This is determined when subsidence results in significant and unreasonable impacts to critical infrastructure as indicated by monitoring points established by a basin wide coordinated GSP subsidence monitoring plan.*

One of the purposes for improving the subsidence monitoring network is to collect additional data at each AOI to fill data gaps so that sustainable management criteria (SMCs) can be set. As more data are gathered for the AOIs, Kern County Subbasin GSAs and stakeholders can establish SMCs to avoid undesirable results stemming from subsidence.

## **AOI Screening and Monitoring Approach**

The first step in the subsidence monitoring approach is to identify AOIs based on the presence of critical infrastructure or other surface land uses. These AOIs can then be evaluated based on the decision-making criteria listed below to determine if monitoring is required. This process is illustrated in Figure 1.

An AOI requires monitoring if the following three criteria apply:

1. Infrastructure or surface land uses are susceptible to land subsidence.
2. Significant land subsidence has been observed in screening from Interferometric Synthetic-Aperture Radar (InSAR) or other remote sensing techniques.
3. The subsidence is caused by groundwater extraction.

Where data gaps exist in evaluating the criteria, additional investigation may be necessary. For example, further investigation at AOI-2 is necessary to evaluate if groundwater extraction is causing subsidence.

### **Monitoring Parameters**

If the area is identified as an AOI that requires monitoring, then the following actions should be taken:

- A. Groundwater level monitoring near the AOI,
- B. Ground-truthing of subsidence detected by InSAR (CGPS, extensometer, or level surveying), and
- C. Monitoring of the critical infrastructure.

As depicted in Figure 1, the process for establishing monitoring points includes locations with susceptible critical infrastructure where InSAR and/or other historical and recent monitoring has detected recent subsidence that is likely caused by groundwater extraction.

### **Regional Coordination**

Regional coordination of monitoring is key to the design of the network in the subbasin because regional groundwater extraction is a main driver of subsidence. In addition, many of the critical infrastructure are regional and may require coordination for access within the vicinity and data sharing.

Subsidence associated with oil and gas activities may also occur in the subbasin. However, any subsidence potentially associated with oil and gas activities is regulated by the California Division of Oil, Gas, and Geothermal Resources (DOGGR) under the California Public Resources Code and is therefore separate from SGMA requirements. Coordination between groundwater and oil and gas stakeholders may be needed where there is potential for both activities to cause subsidence that impacts critical infrastructure.

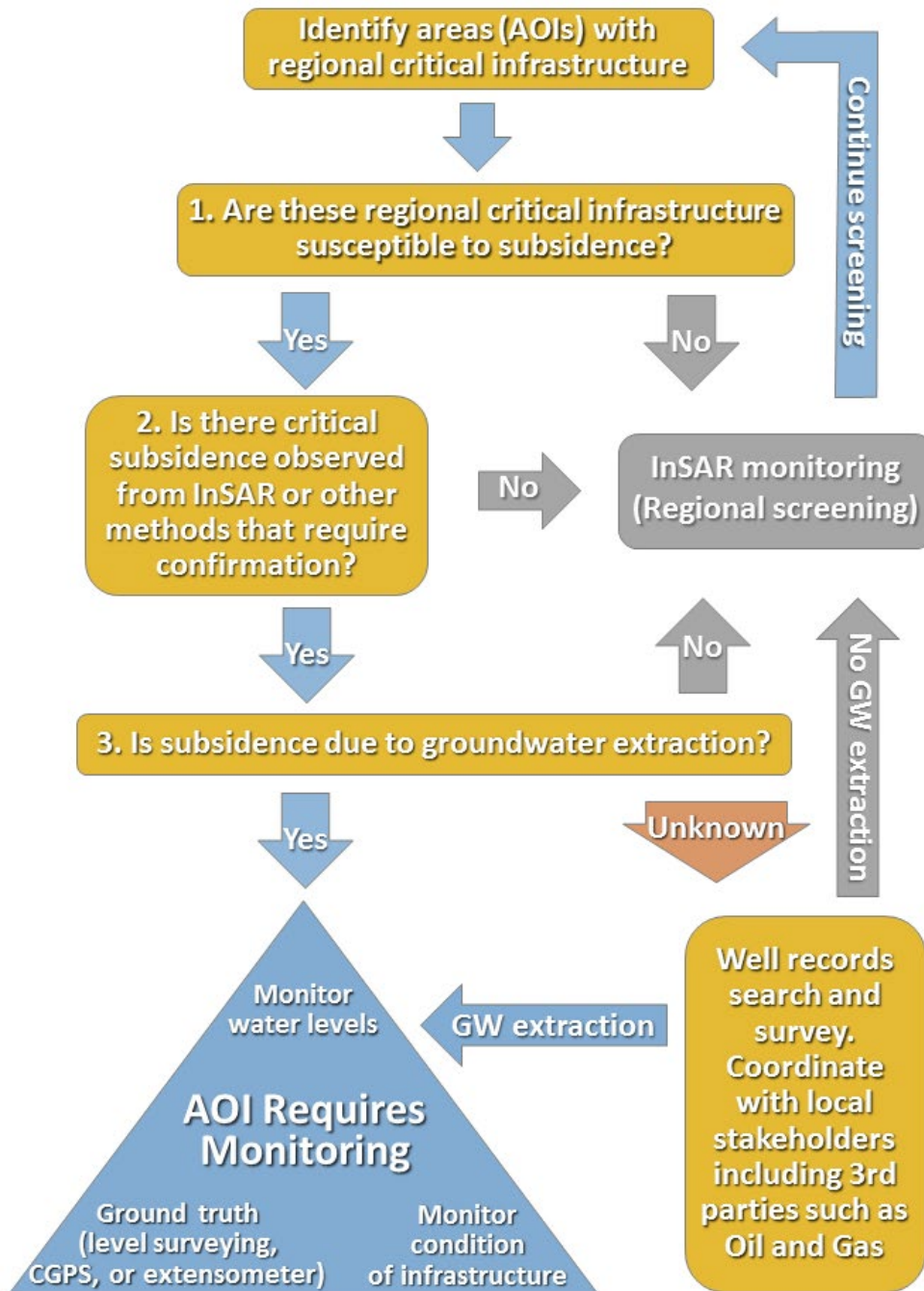


Figure 1. Subsidence Monitoring Decision Making Process and Criteria.



## Improvements to Monitoring Network

### Timeline and Approach

Five AOIs were identified, in order of priority, to improve the subbasin monitoring network (AOI-1 to AOI-5). Two of these areas are located along the Friant-Kern Canal (FKC), two are along the California Aqueduct, and one area is for monitoring changes in land surface elevation along the northern boundary of the subbasin where a significant amount of subsidence has been reported in the InSAR data.

It is anticipated that these sites will be evaluated in order of priority and may take up to several years to design and implement monitoring points.

Each monitoring site design will consider the following:

1. Confirm groundwater extraction is the cause of subsidence (if necessary),
2. Land siting and ownership,
3. Site access,
4. Monitoring design (CGPS or extensometer),
5. Confirmation that data for all three monitoring parameters can be collected (a. groundwater elevations, b. subsidence, and c. condition of infrastructure), and
6. Connection to the monitoring network and data sharing.

The subsidence monitoring network AOIs are presented on Figure 2. AOI-1 was selected to monitor along the FKC where subsidence has been detected near the northern boundary of the subbasin. AOI-2 was selected where the California Aqueduct has had historical impacts partially attributed to subsidence. AOI-3 along the FKC south of Poso Creek has had subsidence detected and reported by the North Kern WSD. AOI-4 along the California Aqueduct has had subsidence reported by DWR Division of Engineering (DOE) and InSAR, and AOI-5 along the northern boundary of the subbasin is not associated with critical infrastructure but is the location of high cumulative subsidence at the boundary of the subbasin and may be indicative of conditions in the neighboring subbasins which have the potential to impact the conditions of the Kern County Subbasin.

### **Groundwater Elevations**

A key parameter in evaluating subsidence as a sustainability indicator for groundwater management is understanding groundwater level changes with respect to subsidence, particularly regional changes in water level. Figure 3 presents the regional water level monitoring points (RMWs) from the draft GSP with respect to the five AOIs for subsidence monitoring. The following are observations of RMWs within AOI vicinity:

- AOI-1 has a few surrounding RMWs; however, none are within 1 mile of the FKC.
- AOI-2 has one RMW within a mile of the Aqueduct and the AOI.
- AOI-3 has one RMW in the central portion about 1 mile from FKC.
- AOI-4 has two RMWs within the vicinity of the Aqueduct.
- AOI-5 has no RMWs within 1 mile.

***Recommendation***

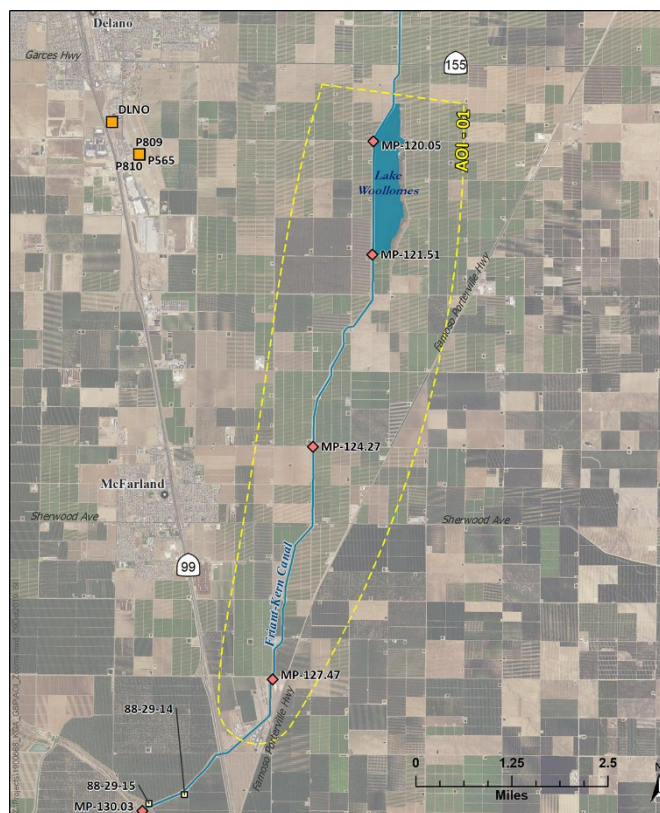
Where possible, subsidence monitoring stations should be installed within 1 mile of a reliable RMW. If necessary, a new RMW may be installed to provide a point at which groundwater level may be collected in proximity to the land surface elevation monitoring point.

*AOIs listed on subsequent pages*

### AOI-1. FKC Milepost 120 to 130

This high priority area is located along the FKC between Mileposts 120 to 130 (Figure 2), east-northeast of the City of McFarland. The purpose of this AOI is to monitor subsidence along the FKC and its related infrastructure. At times, InSAR monitoring has reported up to 5 inches per year of subsidence in areas surrounding this segment of the FKC. At present, no significant impacts to the FKC have been reported along this portion of the canal's alignment. According to leveling survey data from Friant Water Authority (FWA, 2019), the FKC invert may have subsided from 2 ft to 3 ft below original as-built elevations between Mileposts 120 to 135. Continued lowering of the canal invert can decrease freeboard from the original as-built conditions, which may contribute to reduction in emergency storage capabilities and delivery options of the Canal.

In contrast, beyond the subbasin's northern boundary, subsidence has caused significant impacts to the FKC conveyance capabilities between Mileposts 101 to 108.



**Figure 4. AOI-1. FKC Milepost 120 to 130**  
(symbol legend on Figure 2)

#### **Existing Monitoring**

Currently, this area is screened by InSAR, and previous level surveying was performed by FWA at the mileposts labeled on Figures 2 and 4. There are no other active monitoring points except for InSAR along this stretch.

#### **New Monitoring Approach**

A new CGPS station that monitors at the ground surface any subsurface subsidence, regardless of the depth interval, is recommended because the only known cause of subsidence in this area is attributed to groundwater extraction. This CGPS data will complement any manual level surveys that may incorporate the FWA reported measuring points. CGPS data may also provide on-demand data as needed.

#### **Coordination of Monitoring**

Subsidence monitoring along the FKC benefits local stakeholders, CVP contractors, and the FWA. It is anticipated that this monitoring can be coordinated with FWA to share data as well as potentially share resources and cost.

Any level surveying along the canal from the United States Bureau of Reclamation (USBR) Friant-Kern benchmarks (Figure 2) will require coordination with the FWA.

## AOI-2. California Aqueduct Milepost 196 to 215

This high priority area is the segment of the California Aqueduct where an embankment failure occurred at Milepost 208 in June 2011 (DWR, 2017). This failure is partially attributed to subsidence. The cause of this subsidence is unknown and is therefore a subject of monitoring at this location. This area is along the Aqueduct between Mileposts 196 to 215 in the western central subbasin (Figure 2). In addition to embankment failure, other consequences of subsidence include loss in freeboard in the Aqueduct. This area has experienced at least 2 feet of subsidence since the Aqueduct was constructed.

### Existing Monitoring

Currently, this area is screened by InSAR and is monitored with level surveys every three to seven years by the DWR's DOE. There are no other active monitoring points along this stretch.

### New Monitoring Approach

The source of subsidence, either by groundwater extraction activities or other activities, will be investigated by performing well records searches from DWR well completion records, the Kern County Public Health Department well permit records, and the DOGGR's databases. If necessary, a field well survey may be performed. Coordination may be needed with local stakeholders to confirm the magnitude of groundwater extracted within 1 mile of this portion of the Aqueduct's alignment and the volume of fluids extracted and injected by oil and gas activities within 1 mile of this alignment. A third potential source for subsidence in this area could be hydrocompaction, which was identified during the initial design and construction of the Aqueduct. Pre-consolidation of soil was performed during initial construction so hydrocompaction is likely not significant, however, it cannot be ruled out at this time.

If it is determined that groundwater extraction is playing a role in subsidence for this area, a monitoring point should be installed away from the footprint of the Aqueduct to avoid potential signatures of hydrocompaction if any exist. If there is question of whether some of the subsidence is related to nearby oil and gas activities, then an extensometer should be installed in the interval where groundwater production occurs. An extensometer will provide data of subsidence pertaining to intervals with groundwater production, whereas a CGPS would capture any subsidence regardless of the depth interval.

### Coordination of Monitoring

Subsidence monitoring along the Aqueduct benefits local stakeholders, State Water Project (SWP) contractors, and the DWR's DOE. It is anticipated that this monitoring can be coordinated with DWR to share data as well as potentially share resources and cost.

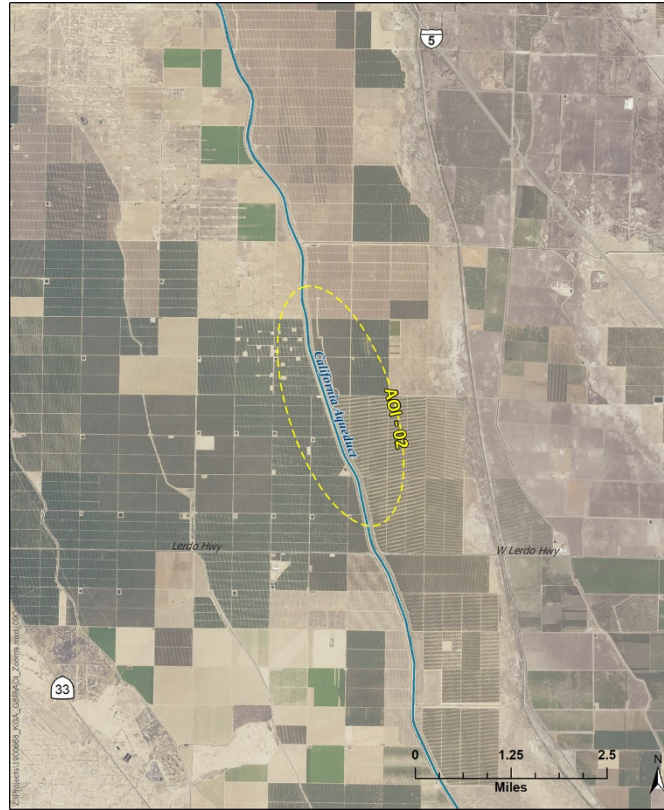


Figure 5. AOI-2. CA Aqueduct Milepost 196 to 215  
(symbol legend on Figure 2)

### AOI-3. FKC Milepost 130 to 137

This medium priority area is located along the FKC between Mileposts 130 to 137 (Figure 2), southwest of Famoso and Poso Creek. The purpose of this AOI is to monitor subsidence along the FKC infrastructure where InSAR and local stakeholders have reported subsidence in the surrounding area. As with AOI-1, no significant impacts to the FKC have been reported along this stretch. According to leveling survey data from the FWA (2019), the FKC invert may have subsided from 2 ft to 3 ft below original as-built elevation between Mileposts 120 to 135. Continued lowering of the canal invert can decrease freeboard from the original as-built conditions, which may contribute to reduction in emergency storage capabilities and delivery options of the Canal.

#### Existing Monitoring

Currently, this area is screened by InSAR, and previous level surveying was performed by the FWA at Mileposts labeled on Figure 2. Local districts monitor this stretch regularly as labeled on Figures 2 and 6. Currently there are no continuous monitoring points along this stretch.

#### New Monitoring Approach

A CGPS station that monitors from the ground surface, any subsurface subsidence regardless of the depth interval, is recommended because the only known cause of subsidence in this area is attributed to groundwater extraction. This CGPS data will complement manual level surveys from local district surveys. CGPS data will also provide nearly on-demand data as needed.

Where possible, this station should be tied in to benchmark surveys performed by local districts.

#### Coordination of Monitoring

Subsidence monitoring along the FKC benefits local stakeholders, CVP contractors, and the FWA. It is anticipated that this monitoring can be coordinated with FWA to share data as well as potentially share resources and cost.

Any level surveying along the canal from USBR Friant-Kern benchmarks (Figures 2 and 6) will require coordination with the FWA.

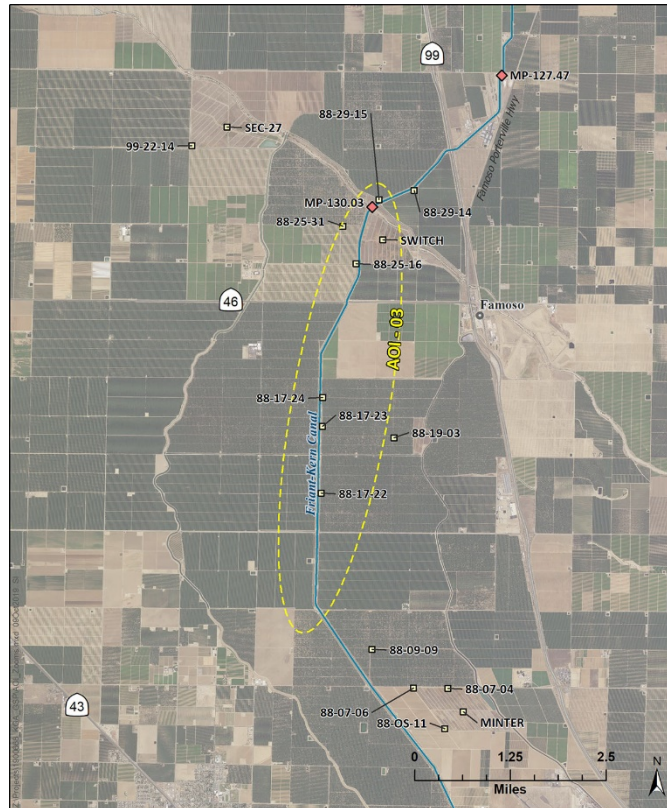


Figure 6. AOI-3. FKC Milepost 130 to 137  
(symbol legend on Figure 2)

#### **AOI-4. California Aqueduct Milepost 267 to 271**

This medium priority area is located along the Aqueduct between Milepost 267 to 271 near Old River Road. InSAR data report subsidence southwest and along I-5 and southwest toward the Aqueduct along Old River Road. A former CGPS station (BKR1/2) located about 5 miles north of the Aqueduct along Old River Road also reported significant subsidence; however, this station has since been decommissioned (2016).

#### **Existing Monitoring**

Currently, this area is screened by InSAR, and is monitored by level surveying every three to seven years by the DWR's DOE. There are no other active monitoring points along this stretch.

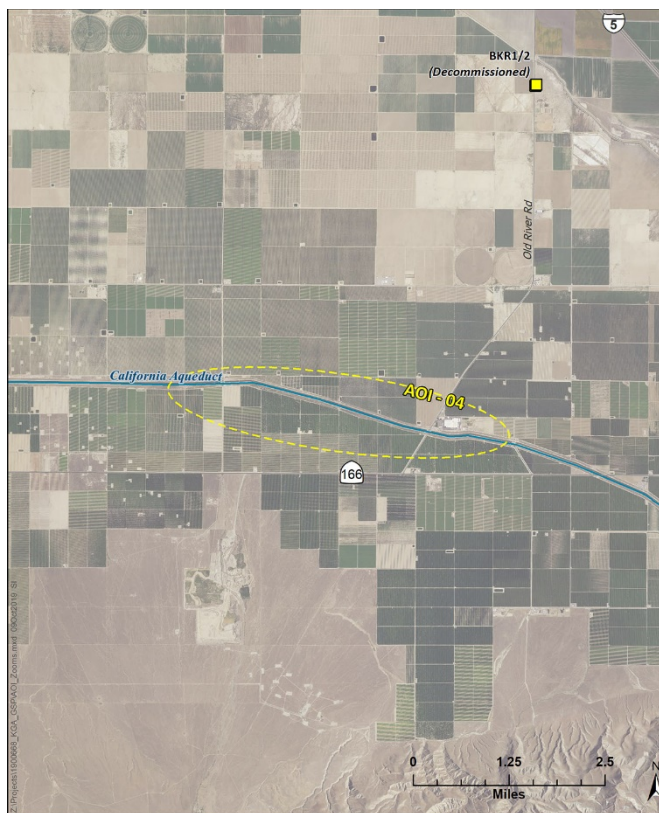
#### **New Monitoring Approach**

Groundwater extraction is potentially the source of subsidence, so a continuous monitoring station such as a CGPS or extensometer will be installed. Other potential sources could be oil and gas extraction and hydrocompaction. A DOGGR records search may provide sufficient information to understand the extent of oil and gas extraction in this area. Although hydrocompaction may not be significant because of pre-consolidation practices during Aqueduct construction, nonetheless, in order to avoid potential signatures of hydrocompaction, a monitoring point should be installed away from the footprint of the Aqueduct. If feasible during the siting study, the site location may be selected to the north between the Aqueduct and former BKR1/2.

Where possible, this station should be tied in to benchmark surveys performed by local districts.

#### **Coordination of Monitoring**

Subsidence monitoring along the Aqueduct benefits local stakeholders, SWP contractors, and the DWR's DOE. It is anticipated that this monitoring can be coordinated with DWR to share data as well as potentially share resources and cost.



**Figure 7. AOI-4. CA Aqueduct Milepost 267 to 271**  
(symbol legend on Figure 2)

### **AOI-5. Central-Northern Boundary of Subbasin**

This medium priority area is in the northern quarter of T25S-R24E and T25S-R25E. Currently, this AOI does not have recognized susceptible critical infrastructure. It has significant subsidence reported both historically (USGS level surveys) and recently (InSAR). A CGPS station in this area will provide a needed ground truthing point to confirm InSAR readings and will act as a useful monitoring point to gauge progress of groundwater management along the border of the subbasin in relation to neighboring subbasins to the north.

#### **Existing Monitoring**

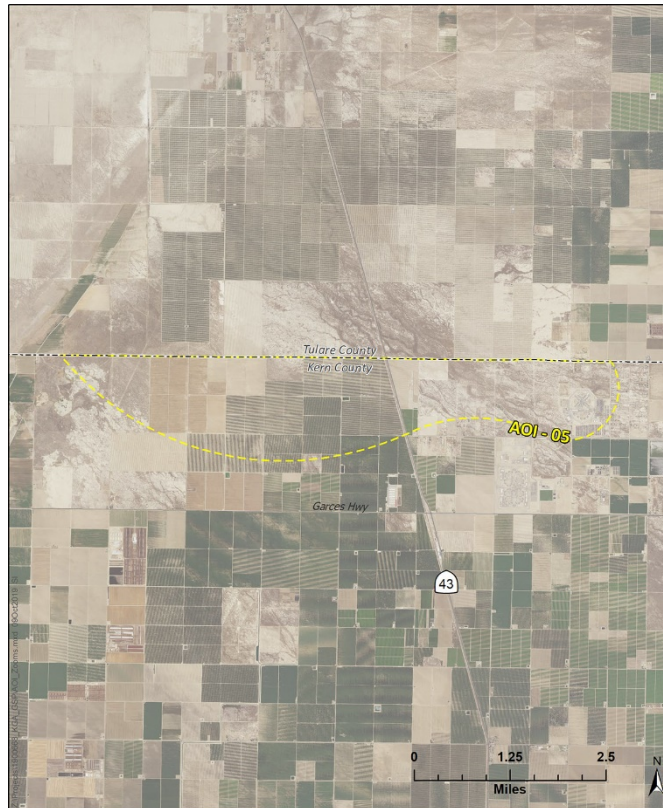
Currently, this area is screened by InSAR. There are no other active monitoring points along this stretch.

#### **New Monitoring Approach**

Groundwater extraction is potentially the source of subsidence, so a CGPS or extensometer monitoring station should be installed. Where possible, this station should be tied in to benchmark surveys performed by local districts.

#### **Coordination of Monitoring**

Subsidence monitoring along the subbasin boundary benefits local stakeholders in Kern County subbasin and adjacent subbasins. In the future, data may be shared with neighboring GSAs for coordination.



**Figure 8. AOI-5 Central-Northern Boundary of Subbasin**  
(symbol legend on Figure 2)

## Monitoring and Design Guidelines

According to the BMP (DWR, 2016), Leveling surveys and CGPS surveys must follow, at a minimum, guidelines in the *CalTrans Survey Manual*: <https://dot.ca.gov/programs/right-of-way/surveys-manual-and-interim-guidelines>. Extensometer resources from USGS are also listed in the BMP (DWR, 2016).

In addition to CalTrans guidance, UNAVCO has provided many CGPS design specifications on their website. UNAVCO offers a robust CGPS monument design (deep drill based monument [DDBM] that minimizes interference in data recording from soil expansion and temperature effects. Attachments 1 and 2 include example specifications for CGPS stations from CalTrans and UNAVCO, respectively. Attachment 3 includes sample extensometer designs for reference.

## Rough Costs to Consider

For subbasin-wide monitoring to be implemented with the recommended AOIs in this memorandum, Kern Subbasin stakeholders will coordinate how the work will be implemented. Below is a brief summary of rough costs expected for the installation of each monitoring solution. Costs do not include ongoing management and maintenance of the stations. Actual costing will be confirmed during procurement and the planning process.

### Level Surveying and Benchmarks (not proposed in this memo, but is an alternative approach).

- Install benchmarks where none available along linear features every 1/8 to 1/4 mile in area of interest.
- Each ~\$500 to \$2500 installation
- Initial Survey (5 to 8 monuments per day). ~\$1500-\$2500 per day (includes reporting).
- Subsequent Surveys (8 to 10 monuments per day). ~\$1500-\$2500 per day (includes reporting).

### CORS CGPS Station

- ~\$30k to \$100k depending on equipment (purchase and installation). This may not include programming and digital network setup.
- DWR may be able to provide technical assistance, and at a minimum, review design specifications if DWR concurrence is wanted. DWR has not at this time offered any current specifications or assistance in developing designs.
- Optional outside consulting may be recommended for design and programming.

### Extensometer

Drilling and installation costs ~\$200k to \$300k (design and operation not included).

## Conclusions

This memorandum was prepared, in coordination with subbasin stakeholders, to improve the Kern County Subbasin subsidence monitoring network. It prioritizes areas of interest, at a subbasin-level, that require additional subsidence monitoring. Figures 2 and 3 present the AOIs for future monitoring points and associated water level monitoring wells (RMWs). AOIs are listed in order of highest priority for investigation and monitoring installation. Figures 4 to 8 present aerial images of these areas. In AOIs where groundwater extractions and oil and gas activities may be contributing to subsidence, extensometers will be installed in lieu of CGPS points in order to monitor the depth interval of groundwater extractions. Where subsidence monitoring is required, monitoring water levels and the condition of infrastructure is necessary. Where groundwater extraction is not causing subsidence, the AOI can be screened by the region-wide InSAR subsidence monitoring network.

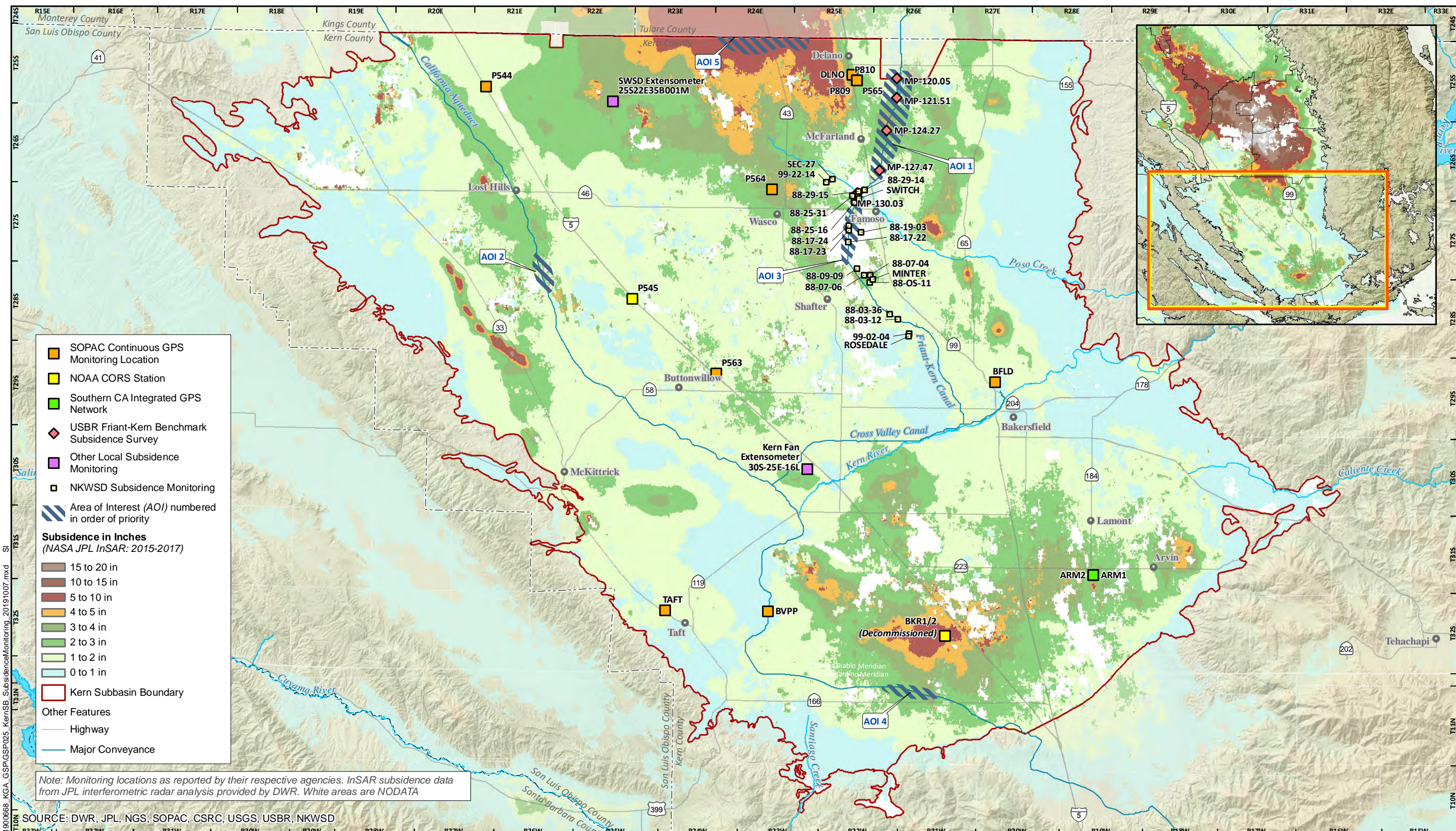


## References

DWR. 2016. Monitoring Networks and Identification of Data Gaps. Best Management Practices (BMP) for the Sustainable Management of Groundwater. December.

DWR. 2017. California Aqueduct Subsidence Study. San Luis Field Division. San Joaquin Field Division. June.

Kern Groundwater Authority (KGA). 2019. Groundwater Sustainability Plan of Kern County Subbasin. Public Draft. August.



- SOPAC Continuous GPS Monitoring Location
- NOAA CORS Station
- Southern CA Integrated GPS Network
- USBR Friant-Kern Benchmark Subsidence Survey
- Other Local Subsidence Monitoring
- NKWSD Subsidence Monitoring
- Area of Interest (AOI) numbered in order of priority

- Subsidence in Inches**  
(NASA JPL InSAR: 2015-2017)
- 15 to 20 in
  - 10 to 15 in
  - 5 to 10 in
  - 4 to 5 in
  - 3 to 4 in
  - 2 to 3 in
  - 1 to 2 in
  - 0 to 1 in

- Kern Subbasin Boundary
- Other Features**
- Highway
- Major Conveyance

Note: Monitoring locations as reported by their respective agencies. InSAR subsidence data from JPL interferometric radar analysis provided by DWR. White areas are NODATA

SOURCE: DWR, JPL, NGS, SOPAC, CSRC, USGS, USBR, NKWSD



Kern Groundwater Authority  
Basin Setting

Kern County, California



REGIONAL SUBSIDENCE  
MONITORING NETWORK

OCTOBER 2019

**DRAFT**

FIGURE 2

07-Oct-2019 Z:\Projects\1900668\_KGA\_GSP\GSP025\_KernSB\_SubSubsidenceMonitoring\_20191007.mxd SI



- Kern Subbasin Boundary
- Monitored for Water Quality Only
- Monitored for Water Quality and GWE
- Kern Groundwater Authority GSA
- KERN RIVER GSA
- BELTRIDGE W.S.D.
- BERRENDAS MESA W.D.
- BUENA VISTA W.S.D.
- CAWELO W.D.
- DEVILS DEN W.D.
- DUDLEY RIDGE W.D.
- HENRY MILLER W.D.
- LOST HILLS W.D.
- SEMITROPIC W.S.D.
- WHEELER RIDGE-MARICOPA W.S.D.
- ARVIN-EDISON W.S.D.
- DELANO-EARLIMART I.D.
- SHAFTER-WASCO I.D.
- KERN-TULARE W.D.
- SOUTHERN SAN JOAQUIN M.U.D.
- TEJON CASTAIC W.D.
- NORTH KERN W.S.D.
- SHAFTER-WASCO I.D. additional M.A.
- ROSEDALE RIO BRAVO W.S.D.
- WEST KERN W.D.
- KERN WATER BANK AUTHORITY
- OIL AND GAS LANDS
- EASTSIDE WATER MANAGEMENT AREA
- SEMITROPIC W.S.D. additional M.A.
- ROSEDALE RIO BRAVO W.S.D. additional M.A.
- ARVIN-EDISON W.S.D. additional M.A.
- BELTRIDGE W.S.D. additional M.A.
- BERRENDAS MESA W.D. additional M.A.



Kern Groundwater Authority  
Basin Setting

Kern County, California



REGIONAL GROUNDWATER QUALITY  
MONITORING NETWORK

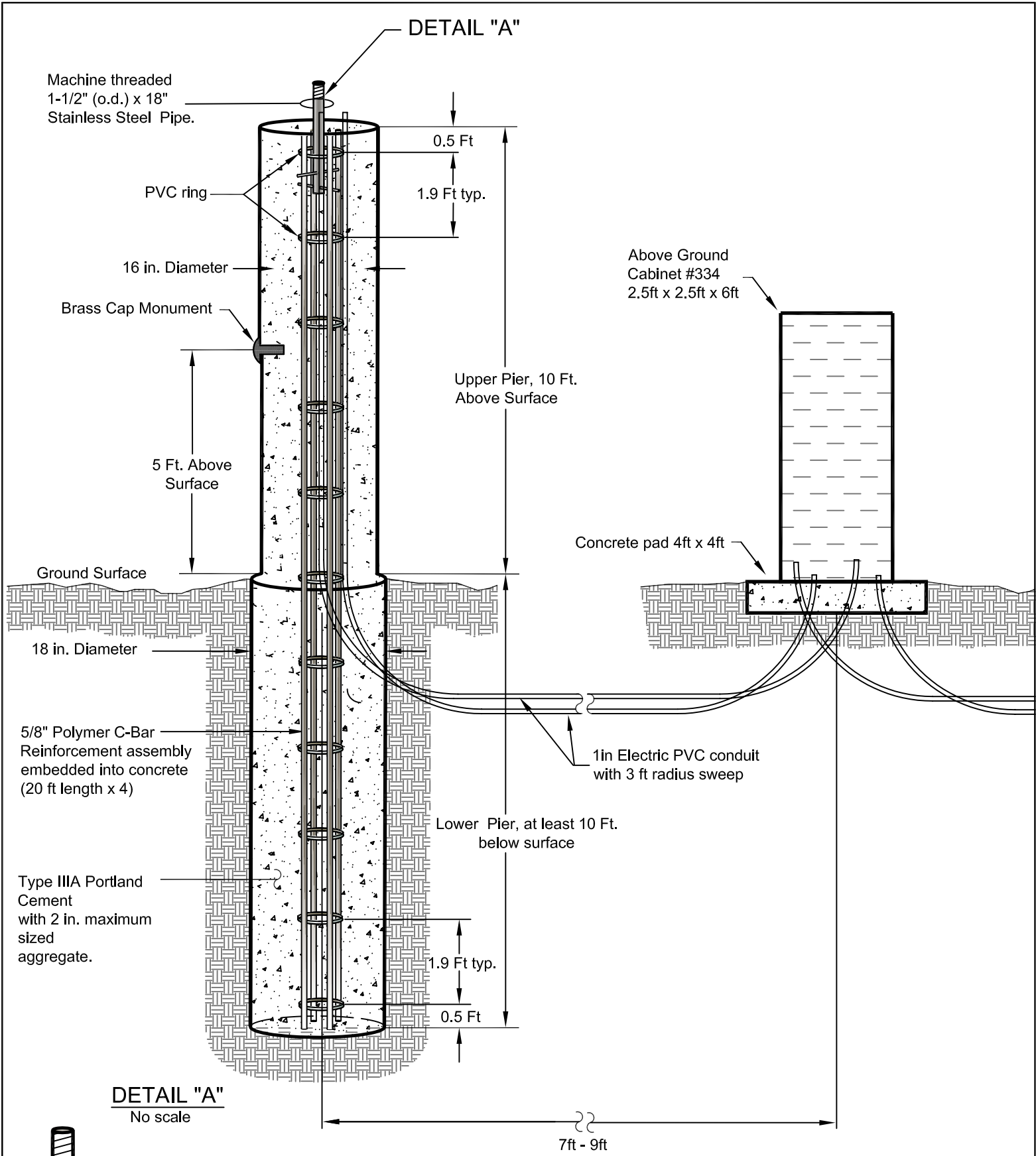
DECEMBER 2019

**DRAFT**

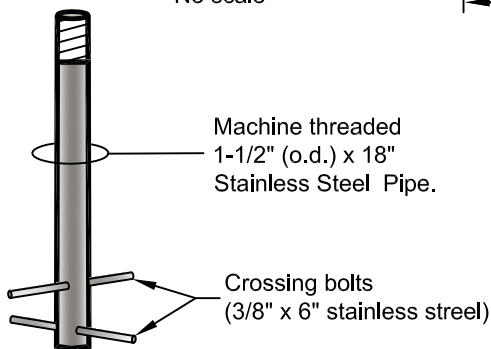
FIGURE 3

10Jan2020 Z:\Projects\1900668\_KGA\_GSP\GIS\040\_MTM0\_WQ\_MonNetwork\_2020110.mxd AB/SL

Attachment 1. CGPS CDOT Design



**DETAIL "A"**  
No scale












<b>Monument CVSRN</b>		<b>TAFT MS</b> Station Name	
CENTRAL VALLEY SPATIAL REFERENCE NETWORK		Design By: GC	Revision: Feb 20, 2007
		Drawn By: PNP	Scale: None
<b>CVSRN</b>		File: Monument TAFT	
Date: Feb 20, 2007			Sheet 1 of 1

Attachment 2. CGPS UNAVCO Design and Resources

# Deep Drilled Braced Monument Overview

Article ID: 300 | Rating: Unrated | Last Updated: Wed, Oct 26, 2011 at 6:49 PM

## Deep Drilled Braced Monument

<a href="#">Back to comparison table</a>	Mount Commonly Used	Stability	Cost	Install Time	Labor	Substrate	Site Impact
	 SCIGN mount	 high	 \$7,500-15,000	  2-4 d	  3-4	BR, U	 high

The deep drilled braced monument (UNAVCO DDBM\*) provides for a high degree of stability and longevity and can be anchored in bedrock or unconsolidated material. It is in the form of a tripod, each leg extending into the ground up to about 40 feet and welded at the top with gusset reinforcements. If site access is an issue and bedrock is available, the short drilled braced monument is the next best alternative to this type. The UNAVCO DDBM is used throughout the PBO network. It is based on the SCIGN design used at older installations in the SCIGN, BARGEN, PBO and PANGA networks.

\* Modified from the original SCIGN DDBM design of Duncan Agnew and Frank Wyatt.



Site ASHM of the BARGEN network, Nevada, Utah, and California.

## Pros

- high stability
- longevity
- can be installed in either bedrock or unconsolidated materials

## Cons

- labor and tool intensive (requires a drilling rig and crew)
- expensive (can be \$7,500 to \$15,000, depending on drilling)
- time intensive (requires 2-4 days)
- may not be able to install in some remote locations... depends upon ease of site access
- large construction disturbance footprint

## Design and Construction

A drilling contractor is required to install this monument. The cost of installation can typically range between \$6,000 and \$10,000 depending upon factors such as the type of drilling rig used, distance the drill rig and crew need to travel to site (mobilization/de-mobilization), foundation material (ground) being drilled, etc.

- [Driller's Instructions \(.pdf\)](#)

## Documents

- Deep Drilled Braced Monument Technical Drawings in .pdf format:
  - [Full](#)
  - [Above Surface](#)
  - [Top](#)
  - [Construction](#)
  - [Site Layout](#)
  - [Sub-surface](#)
- Deep Drilled Braced Monument Alignment Tool Diagrams in .pdf format:
  - [sign-01-01-010.pdf](#)
  - [sign-01-01-020.pdf](#)
  - [sign-01-01-030.pdf](#)
  - [sign-01-02-010.pdf](#)
  - [sign-01-02-020.pdf](#)
  - [sign-01-02-030.pdf](#)

## Installation Photos

- [Construction Photos](#)

## Approximate Cost

\$7,500-15,000 depending principally on drilling (substrate, distance drill rig needs to travel to and from the site)

*This cost is for the monumentation only; the antenna mount (e.g. SCIGN mount) is not included.*

## Materials

- 21-foot 1.25" diameter schedule 40 stainless steel pipe, threaded (5 per site)



- 10-foot 1.25" diameter schedule 40 stainless steel pipe, threaded (5 per site)
- 1.25" schedule 40 stainless steel threaded adapters (5 per site)
- 3 weld gussets
- threaded adapter (if using the SCIGN antenna mount; see below)
- 2.5" diameter schedule 40 PVC (for each leg and for center post)
- foam wrapper (for each leg and for center post)
- rebar (for each leg and for center post)
- duct tape (for foam)
- concrete (provided by drillers)
- water (provided by drillers)
- welding rod
- gas for the generator (if there is no AC hookup)
- string, paint, nails, and wood stakes (for marking legs)

## Tools

- generator (if there is no AC hookup)
- compass
- reel measuring tape (30m/100ft)
- leg alignment tool
- mallet
- large vice grips (2 or more)
- grinder
- vertical and angle level(s)
- welder
- file, pick, brush, gloves, helmet, long-sleeved shirt, hat (for welding)

## Mount Commonly Used



The [SCIGN mount](#) is the antenna mount most commonly used with the deep drilled braced monument, although it is only required when using the SCIGN radome. Otherwise, any other leveling mount, such as the SECO 2072-series antenna mount, is acceptable.



## **GPS Deep Drilled Braced Monument Installation Driller Instructions**

### **Overview**

The deep drilled braced GPS monument (DDBM) is designed to create a highly rigid and immobile structure isolated from surface soil movement and cemented in place at depth. The monument consists of 5 legs (stainless steel pipes) placed into drilled holes, and welded together above the surface to create a “tripod” frame. Of the 5 legs, the center leg is vertical and the 4 other legs are installed at angles to brace the vertical leg.

The Plate Boundary Observatory (PBO) project will require the installation of at least 600 of these DDBM monuments throughout the Western US and Alaska. We hope to locate a small number of highly skilled contractors throughout the Western US and Alaska to install these monuments during the next five years. This scope of work is for a one-time installation project consisting of a small number (1-5) of these installations. This will allow us to evaluate the contractor for possible future work within PBO. Please provide a quote for services based upon the scope of work outlined below.

### **Material**

Contractor to supply to the following material:

- 1) A sufficient amount of grout to fill 5-35 foot deep holes (4.5”-6” diameter) will be used. Contractor will assure the following:
  - a) Type I, II Portland cement and Class F Flyash shall be used for grout materials.
  - b) Flyash shall replace 10-15% of the volume of Portland cement.
  - c) Grout shall be proportioned to have a water to cementitious material ratio of 0.50.
  - d) If using pre-packaged grout, grout shall be 1118 Grout supplied by Surecrete, Seattle, WA, or an approved equal meeting these specifications. Grout 1119 should be used for applications when water is present in the hole.
  
- 2) Water sufficient to mix grout. Final mix should be consistency of a milk shake.

All other material will be supplied by UNAVCO.

### **Construction Procedure**

#### Drilling/Casing/Pipe Placement

- 1) Drill rig type and size selection shall be determined by contractor such that equipment used is most suited to site geology and hole precision requirements.
  
- 2) UNAVCO shall provide to the contractor a summary of expected site conditions such as surface topography and subsurface material.



GPS Deep Drilled Braced Monument  
Driller Instructions Template

v3.1

- 3) Contractor shall drill 5 holes of 4.5” diameter to minimum depths of 35 ft.
  - a) Center hole shall be drilled at vertical orientation plus/minus 2 degrees.
  - b) Four angled holes shall be drilled at 35 degrees from vertical plus/minus 2.5 degrees.
- 4) Holes drilled at precise locations specified by UNAVCO engineering staff. Frequent measurement of hole inclination during drilling shall be made to ensure holes are drilled to exact specifications. The centerlines of all 5 holes shall intersect at a single point plus/minus 3”. This point of intersection shall be located 62” above the surface, at the center leg. On level ground, each of the 4 angled legs will enter the ground at 43.5” from the center leg.
- 5) All holes shall be drilled straight enough so that PVC casing can be installed in the top 15.5 ft of each hole, and that the steel pipe can be freely lowered, not forced, for its entire 35 ft length.
- 6) Hole depth is to be determined by actual measurement after drilling. If necessary, loose material may need to be removed from the bottom of the holes to achieve required depth.
- 7) 2.5” PVC casing (wrapped with insulation) shall be installed in upper 15.5 ft of each hole immediately after drilling. It may be necessary to use drill rig to push casing into hole.
- 8) Contractor shall assist UNAVCO staff in placement of steel piping immediately after drilling and casing installation. 1.25” schedule 40 steel pipe shall be installed inside casing in each hole to a depth of 32-38 ft.
- 9) A single 5 foot vertical hole shall be drilled for the equipment enclosure.
- 10) UNAVCO is responsible for siting and alignment.
- 11) Contractor shall assist in the clearing of cuttings from the hole, during the drilling operation.

Grout Installation

- 1) Contractor shall provide grouting material and water for mixing.
- 2) All five legs are to be cemented in place with expansive grout.
- 3) Contractor shall prepare the pumpable grout to a “milkshake” consistency. Jobsite conditions may affect actual quantities of water needed.
- 4) Following steel pipe installation, contractor shall pump grout down steel pipes until grout fills pipe and pipe-casing annulus, and is seen emerging from top of annulus. Due to small clearances within pipe and at pipe-casing annulus, high pressures may be encountered during grout placement.



5) Contractor shall place grout such that no air bubbles are introduced. Ensuring a continuous flow of grout through pipe and back up through annulus requires proper grout handling, mixing, and pumping equipment and procedures.

6) Contractor shall neatly finish grout at surface of casing such that water will not puddle around monument legs.

### **Site Documentation and Cleanup**

Contractor shall assist UNAVCO personnel in compiling site documentation including:

1) Depths of holes. All drilling documentation including drilled, measured, tamped, and shimmed pipe depths shall be recorded by contractor.

2) Grout information. Time of day, grout sack ID#, grout amount sifted, mixed, pumped, and lost shall all be monitored by contractor and reported to UNAVCO engineer for recording.

3) Contractor shall be responsible for removal of hazardous materials (i.e. hydraulic fluid, diesel fuel and/or contaminated soil) and debris. Site shall be left in suitable condition.

4) Contractor shall be responsible for containing and disposing of excess grouting material and debris such as cement bags, trash, and cigarette butts.

5) Contractor shall be responsible for leveling and raking of areas that were disturbed by drill rig and support vehicles at the site.

### **Miscellaneous**

1) Contractor is responsible for hotel and per diem for the drilling crew.

2) Contractor shall assist UNAVCO personnel in any tasks related to GPS site installation such as pipe/coupling preparation, installation of pipe and insulation piping.






3) UNAVCO will mark for Underground Services Alert.








4) UNAVCO will provide maps, directions and relevant access information for drilling access.







5) Contractor's equipment and tools are the sole responsibility of the contractor. UNAVCO will not reimburse the contractor for any lost or damaged equipment.

**All work shall be done to highest professional standards.**

## GPS/GNSS Receiver Comparison Table


	Receiver	Multi-GNSS ?	Available as special buy	Available on loan	Serviceable at UNAVCO	File Size (24 hr, 15 s)	Memory	Time lasts recording at 15 s	Power draw w/ antenna	Time lasts on 18amphr battery
	<a href="#">Alert Geomatics/XEOS Resolute Polar</a>	● Y	● Y	● Y	● N	● 4.2MB	● 8GB	● 5.2 years	● 1.2 - 2W	● 1 Week
	<a href="#">Ashtech ProFlex 500 CORS</a>	● Y	● <u>Y</u>	● N	● Y	N/A	● 8MB + Ext. USB	N/A	● <5W	● >1.5 days
	<a href="#">Javad Sigma</a>	● Y	● N	● N	● N	N/A	● up to 2 GB	N/A	● <u>4 W</u>	● 1.9 days
	<a href="#">Leica GR25</a>	● Y	● <u>Y</u>	● N	● N	● 1.6 MB 1.2 MB (zip)	● up to 32 GB SD card	● 54 years on an 32 GB card	N/A	N/A
	<a href="#">Leica GR10</a>	● Y	● <u>Y</u>	● N	● N	● 1.6 MB 1.2 MB (zip)	● up to 32 GB SD card	● 54 years on an 32 GB card	● <u>3.5 W</u>	● 2.5 days

	<a href="#">Septentrio PolaRx5</a>	● Y	● Y	● N	● N	N/A	● up to 32 GB	N/A	● 2-4 W	● 4.5 days
	<a href="#">Septentrio PolaRx4</a>	● Y	● <u>Y</u>	● N	● N	N/A	● up to 7.4 GB	N/A	● <u>6.1W</u>	● 1.25 days
	<a href="#">Septentrio AsteRx3 HDC</a>	● Y	● <u>Y</u>	● N	● N	N/A	N/A	N/A	N/A	N/A
	<a href="#">Septentrio AsteRx2el HDC</a>	● N	● <u>Y</u>	● N	● N	N/A	N/A	N/A	N/A	N/A
	Topcon NetG5	● Y	● <u>Y</u>	● N	● Y	● 6.8 MB (default messages)	● up to 32 GB	● ~10 years	● 4 W	● 1.9 days
	<a href="#">Topcon Net-G3 and Net-G3A</a>	● Y	● <u>Y</u>	● N	● Y	● 6.8 MB (default messages)	● up to 8 GB CF card	● 3.2 years	● <u>4 W</u>	● 1.9 days
	<a href="#">Topcon GB-1000</a>	● Y	● N	● Y	● Y	● 4.6 MB	● 1 GB internal, 1 GB CF card	● 1.2 years	● 3.9+ W	● 1.9 days

	<a href="#">Trimble NetR9</a>	<span style="color: green;">●</span> Y	<span style="color: green;">●</span> <u>Y</u>	<span style="color: green;">●</span> Y	<span style="color: green;">●</span> Y	<span style="color: green;">●</span> 0.9 MB	<span style="color: green;">●</span> 8 GB Internal + External USB	<span style="color: green;">●</span> 24 years at 8 GB	<span style="color: orange;">●</span> 3.8 W	<span style="color: orange;">●</span> 2.4 days
	<a href="#">Trimble NetR8</a>	<span style="color: green;">●</span> Y	<span style="color: red;">●</span> N	<span style="color: green;">●</span> Y	<span style="color: green;">●</span> Y	<span style="color: green;">●</span> 0.9 MB	<span style="color: green;">●</span> 4 GB	<span style="color: green;">●</span> 12 years	<span style="color: orange;">●</span> 4.3 W	<span style="color: orange;">●</span> 1.8 days
	<a href="#">Trimble NetR5</a>	<span style="color: green;">●</span> Y	<span style="color: red;">●</span> N	<span style="color: red;">●</span> N	<span style="color: green;">●</span> Y	<span style="color: yellow;">●</span> 1.4 MB	<span style="color: orange;">●</span> 256 MB	<span style="color: orange;">●</span> 6 months	<span style="color: orange;">●</span> 4.8 W	<span style="color: orange;">●</span> 1.6 days
	<a href="#">Trimble NetRS</a>	<span style="color: red;">●</span> N	<span style="color: red;">●</span> N	<span style="color: green;">●</span> Y	<span style="color: green;">●</span> Y	<span style="color: yellow;">●</span> 800 kb	<span style="color: green;">●</span> 1 GB	<span style="color: green;">●</span> 3.5 years	<span style="color: yellow;">●</span> <u>3.4 W</u>	<span style="color: yellow;">●</span> 2.25 days
	<a href="#">Trimble R7</a>	<span style="color: red;">●</span> N	<span style="color: red;">●</span> N	<span style="color: green;">●</span> Y	<span style="color: green;">●</span> Y	<span style="color: yellow;">●</span> 1 MB	<span style="color: green;">●</span> up to 2 GB CF card	<span style="color: orange;">●</span> - <span style="color: green;">●</span> 4 mo.- 5.5 years or 512 files	<span style="color: yellow;">●</span> 3.7 W	<span style="color: yellow;">●</span> 2 days
	<a href="#">Trimble 5700</a>	<span style="color: red;">●</span> N	<span style="color: red;">●</span> N	<span style="color: green;">●</span> Y	<span style="color: green;">●</span> Y	<span style="color: yellow;">●</span> 1 MB	<span style="color: green;">●</span> up to 2 GB CF card	<span style="color: orange;">●</span> - <span style="color: green;">●</span> 4 mo. - 5.5 years or 512 files	<span style="color: yellow;">●</span> <u>3 W</u>	<span style="color: yellow;">●</span> 2.5 days

	<a href="#">Trimble 4800/5800/R8</a>	● N	● N	● N	● N	-	● 0 MB	requires external data collection	● varies: 6+ W - 2.5 W	● 1.25 - 3 days
<b>No longer supported</b>	<b>Receiver</b>	<b>GNSS ?</b>	<b>Available as special buy</b>	<b>Available on loan</b>	<b>Serviceable at UNAVCO</b>	<b>File Size (24 hr, 15 s)</b>	<b>Memory</b>	<b>Time lasts recording at 15 s</b>	<b>Power Draw</b>	<b>Time lasts on 18amphr battery</b>
	<a href="#">Allen Osborne TurboRogue</a>	● N	● N	● N	● N	● 2.2 MB turbo binary ● 900 kb conan binary	● low	● low	● high	● low
	<a href="#">Ashtech Z-12</a>	● N	● N	● N	● N	● 1.8 MB	● 32 MB or less	● 18 days or less	● <a href="#">12 W</a>	● 15 hrs
	<a href="#">Ashtech MicroZ &amp; ICGRS</a>	● N	● N	● N	● Y	● 3.8 MB	● - ● 32-128 MB	● 8 days - 1 month	● <a href="#">8 W</a>	● 23 hrs
	<a href="#">Canadian Marconi AllStar</a>	● N	● N	● N	● N		● 0 MB	requires external data collection		
	<a href="#">Trimble 4000</a>	● N	● N	● N	● N	● 1.8 MB	● 10 MB or less	● 5 days	● <a href="#">10 W</a>	● 18 hrs



	<u>Trimble 4700</u>	● N	● N	● N	● N		● 0 MB	requires external data collection	● <u>4.5 W</u>	● 1.7 days
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**Available as special buy:** Special pricing is available to UNAVCO members and associate members on select equipment. For more information see the [GNSS Equipment Purchase Information](#) page.

**Available on loan:** UNAVCO maintains a large pool of GPS and related equipment, available on loan to member and associate member institutions and NSF-funded programs. To submit a request, fill out the [Online Support Request Form](#).

**Serviceable at UNAVCO:** UNAVCO is licensed to repair select GNSS receivers and antennas. For more information see the [Equipment Repairs](#) page.

**File size (24 hr, 15 s):** File size for a 24 hour-long file collected at a 15 second sample rate. File size is approximate and varies based on # of satellites tracked and frequencies recorded. File sizes shown here were taken from site data in the UNAVCO data archive.

**Memory:** Memory for receivers from the dealer may vary; values are given for UNAVCO-owned receivers.

**Time last recording at 15 s:** Estimated length of time the receiver can record at its given internal memory at a sample rate of 15 seconds.



**Power draw:** Estimated power draw in Watts. The power draw varies depending on the other equipment e.g. antenna(s) connected to the receiver.




**Time lasts on 18 amphr battery:** Estimated length of time the receiver can operate on the 12 volt, 18 amphr battery standard for UNAVCO campaign systems, without a solar panel. Time will vary based on temperature and battery health.


## UNAVCO Resources: GNSS Antennas

Dual frequency (L1/L2) Choke Ring Antennas provide geodetic-quality GNSS measurements for surveying, map Typical dual-frequency choke ring antennas maintain a stable phase center that has less than 1 mm of drift. T on the geodetic research standard and features aluminum choke rings and a Dorne Margolin antenna elemen have a low power consumption, and have excellent multipath rejection characteristics. Less-expensive but also available as well. The UNAVCO Facility currently supports the following GNSS antennas.

### GPS/GNSS Antennas Used by UNAVCO

		MENU
	<p>Trimble Choke Ring</p>	<ul style="list-style-type: none"> <li>• NGS antenna calibration (Trimble GNSS Choke Ring, TRM59800.00 SCIT) (<a href="http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=TRM59800.00_SCIT.atx">http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=TRM59800.00_SCIT.atx</a>)</li> <li>• NGS antenna calibration (TRM29659.00 SCIT) (<a href="http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=TRM29659.00_SCIT.atx">http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=TRM29659.00_SCIT.atx</a>)</li> <li>• Note: Trimble GNSS Choke Ring TRM59800.80 is a TRM29659.00 reworked with a wide-band low noise amplifier (LNA) for GNSS. The TRM59800.00 and TRM59800.80 elements are identical in construction, the two antenna types are assumed to show similar phase center corrections. The TRM59800.80 calibrations are copies of the TRM59800.00 calibrations.</li> </ul>
	<p>Ashtech Choke Ring</p>	<ul style="list-style-type: none"> <li>• NGS antenna calibration (ASH701945G_M SCIT) (<a href="http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=ASH701945G_M_SCIT.atx">http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=ASH701945G_M_SCIT.atx</a>)</li> <li>• NGS antenna calibration (ASH701945E_M SCIT) (<a href="http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=ASH701945E_M_SCIT.atx">http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=ASH701945E_M_SCIT.atx</a>)</li> <li>• NGS antenna calibration (ASH701945C_M SCIT) (<a href="http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=ASH701945C_M_SCIT.atx">http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=ASH701945C_M_SCIT.atx</a>)</li> <li>• NGS antenna calibration (ASH701945B_M SCIT) (<a href="http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=ASH701945B_M_SCIT.atx">http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=ASH701945B_M_SCIT.atx</a>)</li> <li>• NGS antenna calibration (ASH700936D_M NONE) (<a href="http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=ASH700936D_M_NONE.atx">http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=ASH700936D_M_NONE.atx</a>)</li> <li>• Preliminary Report on Data Quality with a Trimble 5700 GPS Receiver and an Ashtech Choke Ring Antenna (2002) (<a href="http://kb.unavco.org/kb/article.php?id=237">http://kb.unavco.org/kb/article.php?id=237</a>)</li> </ul>

	Trimble Zephyr Geodetic	<ul style="list-style-type: none"> <li>• NGS antenna calibration (TRM41249.00 NONE) (<a href="http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=TRM41249.00_NONE.atx">http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=TRM41249.00_NONE.atx</a>)</li> <li>• NGS antenna calibration (TRM57971.00_NONE) (<a href="http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=TRM57971.00_NONE.atx">http://www.ngs.noaa.gov/ANTCAL/LoadFile?file=TRM57971.00_NONE.atx</a>)</li> <li>• Trimble Zephyr Geodetic - Dimensions (from Trimble) (<a href="http://kb.unavco.org/kb/article.php?id=240">http://kb.unavco.org/kb/article.php?id=240</a>)</li> <li>• The Design and Performance of the Zephyr Geodetic Antenna (Trimble publication) (<a href="http://kb.unavco.org/kb/article.php?id=241">http://kb.unavco.org/kb/article.php?id=241</a>)</li> </ul>
	Trimble Zephyr	<ul style="list-style-type: none"> <li>• NGS antenna calibration (TRM39105.00) (<a href="http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=TRM&amp;Antenna=TRM39105.00">http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=TRM&amp;Antenna=TRM39105.00</a>)</li> </ul>
	Topcon PG-A1	<ul style="list-style-type: none"> <li>• NGS antenna calibration (TPSPG_A1+GP) (<a href="http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=TPS&amp;Antenna=TPSPG_A1,GP">http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=TPS&amp;Antenna=TPSPG_A1,GP</a>)</li> <li>• Topcon PG-A1 Antenna Dimensions (.pdf) (<a href="http://kb.unavco.org/kb/assets/102/TPSPG_A1GP.pdf">http://kb.unavco.org/kb/assets/102/TPSPG_A1GP.pdf</a>)</li> </ul>
no photo available	AOA TurboRogue SNR-800	<ul style="list-style-type: none"> <li>• NGS antenna calibration (AOAD/M_T) (<a href="http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=AOA&amp;Antenna=AOAD/M_T">http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=AOA&amp;Antenna=AOAD/M_T</a>)</li> </ul>
no photo available	Trimble L1/L2 microcentered geodetic with groundplane	<ul style="list-style-type: none"> <li>• NGS antenna calibration (TRM33429.20+GP) (<a href="http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=TRM&amp;Antenna=TRM33429.20,GP">http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=TRM&amp;Antenna=TRM33429.20,GP</a>)</li> </ul>
no photo available	Trimble Permanent L1/L2	<ul style="list-style-type: none"> <li>• NGS antenna calibration (TRM23903.00) (<a href="http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=TRM&amp;Antenna=TRM23903.00">http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=TRM&amp;Antenna=TRM23903.00</a>)</li> </ul>
no photo available	Trimble Geodetic Compact L1/L2	<ul style="list-style-type: none"> <li>• NGS antenna calibration (w/ ground plane) (TRM22020.00+GP) (<a href="http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=TRM&amp;Antenna=TRM22020.00,GP">http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=TRM&amp;Antenna=TRM22020.00,GP</a>)</li> <li>• NGS antenna calibration (w/o ground plane) (TRM22020.00-GP) (<a href="http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=TRM&amp;Antenna=TRM22020.00-GP">http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=TRM&amp;Antenna=TRM22020.00-GP</a>)</li> </ul>

no photo available	Trimble 4000SST L1/L2 Geodetic	<ul style="list-style-type: none"> <li>NGS antenna calibration (TRM14532.00) (<a href="http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=TRM&amp;Antenna=TRM14532.00">http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=TRM&amp;Antenna=TRM14532.00</a>)</li> </ul>	
no photo available	Trimble 4000SSE Kinematic L1/L2	<ul style="list-style-type: none"> <li>NGS antenna calibration (TRM14532.10) (<a href="http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=TRM&amp;Antenna=TRM14532.10">http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=TRM&amp;Antenna=TRM14532.10</a>)</li> </ul>	MENU
	UNAVCO/Micro Pulse L1	<ul style="list-style-type: none"> <li>NGS antenna calibration (MPL1370W) (<a href="http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=MPL&amp;Antenna=MPL1370W">http://www.ngs.noaa.gov/cgi-bin/query_cal_antennas.prl?Model=MPL&amp;Antenna=MPL1370W</a>)</li> <li>UNAVCO/Micro Pulse L1 - How to make UNAVCO's L1 antenna (<a href="http://kb.unavco.org/kb/article.php?id=635">http://kb.unavco.org/kb/article.php?id=635</a>)</li> </ul>	

### Setting up GPS/GNSS Antennas

- Introduction to GNSS Antenna Set-up Methods for Campaigns (<http://kb.unavco.org/kb/article.php?id=71>)  
An introduction for inexperienced surveyors including antenna height measurement methods and g
- How to use declination to align the GNSS antenna to true north (<http://kb.unavco.org/kb/article.php?id=61>)  
Antennas are typically aligned to true north to keep measurements both within and between camp; that the location of the antenna phase center is modeled correctly.
- Geographic Magnetic Calculator (<http://www.resurgentsoftware.com/GeoMag.html>)  
Link to software you can download and use to calculate the declination in your study area.

### Development and Testing of GPS/GNSS Antennas



- Choke Ring Antenna Calibrations (<http://kb.unavco.org/kb/article.php?id=311>)
- Equipment Power Usage Testing (<http://kb.unavco.org/kb/article.php?id=235>)
- Antenna Phase Center Plots (.pdf) (<http://kb.unavco.org/kb/assets/242/phaseplots.pdf>) (L1 and L2 phase center p Trimble Zephyr Geodetic, Trimble Zephyr, and Leica Choke Ring antennas)
- Iridium & GPS Antenna Interference Test (2008) (<http://kb.unavco.org/kb/article.php?id=110>)
- Assessing the Impact of the SCIGN Radome on Geodetic Parameter Estimates (2007) (<http://kb.unavco.org/kb/article.php?id=254>)
- Development of an antenna and multipath calibration system for Global Positioning System sites (2004) (<http://kb.unavco.org/kb/article.php?id=254>)
- UNAVCO 2004 GPS Campaign System Testing in Support of the Plate Boundary Observatory (PBO) (<http://kb.unavco.org/kb/article.php?id=5>)
- UNAVCO 2003 GPS Receiver and Antenna Testing in Support of the Plate Boundary Observatory (PBO) (<http://kb.unavco.org/kb/article.php?id=15>)
- Multipath characteristics of GPS signals as determined from the Antenna and Multipath Calibration (<http://kb.unavco.org/kb/article.php?id=253>)
- Preliminary report on data quality with a Trimble 5700 GPS receiver and an Ashtech Choke Ring Antenna (<http://kb.unavco.org/kb/article.php?id=237>)





# UNAVCO Resources: Permanent GNSS Station Enclosures


Article ID: 381 | Rating: 1/5 from 2 votes | Last Updated: Wed, Aug 24, 2016 at 8:36 PM

## UNAVCO Resources: Permanent GNSS Station Enclosures

UNAVCO has installed and supports a large variety of equipment enclosures for both AC and DC GNSS sites, from enclosures specifically designed for solar systems (the SunWize battery enclosure) to simple storage containers modified to accommodate cable pass-throughs. We can work to find the most suitable enclosure given the budget and the location of each permanent or semi-permanent GNSS installation. Below is a list of enclosures used within the last several years in UNAVCO-supported projects; click on the photographs to see sample content lists and more photos of actual installations. For standard UNAVCO campaign enclosures, check out [UNAVCO Campaign GNSS Systems](#).

	<a href="#">SunWize Premium F-Series Battery Enclosure</a>	<p>The <a href="#">SunWize</a> F-Series 4-battery enclosure is used throughout the Plate Boundary Observatory network, as well as in several other permanent GPS station networks in the US. Benefits include reasonable strength (the enclosure is made of aluminum), security (two key locks secure the enclosure), both internal and external knockouts for passing wires and cables, weatherproof seals, and a generous amount of space. Drawbacks include cost (\$700-\$1000 as of February 2009), size (if on-site space is limited or if equipment must be shipped), and mounting requirements (enclosure is designed to be mounted on a post, which must be cemented into the ground and strong enough to support batteries).</p>
	<a href="#">Hardigg Case</a>	<p><a href="#">Hardigg</a> (now owned by Pelican Products) makes rugged, well-sealed plastic enclosures which are stackable, easy to handle, and UV resistant. Connectors are recessed within the ribs of the case to reduce the risk of damage during shipping.</p>

	<p><a href="#">JOBBOX</a></p>	<p>JOBBOX chests, made by <a href="#">Delta Consolidated Industries, Inc.</a>, are durable, weatherproof metal enclosures that UNAVCO has used in several long-term installations, including the EarthScope-sponsored Rio Grande Rift network. Chests are secured with key locks. The major drawback of the JOBBOX is weight; boxes are heavy and cumbersome, thus not ideal for shipping and for transporting by foot over long distances. Cost of the box shown here is approximately \$300-400 (as of February 2009).</p>
	<p><a href="#">Pelican Case (large)</a></p>	<p>The <a href="#">Pelican</a> case is easily portable, can be used to transport equipment, and is weatherproof. The case shown here, as deployed in the EarthScope-sponsored Rio Grande network, contains 2 100 amphr batteries in addition to the GPS receiver. The case is difficult to destroy and can be locked with padlocks. Cost is approximately \$250-\$300 (February 2009). Smaller cases are available (see below), and have been used in networks with year-round, reliable sunlight where large battery banks are not required.</p>
	<p><a href="#">Pelican Case (small)</a></p>	<p>Like the larger <a href="#">Pelican</a> cases (above), the smaller Pelican case is weatherproof and can be used to transport equipment. A smaller case is ideal if space is not an issue--specifically, if the requirement for amount of power stored is small (e.g. in a year-round sunny environment, as is common near the equator). The case is difficult to destroy and can be locked with padlocks. Networks utilizing small Pelican cases include Afar, Ethiopia, and Sierra Negra, Galapagos. Cost for the case shown here is approximately \$125 (February 2009).</p>
	<p><a href="#">Commercial Electrical Enclosure</a></p>	<p>Electrical boxes can be often purchased 'locally,' in major cities, rather than being shipped. Boxes may include knock-outs for passing cables through and locking options, like the box shown here. Electrical boxes are often sturdy, made of either strong plastic or of metal, and may or may not be weatherproof. Networks utilizing local electrical enclosures include Calabria, Italy and Bangladesh. Typical price range is about \$100-\$300.</p>

 <p data-bbox="163 99 289 152"><a href="#">Storage Container</a></p>	<p data-bbox="327 99 1463 272">A heavy-duty storage container, such as the <a href="#">Contico</a> Tuff Box, designed for the back of a truck or other outdoor use may work well for an equipment enclosure. They are generally low cost (about \$70 for the container shown here, as of February 2009), available in most US cities, rugged, and lockable with padlocks. The case shown here fits four sealed 100 Amphr batteries along with the GPS and communications equipment. Used as enclosures in the Peatland Bog, Minnesota network.</p>
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# Cellular Modem Summary

Article ID: 357 | Rating: Unrated | Last Updated: Wed, Oct 28, 2009 at 3:12 PM

## Cellular Modem Summary

Cellular modems need to be very robust as the inherent disadvantages of the analog cellular phone system become especially evident with high speed data transfers. Cellular coverage could be of a quality not compatible with high speed data transfers and handshaking protocols. Often more than one cellular provider offers coverage in an area and it is worthwhile to investigate several options. A good voice communication does not translate into an acceptable data communication. Your choice of cellular modem and cellular phone should be able to run off 12VDC, even if AC power is available, to facilitate DC (battery) backup.

## Suggested Minimum Requirements

- 12 VDC power
- V.32, V.32bis communication protocols
- V.42, MNP error correction/data compression
- RTS/CTS hardware flow control
- High speed baud rates (2.4-19.2 kbps)
- Compatible with CCITT and Bell standards
- Support industry-standard AT command set
- Compatible with RS-232 Control Signals

## Information on radio modems used by UNAVCO

### Proxicast LANCell Gateway



Used throughout the Plate Boundary Observatory (PBO) network, Western U.S.

- [UNAVCO summary of Proxicast cellular modems and networking](#)

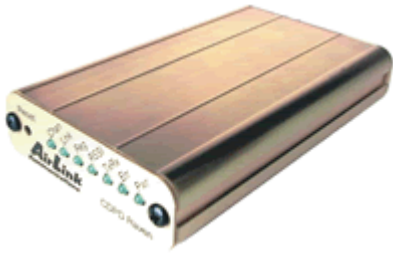
### ZyXEL U-1496P





- [ZyXEL U-1496P Portable Cellular Modem Summary Page](#)

### Raven II CDPD



- [How to use the Raven II CDPD modem with the Lantronix MSS100 serial-to-ethernet device](#)

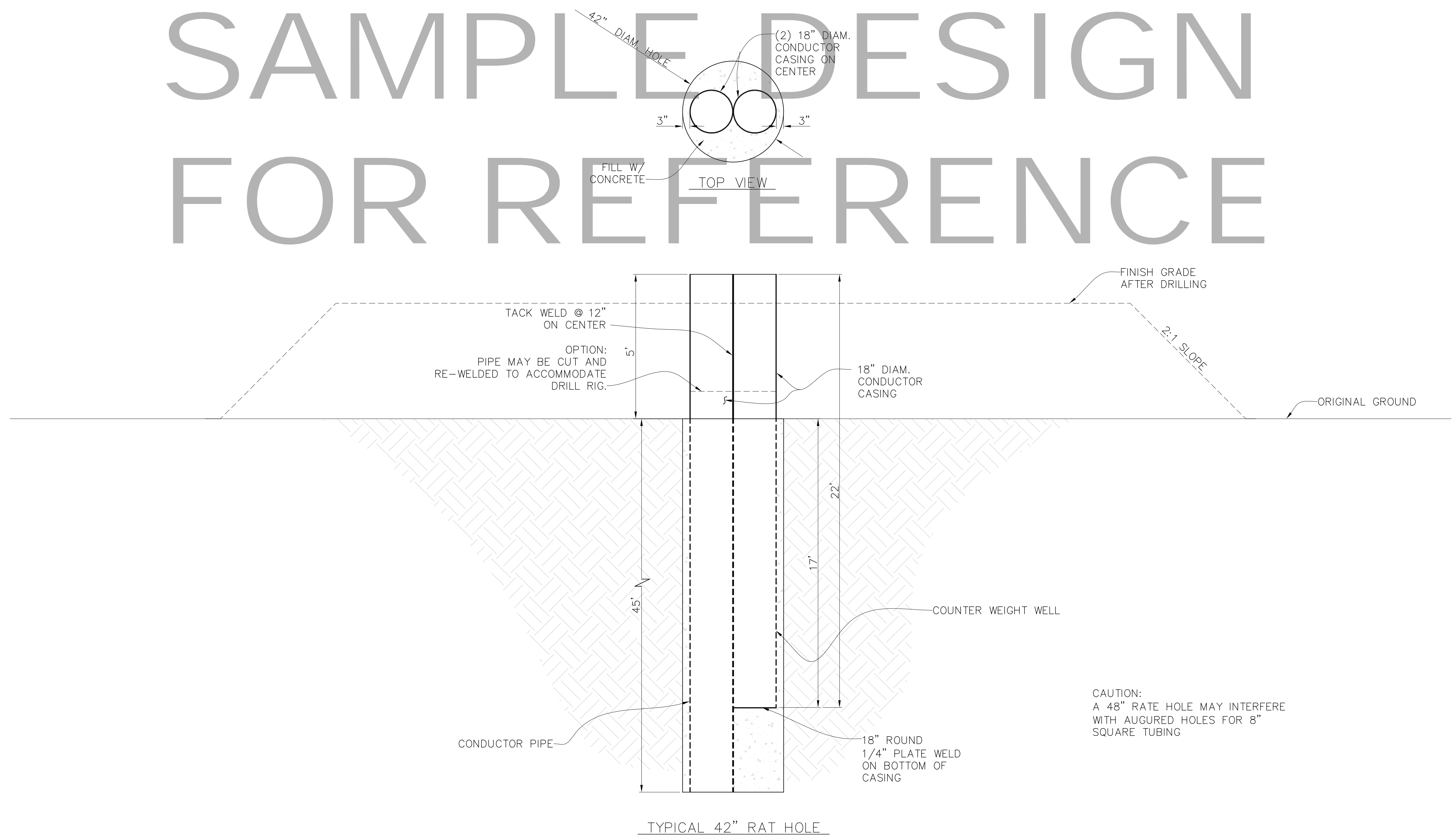
## Attachment 3. Extensometer Design

# SAMPLE DESIGN FOR REFERENCE

PAGE No.	DRAWING No.	DRAWING TITLE
1	100	TITLE SHEET
2	300	TYPICAL RAT HOLE
3	301	GRADING AND FOUNDATION PAD
4	302	EXTENSOMETER UNIT
5	303	BUILDING
6	304	SCHEMATIC DIAGRAM OF EXTENSOMETER

									DATE
					APPROVED BY:		EXTENSOMETER CONSTRUCTION TITLE SHEET		DRAWING NUMBER
					DATE: _____				100
REV	DATE	DESCRIPTION	SUB	APP'D					

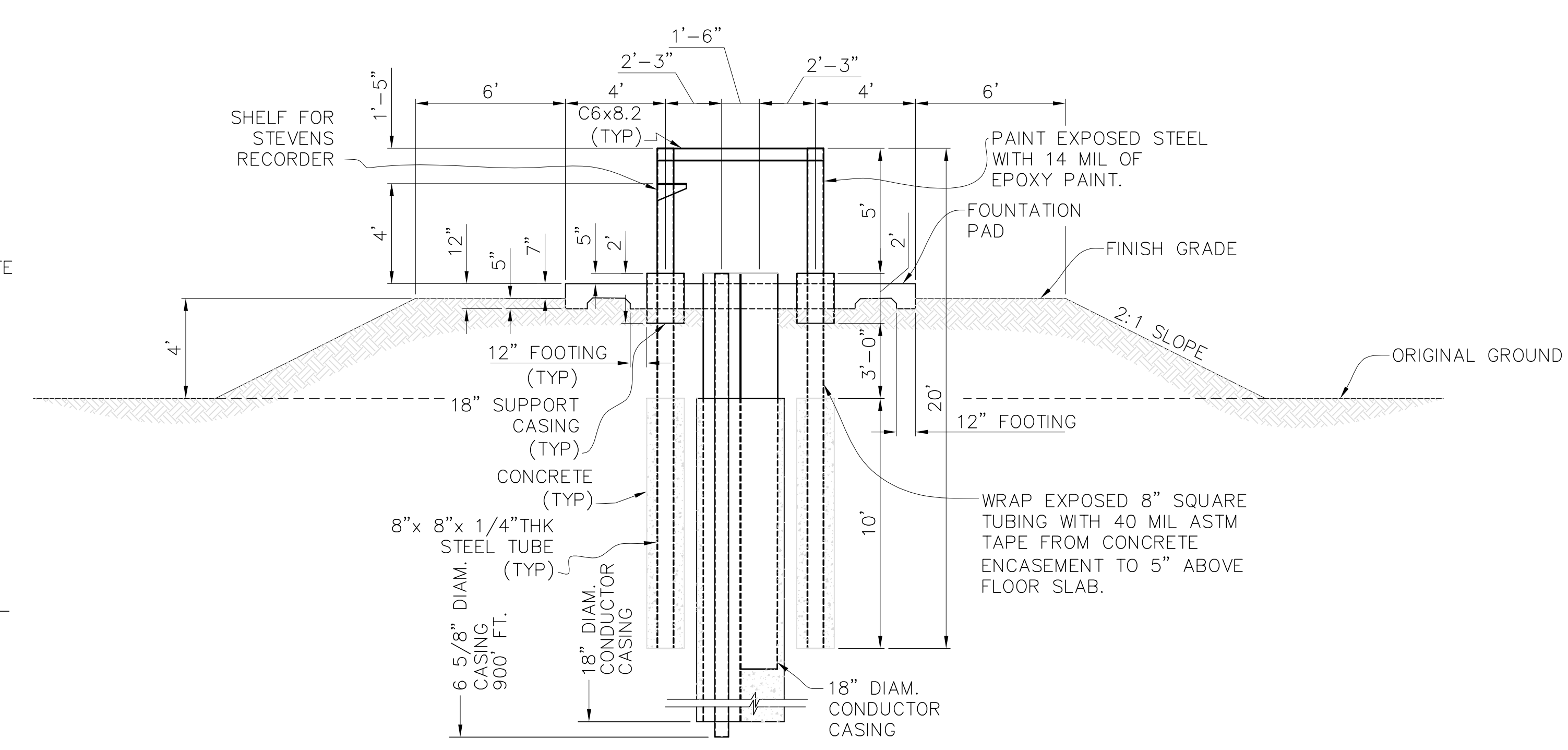
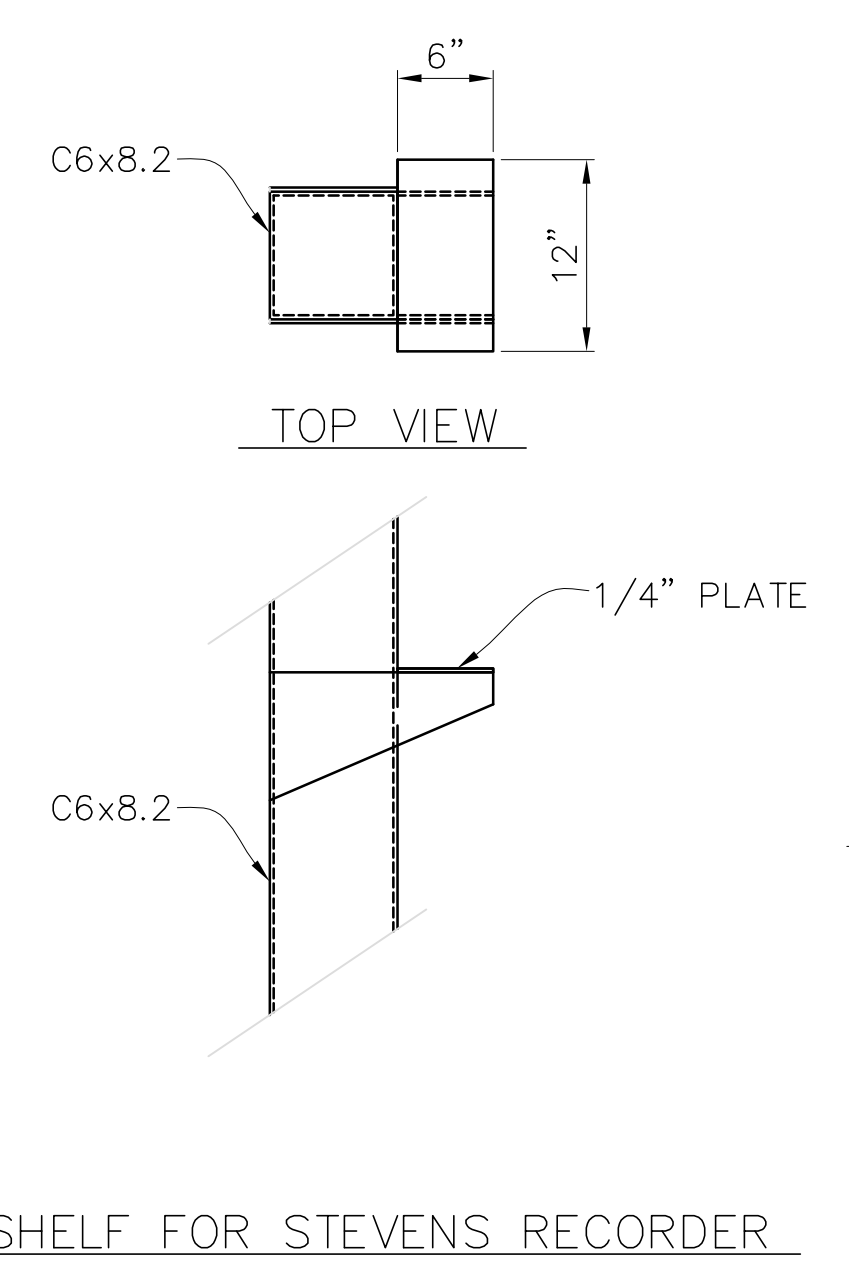
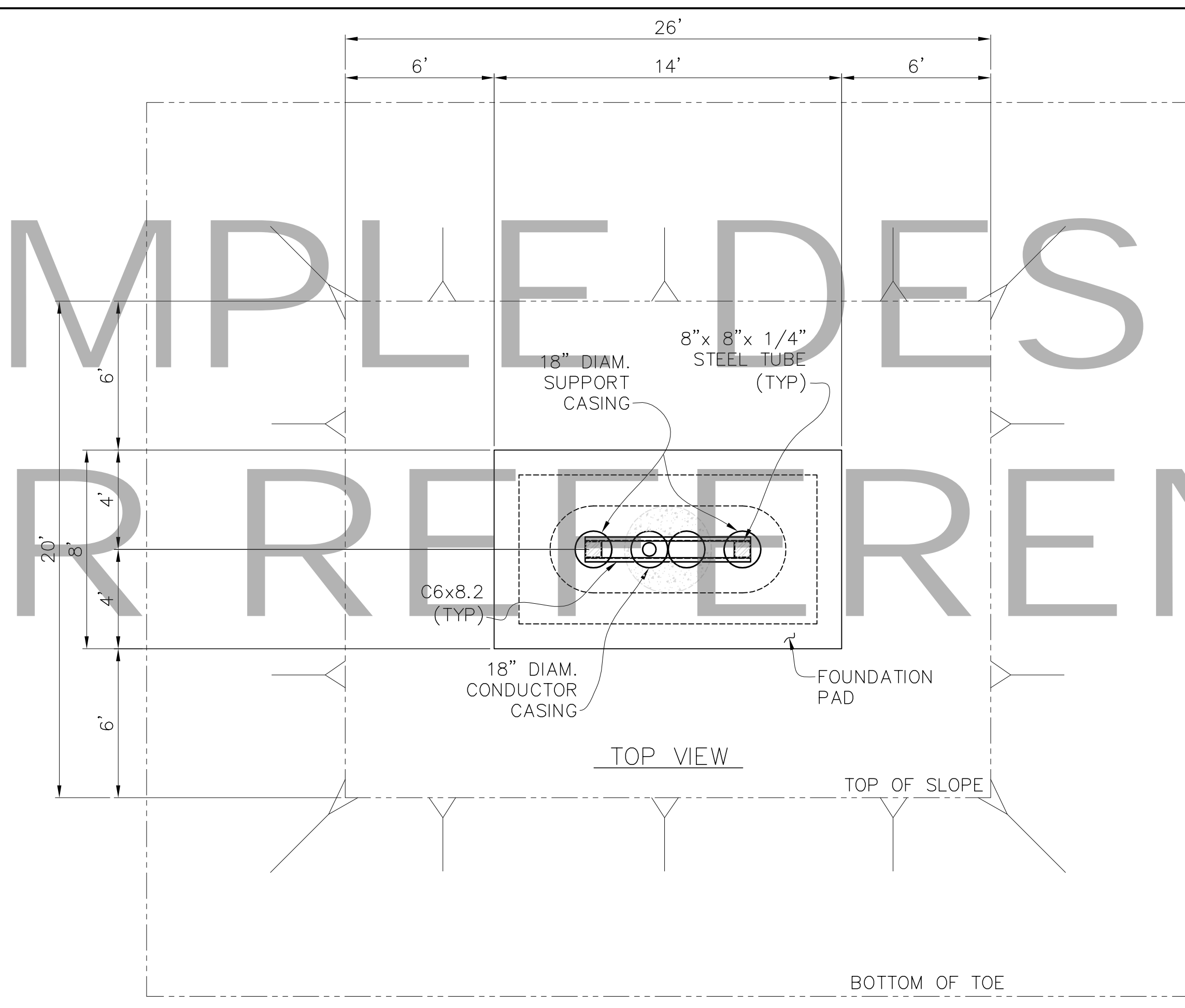
# SAMPLE DESIGN FOR REFERENCE



CAUTION:  
A 48" RATE HOLE MAY INTERFERE  
WITH AUGURED HOLES FOR 8"  
SQUARE TUBING

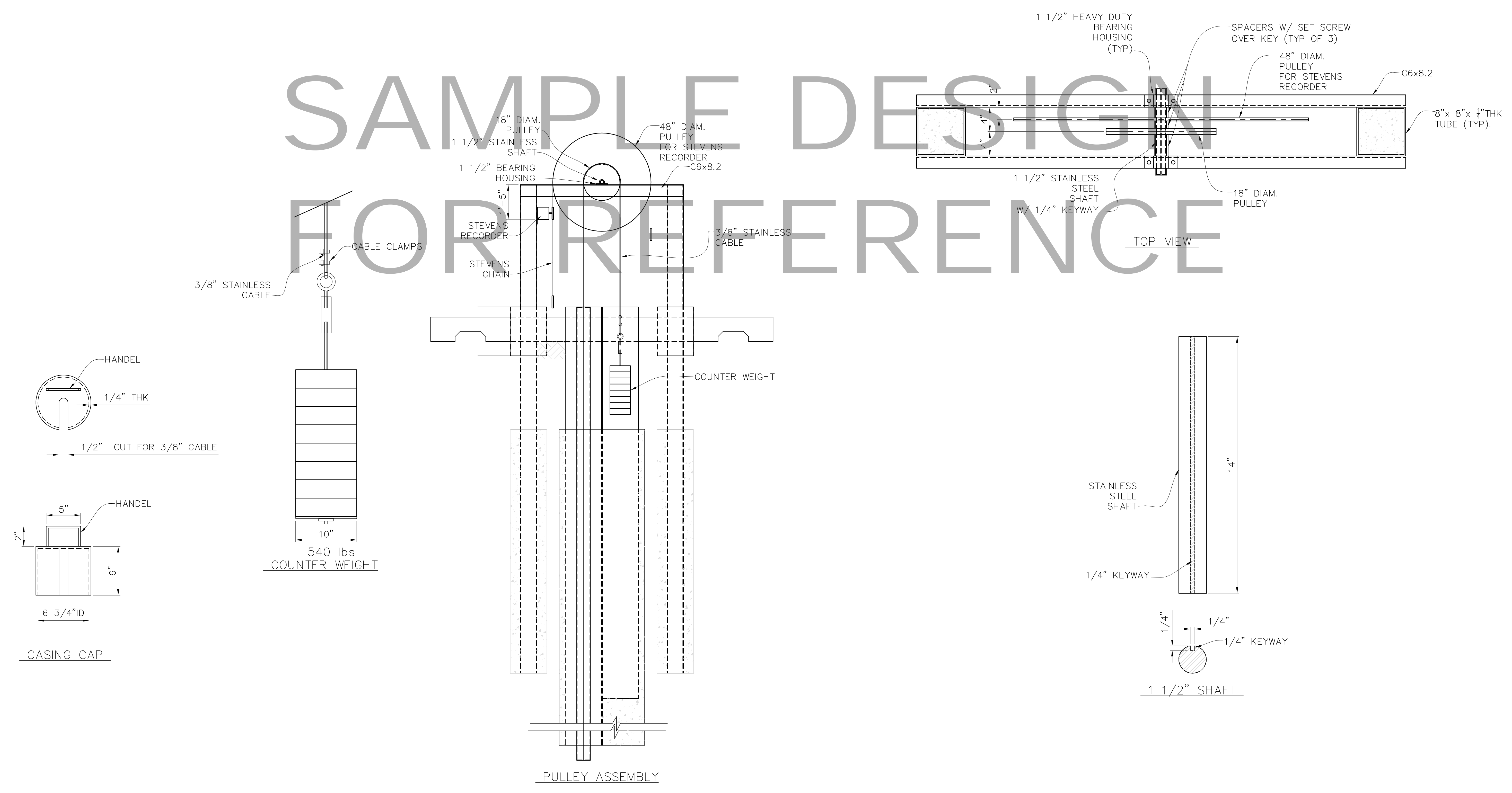
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													DRAWING NUMBER		300
	REV	DATE	DESCRIPTION	SUB	APP'D										

SAMPLE DESIGN  
FOR REFERENCE

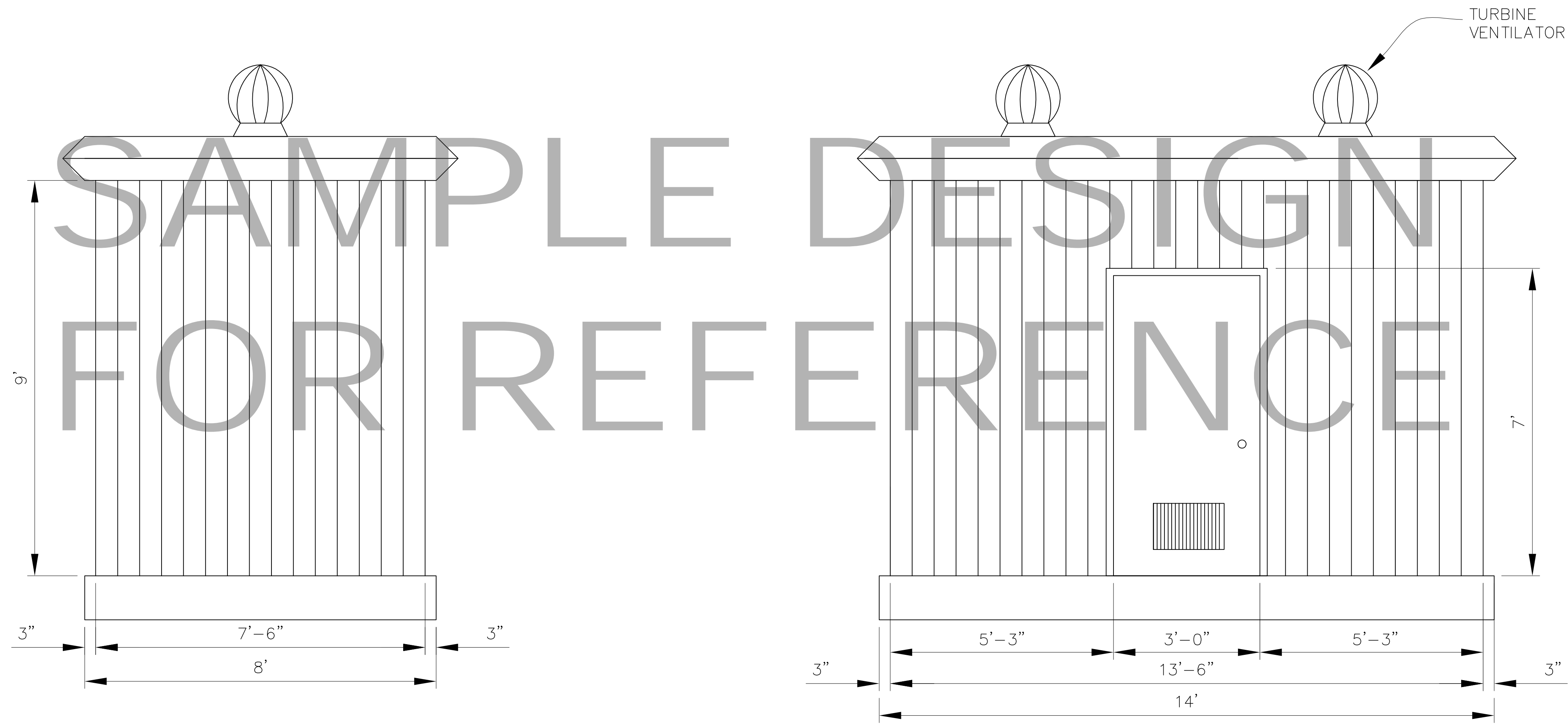


									DATE
					APPROVED BY:				DRAWING NUMBER
					DATE:		APPROVED		301
REV	DATE	DESCRIPTION	SUB	APP'D	EXTENSOMETER CONSTRUCTION GRADING AND FOUNDATION PAD				

# SAMPLE DESIGN FOR REFERENCE

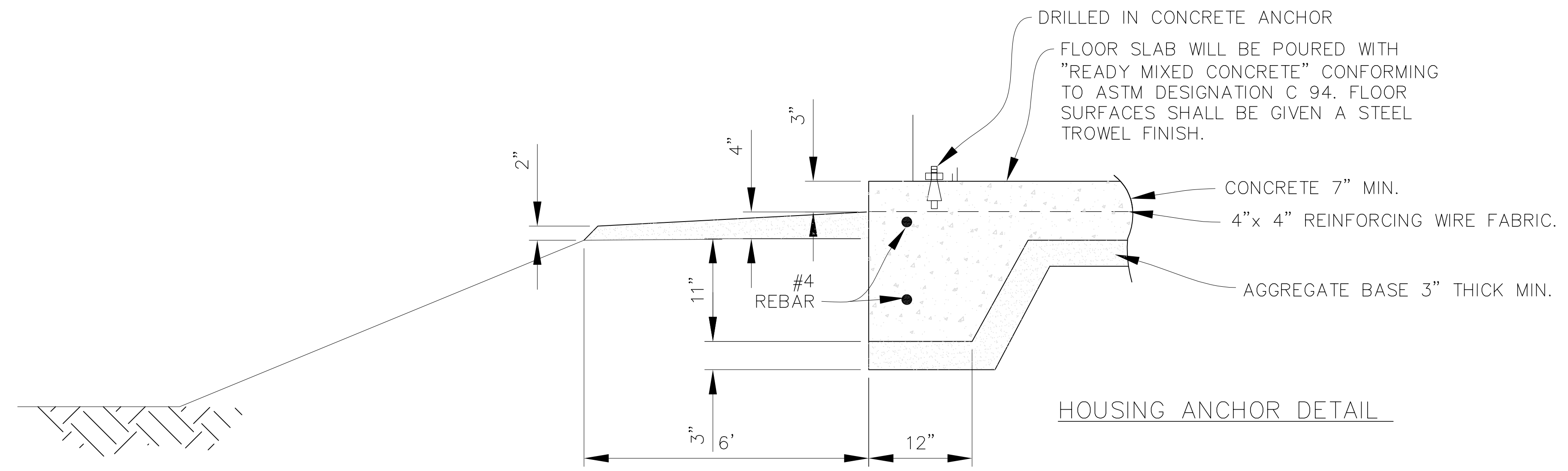


								DATE
					APPROVED BY:			
						DATE:		
						APPROVED		
						EXTENSOMETER UNIT		
								DRAWING NUMBER
								302
REV	DATE	DESCRIPTION	SUB	APP'D				



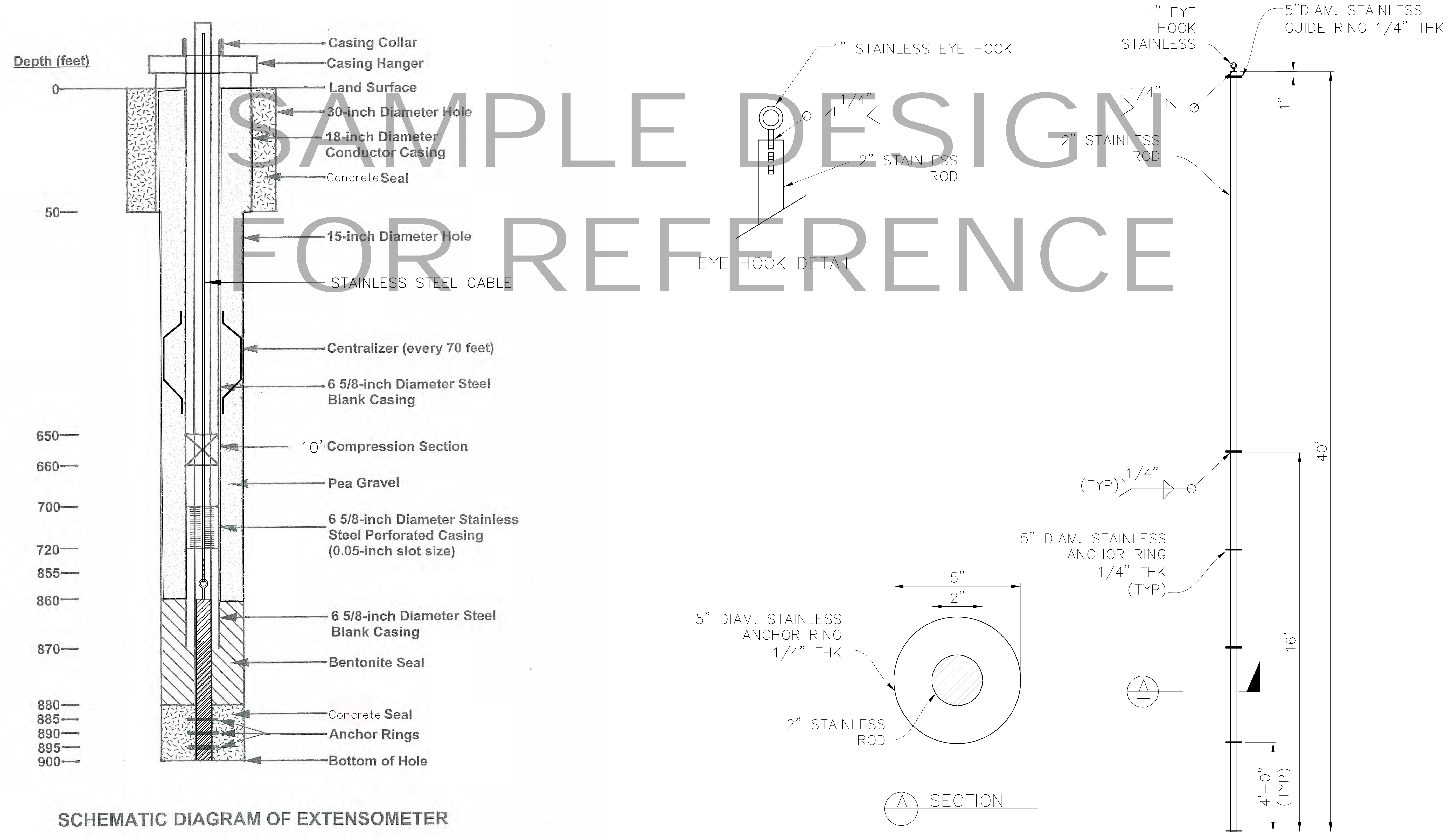
ENDWALL  
 ARMCO STEELOX BUILDING SYSTEMS TEC-LINE  
 1 BUILDING OR EQUIVALENT

SIDE VIEW



HOUSING ANCHOR DETAIL

							DATE	
					APPROVED BY:	EXTENSOMETER CONSTRUCTION BUILDING		DRAWING NUMBER
					DATE:			303
REV	DATE	DESCRIPTION	SUB	APP'D				



**SCHEMATIC DIAGRAM OF EXTENSOMETER**

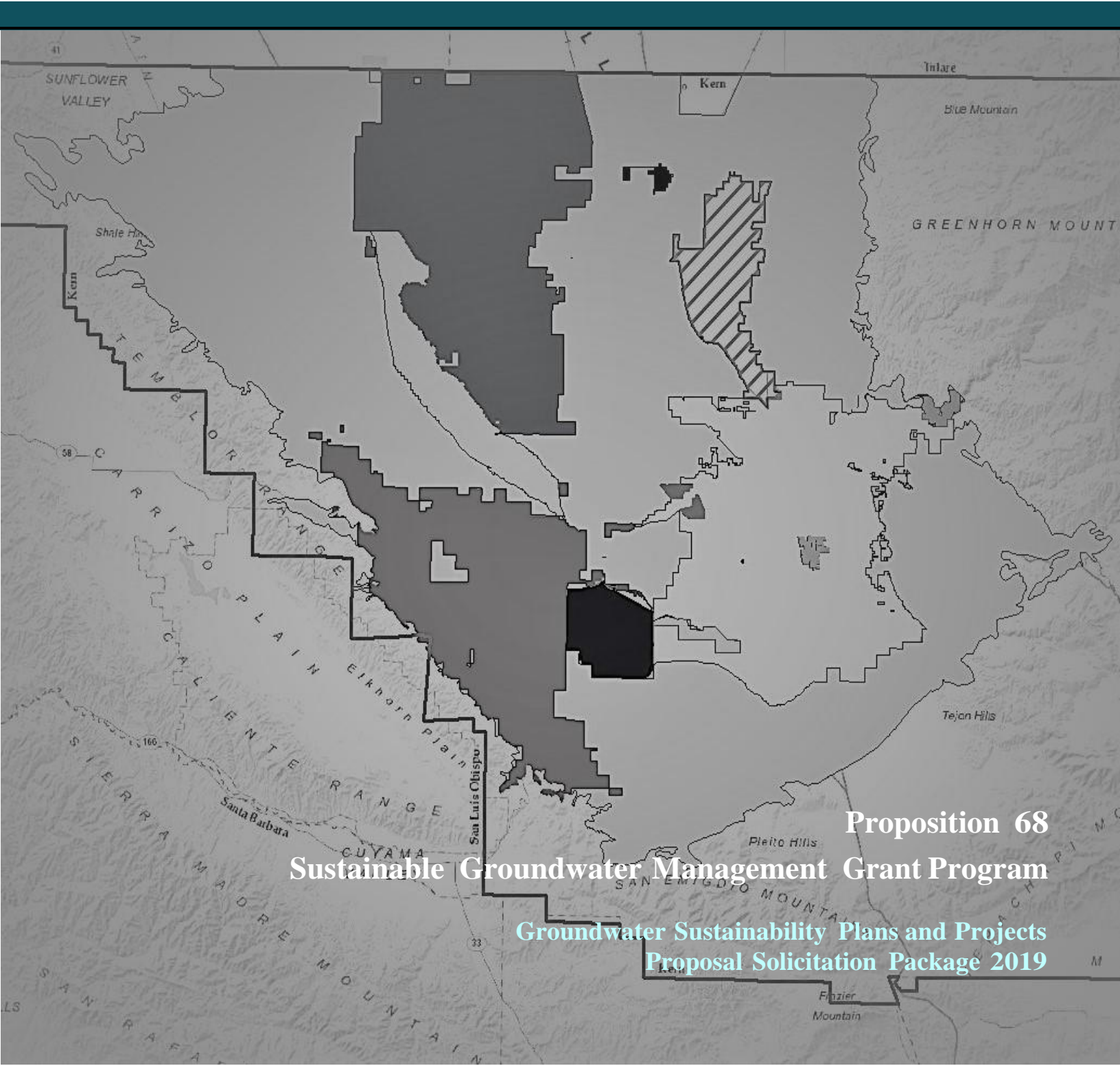
					APPROVED BY: _____		DATE: _____		APPROVED		EXTENSOMETER CONSTRUCTION SCHEMATIC DIAGRAM OF EXTENSOMETER		DATE
REV	DATE	DESCRIPTION	SUB	APP'D								DRAWING NUMBER	
												304	



# **APPENDIX 5**

**At this time, the Kern subbasin is working on the development of a basin-wide coordinated Data Management System. Please see the following documents related to that development of an application to DWR Prop 68 Grant requesting funds for the development. For the current year of annual reporting, see the following document related to a coordinated basin-wide cost share agreement.**

# Kern County Subbasin Groundwater Sustainability Plan Support 2019 Grant Application



Proposition 68  
Sustainable Groundwater Management Grant Program  
Groundwater Sustainability Plans and Projects  
Proposal Solicitation Package 2019

## Proposal Full View

### Applicant Information

<b>Organization Name*</b>	Kern River GSA			
<b>Point Of Contact</b>	<b>First Name:*</b>	Kristin	<b>Last Name:*</b>	Pittack
	<b>Email:*</b>	kpittack@bakersfieldcity.us		
	<b>Division Name:</b>	City of Bakersfield	<b>Phone:*</b>	(661) 3263646 Ext:
	<b>Address Line 1:*</b>	1600 Truxtun Avenue	<b>Address Line 2:</b>	
	<b>City:*</b>	Bakersfield	<b>State:*</b>	California
	<b>Zip:*</b>	93301		
<b>Point Of Contact Position Title*</b>	Water Resources Planner			
<b>Proposal Name*</b>	Kern County Subbasin Groundwater Sustainability Plan Support - Phase II			
<b>Proposal Objective*</b>	<p>The Kern County Subbasin is a critically overdrafted groundwater basin of high priority, located in the Southern San Joaquin Valley. The Proposal covers the entire Kern County Subbasin and is submitted by the Applicant, the Kern River Groundwater Sustainability Agency (KRGSA), on behalf of all the GSAs and participating entities in the Subbasin.</p> <p>The overarching goal of the proposed Subbasin Data Management System (DMS) Development project is to initiate the key steps to develop and build a Subbasin DMS. This DMS will ultimately support SGMA compliance by Subbasin GSAs by providing (1) improved coordination of groundwater monitoring and management actions and (2) the ability to meet the reporting and implementation requirements of SGMA for the Kern County Subbasin.</p> <p>To meet this goal, the project objectives are to retain a contractor to develop, manage, and coordinate use of the DMS with the GSAs and participating agencies; identify the data types that would be required to monitor GSP implementation and Subbasin progress toward sustainability; and investigate, select, and procure a commercially available or custom-designed DMS with an appropriate configuration that combines technical rigor, flexibility, ease of use, and expansion capabilities to store data in text, spreadsheet, graphical, and map-based formats.</p> <p>Some aspects of the DMS project, such as development of a User's Manual and DMS review and assessment, will be funded by the grant but may also be subject to GSA funding if needed. These tasks are included in the project Work Plan to provide context for the work to be completed under this Round 3 Planning funding request.</p>			

### Budget Information

<b>Other Contribution</b>	\$0.00
<b>Local Contribution</b>	\$0.00
<b>Federal Contribution</b>	\$0.00
<b>Inkind Contribution</b>	\$0.00
<b>Amount Requested*</b>	\$500,000.00
<b>Total Proposal Cost*</b>	\$500,000.00

### Geographic Information

<b>Latitude*</b>	<b>DD(+/-):</b>	35	<b>MM:</b>	25	<b>SS:</b>	39
<b>Longitude*</b>	<b>DD(+/-):</b>	119	<b>MM:</b>	19	<b>SS:</b>	37
<b>Longitude/Latitude Clarification</b>	Location of the approximate center of the Kern County Subbasin.					
<b>Location</b>	The Kern County Subbasin is located in the center of the southern end of the San Joaquin Valley.					
<b>County*</b>	Kern					
<b>Ground Water Basin</b>	5-022.14 San Joaquin Valley-Kern County					
<b>Hydrologic Region</b>	Tulare Lake					
<b>Watershed</b>	115 7557 South Valley Floor; 116 7558 South Valley Floor					

### Legislative Information

<b>Assembly District*</b>	32nd Assembly District, 34th Assembly District
<b>Senate District*</b>	16th Senate District, 18th Senate District
<b>US Congressional District*</b>	District 21 (CA), District 23 (CA)

## Project Information

	<b>Project Name: Subbasin Data Management System Development Project</b>
<b>Implementing Organization</b>	Kern River GSA
<b>Secondary Implementing Organization</b>	All of the Kern County Subbasin GSAs
<b>Proposed Start Date</b>	2/1/2020

<b>Proposed End Date</b>	7/31/2022
<b>Scope Of Work</b>	The scope of the project includes Grant Administration, Stakeholder Engagement / Outreach, GSP Development: Subbasin DMS Scoping and Development, and Review and Assessment. Deliverables include: executed contract with database development consultant; list of data types to be collected; report and recommendation on available formats for required information; and possibly recommendation and GSA Boards' decision to select a DMS package.
<b>Project Description</b>	<p>The Kern County Subbasin is the largest Subbasin in California, with a complex water management structure, a large portfolio of local and imported water sources, and numerous large groundwater banking projects, collectively providing local and State-wide benefits for water supply. Given this framework, numerous structures for data management have been developed by local agencies for their own objectives, resulting in disparate data sets and isolated pieces of information.</p> <p>The Kern County Subbasin GSAs recognize the need to develop a centralized, Subbasin-wide DMS. Accordingly, the GSAs are cooperating on this proposal to support monitoring, evaluation, reporting, management, and, importantly, GSP implementation. The Subbasin GSAs have previously coordinated and collaborated on the basin-wide water modeling for GSP development and thus believe that this is the next step forward.</p> <p>The immediate need for a centralized DMS is highlighted by the GSAs' ongoing cooperative efforts for annual reporting. In order to comply with the requirements of SGMA for standardized reporting, and to coordinate on a Subbasin-wide basis for consistent data evaluation, it is crucial that a DMS be developed for the entire Subbasin that will allow the various GSAs to gather and share information regarding local groundwater conditions. The proposed DMS planning and scoping project will ultimately support Subbasin GSAs by providing (1) improved coordination of groundwater monitoring and management actions and (2) the ability to meet the reporting and implementation requirements of SGMA for the Kern County Subbasin.</p>
<b>Project Objective</b>	The project objectives are to retain a contractor to develop, manage, and coordinate use of a Subbasin-wide DMS; identify the data types required to monitor the Subbasin's progress toward sustainability; and investigate, select, and procure a DMS with an appropriate configuration that combines technical rigor, flexibility, ease of use, and expansion capabilities to store data in text, spreadsheet, graphical, and map-based formats.

Project Benefits Information	
No records found.	

Budget Information	
<b>Other Contribution</b>	\$0.00
<b>Local Contribution</b>	\$0.00
<b>Federal Contribution</b>	\$0.00
<b>Inkind Contribution</b>	\$0.00
<b>Amount Requested*</b>	\$500,000.00
<b>Total Project Cost*</b>	\$500,000.00

Geographic Information						
<b>Latitude*</b>	<b>DD(+/-):</b>	35	<b>MM:</b>	25	<b>SS:</b>	39
<b>Longitude*</b>	<b>DD(+/-):</b>	119	<b>MM:</b>	19	<b>SS:</b>	37
<b>Longitude/Latitude Clarification</b>	Location of the approximate center of the Kern County Subbasin.					
<b>Location</b>	The Kern County Subbasin is located in the center of the southern end of the San Joaquin Valley.					
<b>County*</b>	Kern					
<b>Ground Water Basin</b>	5-022.14 San Joaquin Valley-Kern County					
<b>Hydrologic Region</b>	Tulare Lake					
<b>Watershed</b>	115 7557 South Valley Floor; 116 7558 South Valley Floor					

Legislative Information	
<b>Assembly District*</b>	32nd Assembly District, 34th Assembly District
<b>Senate District*</b>	16th Senate District, 18th Senate District
<b>US Congressional District*</b>	District 21 (CA), District 23 (CA)

### Section : Questions

**Q1. Project Description:**

Provide a brief abstract of the proposal. This abstract must provide an overview of the proposal including the main issues and priorities addressed in the proposal. (25 words or less)\*

This Proposal develops a data management system (DMS) that covers the Kern County Subbasin and allows Subbasin GSAs to improve GSP coordination, and implementation.

**Q2. Previous Funding:**

**Has the applicant received prior funding through the Proposition 1 SGWP Round 2 grant? \***

- a)  Yes  
 b)  No

**If so, how much funds did the applicant receive?**

\$1,500,000

**Q3. Project Representative:**

**Provide the name and details of the person responsible for signing and executing the grant agreement for the applicant. Persons that are subcontractors to be paid by the grant cannot be listed as the Project Representative. Other entities included in the GSA can be listed here. \***

Rodney Palla  
 Chair, Kern River Groundwater Sustainability Agency  
 1600 Truxtun Avenue  
 Bakersfield, California, 93301  
 (661) 326-3767

**Q4. Project Manager:**

**Provide the name, title, and contact information of the Project Manager from the applicant agency or organization that will be the day-to-day contact on this application. \***

Kristin Pittack  
 Water Resources Planner, City of Bakersfield  
 1600 Truxtun Avenue  
 Bakersfield, CA 93301  
 (661) 326-3646

**Q5. Eligibility:**

**Has the applicant met the requirements of DWR's CASGEM Program? \***

- a)  Yes  
 b)  No

**Q6.1. Eligibility:**

**Is the applicant an agricultural water supplier? \***

- a)  Yes  
 b)  No

**Q6.1.a Eligibility:**

**If yes, has the applicant submitted a complete Agricultural Water Management Plan (AWMP) to DWR?**

- a)  Yes  
 b)  No

**Q6.1.b Eligibility:**

**If yes, has the AWMP been verified as complete by DWR?**

- a)  Yes  
 b)  No

**Q6.1.c Eligibility:**

**If the AWMP has not been submitted, explain and provide the anticipated submittal date.**

**Q7.1. Eligibility:**

**Is the applicant an urban water supplier? \***

- a)  Yes  
 b)  No

**Q7.1.a Eligibility:**

If yes, has the applicant submitted a complete Urban Water Management Plan (UWMP) to DWR?

- a)  Yes  
b)  No

**Q7.1.b Eligibility:**

If yes, has the UWMP been verified as complete by DWR?

- a)  Yes  
b)  No

**Q7.1.c Eligibility:**

If the UWMP has not been submitted, explain and provide the anticipated date for submittal.

**Q8.1 Eligibility:**

Is the applicant a surface water diverter?\*

- a)  Yes  
b)  No

**Q8.1.a Eligibility:**

If yes, has the applicant submitted to the SWRCB their surface water diversion reports in compliance with requirements outlined in Part 5.1 (commencing with §5100) of Division 2 of the Water Code?

- a)  Yes  
b)  No

**Q8.1.b Eligibility:**

If the reports have not been submitted, explain and provide the anticipated date for meeting the requirements.

**Q9. Eligibility:**

Does the proposal include any of the following activities:

- 1.) The potential to adversely impact a wild and scenic river or any river afforded protection under the California or Federal Wild and Scenic Rivers Act
- 2.) Acquisition of land through eminent domain
- 3.) Design, construction, operation, mitigation, or maintenance of Delta conveyance facilities
- 4.) Acquisition of water except for projects that will provide fisheries or ecosystem benefits or improvements that are greater than required currently applicable environmental mitigation measures or compliance obligations
- 5.) Pay any share of the costs of remediation recovered from parties responsible for the contamination of a groundwater storage aquifer
- 6.) Projects or groundwater planning activities associated with adjudicated groundwater basins.

If yes, the project is not eligible for grant funding.\*

- a)  Yes (not eligible for grant funding)  
b)  No

**Q10. Eligibility: Consistency with California SB 985– Stormwater Resource Planning Act:**

To satisfy SB 985 requirements, stormwater and dry weather capture project must be listed in a SWRP that is consistent with the relevant code provisions enacted by SB 985 (Water Code §10562 (b)(7)) as determined by the SWRCB.

- a)  This Project is Consistent

**Q11. DA Cost Share Waiver or Reduction:**

Are you applying for cost share waiver or reduction as a DA? Fill out Attachment 6 – DAC, SDAC, and/or EDA, as appropriate.\*

- a)  Yes; See Attachment 6  
b)  No

**Q12. Certification:**

By submitting the application, the Project Director is certifying that:

- a) The applicant is an eligible entity;
- b) He/She is aware that any attachment exceeding the page limit listed in the attachment templates will not be reviewed;
- c) He/She is aware that, once the proposal is submitted in GRanTS, any privacy rights and other confidentiality protections offered by law with respect to the application package and project location are waived; and
- d) He/She has read and agrees to all of the Terms and Conditions of the grant agreement.\*

- a)  Yes (Certified)
- b)  No

## Section : Climate Risk in Investments

**Climate Risk in Investment**

**Q13: Does the organization have a strategic business plan?**

- a)  Yes
- b)  No

**If Yes, please submit a copy.**

Last Uploaded Attachments: Q13\_Prop 68 Cost Share Packet\_combined.pdf

**Q14: Has the organization conducted a climate change vulnerability assessment?**

- a)  Yes
- b)  No

**If Yes, please submit a copy.**

**Q15: Does the organization have a main contact person for climate change?**

- a)  Yes
- b)  No

**If Yes, to what position in the origination does that person report?**

**Q16: Has the organization considered the risk of climate change in its capital reserves and investments? (Open ended; one-three paragraphs, with specific examples, should suffice).**

This Proposal involves funding of a planning effort rather than an implementation project. As such, the Subbasin Data Management System Development project would not involve activities that could emit greenhouse gases or affect carbon sequestration. The project would have no effect related to climate change. Therefore, documentation of climate change effects is not applicable for this Proposal, applicant, or project proponents.

## Section : Attachments

**Attachment 1: Authorizing Documentation (e.g. resolution)**

**Upload Authorizing Documentation here. The Attachment is mandatory.\***

Last Uploaded Attachments: Att1\_SGM\_AuthDoc\_1of1.pdf

**Attachment 2: Eligibility Applicant Documentation**

**Upload Eligibility Applicant Documentation here. The attachment is mandatory.\***

Last Uploaded Attachments: Att2\_SGM\_EligDoc\_1of1.pdf

**Attachment 3: Work Plan**

**Upload Work Plan here. (Applicant MUST use supplied template) The attachment is mandatory.\***

Last Uploaded Attachments: Att3\_SGM\_WrkPlan\_1of1.pdf

**Attachment 4: Budget**

**Upload Budget here. (Applicant MUST use supplied template) The attachment is mandatory.\***

Last Uploaded Attachments: Att4\_SGM\_Budget\_1of1.pdf

**Attachment 5: Schedule**

**Upload Schedule here. (Applicant MUST use supplied template) The attachment is mandatory.\***

Last Uploaded Attachments: Att5\_SGM\_Schedule\_1of1.pdf

**Attachment 6: SDAC, DAC, and/or EDA**

**Upload SDAC, DAC, and/or EDA (as applicable) here.**

Last Uploaded Attachments: Att6\_SGM\_SDAC-DAC-EDA\_1of1.pdf





## KERN RIVER GSA

Rodney J. Palla, Chair  
Bob Smith  
Gene Lundquist

October 21, 2019

To: Kern Groundwater Authority  
Buena Vista WSD GSA  
Henry Miller WD GSA  
Olcese WD GSA

**Re: Reimbursement Agreement for the Kern County Subbasin – DWR Proposition 68 Grant Application Development and Grant Administration.**

The Kern River Groundwater Sustainability Agency (KRGSA), the Kern Groundwater Authority (KGA), the Buena Vista WSD Groundwater Sustainability Agency (BVGSA), the Henry Miller WD Groundwater Sustainability Agency (HMGSA), and the Olcese WD Groundwater Sustainability Agency (OGSA) wish to participate in the Reimbursement Agreement for the Kern County Subbasin – DWR Proposition 68 Grant Application Development and Grant Administration (Grant).

On behalf of the Subbasin, the KRGSA has approved a contract with Horizon Water and Environment (Horizon) which includes a scope of work with the following tasks: 1) Develop and Submit Grant Application (\$19,950); 2) Support Database Project Lead in Developing RFP for Database Developer (\$1,990); and 3) Grant Administration (\$27,680). Horizon's proposal for the scope of work is provided as Attachment 1. All parties agree to cost share this effort according to following terms and conditions:

The participant signatories below will pay their share of the proposed budget of \$49,620 as shown on Attachment 2. The first two (2) tasks will be invoiced upon approval of this Agreement. Task three (3) will be billed as future Grant Administration work is performed. All payments shall be due 45 days after the receipt of invoice from the City of Bakersfield.

If the above terms and conditions are acceptable, please sign and date all copies of this letter and return them to the KRGSA. A fully executed original will be returned to all GSA's.

Sincerely,



Rodney Palla  
Chairman

Accepted:

**Kern Groundwater Authority**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

**Buena Vista WSD GSA**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

**Henry Miller WD GSA**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

**Olcese WD GSA**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Sincerely,

Rodney Palla  
Chairman

Accepted:

**Kern Groundwater Authority**

By: 

Title: CHAIR

Date: 10-23-2019

**Buena Vista WSD GSA**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

**Henry Miller WD GSA**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

**Olcese WD GSA**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Sincerely,



Rodney Palla  
Chairman

Accepted:

**Kern Groundwater Authority**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

**Buena Vista WSD GSA**

By:  \_\_\_\_\_

Title: Engineer-Manager

Date: 10-22-19

**Henry Miller WD GSA**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

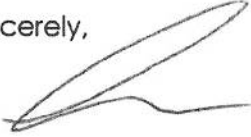
**Olcese WD GSA**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Sincerely,



Rodney Palla  
Chairman

Accepted:

**Kern Groundwater Authority**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

**Henry Miller WD GSA**

By: Top Uprich

Title: PRESIDENT

Date: 10-22-19

**Buena Vista WSD GSA**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

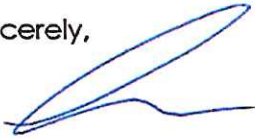
**Olcese WD GSA**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Sincerely,



Rodney Palla  
Chairman

Accepted:

**Kern Groundwater Authority**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

**Buena Vista WSD GSA**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

**Henry Miller WD GSA**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

**Olcese WD GSA**



By: \_\_\_\_\_

Title: **James L. Nickel, President**

Date: Oct. 22, 2019

## **Kern County Subbasin – DWR Proposition 68 Grant Application Development Revised Proposal for Consultant Services Provided by Horizon Water and Environment**

**October 10, 2019**

Horizon will develop a Proposition 68 grant application/proposal for the Kern County Subbasin based on the grant requirements provided by DWR. This application will rely heavily on materials Horizon previously developed preparing the Proposition 1 grant application. Horizon will update those materials as appropriate to reflect the status of current GSPs in the Kern County Subbasin.

Using these existing materials as a starting point, Horizon will develop the grant application efficiently and ensure that the information provided for the Prop 68 grant is consistent with, and builds on, the Proposition 1 grant received in 2017.

This scope of work assumes that one project will be included in the grant application:

- Project 1: Subbasin data management system development

Horizon will work with the appropriate GSAs to receive good baseline information or a project description for the project. Horizon will then use our grant application expertise to articulate how the project aligns and supports the primary objectives of the Proposition 68 Grant and why the Kern County Subbasin is an excellent fit for this grant. Following award of grant funding, Horizon will administer the grant reporting and invoicing process.

Horizon's work will be organized into the following tasks:

### **Task 1: Develop and Submit Grant Application**

#### *Develop Draft Application Materials*

- Horizon will use the grant application requirements to frame and structure the grant submittal documents.
- Horizon will review DWR-provided templates to collect and organize project information for the grant application forms and Attachments (e.g., Work Plan, Schedule, Budget) and distribute them to the appropriate project leads.
- Horizon will coordinate data requests with the GSA staff members who will be serving as the project leads for the target project. Horizon will edit/adjust the project information as necessary to support the grant application.
- Horizon will generate draft grant application materials, including necessary text to populate the online GRanTS application tabs and required Attachments.
- Horizon will distribute the draft grant application materials to the KRGSA and other project lead GSAs for their review, with a due date to receive requested edits and/or comments.

### *Finalize Grant Application Materials*

- Horizon will finalize the grant application materials based upon GSA review and feedback described above. Horizon will send final grant application materials to KRGSA and other project lead GSAs for final review and approval prior to DWR submittal.

### *Submit Grant Application to DWR*

- Horizon will complete the online GRanTS application information tabs, and upload all Attachments, before DWR's application period deadline of 1 p.m. on November 1.

### **Task 2: Support Database Project Lead in Developing RFP for Database Developer**

- Horizon will coordinate with Basin Database project lead (KGA, KRGSA, or a committee) to confirm the general database objectives and needs.
- Horizon will develop a draft RFP for review by project lead.
- Horizon will revise and develop final RFP for review and use by project lead.

This task assumes that the project lead, rather than Horizon, will administer the proposal process, including distribution of RFP, review and evaluation of proposals, and contracting of selected firm.

### **Task 3: Grant Administration (*pending award*)**

#### *Grant Initiation, Agreements, and Templates*

- Following notification of grant award, Horizon will coordinate with DWR, KRGSA, and KGA to finalize grant materials.

#### *Grant Implementation, Reporting, and Invoicing*

- Horizon will develop and distribute templates for quarterly reports, invoices, and backup documentation.
- Horizon will identify deadlines for submittal of information from KRGSA and KGA and will review and clarify the submitted information each quarter to ensure that it meets grant requirements.
- Following review and revision, Horizon will submit reports and invoices to DWR.
- Horizon will coordinate with DWR regarding any needed revisions to submitted materials.
- Throughout the grant period, Horizon will communicate regularly with KRGSA and KGA to maintain the flow of information.

#### *Grant Completion and Closeout*

- Horizon will coordinate and review the project's draft Project Completion Report.
- Horizon will assist KRGSA and KGA in developing the Grant Completion Report.
- Horizon will coordinate and upload all completion reports to DWR.
- Horizon will develop a post-performance report template.
- Horizon will coordinate with project leads and DWR in grant closeout.



**Cost Estimate:**

<b>Task</b>	<b>Estimated Cost</b>
1. Develop and Submit Grant Application	\$19,950
2. Support Database Project Lead in Developing RFP for Database Developer	\$1,990
3. Grant Administration ( <i>pending award</i> )	\$27,680
<b>Total</b>	<b>\$49,620</b>

**Schedule:**

Horizon will complete the grant submittal process on or before the DWR deadline of November 1, 2019, at 1:00 p.m. Tasks 2 and 3 will be completed following notification of grant award.

### Funding Contribution and Participation Percentages

Total Horizon Contract Amount:           \$49,620.00  
 Funding Request for App/RFP:               \$21,940.00

	Funding Entity	Funding Request
1	Arvin-Edison Water Storage District	\$953.91
2	Buena Vista Water Storage District	\$953.91
3	Bellridge Water District	\$953.91
4	Berrenda Mesa Water District	\$953.91
5	Cawelo Water District	\$953.91
6	City of Bakersfield	\$953.91
7	Eastside Water Management Area	\$953.91
8	Henry Miller	\$953.91
9	Improvement District No. 4	\$953.91
10	Lost Hills Water District	\$953.91
11	Kern Delta Water District	\$953.91
12	Kern-Tulare Water District	\$953.91
13	Kern Water Bank Authority	\$953.91
14	North Kern Water Storage District	\$953.91
15	Olcese Water District	\$953.91
16	Rosedale-Rio Bravo Water District	\$953.91
17	Semitropic Water Storage District	\$953.91
18	Shafter-Wasco Irrigation District	\$953.91
18	Shafter-Wasco 7th Standard Annex	\$953.91
19	South San Joaquin Municipal Utilities District	\$953.91
20	Tejon-Castac Water District	\$953.91
21	West Kern Water District	\$953.91
22	Wheeler Ridge-Maricopa Water Storage District	\$953.91
Totals		\$21,940.00

**Note:**

Managers/GSAs all agreed to use Horizon and to split the costs per agency.

Above funding request to cover Grant App. DMS RFP. Future Grant Admin to be billed per agency as costs incurred (monthly).

**Invoices:**

KGA:	\$16,216.52
KRGSA:	\$2,861.74
BV	\$953.91
Henry Miller:	\$953.91
Olcese	\$953.91
	\$21,940.00

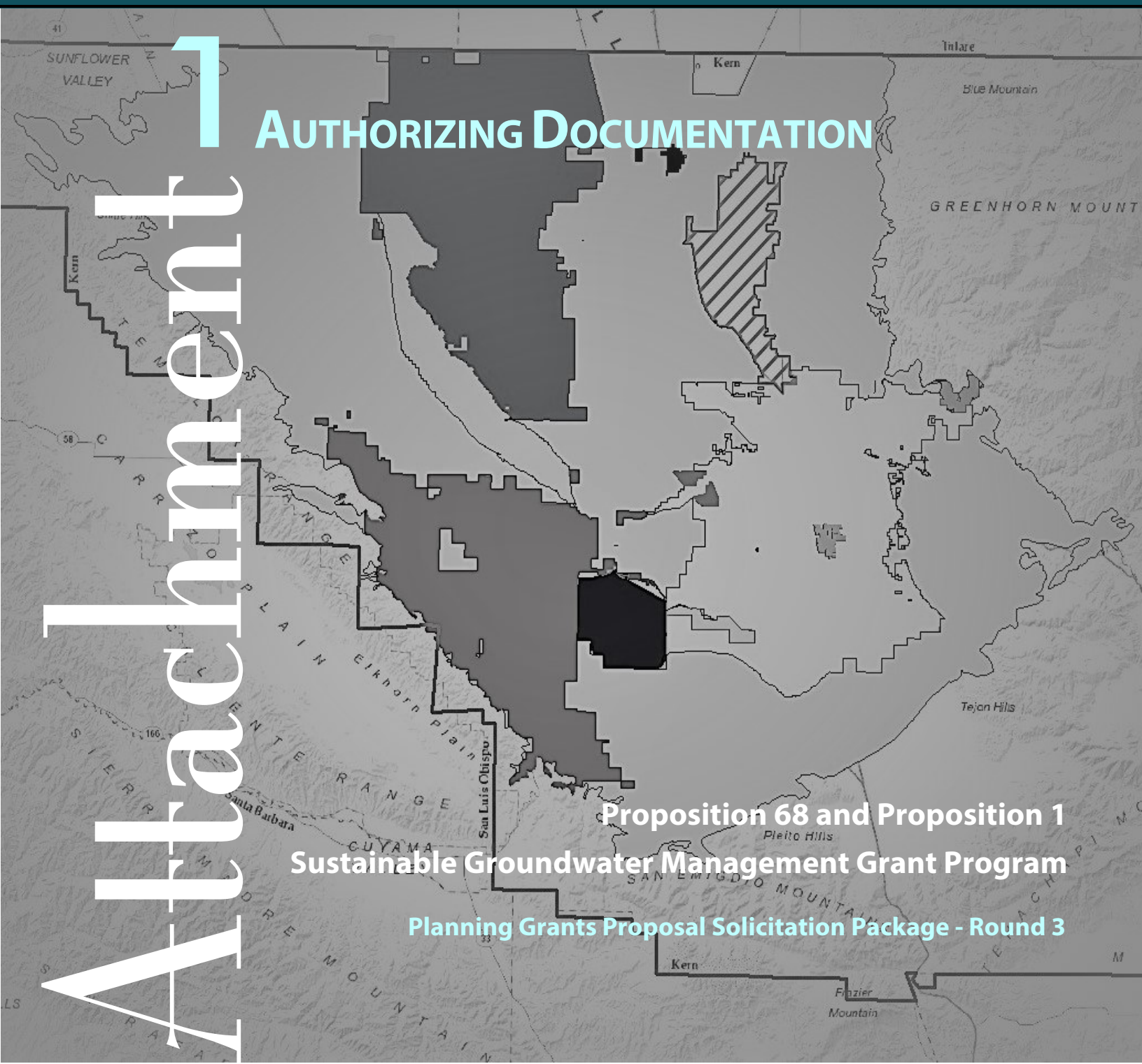
# Kern County Subbasin Groundwater Sustainability Plan Support - Phase II 2019 Grant Application

**AUTHORIZING DOCUMENTATION**

**Attachment 1**

**Proposition 68 and Proposition 1  
Sustainable Groundwater Management Grant Program**

**Planning Grants Proposal Solicitation Package - Round 3**



# ATTACHMENT 1: AUTHORIZING DOCUMENTATION

Kern County Subbasin Groundwater Sustainability Plan Support - Phase II

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## Introduction

Attachment 1 includes authorizing documentation for submittal of this Proposition 68 and Proposition 1 Sustainable Groundwater Management Grant Program, Planning Grants Proposal Solicitation Package – Round 3 grant application. The applicant has provided a resolution adopted by the applicant's governing body designating an authorized representative to submit the application and execute an agreement with the State of California for a Sustainable Groundwater Management Grant.

## Applicant Authorizing Documentation

The Kern River Groundwater Sustainability Agency (KRGSA) is pleased to serve as the applicant for Kern County Subbasin Groundwater Sustainability Plan Support – Phase II grant application. The Kern County Subbasin Groundwater Sustainability Plan Support – Phase II application includes one project led by and supporting all the GSAs in the Kern County Subbasin. The proposed project will benefit the entire Kern County Subbasin.

KRGSA is a Groundwater Sustainability Agency (GSA) formed in 2016 under Section 10723.8 of the California Water Code and is comprised of public agency members including the City of Bakersfield, the Kern Delta Water District, and the Kern County Water Agency Improvement District No. 4. An excerpt from the GSA application package submitted to the California Department of Water Resources' (DWR's) Sustainable Groundwater Management Section on April 12, 2016, is included as supporting documentation with Attachment 2, Appendix A. Further information and the entire GSA application package may be found on KRGSA's website: <http://www.kernrivergsa.org>.

The Round 3 Planning Grants Proposal Solicitation Package states that eligible applicants are GSAs, member agencies of the GSAs, or member agencies of an approved Alternate to a GSP for the basin for which the application is submitted. The KRGSA is a GSA for a portion of the Kern County Subbasin (Basin Number 5-22.14) and, as such, is an eligible applicant for this Proposition 68 and Proposition 1 Sustainable Groundwater Management Grant Program, Planning Grants Proposal Solicitation Package – Round 3 grant application.

The KRGSA Executive Board adopted Resolution KRGSA 001-19 on October 21, 2019, authorizing KRGSA to submit this application to obtain a grant under the Sustainable Groundwater Management Grant Program and execute an agreement with the State of California to receive a grant under the Proposition 68 and Proposition 1 Sustainable Groundwater Management Grant Program, Planning Grants Proposal Solicitation Package – Round 3 grant opportunity. A copy of the resolution is included on the following pages.

**RESOLUTION NO. KRGSA 001-19**

**A RESOLUTION BY THE KERN RIVER GROUNDWATER SUSTAINABILITY AGENCY (KRGSA) THAT APPLICATION BE MADE TO THE CALIFORNIA DEPARTMENT OF WATER RESOURCES TO OBTAIN A GRANT UNDER THE SUSTAINABLE GROUNDWATER PLANNING GRANT PROGRAM FOR THE KERN COUNTY SUBBASIN GROUNDWATER SUSTAINABILITY PLAN SUPPORT - PHASE II**

**WHEREAS**, the California Department of Water Resources (DWR) is administering the Sustainable Groundwater Management (SGM) Grant Program Planning Grants using funds authorized by the California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access for All Act of 2018 (Proposition 68) and the Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1); and

**WHEREAS**, DWR will award \$50 million for projects that develop and implement groundwater plans and projects; and

**WHEREAS**, Proposition 68 requires a minimum cost share of 25% of the total project cost, and Proposition 1 requires a minimum cost share of 50% of the total project cost; and

**WHEREAS**, only one grant will be awarded per basin; and

**WHEREAS**, the KRGSA represents all potential applicants in the kern subbasin, and

**WHEREAS**, DWR requires a resolution to be adopted by the applicant's governing body designating an authorized representative to submit the application and execute and agreement with the State of California for a SGM Grant; and

**NOW, THEREFORE, BE IT RESOLVED**, by the KRGSA as follows:

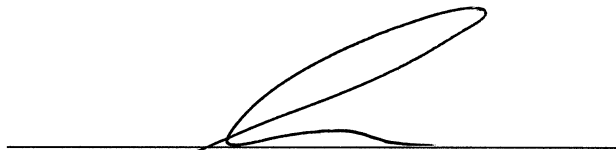
1. The above recitals and findings are true and correct and are incorporated herein by reference.
2. That application be made to the California Department of Water Resources to obtain a grant under the 2019 Sustainable Groundwater Planning Grant Program pursuant to the Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1) (Water Code Section 79700 et seq.) and/or the California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access for All Act of 2018 (Proposition 68) for the Kern

County Subbasin Groundwater Sustainability Plan Support - Phase II.

3. That the Board Chair of the KRGSA or his designee is hereby authorized and directed to prepare the necessary data, conduct investigations, file such application, and execute a grant agreement with the California Department of Water Resources and make amendments or changes thereto.

-----oo000oo-----

**I HEREBY CERTIFY** that the foregoing Resolution was passed and adopted by the Kern River Groundwater Sustainability Agency on **OCT 21 2019**,

A handwritten signature in black ink, appearing to read "Rodney S. Palla", is written over a horizontal line. The signature is fluid and cursive, with a large loop at the end.

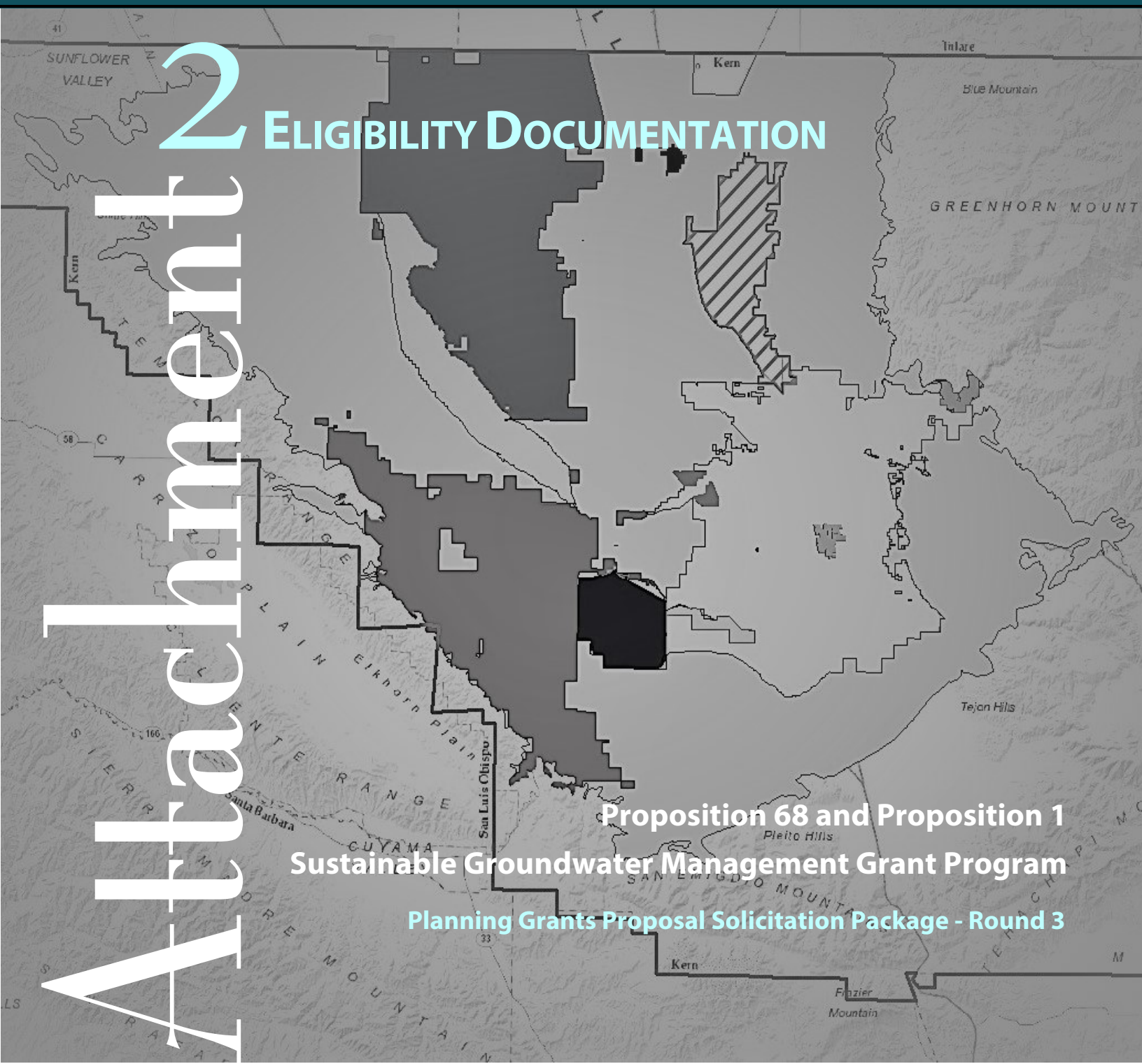
**Rodney S. Palla, Chairman**

# Kern County Subbasin Groundwater Sustainability Plan Support - Phase II 2019 Grant Application

## 2 ELIGIBILITY DOCUMENTATION

# Attachment

Proposition 68 and Proposition 1  
Sustainable Groundwater Management Grant Program  
Planning Grants Proposal Solicitation Package - Round 3





# ATTACHMENT 2: ELIGIBILITY DOCUMENTATION

## Kern County Subbasin Groundwater Sustainability Plan Support - Phase II

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## Introduction

Attachment 2 includes eligibility documentation for this Groundwater Sustainability Plan Support – Phase II Grant Application. Attachment 2 includes the following sections as required by the Proposal Solicitation Package (PSP):

- A. Applicant Information
- B. Agricultural Water Management Compliance
- C. CASGEM Basin Prioritization and Compliance
- D. Climate Change
- E. Groundwater Management Compliance
- F. Open and Transparent Water Data
- G. Public Utilities and Mutual Water Companies
- H. Stormwater Resource Plan (SWRP) Compliance
- I. Surface Water Diverter Compliance
- J. Sustainable Water Use and Demand Reduction
- K. Urban Water Management Compliance
- L. Water Metering Compliance

## A. Applicant Information

The Kern River Groundwater Sustainability Agency (KRGSA) is pleased to serve as the applicant for Kern County’s Kern County Subbasin Groundwater Sustainability Plan Support – Phase II grant application. The Kern County Subbasin Groundwater Sustainability Plan Support – Phase II application includes one project led by and supporting all the GSAs in the Kern County Subbasin. . The proposed project will benefit the entire Kern County Subbasin.

The Kern County Subbasin has been identified as a critically overdrafted, high priority groundwater basin. The Proposal objective is to implement a high-priority project that provides direct groundwater planning benefits to the Subbasin, meets Groundwater Sustainability Plan (GSP) regulations, and meets the California Department of Water Resources’ (DWR’s) evaluation criteria for Sustainable Groundwater Management Grant Program, Round 3 Planning Grants funding.

This project is entitled Subbasin Data Management System Development and it will develop a critical groundwater sustainability planning element encompassing all parts of the Subbasin. The proposed project includes the following primary objectives to initiate developing the Subbasin’s Data Management System (DMS): (1) conduct stakeholder outreach and engagement activities, (2) procure consultant assistance for DMS development, (3) identify DMS information requirements, (4) research and select the appropriate DMS approach for the Subbasin, (5) procure or design the DMS and refine and customize the DMS as needed, and (6) develop data protocols and templates (7) train GSA staff . If additional funding is required, the GSAs in the Kern subbasin have agreed to work together to either locate additional funding or to fund. This project is critical to meet immediate Kern County Subbasin GSP planning needs, as well as essential for the next steps in basin coordination and Sustainable Groundwater Management Act (SGMA) compliance requirements.

KRGSA is a Groundwater Sustainability Agency formed in 2016 under § 10723.8 of the California Water Code and is comprised of public agency members including the City of Bakersfield, the Kern Delta Water District, and the Kern County Water Agency Improvement District No. 4. An excerpt from the GSA application package submitted to DWR’s Sustainable Groundwater Management Section on April 12, 2016, is included as supporting documentation in Appendix A to this Attachment 2. Further information may be found on KRGSA’s website: <http://www.kernrivergsa.org>.

The Round 3 Planning Grants PSP states that eligible applicants are GSAs, member agencies of the GSAs, or member agencies of an approved Alternate to a GSP for the basin for which the application is submitted. KRGSAs are GSAs for a significant portion of the critically overdrafted, high priority Kern County Subbasin (Basin Number 5-22.14) and as such are eligible applicants for this Proposition 68 and Proposition 1 Sustainable Groundwater Management Grant Program, Planning Grants PSP – Round 3 grant application.

The KRGSAs Executive Board adopted Resolution KRGSAs 001-19 on October 21, 2019, authorizing KRGSAs to submit this application on behalf of the entire Kern subbasin to obtain a grant under the Sustainable Groundwater Management Grant Program and execute an agreement with the State of California to receive a grant under the Proposition 68 and Proposition 1 Sustainable Groundwater Management Grant Program, Planning Grants PSP – Round 3 grant opportunity. A copy of the resolution is included in Attachment 1.

## B. Agricultural Water Management Compliance

Agricultural Water Management eligibility for the applicant for this Proposal is discussed in this section.

The applicant, KRGSAs, is not an agricultural water supplier. No agricultural water suppliers will receive funding from the proposed grant through a joint-powers agreement or other legal agreement. The project will be implemented by the applicant, KRGSAs, and KGA on behalf of all the GSAs in the Subbasin. KGA is also a GSA within the basin, and KGA is not an agricultural water supplier. Neither the applicant nor the additional project proponent, KGA, is an agricultural water supplier, and as such these entities are not required to develop or submit Agricultural Water Management Plans (AWMPs).

Therefore, documentation of Agricultural Water Management Compliance is not applicable for this Proposal, applicant, or project proponents.

It is noted that while the applicant, KRGSAs, is not an agricultural water supplier, one of the member agencies of the KRGSAs is the Kern Delta Water District, which is required to develop and submit an AWMP. The Kern Delta Water District is in full agricultural water management compliance, having submitted and received DWR approval, with documentation provided in Appendix B.

## C. CASGEM Basin Prioritization and Compliance

This section discusses California Statewide Groundwater Elevation Monitoring (CASGEM) eligibility status for the overall Proposal, project proponents, and the proposed project. The Subbasin Data Management System Development project proposed in this application package will benefit the entire Kern County Subbasin, identified as groundwater Subbasin number 5-022.14. Pursuant to Water Code § 10933(b) and Bulletin 118, DWR has designated the Kern County Subbasin as high priority and critically overdrafted.

Determining CASGEM compliance status for the overall Kern County Groundwater Basin (5-022.14) requires identifying:

- (1) whether the entirety of the groundwater basin is monitored through identification and establishment of monitoring entities, and
- (2) if monitoring data is uploaded to CASGEM regularly each spring and fall, once monitoring entities are established.

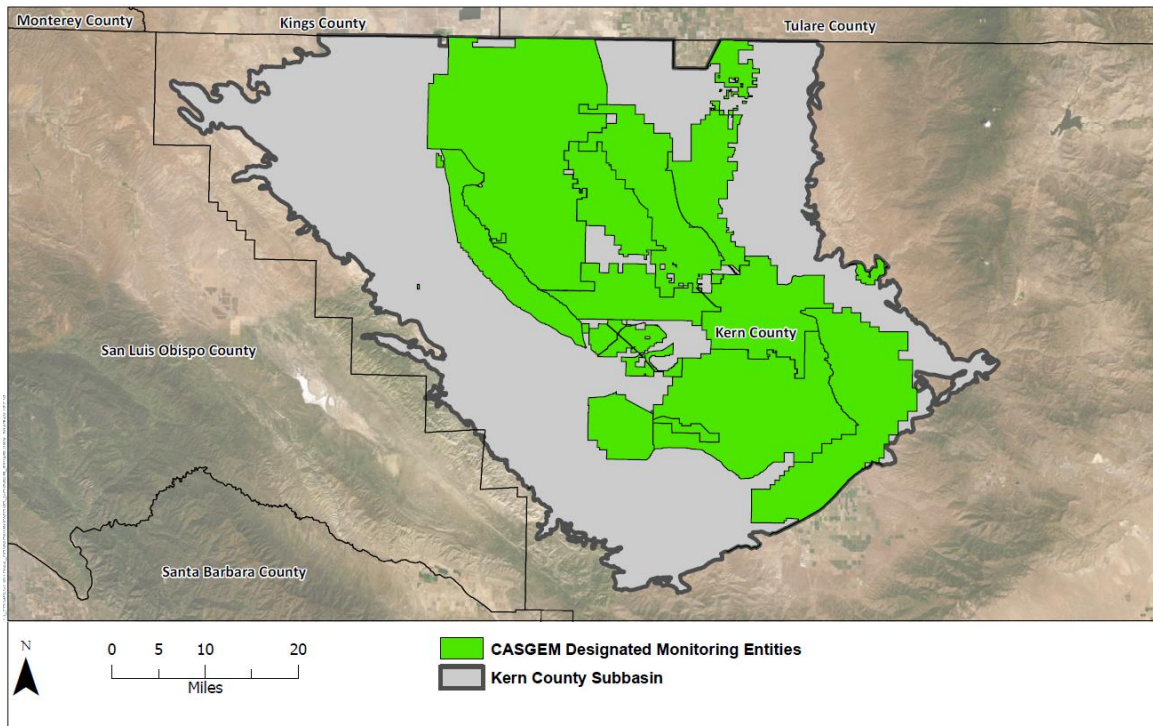
For the portion of high-priority basins that do not have a CASGEM monitoring entity, the grant applicant will not be eligible to receive grant funding (Water Code § 10933.7(a)). Consistent with Water Code § 10933.7(b), if the applicant area is demonstrated to be a DAC or SDAC, the project will be considered eligible for grant funding notwithstanding CASGEM compliance.

The Subbasin Data Management System Development project will be implemented by the applicant, KRGSAs, in collaboration with KGA on behalf of and in coordination with all the GSAs in the Subbasin. The applicant, KRGSAs, is not identified as a CASGEM monitoring entity for the basin. KGA is also a GSA within the Kern County Subbasin. KGA is not a CASGEM monitoring entity. Neither the applicant nor the additional project proponent, KGA, is serving as a CASGEM monitoring entity for the basin. However, approximately 46% of the

Kern County groundwater basin is CASGEM compliant as described below, based on established monitoring entities that provide data to DWR’s CASGEM program. This project includes a basin-wide project that will benefit the entire Subbasin, including the 54% non-CASGEM compliant area, of which 90% is characterized as Disadvantaged Community and, as such, is exempt from the requirement for CASGEM compliance.

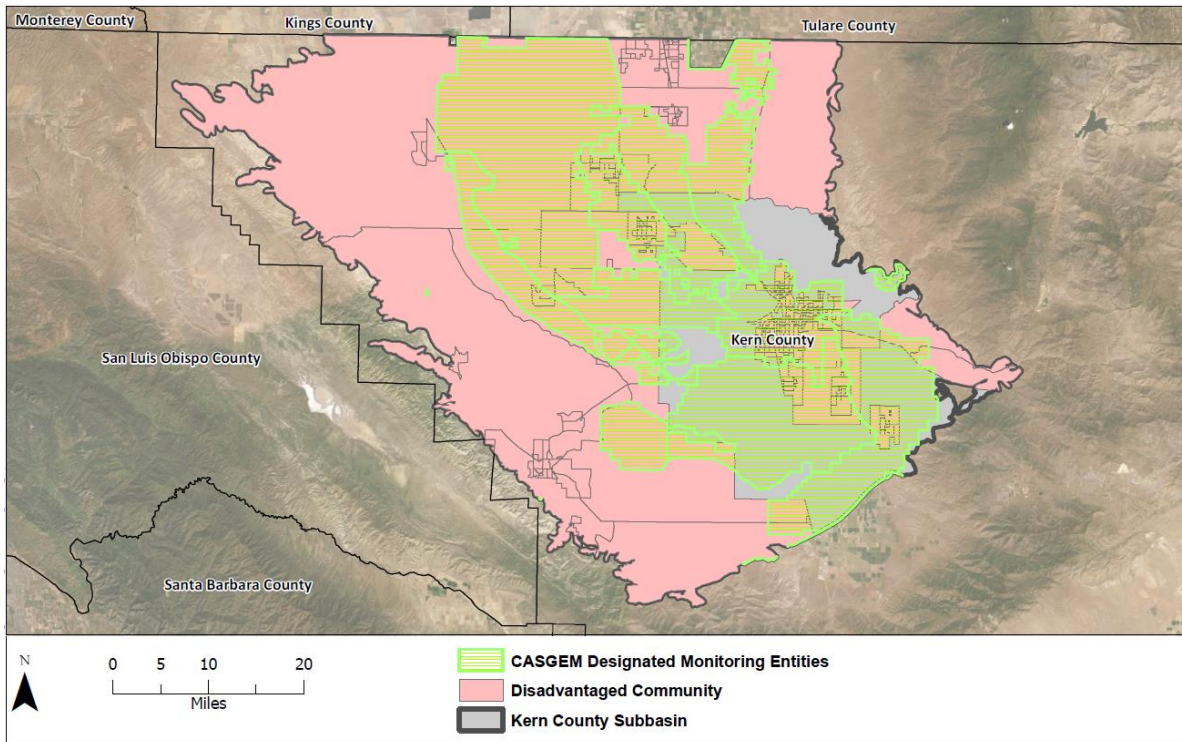
**Figure 2-1**, below, depicts the Kern County Subbasin, showing areas where CASGEM monitoring entities have been established (green), and areas where CASGEM monitoring entities are not yet established (gray). This map shows that 46% of the basin is CASGEM compliant in terms of having established monitoring entities that meet CASGEM requirements.

**Figure 2-1. Kern County Subbasin Area with Established Monitoring Entities**



**Figure 2-2**, below, depicts the Kern County Subbasin, showing CASGEM compliant areas and DAC boundaries within the Subbasin (data acquired from DWR’s DAC Mapping tools). This map shows that, within the 54% of the basin that is not CASGEM compliant (in terms of not having established monitoring entities); 90% of that area is characterized as a DAC, and as such, exempt from the PSP requirement for CASGEM compliance. It is noteworthy that only 5.6% of the Subbasin is both not CASGEM compliant and not DAC.

**Figure 2-2. Kern County Subbasin Areas with Established Monitoring Entities and DAC Areas**



## CASGEM Monitoring Data – Current Submittal Status

**Table 2-1**, below, is featured on DWR’s CASGEM website, and presents a list of the established CASGEM monitoring entities for the basin. The table also shows latest elevation data submitted as of October 23, 2019. This table shows that established monitoring entities are providing current elevation data.

**Table 2-1. Kern County Subbasin Monitoring Entities and Data Submittal Status**

Monitoring Entity	Groundwater Basin/ Subbasin Name	Groundwater Basin/ Subbasin Number	Authority Type	Last Elevation Data Submitted	Associated Well Count
Arvin-Edison Water Storage District	Kern County	5-022.14	Ground Water Management Agency	3/12/2019 5:01:00 PM	41
Cawelo Water District	Kern County	5-022.14	Ground Water Management Agency	3/11/2019 6:48:00 PM	7
Deer Creek & Tule River Authority	Kern County	5-022.14	Local Agency Pursuant to WC Part 2.75	2/25/2019 12:00:00 AM	3
Kern County Water Agency Improvement District No. 4	Kern County	5-022.14	Local Agency Pursuant to WC Part 2.75	3/6/2019 3:46:00 PM	5
Kern River Fan Group	Kern County	5-022.14	Voluntary Cooperative Groundwater Monitoring Association	4/1/2019 12:00:00 AM	34
Kern Water Bank Authority	Kern County	5-022.14	Voluntary Cooperative Groundwater Monitoring Association	7/16/2019 12:00:00 AM	15
Kern-Tulare Water District	Kern County	5-022.14	Local Agency Pursuant to IRWM	10/8/2019 12:00:00 AM	25
North Kern Water Storage District	Kern County	5-022.14	Local Agency Pursuant to WC Part 2.75	5/8/2019 12:00:00 AM	9
Semitropic Water Storage District	Kern County	5-022.14	Local Agency Pursuant to WC Part 2.75	6/8/2019 12:00:00 AM	46
Shafter-Wasco Irrigation District	Kern County	5-022.14	Local Agency Pursuant to WC Part 2.75	2/1/2019 12:00:00 AM	8
West Kern Water District	Kern County	5-022.14	Ground Water Management Agency	8/7/2019 12:00:00 AM	49

Source: DWR’s CASGEM website.

The monitoring entities listed in Table 2-1 above are providing elevation data submitted for Kern County Subbasin and encompass approximately 46% of the Subbasin area. The other 54% of the Kern County Subbasin is not yet CASGEM compliant.

## Conclusion

As described above, approximately 46% of the Kern County Groundwater Subbasin is CASGEM compliant from the perspective of having established monitoring entities, as well as from the perspective of providing monitoring data to DWR's CASGEM program. Figure 2-2 illustrates that, of the 54% of the basin that is not CASGEM compliant, 90%, or the great majority, is a DAC and, as such, exempt from the PSP requirement for CASGEM compliance. The remaining areas that are still not compliant and not DAC, 5.6% of the Subbasin, will not receive grant funding.

CASGEM compliance is sufficiently demonstrated for the Kern County Groundwater Subbasin for purposes of this grant proposal.

## D. Climate Change

This section discusses Climate Change eligibility status for the overall Proposal. The SGM Grant Program 2019 Guidelines document requires that applicants seeking funding must demonstrate that the applicant's project contributes to addressing the risks in the region to water supply and water infrastructure arising from climate change (Water Code § 79742(e)). To the extent practicable, applicants must measure the amount of greenhouse gas emissions reduced and carbon sequestered resulting from an implementation project funded by the SGM Grant Program (Public Resources Code § 80001(b)(7)).

This Proposal involves funding of a planning effort rather than an implementation project. As such, the Subbasin Data Management System Development project would not involve activities that could emit greenhouse gases or affect carbon sequestration. The project would have no effect related to climate change. Therefore, documentation of climate change effects is not applicable for this Proposal, applicant, or project proponents.

## E. Groundwater Management Compliance

This section discusses Groundwater Management Compliance eligibility status for the overall Proposal. The SGM Grant Program 2019 Guidelines document requires that, for groundwater implementation projects that directly affect groundwater levels or quality, the applicant must self-certify that one or more option below has been, or is currently, being satisfied.

SGMA (Water Code § 10720 et seq.) specifies actions for critically overdrafted groundwater basins, high and medium priority basins, and low and very low priority basins. Groundwater project proponents must demonstrate how their project is consistent with SGMA efforts in the basin. To be eligible to receive Implementation grant funds, applicants must be from a medium or high priority basin with either:

- An adopted GSP that has been submitted to DWR for review and deemed complete by DWR, or
- An approved Alternative to a GSP.

This Proposal involves funding of a planning effort rather than an implementation project that directly affects groundwater levels or quality. The proposed project, the Subbasin Data Management System (DMS) Development, will develop a critical groundwater sustainability tool encompassing all parts of the Subbasin. The proposed project consists of scoping and development of the DMS including activities such as: (1) conducting stakeholder outreach and engagement activities, (2) procuring consultant assistance for DMS development, (3) identifying DMS information requirements, (4) researching and selecting the appropriate DMS approach for the Subbasin, and (5) procuring and designing the DMS and customizing it as needed. This proposed project is critical to meet Kern County Subbasin GSP, basin coordination, and SGMA compliance needs.

This Proposal is entitled Kern County Subbasin Groundwater Sustainability Plan Support – Phase II. The first phase of this GSP support work is currently underway and is being funded under a Proposition 1 SGMA Round

2 Planning Grant entitled Kern County Subbasin Groundwater Sustainability Support – 2017 Grant Application. Activity under the Proposition 1 grant includes generating a GSP for KRGSA to be submitted to DWR as a deliverable. As of this writing (October 2019) the GSP is in draft form and will be submitted to DWR on or before January 31, 2020.

## F. Open and Transparent Water Data

This section discusses Open and Transparent Water Data Compliance for the overall Proposal. The SGM Grant Program 2019 Guidelines document requires that recipients of State funds through grants or contracts for research or projects relating to the improvement of water or ecological data shall, as a condition of the receipt of a grant or contract, adhere to the protocols developed pursuant to subdivision (a) for data sharing, transparency, documentation, and quality control (Water Code § 12406(b)). KRGSA will adhere to all required data sharing, transparency, and documentation protocols.

## G. Public Utilities and Mutual Water Companies

This section discusses Public Utilities and Mutual Water Companies Compliance for the overall Proposal. The SGM Grant Program 2019 Guidelines document requires that a project proposed by a public utility regulated by the Public Utilities Commission or a mutual water company shall have a clear and definite public purpose and shall benefit the customers of the water system and not the investors (Water Code § 79712(b)(1)).

This Proposal involves funding of a planning effort rather than an implementation project. The Subbasin Data Management System Development project it will develop a critical groundwater sustainability tool encompassing all parts of the Subbasin. The proposed project consists of scoping and development of the DMS. Once the planned DMS becomes operational, the collected data will inform understanding of existing and projected groundwater levels; consequently, this knowledge will contribute to addressing and reducing risks in the region to water supply and water infrastructure arising from climate change. This is a clear and definite public purpose and benefits the customers and residents of the entire project area, the Kern County Subbasin. There are no investors associated with this project, and there shall be no benefits to investors as a result of this project.

## H. Stormwater Resource Plan (SWRP) Compliance

This section discusses Stormwater Resource Plan Compliance for the overall Proposal. The SGM Grant Program 2019 Guidelines document states that Senate Bill (SB) 985 (Water Code § 10563(c)) requires the development of a SWRP or functionally equivalent plan for stormwater and dry weather runoff capture projects to receive grant funds through these provisions.

This Proposal involves funding of a planning effort, not an implementation project. As such, the Subbasin Data Management System Development project would not involve activities that could affect stormwater or dry weather resources. Since this project will conduct no construction, a Stormwater Resource Plan will not be needed.

## I. Surface Water Diverter Compliance

Surface Water Diverter eligibility for the overall Proposal is discussed in this section. The SGM Grant Program 2019 Guidelines document states that a diverter of surface water is not eligible for a water grant or loan awarded or administered by the State unless it complies with surface water diversion reporting requirements outlined in Part 5.1 of Division 2 of the Water Code.

The applicant, KRGSA, is not a surface water diverter. No surface water diverters will receive funding from the proposed grant through a joint-powers agreement or other legal agreement. The project included in this proposal will be implemented by the applicant, KRGSA, in collaboration with KGA on behalf of all the GSAs in the Subbasin. KGA is also a GSA within the basin, and KGA is not a surface water diverter. Neither the applicant nor the additional project proponent, KGA, is a surface water diverter, and as such these entities are not required to submit to the State Water Resources Control Board (SWRCB) surface water diversion reports in



compliance with requirements outlined in Part 5.1 (commencing with Section 5100) of Division 2 of the Water Code.

Therefore, documentation of Surface Water Diverter Compliance is not applicable for this proposal, applicant, or project proponents.

It is noted that while the applicant, KRGSA, is not a surface water diverter, two of the member agencies of the KRGSA are surface water diverters. The City of Bakersfield and Kern Delta Water District have longstanding water rights on the Kern River. Both these member agencies are in full compliance with regard to submitting diversion reports with the SWRCB.

## J. Sustainable Water Use and Demand Reduction

This section addresses Sustainable Water Use and Demand Reduction eligibility for the overall Proposal. The SGM Grant Program 2019 Guidelines document states that SBx7-7 (Water Code § 10608 *et seq.*) conditions the receipt of a water management grant or loan for urban water suppliers on gallons per capita per day reduction targets with the end goal of a 20% reduction by 2020.

As discussed below in Section K, Urban Water Management Compliance, the applicant, KRGSA, is not an urban water supplier. No urban water suppliers will receive funding from the proposed grant through a joint-powers agreement or other legal agreement. The Sustainable Water Use and Demand Reduction criterion is not applicable for this Proposal.

## K. Urban Water Management Compliance

Urban Water Management eligibility for the applicant for this Proposal is discussed in this section. The applicant, KRGSA, is not an urban water supplier. No urban water suppliers will receive funding from the proposed grant through a joint-powers agreement or other legal agreement. The project included in this proposal will be implemented by the applicant, KRGSA, in collaboration with KGA on behalf of and in coordination with all the GSAs in the Subbasin. KGA is also a GSA within the basin, and KGA is not an urban water supplier. Neither the applicant nor the additional project proponent, KGA, is an urban water supplier, and as such these entities are not required to develop or submit Urban Water Management Plans, to maintain compliance with Sustainable Water Use and Demand Reduction, Part 2.55 of Division 6 (Water Code Section 10608 *et seq.*), or to comply with water metering requirements contained in Water Code Section 525 *et seq.*

Therefore, documentation of Urban Water Management Compliance is not applicable for this proposal, applicant, or project proponents.

It is noted that while the applicant, KRGSA, is not an urban water supplier, two of the KRGSA member agencies, the Kern County Water Agency Improvement District No. 4 and the City of Bakersfield, are required to develop and maintain an Urban Water Management Plan (UWMP) that is submitted to DWR for review. Kern County Water Agency Improvement District No. 4 is in full urban water management compliance, having submitted and received DWR approval on its 2015 UWMP, which is included in Appendix B. The City of Bakersfield's UWMP was submitted on June 30, 2017. Documentation is also included in Appendix B.

## L. Water Metering Compliance

This section addresses Water Metering Compliance eligibility for the overall Proposal. The Round 3 Planning Grants Proposal Solicitation Package states that any urban water supplier applying for State grant funds for wastewater treatment projects, water use efficiency projects, drinking water treatment projects, or for a permit for a new or expanded water supply, shall demonstrate that they meet the water meter requirements in Water Code § 525 *et seq.*

The applicant, KRGSA, is not an urban water supplier. The project included in this proposal will be implemented by the applicant, KRGSA, in collaboration with KGA on behalf of and in coordination with all the GSAs in the Subbasin. KGA is also a GSA within the basin, and KGA is not an urban water supplier. Neither the applicant nor the additional project proponent, KGA, is an urban water supplier.

This Proposal is not seeking funding for a wastewater treatment project, water use efficiency project, drinking water treatment project, or permit for a new or expanded water supply.

Therefore, the Water Metering Compliance criterion is not applicable for this proposal, applicant, or project proponents.

It is noted that while the applicant, KRGSa, is not an urban water supplier, two of the KRGSa member agencies, the Kern County Water Agency Improvement District No. 4 is a treated water wholesaler and provides a supply to four customers. All connections are metered; however, ID4 is not required to obtain documentation because it is not a retail urban water supplier.

## **Appendix A**

### **Kern River Groundwater Sustainability Agency GSA Application Package (excerpt)**

April 12, 2016 GSA application package cover letter submitted to DWR's Sustainable Groundwater Management Section

Full application package may be found on KRGSA's website: <http://www.kernrivergsa.org>



## **Kern River Groundwater Sustainability Agency**

April 12, 2016

Mark Nordberg, GSA Project Manager  
Sustainable Groundwater Management Section  
California Department of Water Resources  
P.O. Box 942836  
Sacramento, California 94236-0001

Re: Notice of Decision to Become a Groundwater Sustainability Agency

Dear Mr. Nordberg,

Per Section 10723.8(a) of the California Water Code, the City of Bakersfield, the Kern Delta Water District, and the Kern County Water Agency Improvement District No.4 hereby give notice of their decision to form the Kern River Groundwater Sustainability Agency (GSA) for a portion of the Kern County Subbasin (Basin Number 5-22.14, DWR Bulletin 118) within the San Joaquin Valley Groundwater Basin.

The Sustainable Groundwater Management Act (SGMA), passed in 2014, requires that all basins designated as high- or medium-priority basins that are subject to critical overdraft conditions are to be managed under a groundwater sustainability plan (GSP) or coordinated GSPs (Section 10720.7). The Kern County Subbasin is a high-priority basin and is identified as having critical overdraft conditions. Information regarding the status of groundwater basins is provided by the California Department of Water Resources (DWR) at: <http://www.water.ca.gov/groundwater/sgm/cod.cfm>.

This GSA notification and supporting materials are submitted to DWR within 30 days of the decision to form the GSA by its member agencies per Water Code §10723.8(a).

Water Code §10723.8(a)(1) requires that this GSA notification include information regarding the service area boundaries of the GSA and the boundaries of the basin the GSA intends to manage. Exhibit 1 includes three maps to satisfy the requirements of Water Code §10723.8(a)(1). Map (A) shows the Kern River GSA boundary. Map (B) shows the Kern River GSA boundary within the Kern County Subbasin. Map (C) shows the boundaries of the service areas of the agencies that comprise the Kern River GSA. The digital GIS data corresponding to the GSA boundary maps shown in Exhibit 1 are included with this submittal and provided on compact disc.

Water Code §10723.8(a)(1) also requires information regarding other agencies managing or proposing to manage groundwater within the basin. At the time of this Kern River GSA Notification submittal to DWR, it is our understanding that the Buena Vista Water Storage District has submitted a Notification to Form a GSA with DWR for a portion of the Kern County Subbasin. Within the Kern County subbasin, we understand that other agencies may be considering or proposing to form GSAs to manage groundwater resources in their own services areas. To our knowledge at this time, the following entities have held either a public hearing or expressed interest in forming a GSA: the Kern Groundwater Authority (KGA) and the Olcese Water District. We understand that the Greenfield County Water District has held a public hearing, passed a resolution to form a GSA, and will be submitting their Notification to Form a GSA with DWR.

On March 1, 2016 the governing Board of the Kern Delta Water District held a public hearing (Water Code §10723.b) regarding formation of the Kern River GSA. On March 15, 2016 the Board passed Resolution 2016-03 wherein the District resolved to become a GSA in cooperation with the City of Bakersfield and Improvement District No.4 of the Kern County Water Agency for the portion of the Kern County Subbasin as shown in Exhibit 1. Exhibit 2 contains a copy of the approved resolution to form the Kern River GSA by the governing Board of the Kern Delta Water District. Exhibit 3 includes details regarding the public noticing of the March 1, 2016 hearing by the Kern Delta Water District. The noticing process was consistent with the requirements of Section 6066 of the California Government Code.

On March 2, 2016 the City Council of Bakersfield held a public hearing (Water Code §10723.b) regarding formation of the Kern River GSA. On March 30, 2016 the City Council passed Resolution 039-16 wherein the City resolved to become a GSA in cooperation with the Kern Delta Water District and Improvement District No.4 of the Kern County Water Agency for the portion of the Kern County Subbasin as shown in Exhibit 1. A copy of Resolution 039-16 is included in Exhibit 2. Details regarding the public noticing of the March 2, 2016 hearing by the City Council are provided in Exhibit 3 and are consistent with the requirements of Section 6066 of the California Government Code.

On March 31, 2016 the Board of Directors of the Kern County Water Agency on behalf of Improvement District No.4 held a public hearing (Water Code §10723.b) regarding formation of the Kern River GSA. On March 31, 2016 the Board of Directors passed Resolution 11-16 wherein the Kern County Water Agency, Improvement District No.4 resolved to become a GSA in cooperation with the Kern Delta Water District and the City of Bakersfield for the portion of the Kern County Subbasin as shown in Exhibit 1. A copy of Resolution 11-16 is included in Exhibit 2. Details regarding the public noticing of the March 31, 2016 hearing by the Board of Directors are provided in Exhibit 3 and are consistent with the requirements of Section 6066 of the California Government Code.

Exhibit 4 provides a memorandum of understanding (MOU) between the Kern Delta Water District, City of Bakersfield, and Kern County Water Agency Improvement District No.4 to form the Kern River GSA and manage groundwater resources sustainably within the GSA boundary. Please note that Exhibit C-1 to the MOU in Exhibit 4 contains a list of additional agencies that have joined the Kern River GSA. Exhibit 5 includes additional supporting documents related to these additional agencies that have joined the Kern River GSA.

Per California Water Code §10723.2, GSAs shall consider the interests of all beneficial uses and users of groundwater within their service area, as well as those responsible for implementing Groundwater Sustainability Plans (GSPs). Exhibit 6 lists interested parties developed pursuant to Water Code §10723.2 and describes how these users and uses will be considered during the development and operation of the Kern River GSA and implementation of the GSP for the Kern River GSA. If additional interested parties are discovered, they too will be included in the development and operation of the GSA and the development and implementation of the agency's sustainability plan (Water Code 10723.8(a)(4)).

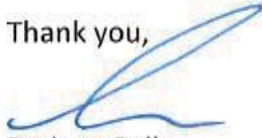
Water Code §10723.4 states that a GSA shall also establish and maintain a list of persons interested in receiving notices regarding plan preparation, meeting announcements, and availability of draft plans, maps, and other relevant documents. Any person may request, in writing, to be placed on the list of interested persons. The Kern River GSA will establish and maintain such a list of persons interested in receiving notices.

Except for the authorities granted to a GSA pursuant to Part 2.74 of Division 6 of the California Water Code (SGMA), no new bylaws, ordinances, or authorities have been adopted by the District or City at this time of forming the Kern River GSA (Water Code §10723.8(a)(3)).

The undersigned hereby represents that the information required by California Water Code §10728.3 is included within this notice and that the notification process is complete.

If you have any further questions or require any clarification regarding the information provided in this GSA Notification submittal, please do not hesitate to contact one of our GSA program coordinators as identified on the following page.

Thank you,



Rodney Palla

President, Board of Directors, Kern Delta Water District



Harold Hanson

Vice Mayor, City of Bakersfield



Ted Page

President, Board of Directors, Kern County Water Agency

#### **GSA Program Coordinators**

Art Chianello  
Water Resources Manager  
Water Resources Department  
(661) 326-3715  
[achianel@bakersfieldcity.us](mailto:achianel@bakersfieldcity.us)

Mark Mulkay  
General Manager  
Kern Delta Water District  
(661) 834-4656  
[mulkay@kerndelta.org](mailto:mulkay@kerndelta.org)

David Beard  
Manager  
Kern County Water Agency  
Improvement District No. 4  
(661) 634-1400  
[dbeard@kcwa.com](mailto:dbeard@kcwa.com)

#### **Exhibits:**

- Exhibit 1: GSA Maps – including (A) map of Kern River GSA boundary, (B) map of Kern River GSA boundary within Kern County Subbasin, and (C) map of Kern River GSA showing member agencies service area boundaries
- Exhibit 2: GSA Forming Resolutions by Kern Delta Water District, City of Bakersfield, and Improvement District No. 4 of the Kern County Water Agency
- Exhibit 3: Public Hearing Noticing Information for GSA Member Agencies
- Exhibit 4: Memorandum of Understanding (MOU) Between the City of Bakersfield, Kern Delta Water District, and Improvement District No.4 of the Kern County Water Agency
- Exhibit 5: Supporting Documents for Entities Also Joining the Kern River GSA
- Exhibit 6: List of Interested Parties
- Exhibit 7: List and Map of Disadvantaged Communities (DAC) in GSA

## **Appendix B**

### **Compliance Documentation**

UWMP Documentation

AWMP Documentation



**DEPARTMENT OF WATER RESOURCES**

1416 NINTH STREET, P.O. BOX 942836  
SACRAMENTO, CA 94236-0001  
(916) 653-5791



August 30, 2016

Mr. David Beard  
Improvement District No. 4 Manager  
Kern County Water Agency  
3200 Rio Mirada Drive  
Bakersfield, California 93308

RE: Urban Water Management Plan Requirements Addressed

Dear Mr. Beard:

The Department of Water Resources (DWR) has reviewed the Kern County Water Agency's 2015 Urban Water Management Plan (UWMP) that was received on June 24, 2016. The California Water Code (CWC) directs DWR to report to the California State Legislature once every five years on the status of submitted UWMPs. In meeting this legislative reporting requirement, DWR reviews all submitted UWMPs.

DWR's review of the Kern County Water Agency's 2015 UWMP has found that the UWMP addresses the requirements of the CWC. DWR's review of plans is limited to assessing whether suppliers have addressed the required legislative elements. In its review, DWR does not evaluate or analyze the supplier's UWMP data, projections or water management strategies. This letter acknowledges that the Kern County Water Agency's 2015 UWMP addresses the CWC requirements. The results of the review will be provided to DWR's Financial Assistance Branch.

If you have any questions regarding the review of the UWMP or urban water management planning please call Gwen Huff at 916-651-9672.

Sincerely,

A handwritten signature in blue ink, appearing to read "Vicki Lake".

Vicki Lake  
Unit Chief  
Urban Water Use Efficiency  
(916) 651-0740

Electronic cc: Luis Avila  
DWR

Jeff Eklund  
Provost & Pritchard Consulting Group

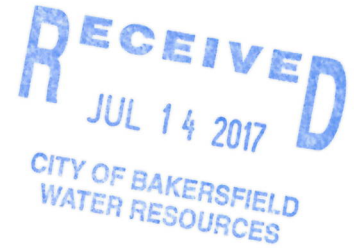
**DEPARTMENT OF WATER RESOURCES**

1416 NINTH STREET, P.O. BOX 942836  
SACRAMENTO, CA 94236-0001  
(916) 653-5791



July 11, 2017

Art Chianello  
Water Resources Manager  
City of Bakersfield  
1000 Buena Vista Road  
Bakersfield, California 93311

**RE: Urban Water Management Plan Submittal**

Dear Mr. Chianello:

This is to inform you that the Department of Water Resources has received the 2015 Urban Water Management Plan for City of Bakersfield on June 30, 2017.

DWR reviews Plans as quickly as possible and in the order they are received. If you require an expedited review, please contact me.

Please feel free to contact Gwen Huff at (916) 651-9672 if you have any questions or would like to discuss the review of 2015 Urban Water Management Plans. Contact Ms. Huff, also, if you require an expedited review.

A handwritten signature in blue ink that appears to read "V. Lake".

Vicki Lake  
Unit Chief  
Urban Water Use Efficiency  
Department of Water Resources  
(916) 651-0740

## 2015 Agricultural Water Management Plans List

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### 2015 Agricultural Water Management Plans List

#### SBX 7-7 Plans

- Alta ID Water Management Plan
  - [Vol 1 of 4](#)
  - [Vol 2 of 4](#)
  - [Vol 3 of 4](#)
  - [Vol 4 of 4](#)
  
- [Browns Valley ID 2016 AWMP](#)
- [Buena Vista 2015 AWMP](#)
- [Butte WD 2016 AWMP](#)
- [Byron Bethany ID AWMP Final 20171024](#)
- [Camrosa WD 2015 AWMP](#)
- [Carpinteria Valley WD 2015 AWMP](#)
- [Casitas MWD 2016 UWMP-AWMP](#)
- [Cawelo WD 2016 AWMP](#)
- [Corcoran AWMP Prepared Pursuant to Water Code Section 10826](#)
- [Consolidated ID 2016 AWMP](#)
- [Dudley Ridge 2015 AWMP](#)
- Feather River Regional AWMP
  - [Biggs-West Gridley WD 2015 AWMP](#)
  - [Richvale Irrigation District \(2015 AWMP Update\)](#)
  - [Western Canal Water District \(WCWD\)](#)
  
- [KernDelta WD 2015 AWMP](#)
- [Laguna ID AWMP 2015](#)
- [Lone Tree MWC 2016 AWMP](#)
- [Merced ID 2015 AWMP](#)
- [Modesto ID 2015 AWMP](#)
- [North Kern WSD 2015 AWMP](#)
- [Oakdale ID 2015 AWMP](#)
- [Orland Unit WUA AWMP 2017](#)
- [Rancho California WD 2015 AWMP UPDATE](#)
- [RD #2068 2016 AWMP](#)
- [Reclamation District #2035 2016 AWMP](#)
- [Riverdale ID 2016 AWMP](#)

- [San Diego Regional 2015 AWMP Part 1 | Part 2](#)
- [Semitropic WSD 2015 AWMP](#)
- [South San Joaquin ID AWMP 2015](#)
- [South Sutter WD 2015 AWMP](#)
- [Sutter Extension WD 2016 AWMP Final](#)
- [Turlock ID 2015 AWMP](#)
- [Ventura Co 2015 AWMP](#)
- [Wheeler Ridge-Maricopa 2015 AWMP](#)
- [Woodbridge ID 2016 AWMP](#)
- [Yolo County Flood Control and Water Conservation District](#)
- [Yuba Co WA 2015 AWMP](#)

### **Federal Plans**

- [Arvin-Edison Water Basin plan](#)
- [Banta-Carbona ID 2015 WMP](#)
- [Central California ID WMP FINAL 6-2014](#)
- [Chowchilla WD 2015 Update](#)
- [Columbia Canal Co 2012 WMP](#)
- [Colusa Co WD WMP Oct2014](#)
- [Delano-Earlimart ID WMP](#)
- [Firebaugh Canal WD 2011 WMP](#)
- [Fresno Irrigation District Agricultural Water Management Plan](#)
- **Sacramento River Settlement Contractors WMP**
  - [RD 108 Water Measurement Program](#)
  - [Sutter Mutual WC Water Measurement Program](#)
  - [Sacramento River Settlement Contractors WMP 9.13.13 Update](#)
  - [GCID Water Measurement Compliance 2016 Update](#)
  - [Sacramento River Settlement Contractors 2016 Drought Mgmt Plan](#)
- [James ID 2016 AWMP](#)
- [Kern-Tulare WD 2016 AWMP](#)
- [Lindmore ID 2016 WMP & Supplemental Report](#)
- [Lower Tule River 2012 WMP Update](#)
- [Madera ID WMP 2014-04-01](#)
- [Maine Prairie WD 2015 WMP 2.2017](#)
- [Orange Cove ID 2015 WCP & Addendum](#)
- [Orland-Artois WD 2015 WMP](#)
- [Panoche WD WCP Final 3-24-14](#)

- [Patterson ID WMP 2016 Update](#)
- [Pixley ID 2012 WMP Update](#)
- [San Benito COWD 2015 WMP](#)
- [San Luis Canal Co WMP Final 6-2014](#)
- [San Luis WD 2015 Supplement Report](#)
- [Shafter-Wasco ID 2015 Addendum to WMP](#)
- [Solano ID 2015 AWMP](#)
- [Stockton-East WD 2015 AWMP 2017.08.01](#)
- **Tulare ID Water Management Plan**
  - [Agricultural Water Measurement Master Plan](#)
  - [Drought Management Plan](#)
  - [Water Management Plan 2010](#)
  - [Water Supply Summary](#)
- [West Stanislaus ID 2014 WMP](#)
- **Westlands WD Water Mangement Plan**
  - [Westlands WD Water Shortage Contingency Plan 4.13.2017](#)
  - [Westlands WD WMP 2012](#)
  - [Westlands WD Worksheet Supply and Demand Final 4.13.2017](#)
  - [Water Supply Summary](#)
- [Westside WD 2013 WMP](#)

**Wednesday, November 01, 2017****Water Suppliers Required and Submitted (<25,000 due 7/1/2016)**

	<b>Date Received</b>	<b>2015 &amp; 2016 Plan Type/Date</b>	<b>&gt;25,000 acres or as noted</b>	<b>Review Completed</b>
Lone Tree MWC	7/1/2015	SBX7-7	10-25,000 acres	X
Columbia Canal Co.	8/10/2015	CVPIA	10-25,000 acres	X
Firebaugh Canal W.D.	8/10/2015	CVPIA	10-25,000 acres	X
Central California ID	8/10/2015	CVPIA/ 2014		X
San Luis Canal Co	8/10/2015	CVPIA/ 2014		X
Corcoran ID	8/18/2015	SBX7-7/ 2015		X
Arvin-Edison WSD	11/12/2015	CVPIA/ 2013-updated		X
Tulare Lake Basin WSD	11/12/2015	SBX7-7/ 2015		X
San Benito WD	11/16/2015	CVPIA/ 2015		X
Alta ID	12/9/2015	SBX7-7/ 2015		X
Turlock ID	12/10/2015	SBX7-7/ 2015		X
Lower Tule River ID	12/21/2015	CVPIA/ 2012		X
Pixley ID	12/21/2015	CVPIA/ 2012		X
Chowchilla WD	12/22/2015	CVPIA/ 2015-updated		X
South San Joaquin ID	12/22/2015	SBX7-7/ 2015		X
<b>Kern Delta WD</b>	<b>12/28/2015</b>	<b>SBX7-7/ 2015</b>		<b>X</b>
Modesto ID	12/29/2015	SBX7-7/ 2015		X
Biggs-West Gridley WD	1/13/2016	SBX7-7/ 2015		X
North Kern WSD	1/19/2016	SBX7-7/ 2015		X
Dudley Ridge WD	1/20/2016	SBX7-7/ 2015	10-25,000 acres	X
Laguna ID	1/27/2016	SBX7-7/ 2015		X
Tulare ID	1/28/2016	CVPIA/ 2015-updated		X
Nevada ID	2/1/2016	SBX7-7/ 2015		X
Ventura Co Waterworks Dist 1	2/11/2016	SBX7-7/ 2015	<10,000 acres	
Shafter-Wasco ID	2/11/2016	CVPIA/ 2015-updated		X
Yolo Co FC&WCD	2/11/2016	SBX7-7/ 2015		X
Fresno ID	2/18/2016	CVPIA/ 2015		X
Western Canal WD	2/26/2016	SBX7-7/ 2015		X
Richvale ID	2/29/2016	SBX7-7/ 2015		X
Solano ID	2/29/2016	CVPIA/ 2016		X
Buena Vista WSD	3/4/2016	SBX7-7/ 2015		X

Carlsbad MWD*	3/15/2016	SBX7-7/ 2015	<10,000 acres	
City of Escondido*	3/15/2016	SBX7-7/ 2015	<10,000 acres	
City of Oceanside*	3/15/2016	SBX7-7/ 2015	<10,000 acres	
City of Poway*	3/15/2016	SBX7-7/ 2015	<10,000 acres	
Fallbrook Public Utilities District*	3/15/2016	SBX7-7/ 2015	<10,000 acres	
Olivenhaim MWD*	3/15/2016	SBX7-7/ 2015	<10,000 acres	
Ramona MWD*	3/15/2016	SBX7-7/ 2015	<10,000 acres	
Rincon del Diablo MWD*	3/15/2016	SBX7-7/ 2015	<10,000 acres	
San Dieguito WD*	3/15/2016	SBX7-7/ 2015	<10,000 acres	
Santa Fe ID*	3/15/2016	SBX7-7/ 2015	<10,000 acres	
Vallecitos WD*	3/15/2016	SBX7-7/ 2015	<10,000 acres	
Yuima MWD*	3/15/2016	SBX7-7/ 2015	<10,000 acres	
Valley Center MWD*	3/15/2016	SBX7-7/ 2015	10-25,000 acres	X
Rainbow MWD*	3/15/2016	SBX7-7/ 2015	10-25,000 acres	X
Camrosa WD	3/29/2016	SBX7-7/ 2015	<10,000 acres	
Oakdale ID	3/29/2016	SBX7-7/ 2015		X
Semitropic WSD	4/1/2016	SBX7-7/ 2015		X
Yuba County WA	4/4/2016	SBX7-7/ 2015	Wholesaler	
Wheeler-Ridge-Maricopa WSD	4/6/2016	SBX7-7/ 2015		X
Carpinteria Valley WD	4/22/2016	SBX7-7/ 2015	<10,000 acres	
South Sutter WD	4/29/2016	SBX7-7/ 2015		X
Rancho California WD	6/23/2016	SBX7-7/ 2016	10-25,000 acres	X
Patterson ID	6/28/2016	CVPIA/ 2016 Update	10-25,000 acres	X
Woodbridge ID	6/29/2016	SBX7-7	10-25,000 acres	X
Cawelo WD	6/29/2016	SBX7-7		X
Casitas MWD	7/1/2016	SBX7-7	<10,000 acres	
Merced ID	7/21/2016	SBX7-7		X
Browns Valley ID	7/22/2016	SBX7-7	10-25,000 acres	X
Reclamation District 2035	7/29/2016	SBX7-7	10-25,000 acres	X
Consolidated ID	8/9/2016	SBX7-7		X
James ID	8/26/2016	CVPIA	10-25,000 acres	X
Kern-Tulare WD	8/31/2016	CVPIA	10-25,000 acres	X
Reclamation District No. 2068	9/14/2016	SBX7-7	10-25,000 acres	X
West Stanislaus I.D.	9/16/2016	CVPIA	10-25,000 acres	X

Westside W.D.	9/21/2016	CVPIA	10-25,000 acres	X
Riverdale I.D.	11/15/2016	SBX7-7	10-25,000 acres	X
Sutter Extension WD	11/17/2016	SBX7-7	10-25,000 acres	X
Glenn-Colusa ID**	12/16/2016	CVPIA/Sac River		X
Butte WD	1/4/2017	SBX7-7	10-25,000 acres	
Princeton-Codora-Glenn ID**	1/6/2017	CVPIA/Sac River	<10,000 acres	X
Meridian Farms**	1/6/2017	CVPIA/Sac River	<10,000 acres	X
Anderson-Cottonwood ID**	1/6/2017	CVPIA/Sac River	<10,000 acres	X
Reclamation District No. 1004**	1/6/2017	CVPIA/Sac River	10-25,000 acres	X
Provident ID**	1/6/2017	CVPIA/Sac River	10-25,000 acres	X
Natomas MWC**	1/6/2017	CVPIA/Sac River	10-25,000 acres	X
Sutter Mutual WC**	1/6/2017	CVPIA/Sac River		X
Reclamation District No. 108**	1/6/2017	CVPIA/Sac River		X
San Luis WD	1/10/2017	CVPIA		X
Delano-Earlimart ID	1/30/2017	CVPIA		X
Maine Prairie W.D.	3/7/2017	CVPIA	10-25,000 acres	X
Westlands WD	4/13/2017	CVPIA		X
Banta-Carbona I.D.	4/19/2017	CVPIA	10-25,000 acres	X
Orland-Artois WD	4/25/2017	CVPIA		X
Madera ID	4/25/2017	CVPIA		X
Colusa Co. WD	5/2/2017	CVPIA		X
Orland Unit WUA	5/11/2017	SBX7-7	10-25,000 acres	X
Stockton-East WD	8/8/2017	CVPIA		X
Orange Cove ID	8/28/2017	CVPIA		X
Lindmore ID	9/15/2017	CVPIA	10-25,000 acres	X
Panoche WD	9/26/2017	CVPIA		X
Byron Bethany I.D.	10/31/2017	CVPIA	10-25,000 acres	

\*San Diego Regional AWMP

\*\*Sac R. Settlement Contractors



**Water Suppliers Required, In Progress**  
**(<25,000 due 7/1/2016)**

	<b>2015-2016 Plan Type/Date</b>	<b>&gt;25,000 acres or as noted</b>
Kings River W.D.	SBX7-7	10-25,000 acres
Ivanhoe I.D.	CVPIA	10-25,000 acres
Saucelito I.D.	CVPIA	10-25,000 acres
Terra Bella I.D.	CVPIA	10-25,000 acres
Tule Lake ID	CVPIA	

**Water Suppliers Required, Not  
Submitted (<25,000 due 7/1/2016)**

Belridge WSD	SBX7-7	
Berrenda Mesa WD	SBX7-7	
Central San Joaquin WCD	CVPIA	
Del Puerto WD	CVPIA	
Lost Hills WD	SBX7-7	
Palo Verde ID	RRA***	
Southern San Joaquin MUD	CVPIA	
Angiola WD		
Bard WD	CVPIA	10-25,000 acres
Exeter I.D.	CVPIA	10-25,000 acres
Henry Miller W.D.	SBX7-7	10-25,000 acres
Lindsay-Strathmore I.D.	CVPIA	10-25,000 acres
Porterville I.D.	CVPIA	10-25,000 acres
Reclamation District No. 999	SBX7-7	10-25,000 acres
St. Johns W.D.	SBX7-7	10-25,000 acres

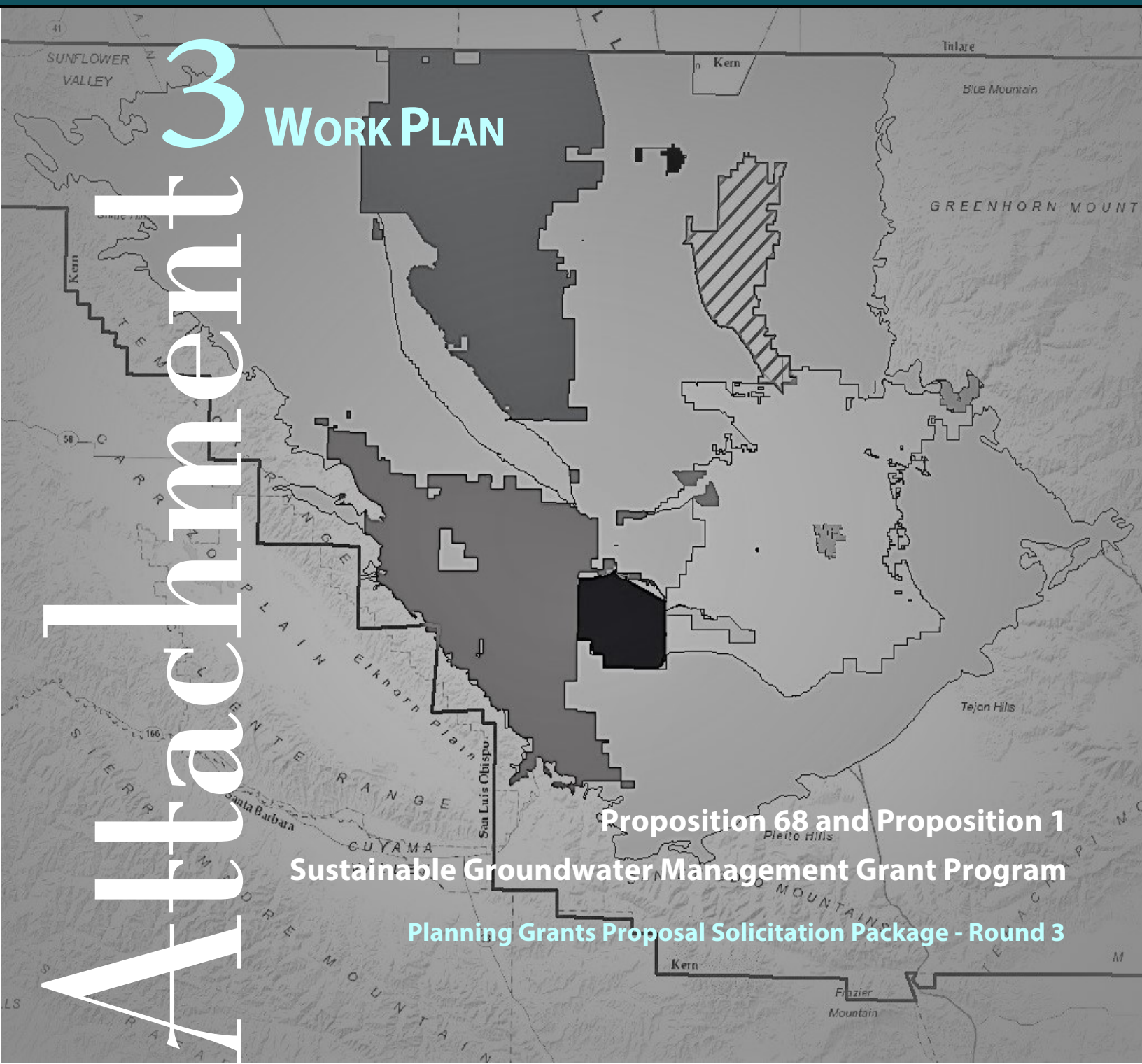
\*\*\*Reclamation Reform Act of 1982

# Kern County Subbasin Groundwater Sustainability Plan Support - Phase II 2019 Grant Application

## 3 WORK PLAN

# Attachment

Proposition 68 and Proposition 1  
Sustainable Groundwater Management Grant Program  
Planning Grants Proposal Solicitation Package - Round 3



# ATTACHMENT 3: WORK PLAN

<b>Work Plan .....</b>	<b>1</b>
<b>Project Justification.....</b>	<b>1</b>
A.    Project Description .....	1
Background and Need for the Project.....	1
Project Goals and Objectives.....	3
Tools to Be Developed.....	4
Differentiation from Round 2 Funding .....	4
B.    Project Benefits .....	5
C.    Technical Expertise.....	7
<b>Project Details .....</b>	<b>8</b>
D.    Scope of Work and Deliverables.....	8
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b. Project Deliverables .....	11
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See Appendix C in Attachment 6, SDAC-DAC-EDA	

## Work Plan

<b>Grant Proposal Title:</b>	<b>Kern County Subbasin Groundwater Sustainability Plan Support – Phase II</b>
<b>Applicant:</b>	<b>Kern River Groundwater Sustainability Agency</b>

## Project Justification

### A. Project Description

The Kern County Subbasin (Subbasin 5-022.14) is identified as a critically overdrafted basin where numerous water and irrigation districts, municipalities, industries, mutual water companies, small water systems, and Kern County residents rely on the shared groundwater resources. In compliance with the Sustainable Groundwater Management Act (SGMA), 11 groundwater sustainability agencies (GSAs) have been formed to cooperatively manage local groundwater in a sustainable manner within the Subbasin.

This proposal includes one critically important project, Kern County Subbasin Data Management System Development, which will be implemented by all the GSAs in the Kern County Subbasin. KRGSAs are submitting this application on behalf of the entire Subbasin.

KRGSAs on behalf of the Kern County Subbasin was awarded \$1,500,000 in Proposition 1 SGMA Planning Grant funds for a suite of six GSP Development project components supporting the entire Kern County Subbasin and proposed under the 2017 Round 2 SGMA grant opportunity. These six project components are well underway and successfully nearing completion at the time of this writing. Given the funding guidelines associated with this 2019, Round 3 SGM Planning Grant opportunity, this proposal requests an additional \$500,000 in Planning Grant funds, which if awarded, will mean that the Kern County Subbasin will have been awarded the published maximum of \$2,000,000 in Proposition 68 and Proposition 1 SGM Planning Grant funding. The Kern County Subbasin is one of the most important groundwater resources in the state, given its large size, high population growth, large number of irrigated acres, reliance on groundwater, and historical groundwater impacts. In light of these relatively high basin prioritization criteria, the Subbasin supports numerous large groundwater banking projects of statewide importance, including the Kern Water Bank, among others. This Subbasin is deserving of earning up to the maximum of grant funding due to the importance of this Subbasin and its various planning needs and challenges.

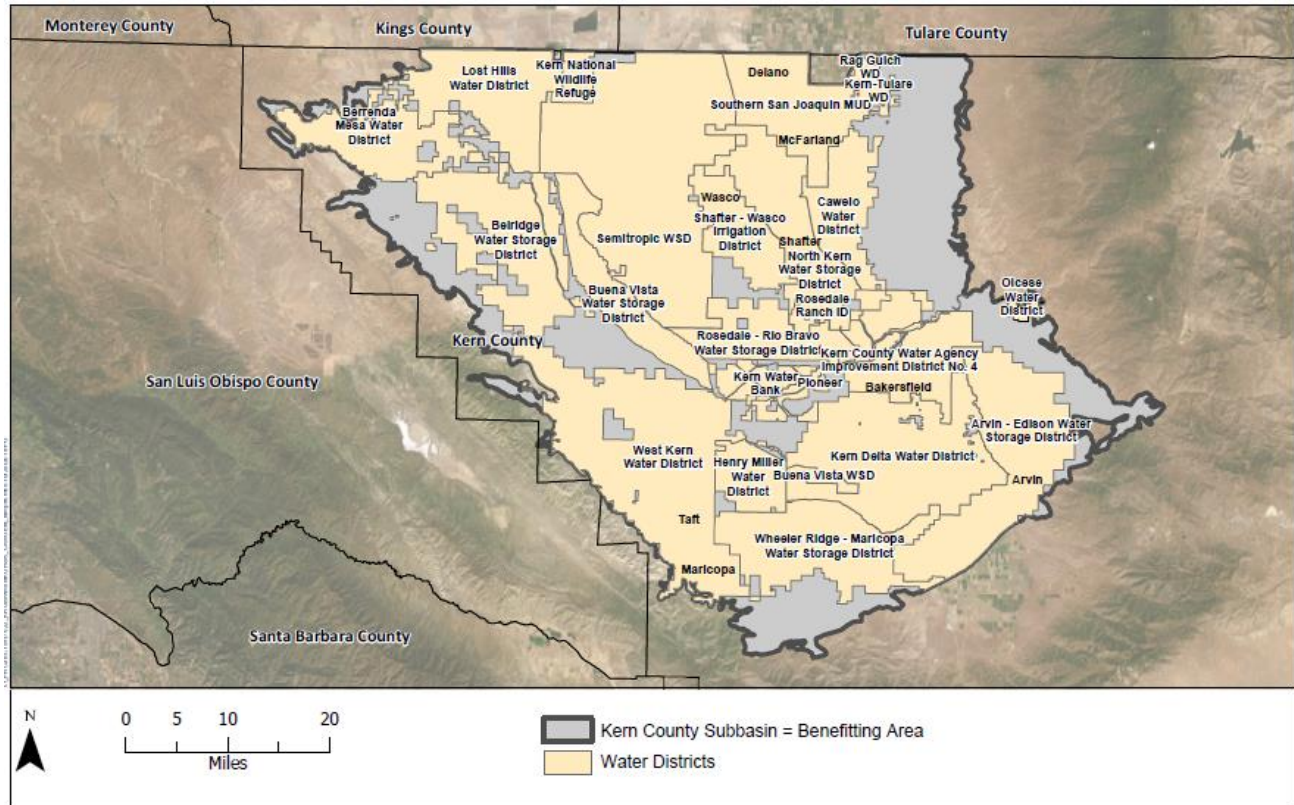
This project included in this proposal and described below will parlay the available \$500,000 in Planning Grant funds to effectively initiate a data management system (DMS) that will benefit all GSAs in the Subbasin and directly support the cross-basin coordination effort.

### **Background and Need for the Project**

Covering about 2,834 square miles, Kern County Subbasin is the largest subbasin in California with a complex water management structure, a large portfolio of local and imported water sources, and numerous large groundwater banking projects, collectively providing both local and State-wide benefits for water supply. The map provided in **Figure 3-1** below shows the boundaries of the Kern County Subbasin, which is also the area that would benefit from the proposed project, as well as the boundaries of the multiple water districts within the Subbasin. The general locations of Disadvantaged

Communities (DACs) are shown in bold-face type; a map showing the areas occupied by DACs is provided as Figure 6-1 in Attachment 6.

**Figure 3-1. Kern County Subbasin and Benefitting Area**



Given this framework, numerous approaches and systems for data management have been developed over time by each local agency for its own objectives – including regulatory compliance. This has resulted in a myriad of disparate data sets with different organizational structures, temporal and spatial scales, data standards, and assumptions regarding data accuracy and reliability. GSP regulations (Article 3, Section 352.6) require agencies to develop and maintain a data management system that is “capable of storing and reporting information relevant to the development or implementation of the Plan and monitoring of the basin.”

The Kern County Subbasin GSAs recognize the need to develop a centralized DMS on a Subbasin-wide basis. Accordingly, the GSAs in the Kern County Subbasin are cooperating on this proposal for a Subbasin-wide DMS to support monitoring, evaluation, reporting, management, and, importantly, GSP implementation. It is recognized that compilation of individual DMSs will require significant manipulation and re-structuring to create a centralized relational DMS that is populated with consistent data sets across the Subbasin.

One of the hallmarks of SGMA is a call for the integrated coordination of groundwater resources across a subbasin planning area. For the Kern County Subbasin, developing a shared, common, and consistent platform across the Subbasin is essential to continue the coordination developed with the C2VSim water modeling, monitoring network, and now annual reporting.

The immediate need for a centralized DMS is highlighted by the GSAs' ongoing cooperative efforts for annual reporting. Specifically, GSAs are working together to collaboratively prepare one Annual Report for each reporting period that covers the entire Subbasin rather than submitting a separate Annual Report from each GSA. As codified in SGMA, Chapter 6, Section 10728 of the California Water Code states:

“On April 1 following the adoption of a groundwater sustainability plan and annually thereafter, a groundwater sustainability agency shall submit a report to the department containing the following information about the basin managed in the groundwater sustainability plan:

- (a) Groundwater elevation data.
- (b) Annual aggregated data identifying groundwater extraction for the preceding water year.
- (c) Surface water supply used for or available for use for groundwater recharge or in-lieu use.
- (d) Total water use.
- (e) Change in groundwater storage.”

In order to comply with the requirements of SGMA for standardized reporting, and to coordinate on a Subbasin-wide basis for consistent data evaluation, it is crucial that a DMS be developed for the entire Subbasin that will allow the various GSAs to gather and share information regarding local groundwater conditions on a shared and consistent data platform.

### **Project Goals and Objectives**

The overarching goal of the proposed Subbasin Data Management System Development project is to initiate the key steps to develop and build the Subbasin DMS, which will ultimately support Subbasin GSAs by providing (1) improved coordination of groundwater monitoring and management actions and (2) the ability to meet the reporting and implementation requirements of their respective groundwater sustainability plans (GSPs) and the California Department of Water Resources (DWR).

It is noted that the total cost to complete the entire DMS development for the Kern Subbasin will likely exceed the available grant funding of \$500,000 under the Sustainable Groundwater Management (SGM) Grant Program, Round 3 (this grant application). This application is submitted to initiate the key steps to develop and build the Subbasin DMS. This Work Plan and the associated Budget and Schedule describe tasks to be funded under this grant and within the available funding, as well as additional tasks that will likely require additional funding, above and beyond this SGM Planning Grant, to be shared among Subbasin GSAs who have already developed successful cost sharing structures for numerous components of the GSP including coordinated development of the Subbasin-wide integrated surface water-groundwater model (C2VSimFG-Kern). The Subbasin GSAs are committed to providing sufficient funds and resources to complete the project.

The work plan steps requested under this grant will provide the necessary DMS framework, addressing needs and processes such as accessibility, transparency, functionality, reliability, and data sharing, among others. The DMS project description, budget, and schedule information provided in Attachments 3, 4, and 5 describe the tasks that will be conducted under the funding support of this grant.

The project objectives are as follows:

- Identify data types to be included in the DMS and required to monitor GSP implementation and Subbasin progress toward sustainability. (funded under this grant)
- Investigate and compare commercially available DMS packages and custom systems to determine the most appropriate and cost-effective format for the Kern County Subbasin DMS. (funded under this grant)

- Select a preferred DMS approach. (funded under this grant)
- Procure or design the DMS and customize as needed with an appropriate configuration that combines technical rigor, flexibility, ease of use, and expansion capabilities to store data in text, spreadsheet, graphical, and map-based formats. (partially funded under this grant; The any additional funding to be provided by Subbasin GSAs)
- Develop data templates that allow each GSA or participating agency to submit the required data in a consistent format that can be combined and adjusted to present information in both local and Subbasin-wide formats to meet DWR reporting requirements. (funded under this grant)
- Develop a DMS User’s Manual and train GSA staff to gather, submit, and update the required data on a regular basis and in a consistent format. (funded under this grant)
- Coordinate with local stakeholders, non-member agencies, and disadvantaged communities (DACs), such as the Cities of Shafter and Arvin and portions of the City of Bakersfield, that have potential activities, tasks, and/or components that are complementary to the DMS development project. (funded under this grant)

### **Tools to Be Developed**

The proposed Subbasin Data Management System Development project will initiate the key steps to develop and build a critically important DMS for the Kern County Subbasin. Specific tools to be developed during implementation of this grant-funded scoping and development effort include the following:

- A process for identifying necessary data types;
- A comparison/decision-making tool for evaluating commercially available DMS packages and custom systems against the needs and resources of the Subbasin;
- The DMS itself, customized to meet the data needs of the Subbasin GSAs; and
- A DMS User’s Manual to train GSA staff in the use of the DMS.

### **Differentiation from Round 2 Funding**

KRGSA is the administering agency for Round 2 funding of six projects under the Kern County Subbasin Groundwater Sustainability Plan Support – 2017 Grant Application (DWR Agreement No. 4600012955):

- Component 1: Grant Administration (KRGSA responsibility)
- Component 2: Groundwater Modeling (KRGSA responsibility)
- Component 3: Groundwater Model Peer Review (KGA responsibility)
- Component 4: Hydrogeologic Conceptual Model and Groundwater Conditions (KGA responsibility)
- Component 5: Groundwater Sustainability Plan Coordination (KGA responsibility)
- Component 6: GSP Development (KRGSA responsibility)

No funding was requested from DWR in Round 2 for the purpose of developing a DMS for the Subbasin, nor is funding being applied to such efforts. The DMS development project included in this proposal is a new and unique project and in no manner duplicative of work included under the six components included in the Round 2 Proposition 1 grant.

Historically, individual GSAs and their member agencies have developed separate systems to comply with various regulations; however, the GSAs in the Kern County Subbasin recognized the need to develop a centralized DMS on a Subbasin-wide basis to specifically conform to the needs of the GSAs and reporting entities to support the Subbasin GSPs. Accordingly, the Subbasin GSAs are cooperating on this proposal for a Subbasin-wide DMS to support monitoring, evaluation, reporting, management, and, importantly, GSP implementation. Compiling the individual DMSs into a coherent system will require significant manipulation and re-structuring to create a centralized relational DMS that is populated with consistent data sets across the Subbasin.

The work being undertaken with Round 2 grant funds, which involves development of GSPs for GSAs in the Subbasin in compliance with SGMA, is proceeding in accordance with DWR-mandated deadlines and will be completed on schedule. No cost overruns have been identified for Round 2 projects, and no additional funding will be required for completion of these projects. No Round 3 funding is intended to be allocated toward these projects.

The Kern County Subbasin Data Management System Project being proposed for Round 3 funding will allow the GSAs to comply with the requirements of SGMA Article 2 (§ 352.6), which requires each GSA to develop and maintain a DMS that is capable of storing and reporting information relevant to the development or implementation of a GSP and monitoring of the basin. Also required under SGMA is the development of a coordinated DMS for the Subbasin (Article 8, § 357.4). The project will assist the GSAs in meeting the requirements of SGMA annual reporting to DWR by April 1 of each year following adoption of its GSP (§ 356.2), as well as the reporting standards provided in Article 3 (§ 352.4) and reporting provisions found in Article 4 (§ 353.4).

## B. Project Benefits

Covering about 2,834 square miles, Kern County Subbasin is the largest subbasin in California with a complex water management structure, a large portfolio of local and imported water sources, and numerous large groundwater banking projects, collectively providing both local and State-wide benefits for water supply. Accordingly, the GSAs are cooperating on this proposal for a Subbasin-wide DMS to support monitoring, evaluation, reporting, management, and, importantly, GSP implementation.

The project has two primary benefits that relate to the Subbasin, DACs within the Subbasin area, and all beneficial users of Subbasin groundwater: (1) development of a Subbasin-wide database that will allow consistent collection and comparison of data from multiple GSAs; and (2) improved watershed coordination among the GSAs.

- **Database Development:** The project will allow the Subbasin GSAs to identify and develop a DMS suitable for collection, storage, and analysis of the various types of data to be generated to support their GSPs. The project will allow the Subbasin GSAs to comply with the requirements of SGMA Article 2 (§352.6), which requires each GSA to develop and maintain a DMS that is capable of storing and reporting information relevant to the development or implementation of a GSP and monitoring of the basin. The proposed project will develop a common data system that all GSAs in the Subbasin can use, and this will enable better coordination across the various GSAs. The goal of the DMS is to support Subbasin GSAs by providing (1) improved coordination of groundwater monitoring and management actions and (2) the ability to meet the reporting and implementation requirements of groundwater sustainability plans (GSPs) and the California Department of Water Resources (DWR).
- **Watershed Coordination:** Located in the largest county and the southern end of the DWR Tulare Lake Hydrologic Region, the Kern County Subbasin involves numerous large and small watersheds of the Sierra Nevada, San Emigdio and Tehachapi mountains, and the



Coast Ranges. As demonstrated through the Integrated Regional Water Management Planning (IRWMP) Group process, Subbasin agencies associated with these contributing watersheds have coordinated on multiple projects over the years and have continued working together collaboratively during the GSP process. To comply with SGMA requirements SGMA for standardized reporting, and to coordinate on a Subbasin-wide basis for consistent data evaluation, it is crucial that a DMS be developed collaboratively for the entire Subbasin, allowing GSAs to combine and share data and information regarding local groundwater conditions using a consistent and comprehensive data platform.

The Kern County Subbasin Groundwater Sustainability Plan Support – Phase II 2019 Grant Application includes outreach, engagement, and support to benefit DACs throughout the entire Subbasin. During numerous community outreach meetings, DAC representatives have been engaged with questions and comments on Subbasin data.

The following DAC communities within the Kern County Subbasin are identified as cities or Census Designated Places (CDPs) in DWR’s DAC database. All communities qualifying as DACs within the Kern County Subbasin will benefit as a result of the DMS project.

Arvin	Lost Hills CDP	Shafter
Buttonwillow CDP	Maricopa	Smith Corner CDP
Delano	McFarland	South Taft CDP
Edmundson Acres CDP	McKittrick CDP	Taft
Ford City CDP	Mettler CDP	Taft Heights CDP
Fuller Acres CDP	Mexican Colony CDP	Tupman CDP
Greenfield CDP	Oildale CDP	Valley Acres CDP
Lamont CDP	Richgrove CDP	Wasco
		Weedpatch CDP

The project would include outreach to DAC staff that are required to report under SGMA. Accessibility of data has been a highly sensitive issue to many stakeholders in the Subbasin with concerns about transparency and privacy. Consistent communication and transparency of the DMS development process will be key to obtaining support from the Subbasin’s beneficial users of groundwater. To support this budget category for Stakeholder Engagement, technical meetings will be held with the DAC staff that are required to report data to DWR, to obtain buy-in to the Subbasin DMS process.

As part of the IRWMP process, various groups were formed in the Kern County Subbasin as a means of developing a collaborative approach involving the governing group of water management districts, regional Stakeholders, and all other Interested Parties (e.g., landowners, public, local communities), all of which were working on regional water management planning and implementation activities.

DACs are directly represented in the IRWM groups through a DAC Representative, an elected member of the governing Regional Water Management Group who addresses the issues and needs of these areas. Moreover, the DACs are represented by a DAC “Work Group” consisting of individual participants from the following identified groups or communities: Ducor Community Services District, Buttonwillow County Water District, Bishop Acres Mutual Water Community, Semitropic School District, Pond Union School District, City of McFarland, City of Delano, City of Wasco, Lost Hills Utility District, Blackwells Corner, and Earlimart Public Utility District. The IRWM Group gives substantial consideration to the issues and needs of these DACs during all regional planning and implementation activities. The IRWM Group has worked closely with DACs for many years to identify DAC concerns and to promote potential solutions, either as standalone projects or programs or as a component of IRWM grant submissions.

Letters of support for the Kern County Subbasin Groundwater Sustainability Plan Support – Phase II 2019 Grant Application – including a joint letter signed by the agencies required to report under SGMA in the Subbasin – have been provided by several beneficial stakeholders and can be found in Attachment 6, Appendix C. As noted previously, outreach to DACs will continue to occur throughout development of the DMS. With grant funding, the DMS project will be better situated to conduct outreach to, engage, and include DACs and DAC concerns so that DACs will benefit from easier access to groundwater sustainability information.

### C. Technical Expertise

The GSAs and participating agencies in the Kern County Subbasin have been working cooperatively for several years to develop GSPs that accurately depict the groundwater management conditions of the Subbasin. Accordingly, the Subbasin GSAs are familiar with the data types and sources in the Subbasin as well as the need to combine and share information. This process will ensure the accuracy of their respective GSPs within the larger Subbasin context and contribute to the success of management actions being proposed for implementation. This need for cooperative and consistent data collection, recordation, management, and use is the impetus for the Data Management System Development project being proposed for this grant.

Agencies involved in this project all involve talented engineers available to lead and assist with this proposed project. All of the agencies are familiar with groundwater data and have experience in groundwater monitoring and management. Thereby, agencies clearly contain the technical expertise to lead in the development of a Subbasin DMS. Many of the agencies also contain web-based technical expertise to provide oversight for potential development of web-based systems and/or complex database structures. GSAs have already demonstrated their collective technical expertise to lead and provide oversight for complex technical projects, including the development of a numerical integrated surface water–groundwater model for GSP applications. Data collection efforts for that model were successfully undertaken by agencies and their technical consultants. GSAs will employ rigorous *Request for Proposal/Qualifications* process to ensure that qualified and competent technical agents are retained for the complex DMS tasks.

KRGSA on behalf of the all the GSAs in the Kern County Subbasin was awarded \$1,500,000 in Proposition 1 SGMA Planning Grant funds for a suite of six GSP Development project components supporting the entire Kern County Subbasin and proposed under the 2017 Round 2 SGMA grant opportunity. These six project components supported by the Proposition 1 planning grant have, and continue to, contribute to development of the all the GSPs in the Kern County Subbasin, which are currently undergoing public review and successfully nearing completion at the time of this writing. GSPs are on schedule to comply with the SGMA requirement that all GSPs for critically overdrafted basins be submitted to DWR by January 31, 2020. This success of the technical components of multiple GSPs, funded in part by a DWR grant, again demonstrates the ability of the GSAs to lead a large, complex technical project such as the DMS development, assisted again with DWR funding.

Letters of support for the Kern County Subbasin Groundwater Sustainability Plan Support – Phase II 2019 Grant Application have been provided by several beneficial stakeholders and can be found in Attachment 6, Appendix C.

## Project Details

### D. Scope of Work and Deliverables

#### a. Scope of Work

##### Subbasin Data Management System Development

##### Implementing Agency: KRGSA

##### Task (a): Grant Administration (funded under this grant)

This task includes managing and administering the project including invoicing, reporting, and grant contract administration.

##### 1. Grant Management

Coordinate with DWR and conduct administrative responsibilities to execute a Grant Agreement and ensure that all contract requirements are met.

##### 2. Invoicing

Prepare and submit to DWR invoices including back up documentation. Backup will be collected and organized by budget category, along with an Excel compatible summary document detailing the contents of the backup documentation.

##### 3. Report Preparation

Prepare and submit quarterly Progress Reports prepared in accordance with Exhibit F. Prepare and submit draft Grant Completion Report prepared in accordance with Exhibit F. Prepare a Final Grant Completion Report addressing the DWR Project Manager's comments and submit to DWR in accordance with the provisions of Exhibit F.

##### Deliverables:

- Executed Grant Agreement
- Invoices and associated backup documentation
- Quarterly Progress Reports
- Draft and Final Grant Completion Report

##### Task (b): Stakeholder Engagement / Outreach (funded under this grant)

Accessibility of data has been a highly sensitive issue to many stakeholders in the Subbasin with concerns about transparency and privacy. Consistent communication and transparency of the DMS development process will be key to obtaining support from the Subbasin's beneficial users of groundwater. To support this budget category for Stakeholder Engagement, technical meetings will be held with the DAC staff that are required to report data to DWR, to obtain buy-in to the Subbasin DMS process.

##### 1. Technical Meetings

Hold technical meetings with staff of DACs that are required to report data to DWR.

##### Deliverables:

- Meeting agenda with DAC staff
- Workshop presentation documentation

##### Task (c): GSP Development: Subbasin DMS Scoping and Development

##### 1. Retain Consultant to Assist with DMS Development (funded under this grant)

This task includes (a) generating a Request for Proposals (RFP) seeking a qualified professional consulting firm that will assist with development, management, and coordination of the Data Management System (DMS), (b) issuing the RFP, and (c) contracting with the selected firm.

During RFP development, the GSAs will work together in a series of meetings to identify high-level goals and basin needs for ongoing data management. Considerations will include, but not be limited to, data coordination, transparency, sharing, and GSP-required components such as those needed to assist with the Subbasin water budget. Data tracking as required under SGMA will also be considered, including the need to track specific DWR-defined categories for water sources and sectors. In addition, DWR has not yet developed the online forms that may need to be completed for GSP annual reporting and may require specific data formatting in the DMS. Accordingly, the DMS will need to be sufficiently flexible to meet a variety of GSA needs.

The GSA group will discuss and identify a range of alternatives for various DMS levels of sophistication ranging from a relatively simple Subbasin-wide relational database to various web-based platforms with broader functionality and visualization tools. In addition, GSAs will reach out to GSAs in other subbasins to gain insight from “lessons learned” as others use existing DMS structures for SGMA purposes. In this manner, the GSAs will ensure that the RFP is written to target firms capable of providing the required technical services. The GSAs may prefer a phased approach, requiring different consulting services for each phase.

Deliverables:

- RFP
- Executed contract

**2. Identify Information Requirements for DMS** (funded under this grant)

This task involves coordination with all the GSAs in the Subbasin and their groundwater consulting firms, to identify the types and sources of data required to monitor GSP implementation, to evaluate groundwater conditions, and to document Subbasin progress toward sustainability. The DMS consultant will work collaboratively with GSAs, a technical DMS subcommittee, and/or a designated Subbasin consultant to develop a list of necessary data types, sources, and preferred formats (e.g., text, spreadsheet, graphical, and map-based formats) for each, which will be presented to all the GSAs in the Subbasin for input and approval.

Considerations will be given to data structures and formats being used for other monitoring programs in the Subbasin to provide efficiencies for agencies with multiple reporting obligations. The structure of State and local databases may also need to be considered if data will be downloaded periodically from existing sources. Some of this work will be accomplished in parallel with Task (c)(1) above to inform the needs of the RFP. Remaining work will be conducted in consultation with the DMS consultant to bring the required details of the DMS into focus.

Deliverables:

- List of data types and sources to be collected to meet ongoing requirements under SGMA

**3. Investigate and Select an Appropriate DMS** (funded under this grant;

The DMS Consultant (contractor) will investigate and compare commercially available DMS packages and custom systems to determine the most cost-effective and usable format for the DMS. The comparison will focus on DMS features determined to be of highest priority by the GSAs and will include items such as levels of security, data entry and uploading, QA/QC, spatial or graphical visualization, potential linkage to other systems, an appropriate user interface, and, importantly, ease of use. Costs of software, support/upgrades, copyright protections, or other

proprietary restrictions will be documented. The contractor will also consider the technical expertise of those users responsible for entering, uploading, and managing the system for the future. A flexible system that can be readily modified with additional modules or functions in the future may be desirable. Costs will be provided for both development and maintenance of the DMS.

The contractor will prepare a report identifying the commercially available packages and custom systems, detailing the advantages and disadvantages of each and offering a series of recommendations for GSA Boards' consideration.

Deliverables:

- Report with recommendation for GSA Boards' consideration
- GSA Boards' decision to select a DMS package

**4. Procure/Design and Customize the Selected DMS** (funded under this grant; additional funding to be provided by GSAs if needed)

Following the GSA Boards' decision, the contractor will procure or design the selected DMS and customize as needed with an appropriate configuration that combines technical rigor, flexibility, ease of use, and expansion capabilities to store data in text, spreadsheet, graphical, and map-based formats, as needed. The system will be implemented according to the requirements identified in Task (c)(2).

Deliverables:

- Documentation of the Kern County Subbasin DMS

**5. Develop Data Protocols and Templates** (funded under this grant)

The contractor will develop data templates that allow each GSA or participating agency to submit the required data in a consistent format that can be combined and adjusted to present information in both local and Subbasin-wide formats to meet DWR reporting requirements. Templates and tables will also be developed for DMS output and reporting. Importantly, protocols and a quality assurance/quality control (QA/QC) process will be developed and documented that considers data entry, uploading, downloading, and DMS accessibility. Protocols will also consider data protection and DMS security.

Deliverables:

- Data templates and tables

**6. Develop DMS User's Manual and Train GSA Staff** (funded under this grant)

GSA staff will be trained in data collection, appropriate use of templates, and uploading procedures to ensure that all GSAs are providing consistent information to the DMS. In addition to the system documentation of the DMS system produced in Task (c)(4), the contractor will develop a functional user's manual that describes templates, outlines DMS protocols, and provides step-by-step procedures for a variety of users and uses.

Deliverables:

- Training session or module for GSA staff
- User's Manual

**7. Review and Assessment of DMS** (funded by GSAs as needed)

Monitoring and assessment activities will include initial review of the DMS by primary users (GSA staff and their groundwater consultants) to determine the suitability of templates for uploading

data and the suitability of the database for combining and using data. Numerous test runs of the new DMS will be conducted to work out system bugs and/or address functional issues. It is anticipated that one reporting period can be managed with the new DMS to provide a test case for future use. After grant completion, the DMS will be assessed on an ongoing basis for potential upgrades, additions or modifications to data, and other DMS adjustments to be funded by the GSAs.

Deliverables:

- Initial review and recommendations for modifications

**Task (d): Monitoring / Assessment**

This project is a planning effort and does not involve on-the-ground monitoring activities.

Deliverables:

- Initial review and recommendations for modifications

**b. Project Deliverables**

Deliverables to be provided as a result of implementing the proposed project will include the following items, presented by task:

**Task (a): Grant Administration** (funded under this grant)

Deliverables:

- Executed Grant Agreement
- Invoices and associated backup documentation
- Quarterly Progress Reports
- Draft and Final Grant Completion Report

**Task (b): Stakeholder Engagement / Outreach** (funded under this grant)

Deliverables:

- Technical meeting agenda with DAC staff that will be required to report data

**Task (c): GSP Development: Subbasin DMS Scoping and Development**

**1. Retain Consultant to Assist with DMS Development** (funded under this grant)

Deliverables:

- RFP
- Executed contract

**2. Identify Information Requirements for DMS** (funded under this grant)

Deliverables:

- List of data types and sources to be collected to meet ongoing requirements under SGMA

**3. Investigate and Select an Appropriate DMS** (funded under this grant)

Possible Deliverables to be provided under this grant:

- Report with recommendation for GSA Boards' consideration

- GSA Boards’ decision to select a DMS package
4. **Procure/Design and Customize the Selected DMS** (funded under this grant; additional funding to be provided by GSAs if needed)

Deliverables:

- Documentation of the DMS
5. **Develop Data Protocols and Templates** (funded under this grant)

Deliverables:

- Data templates and tables
6. **Develop DMS User’s Manual and Train GSA Staff** (funded under this grant; additional funding to be provided by GSAs if needed)

Deliverables:

- Training session or module for GSA staff
  - User’s Manual
7. **Review and Assessment of DMS** (funded by GSAs as part of GSP process)

Deliverables:

- Initial review and recommendations for modifications

**Task (d): Monitoring / Assessment** (funded by GSAs as part of GSP process)

This project is a planning effort and does not involve on-the-ground monitoring activities.

**Environmental Compliance and Permitting**

This Proposal covers the selection and development of a DMS for use by the entire Kern Subbasin to comply with SGMA. The Subbasin Data Management System Development Project does not qualify as a “Project” as defined under CEQA. Under CEQA, a “Project” refers to an action that has the potential to result in a physical change to the environment (Pub. Res. Code § 21065). This proposal consists of research, planning, and data collection and will not result in any foreseeable impact on or alteration of the physical landscape in any shape, matter, or form. Therefore, CEQA does not apply to this Proposal.

## Miscellaneous

### E. Project Support

A joint letter of support for the project, signed by the members of the entire Kern County Subbasin as well as participating DAC entities, is included in Attachment 6, Appendix C.

# Kern County Subbasin Groundwater Sustainability Plan Support - Phase II 2019 Grant Application

4 BUDGET

Attachment

Proposition 68 and Proposition 1  
Sustainable Groundwater Management Grant Program

Planning Grants Proposal Solicitation Package - Round 3

