DISCLAIMER

ECF-HANFORD-24-0090
Revision 0

Plateau to River Model Predictive Simulations for All Ensemble Realizations to Support Modeling Work in Fiscal Year 2025

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract 89303320DEM000030

P.O. Box 1464
Richland, Washington 99352

ECF-HANFORD-24-0090
Revision 0

Plateau to River Model Predictive Simulations for All Ensemble Realizations to Support Modeling Work in Fiscal Year 2025

Document Type: ECF Program/Project: Central Plateau Groundwater

T. J. Budge
INTERA, Inc.

Date Published
February 2025

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract 89303320DEM000030

P.O. Box 1464
Richland, Washington 99352

APPROVED
By Sarah Harrison at 4:07 pm, Mar 12, 2025

Release Approval Date

TRADEMARK DISCLAIMER

Reference herein to any specific commercial product, process, or service by tradename, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

Contents

Appendices

Figures

Tables

This page intentionally left blank.

Terms

CPCCo	Central Plateau Cleanup Company
ECF	environmental calculation file
EMMA	Environmental Model Management Archive
HISI	Hanford Information System Inventory
HMIS	Hanford Mission Integrated Solution
LSQR	Least Squares Regression
P&T	pump and treat
P2R	Plateau-to-River
RET	recharge evolution tool
SP	stress period

This page intentionally left blank.

1 Purpose

The purpose of this environmental calculation file (ECF) is to document predictions of flow and hydraulic head on the Central Plateau of the Hanford Site using the Plateau-to-River (P2R) Model (CP-57037, *Model Package Report for the Plateau-to-River Model: Version 9.1*). This calculation documents the simulation of the groundwater for the parent model domain of the P2R Model as a basis for use in other applications of the P2R Model. This application is unique from the standpoint that it will simulate all ensemble member models of the P2R Model whereas other applications may only utilize specific ensemble members. These simulations provide results that can be used in the process of selecting an appropriate subset of ensemble members for other applications.

2 Background

The P2R Model is the primary modeling platform for the saturated zone of the suprabasalt aquifer that lies below the Central Plateau of the Hanford Site. Development of the model along with a history of applications and previous modeling at the site is documented in CP-57037. A recent update of the model from Version 8.3 to Version 9.1 included a paradigm shift in the model development. Rather than develop a single calibrated model, an ensemble of model realizations was developed as a way of enhancing the model use in the decision-making process. A total of 275 simulations makes up the ensemble of models for the P2R Model. A single model, called the minimum-phi simulation, is the model that most closely matches the observation data from a statistical standpoint. This application of the ensemble is to create a set of predictive simulations for each of the ensemble members that will provide modelers with the necessary information to select ensemble member simulations for other applications.

3 Methodology

P2R Model simulations are executed using the acquired computer software MODFLOW (USGS, 2000, *MODFLOW-2000, The U.S. Geological Survey Modular GroundWater Model—User Guide to Modularization Concepts and the Ground-Water Flow Process*) and MT3DMS (Zheng and Wang, 1999, *MT3DMS: A Modular Three-Dimensional Multispecies Transport Model for Simulation of Advection, Dispersion, and Chemical Reactions of Contaminants in Groundwater Systems; Documentation and User's Guide*). The model consists of a set of input files that contain the parameterization required by MODFLOW that represent the subsurface sediments and groundwater stresses within the model domain. The model simulates groundwater flow and fate and transport of contaminants using finite differencing to compute results on a cell-by-cell basis within the model domain. A description of the governing equation for MODFLOW and a summary of the P2R Model extent and discretization are found below. A discussion of the methods used to determine summary statistics of results and the simulations that will be executed are also presented.

3.1 Groundwater Flow Governing Equation

The governing equation for flow of groundwater in the saturated zone as specified for MODFLOW is shown in Equation 1 (USGS, 2000). The equation is solved numerically using finite differencing techniques to estimate hydraulic head in the subsurface on a cell-by-cell basis. The cell-to-cell fluxes estimated using this software are used by MT3DMS to aid estimation of fate and transport of contaminants. A key input parameter of the governing equation are the sources and sinks to groundwater represented by the W in Equation 1. For proper volumetric balance, the location and volume per time of the sources and sinks in the model are required. This environmental calculation discusses the methodology for creating input files for use in MODFLOW that describe the simulated injection and extraction of water from wells within the P2R Model domain (Figure 1).

$$\frac{\partial}{\partial x}\left(K_{xx}\frac{\partial h}{\partial x}\right)+\frac{\partial}{\partial y}\left(K_{yy}\frac{\partial h}{\partial y}\right)+\frac{\partial}{\partial z}\left(K_{zz}\frac{\partial h}{\partial z}\right)+W=S_s\frac{\partial h}{\partial t} \quad \text{(Eq. 1)}$$

where:

K_{xx}, K_{yy}, K_{zz}	=	are values of hydraulic conductivity along the x, y, and z coordinate axes, which are assumed to be parallel to the major axes of hydraulic conductivity (L/T)
h	=	the potentiometric head, L
W	=	a volumetric flux per unit volume representing sources and/or sinks of water, with W<0.0 for flow out of the groundwater system and W>0.0 for flow in, T^{-1}
S_s	=	the specific storage of the porous material, L^{-1}
t	=	time, T.

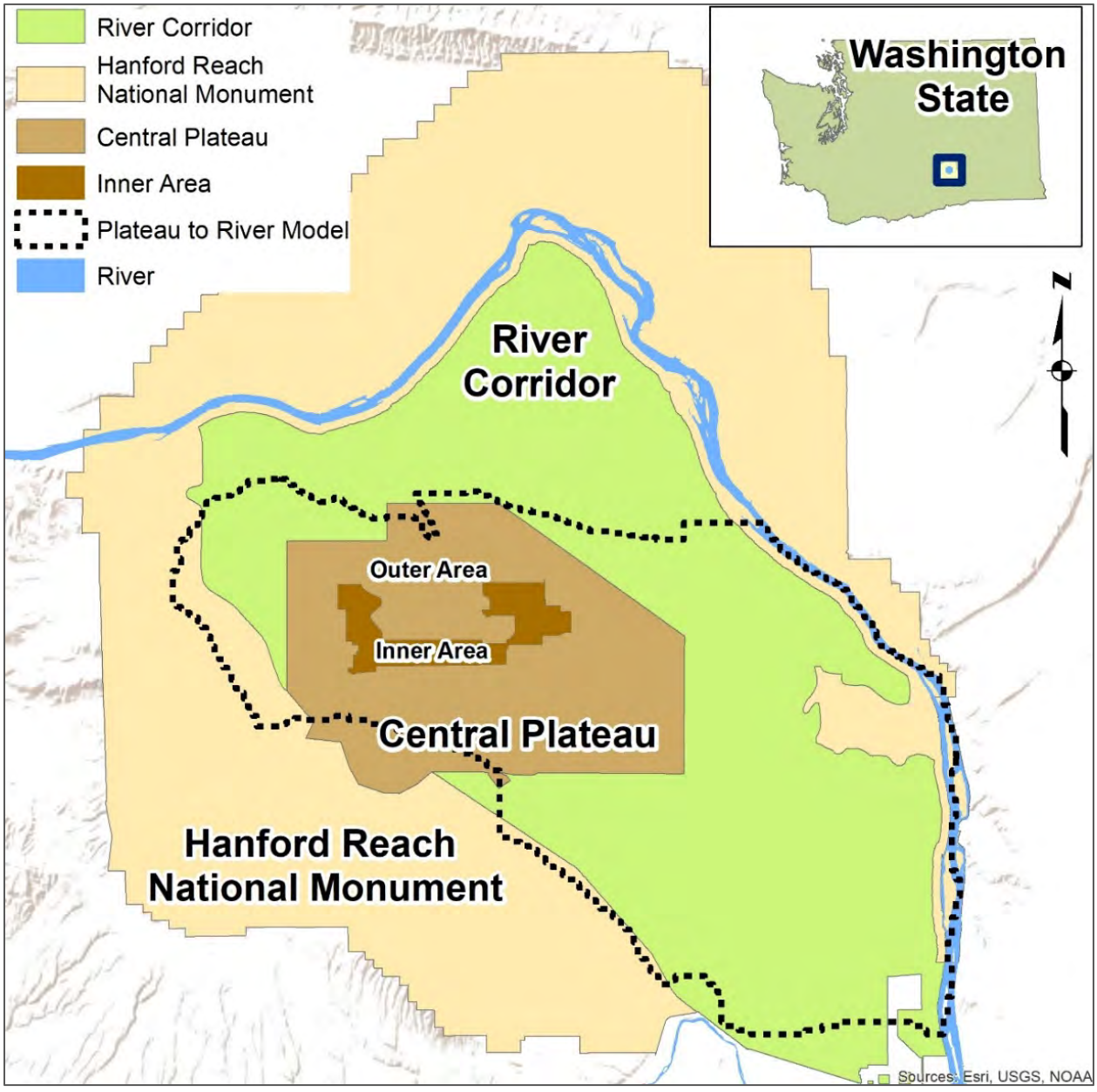

Figure 1. Hanford Site Map and Plateau to River Model Extent

3.2 Model Domain and Spatial Discretization

The P2R Model domain has the following lateral extent and boundaries: extent north to south is 26.6 km (16.5 mi) and extent east to west is 37.6 km (23.4 mi). The lower left corner of the model domain is located at easting 557,800 m and at northing 116,200 m in the Washington State Coordinate System (NAD_1983_StatePlane_Washington_South_FIPS_4602). The vertical extent of the model comprises the subsurface sediments from ground surface to the uppermost unit of the Columbia River Basalt Group. The basalt that is assumed to constitute an impermeable lower boundary defines the base of the domain.

The model is vertically divided into eight layers between the ground surface elevation and the top of the uppermost basalt surface. The discretization of the vertical layers varies to represent the thickness of geologic formations found within the model domain.

Table 1. Model Discretization for the Parent and Child Models Developed for the P2R Model Version 9.1

Model Grid (Acronym)	Model Type	Lower Left Corner*		Grid Dimensions			Individual Cell Size
		Easting (m)	Northing (m)	Layers	Rows	Columns	
Sitewide (SW)	Parent	557800	116200	8	133	188	200 m by 200 m (656.17 ft by 656.17 ft)

* Coordinate corresponds to the projection: State Plane Washington South FIPS 4602 (NAD83).

NAD83 = *North American Datum of 1983*

3.3 Model Temporal Discretization

The temporal discretization for all realizations of the model is the same, 1,053 years. Table 2 shows the start and end time of the simulation. The overall purpose is to produce a set of simulations for the P2R ensemble model that produces a range of possible conditions in the aquifer based on the ensemble models developed in CP-57037.

Table 2. Temporal Discretization for the Parent Model Developed for the P2R Model Version 9.1

Model Grid (Acronym)	Model Type	Simulation Dates		Stress Period Frequency	Description
		Start	End		
Sitewide (SW)	Parent	1/1/2018	1/1/3070	Variable	Simulates the groundwater flow in the saturated zone of the suprabasalt aquifer of the site to capture features, events, and processes that impact the large-scale groundwater flow from the Central Plateau to the Columbia River.

4 Assumptions and Inputs

This section summarizes the inputs and assumptions that are specific to the calculations presented in this document. Features and inputs to the P2R Model (e.g., model layer elevations, hydraulic properties, specific storage, and specific yield) that did not change for the development of the predictive flow field are not presented. The principal inputs to the calculations are:

- Temporal discretization
- Boundary conditions
- Initial head
- Extraction and injection well flow rates by stress period (SP)

4.1 Temporal Discretization

The simulation period for the predictive flow model starts in 2018 and runs for 1,053 years, ending in 3070. The temporal discretization of the predictive flow model is listed in Table 3. A total of 101 SPs were used with varying SP length. The length of any SP through 2570 matched the time periods taken by the recharge evolution tool (RET) documented in ECF-HANFORD-15-0019, *Hanford Site-wide Natural Recharge Boundary Conditions for Groundwater Models*. By staying consistent with the RET temporal discretization, major changes to land use were represented in the boundary conditions of the simulation.

Table 3. Temporal Discretization of Predictive Flow Model

Stress Periods	Duration	Description
1 to 82	82 years	82 transient annual stress periods that span from 2018 through 2099
83	35 years	1 transient stress period that spans from 2100 through 2134.
84	16 years	1 transient stress period that spans from 2135 through 2150
85	343 years	1 transient stress period that spans from 2151 through 2493
86	23 years	1 transient stress period that spans from 2494 through 2516
87	3 years	1 transient stress period that spans from 2517 through 2519
88	1 year	1 transient annual stress period that spans the year 2520
89	4 years	1 transient stress period that spans from 2521 through 2524
90 to 91	2 years	2 transient annual stress periods that span from 2525 through 2526
92	2 years	1 transient stress period that spans from 2527 through 2528
93	1 year	1 transient annual stress period that spans the year 2529
94	3 years	1 transient stress period that spans from 2530 through 2532
95	2 years	1 transient stress period that spans from 2533 through 2534
96	8 years	1 transient stress period that spans from 2535 through 2542
97	7 years	1 transient stress period that spans from 2543 through 2549
98 to 99	2 years	2 transient annual stress periods that span from 2550 through 2551
100	18 years	1 transient stress period that spans from 2552 through 2569
101	501 years	1 transient stress period that spans from 2570 through 3070

4.2 Boundary Conditions

Boundary conditions for the P2R Model were adjusted to match the temporal discretization needed to simulate 1,000 years into the future from site closure in calendar year 2070. Updated boundary conditions include the Columbia River boundary, specified heads, and the recharge. Each of these is discussed in the following sections.

4.2.1 Columbia River Boundary

The Columbia River acts as the eastern boundary condition for the P2R Model. The details on the river boundary features such as river cell location, river stage elevation, river bottom elevation, and river sediment conductance are documented in CP-57037. The process for building the Columbia River boundary condition was kept the same as documented in CP-57037. The river stage is determined by calculating the amount of flow in the river and using a flow vs. stage rating curve for each river cell to establish the river stage at those locations. The river flow value for the simulation period was kept constant to reflect a long-term average for the river. The river flow value was calculated as the 50th

percentile value of the average annual flow rate from 30 years of river gage data (1994 through 2023) at the Priest Rapids Dam gage location, which is just upstream of the Hanford Site.

4.2.2 Specified Heads

The basalt top elevation defines the bottom and most of the lateral boundaries of the model domain (depicted as dark, gray-colored regions in Figure 2). Four locations where the water table is above the top of the basalt are defined by specified head boundaries (shown as red shading in Figure 2).

For the historical period as documented in CP-57037, the specified head values at each of these specified head boundary locations were taken as the annual average observed head at observation wells near the boundary location. However, such observation data is not possible for the predictive model starting from 2020. For the western Gap and northeastern boundary, a constant value of 122.43 m and 110.98 m (representative of the average since 1/1/2001 and 1/1/2002, respectively) were used, respectively. For the Gable Gap and southern boundary near Dry Creek, the specified heads were developed using an exponential equation defined by the observed trend at wells 699-60-60 and 699-10-54A, respectively.

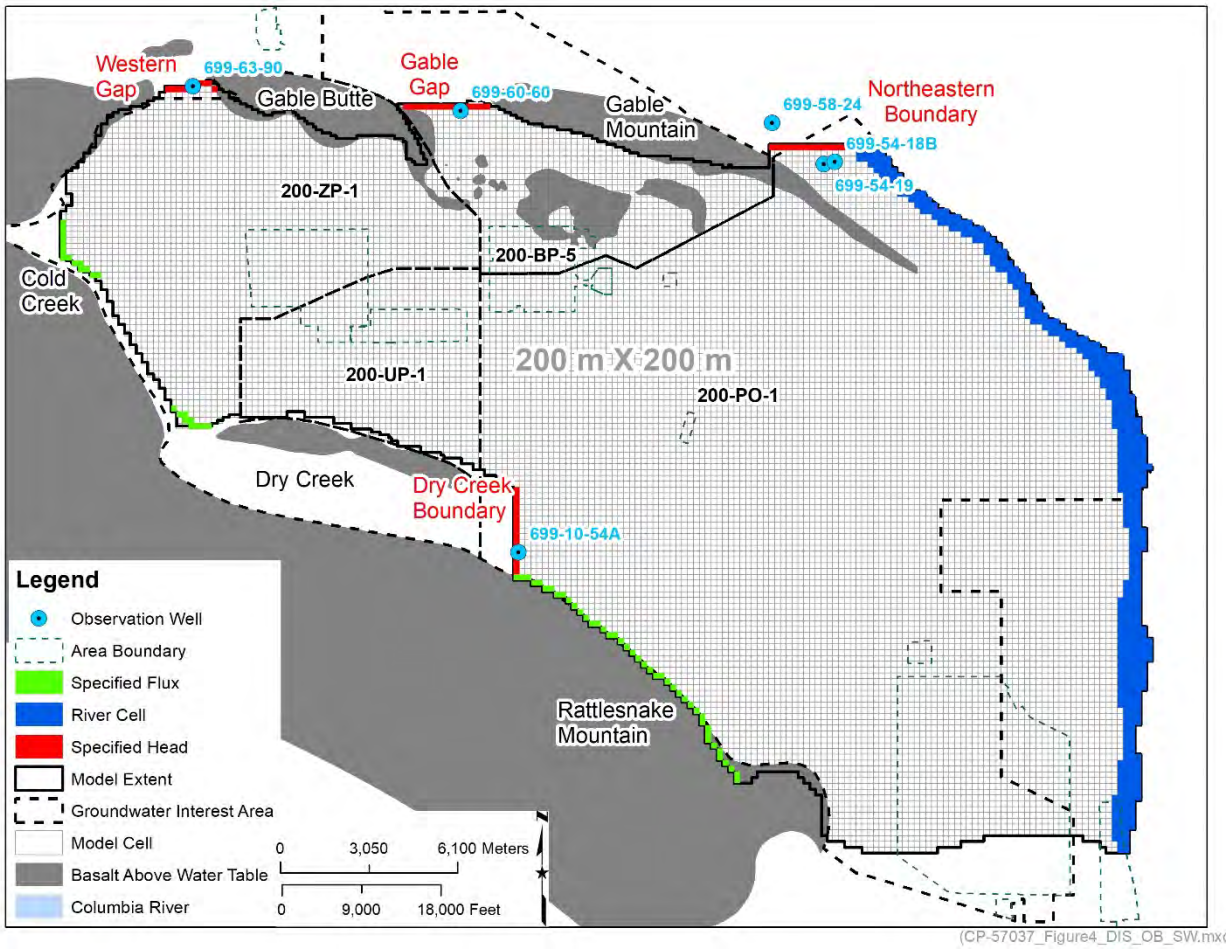

Figure 2. P2R Version 9.1 Model Extent and Boundary Conditions

The following exponential equation was used for calculating the specified head boundary condition:

$$P_i = B + e^{(-X * (Y_i - Y_0))} * (S - B) \quad \text{(Eq. 2)}$$

where:

- P_i = the predicted head for the year i
- B = the base head representing pre-Hanford (01/01/1945) water table
- X = a fitting parameter
- Y_i = the year of the specified head to be predicted
- Y_0 = the starting year of the LSQR fitting dataset
- S = the start head representative of the starting year, Y_0.

The parameters for the exponential equations were estimated using the Least Squares Regression (LSQR) fitting of the observed values. The LSQR fitting parameters used for predicting specified head are shown in Table 4. The base head values representing the pre-Hanford water table elevations for wells 699-60-60 and 699-10-54A (Table 4) were estimated by linear regression of the early water level measurements for each well and hindcasting to 1/1/1944. The observed head and the predicted head calculated using the corresponding fitted exponential equation are shown in Figure 3 at the northern specified head boundary at Gable Gap near Well 699-60-60, and in Figure 4 at the southern specified head boundary at Dry Creek near Well 699-10-54A.

Table 4. LSQR Fitting Parameters used for Predicting Specified Head at Gale Gap and Southern Boundary near Dry Creek

Parameters	Gable Gap	Dry Creek
B (meters)	120.5	121.45
X (dimensionless)	0.0256	0.0077
Y_0 (year)	2003.5	2003.5
S (meters)	122.2	126.98

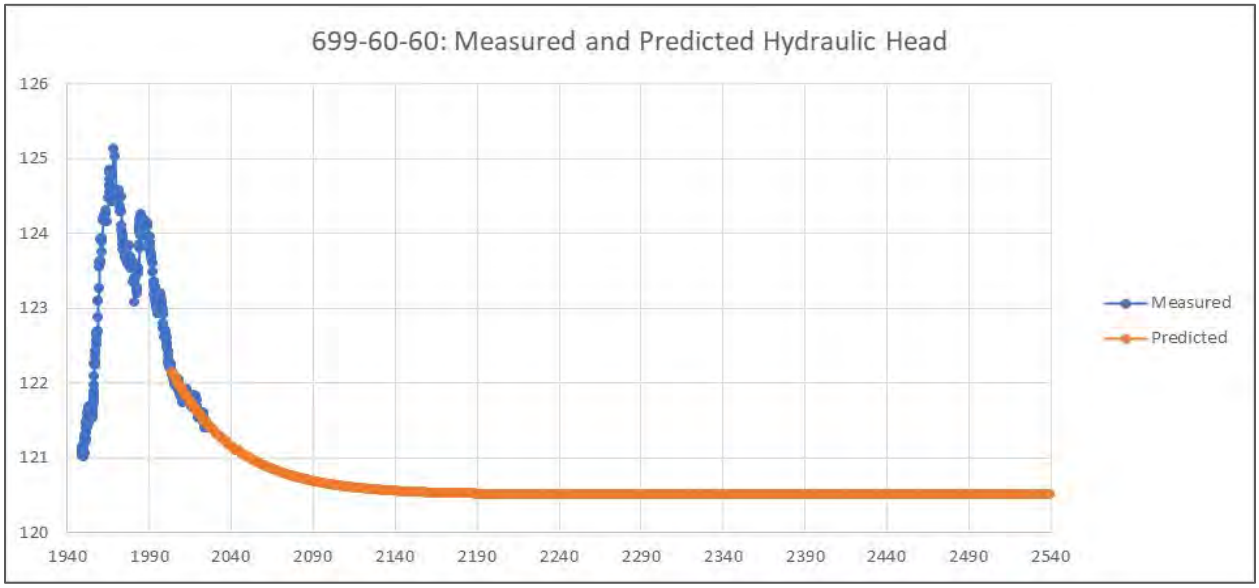

Figure 3. Observed Head Values and Estimated Exponential Regression Function at the Northern Specified Head Boundary at Gable Gap near Well 699-60-60 for the Predictive Model

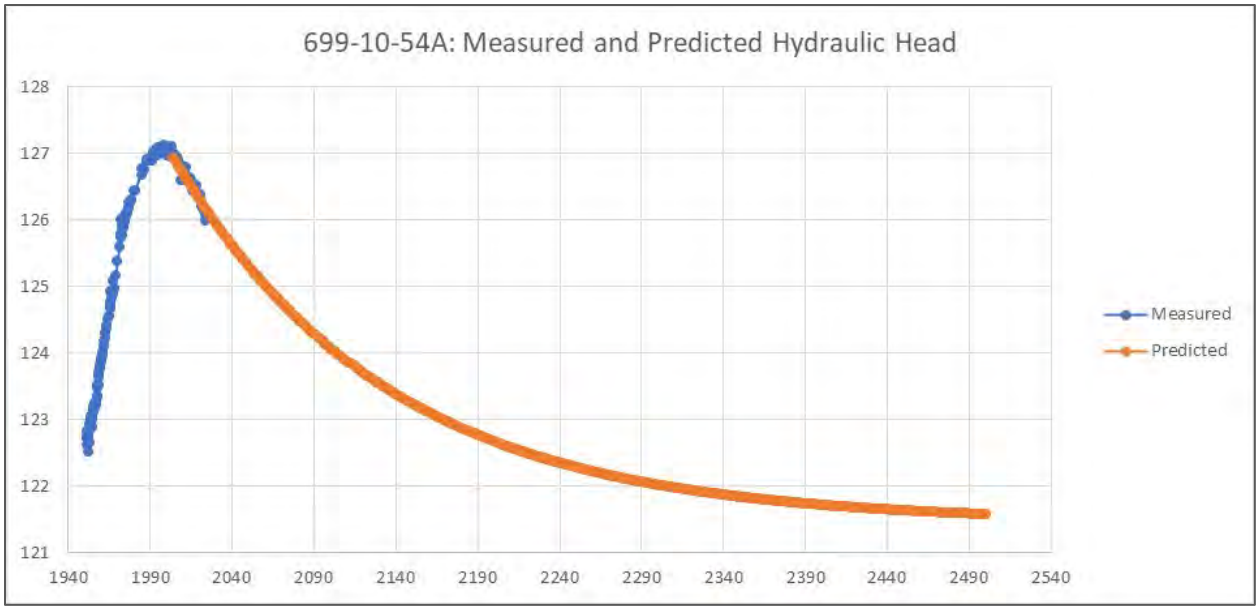

Figure 4. Observed Head Values and Estimated Exponential Regression Function at the Southern Specified Head Boundary at Dry Creek near Well 699-10-54A for the Predictive Model

4.2.3 Recharge

Recharge at the water table in the P2R Model includes the contributions to total recharge from natural sources including meteoric and mountain front recharge, as well as anthropogenic sources associated with waste disposal, operations, and environmental cleanup activities at the site. The most recent estimate including all of these sources of recharge for the P2R Model spatial domain is documented in ECF-HANFORD-22-0092, *Predictive Flow Simulation with the P2R Model for the Cumulative Impact Evaluation Using Alternate Anthropogenic Recharge Estimates*. The estimates for recharge were updated to the new model grid domain of P2R Model Version 9.1 from Version 8.3 used in ECF-HANFORD-22-0092 by spatial weighted averaging.

The recharge estimates were also updated for the various calibrated values of mountain front recharge for all ensemble simulations. The variation of mountain front recharge in each realization is documented as part CP-57037. Where mountain front recharge is specified as a boundary condition in the model (see Figure 2), the values were edited from the values documented in ECF-HANFORD-22-0092 to match the values developed as part of the ensemble.

4.3 Initial Head

The initial hydraulic head for the predictive model was extracted from the simulated head output of the historic calibration of the P2R Model Version 9.1 (CP-57037) at the end of 2017. This coincided with SP 75 timestep 1 of the P2R Model calibration simulation. The simulated output was modified to a format that is acceptable as MODFLOW input for the initial state variable for hydraulic head in the predictive simulation. The initial hydraulic head was derived from the realization with the lowest statistical mismatch during ensemble development, or realization 320. This was used for All Simulations to provide the closest match to the data used to constrain the model development.

4.4 Pumping Scenarios

The predictive flow model simulations include both actual and projected injection and extraction of water to and from the aquifer to represent the operation of the pump and treat (P&T) system on the Central Plateau. Magnitudes of the injection and extraction are taken several sources. Extraction/injection rates for wells are documented in ECF-HANFORD-20-0049, *Description of Groundwater Calculations to*

Support Performance Assessment for the Calendar Year 2019 (CY 2019) 200 Areas Pump-and-Treat Report, for calendar years 2018 and 2019, ECF-HANFORD-22-0043 for calendar years 2020 and 2021, and rates as documented in EMDT-BC-0083 (see Appendix C) for calendar year 2022. EMDT-BC-0083 also contains a forecast of rates from 2025 through 2037. Rates derived from these sources were formatted in a model input file using the Multi-Well Node Package of MODFLOW. Also, injection and extraction rates for the years 2023 and 2024 were updated to reflect actual rates recorded as part of the 200 Area P&T operations. The resulting injection and extraction rates are summarized in Table 5.

The injection rates were scaled to be equal to the total extraction for every year after 2022. This maintained the distribution of water observed during calendar year 2022 and balanced the predicted inflow and outflow from the treatment plant. After preliminary simulations were completed, interrogation of the model output indicated that well 699-38-64 could not sustain the simulated rate of injection. Therefore, the simulated injection rates for the predictive period (2025 through 2037) to nine nearby wells (699-45-67B, 699-45-67, 699-44-67, 699-43-67, 699-40-67, 699-43-67B, 299-E20-1, 299-E20-2, 299-E11-1) were adjusted as the average of the total injection rates for the listed injection wells. The process of averaging the rates reduced the total injection rate at 699-38-64 and did not cause issues with simulation. Also, simulated injection rates at wells 299-E20-1, 299-E20-2, and 299-E11-1 were capped at 100 gpm based on previous assessments of impacts of these wells to the iodine-129 plume discussed in EMDT-BC-0083. Excess simulated injection above 100 gpm at these three wells was distributed to the other seven well locations. Two features of the well package were updated. First, the file was altered to update the location (model row and column) of the wells because of the difference in lateral discretization of the model grid.

Table 5. Extraction and Injection Rates (gpm) for Central Plateau Wells Used in the Simulation

Date	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032-2037
Stress Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15-20
Well Name															
299-W6-13	57.9	54.5	39.5	53.5	47.0	49.8	74.2	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1
299-W6-14	174.0	101.1	127.2	120.1	118.8	120.1	148.4	169.6	169.6	169.6	169.6	169.6	169.6	169.6	169.6
299-W10-36	60.7	17.8	55.7	57.0	56.3	53.9	68.3	80.4	80.4	80.4	80.4	80.4	80.4	80.4	80.4
299-W10-35	108.5	118.9	117.1	106.4	120.4	133.8	150.9	171.9	171.9	171.9	171.9	171.9	171.9	171.9	171.9
299-W15-226	168.6	142.8	132.6	133.1	141.4	143.4	170.2	201.8	201.8	201.8	201.8	201.8	201.8	201.8	201.8
299-W15-227	140.0	142.1	138.5	132.2	147.8	152.0	166.0	211.0	211.0	211.0	211.0	211.0	211.0	211.0	211.0
299-W15-228	109.8	111.0	108.4	102.3	115.4	128.6	143.2	164.7	164.7	164.7	164.7	164.7	164.7	164.7	164.7
299-W18-41	133.4	115.5	126.6	119.8	125.9	137.5	148.5	179.7	179.7	179.7	179.7	179.7	179.7	179.7	179.7
699-49-69	20.6	50.2	61.0	81.0	90.4	86.2	90.9	129.0	129.0	129.0	129.0	129.0	129.0	129.0	129.0
699-45-67B	3.9	33.4	39.5	41.0	43.7	40.2	28.6	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3
699-45-67	28.5	35.4	27.6	40.0	40.2	39.3	45.9	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3
699-44-67	16.6	36.6	26.1	39.5	39.8	39.2	43.6	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3
699-43-67	21.7	47.6	27.3	41.7	41.3	41.1	0.0	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3
699-42-67	57.3	101.0	78.0	121.2	107.7	107.5	112.6	153.8	153.8	153.8	153.8	153.8	153.8	153.8	153.8
699-40-67	39.3	78.2	71.8	102.5	96.5	91.5	95.6	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3
699-38-64	90.4	101.7	88.0	131.3	127.6	120.0	127.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3
699-43-67B	14.5	20.5	18.2	27.8	27.5	27.4	75.7	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3
299-W15-29	60.4	91.1	84.9	93.5	95.5	101.2	105.9	136.4	136.4	136.4	136.4	136.4	136.4	136.4	136.4
299-W18-36	16.1	64.6	82.3	84.2	79.7	83.6	86.5	113.8	113.8	113.8	113.8	113.8	113.8	113.8	113.8
299-W18-37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
299-W18-38	66.3	44.9	72.6	71.0	70.2	54.1	55.1	100.3	100.3	100.3	100.3	100.3	100.3	100.3	100.3
299-W18-39	2.0	25.0	55.7	67.3	23.4	14.6	26.8	71.4	71.4	71.4	71.4	71.4	71.4	71.4	71.4

Table 5. Extraction and Injection Rates (gpm) for Central Plateau Wells Used in the Simulation

Date	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032-2037
Stress Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15-20
Well Name															
699-46-68	41.5	59.2	51.0	70.2	70.7	67.8	70.8	100.9	100.9	100.9	100.9	100.9	100.9	100.9	100.9
299-W15-229	75.0	82.7	95.1	93.6	98.2	105.2	114.8	140.2	140.2	140.2	140.2	140.2	140.2	140.2	140.2
299-W7-14	104.7	83.5	81.0	87.3	98.6	91.9	120.9	140.8	140.8	140.8	140.8	140.8	140.8	140.8	140.8
299-E20-1	71.7	71.4	81.9	80.0	77.2	76.1	76.1	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3
299-E20-2	75.3	66.4	62.5	73.9	68.5	73.2	73.8	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3
299-E11-1	76.4	72.9	61.0	80.8	84.0	82.3	81.9	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3
299-W6-16	0.0	0.0	0.0	0.0	0.0	0.0	25.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
299-W18-44	0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
299-W18-43	139.6	69.5	39.5	46.8	51.0	63.2	78.0	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8
299-W18-42	134.7	85.6	44.1	60.3	22.0	20.7	12.3	71.4	71.4	71.4	71.4	71.4	71.4	71.4	71.4
699-47-78	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
699-47-78C	0.0	0.0	11.6	0.0	0.004	0.0	0.1	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
699-47-78B	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
299-W15-225	-39.0	-79.9	-70.7	-107.7	-103.3	-104.4	-70.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
299-W14-20	-74.9	-99.6	-53.8	-80.8	-84.2	-74.6	-66.1	-80.0	-80.0	-80.0	-80.0	-80.0	-80.0	-80.0	-80.0
299-W14-73	-135.3	-82.7	-77.5	-63.3	-63.8	-54.0	-54.2	-65.0	-65.0	-65.0	-65.0	-65.0	-65.0	-65.0	-65.0
299-W14-74	-100.9	-95.7	-106.7	-106.2	-108.2	-108.6	-107.8	-108.0	-108.0	-108.0	-108.0	-108.0	-108.0	-108.0	-108.0
299-W12-2	-107.5	-95.8	-106.1	-114.6	-120.6	-141.4	-147.9	-118.0	-118.0	-118.0	-118.0	-118.0	-118.0	-118.0	-118.0
299-W11-50	-58.0	-55.9	-75.7	-91.3	-86.5	-67.5	-61.4	-104.0	-104.0	-104.0	-104.0	-104.0	-104.0	-104.0	-104.0
299-W11-90	-88.4	-87.5	-77.8	-91.0	-90.6	-117.6	-132.1	-90.0	-90.0	-90.0	-90.0	-90.0	-90.0	-90.0	-90.0
299-W11-96	-106.6	-78.2	-94.7	-89.5	-94.5	-81.2	-71.7	-97.0	-97.0	-97.0	-97.0	-97.0	-97.0	-97.0	-97.0
299-W17-3	-73.2	-99.4	-75.1	-124.8	-117.3	-126.0	-116.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 5. Extraction and Injection Rates (gpm) for Central Plateau Wells Used in the Simulation

Date	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032-2037
Stress Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15-20
Well Name															
299-W17-2	0.0	-58.2	-71.1	-100.7	-97.7	-99.6	-94.4	-62.0	-62.0	-62.0	-62.0	-62.0	-62.0	-62.0	-62.0
299-W19-111	0.0	-7.6	-20.6	-28.0	-28.9	-25.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
299-W11-49	-133.1	-114.7	-80.2	-96.3	-86.4	-80.7	-74.2	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0	-91.0
299-W11-97	-92.8	-103.6	-127.7	-118.5	-123.8	-127.4	-103.5	-129.0	-129.0	-129.0	-129.0	-129.0	-129.0	-129.0	-129.0
299-W6-15	-95.9	-75.3	-87.2	-81.9	-88.6	-76.3	-66.5	-90.0	-90.0	-90.0	-90.0	-90.0	-90.0	-90.0	-90.0
299-W14-21	-93.2	-89.7	-98.0	-100.0	-97.3	-97.6	-94.2	-102.0	-102.0	-102.0	-102.0	-102.0	-102.0	-102.0	-102.0
299-W11-92	-78.1	-96.1	-77.7	-117.7	-105.1	-110.2	-62.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
299-W5-1	-78.0	-86.4	-98.9	-91.2	-96.2	-98.0	-93.7	-99.0	-99.0	-99.0	-99.0	-99.0	-99.0	-99.0	-99.0
299-W12-3	-98.2	-90.1	-108.3	-104.1	-104.9	-97.7	-95.6	-111.0	-111.0	-111.0	-111.0	-111.0	-111.0	-111.0	-111.0
299-W12-4	-129.3	-121.7	-126.8	-121.4	-123.1	-125.5	-122.4	-125.0	-125.0	-125.0	-125.0	-125.0	-125.0	-125.0	-125.0
299-W14-22	-103.2	-102.5	-110.4	-106.8	-107.9	-104.4	-93.9	-110.0	-110.0	-110.0	-110.0	-110.0	-110.0	-110.0	-110.0
299-W22-90	-24.7	-20.5	-24.1	-24.8	-23.8	-24.4	-24.4	-25.0	-25.0	-25.0	-25.0	-25.0	-25.0	-25.0	-25.0
299-W22-91	-29.3	-29.5	-29.7	-28.9	-28.6	-29.3	-29.3	-30.0	-30.0	-30.0	-30.0	-30.0	-30.0	-30.0	-30.0
299-W22-92	-24.8	-24.4	-24.8	-24.9	-22.7	-22.5	-22.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
299-W19-125	-49.4	-47.6	-48.6	-53.8	-52.4	-49.6	-46.2	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0
299-W19-113	-43.5	-46.6	-39.4	-33.1	-24.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
299-W19-114	-54.3	-71.5	-61.8	-56.4	-56.8	-46.0	-32.7	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0
699-48-70	0.0	-6.0	-75.4	-73.0	-70.6	-113.3	-101.9	-74.0	-74.0	-74.0	-74.0	-74.0	-74.0	-74.0	-74.0
299-E33-268	0.0	0.0	-3.9	0.0	0.0	-46.0	-48.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
299-E33-360	-162.8	-125.7	-71.2	-112.0	-108.1	-105.7	-111.5	-110.0	-110.0	-110.0	-110.0	-110.0	-110.0	-110.0	-110.0
299-E33-361	0.0	-35.2	-37.0	-50.3	-48.5	-2.0	0.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0
299-W19-123	0.0	0.0	0.0	0.0	0.0	0.0	-20.2	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0

Table 5. Extraction and Injection Rates (gpm) for Central Plateau Wells Used in the Simulation

Date	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032-2037
Stress Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15-20
Well Name															
299-E27-157	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-175.0	-175.0	-147.3	-65.0	-65.0	-65.0	-65.0	-65.0
299-E25-240	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-65.0	-65.0	-92.7	-175.0	-175.0	-175.0	-175.0	-175.0
299-W19-134	0.0	0.0	0.0	0.0	0.0	-33.0	-46.3	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0
299-W11-106	0.0	0.0	0.0	0.0	0.0	0.0	-51.6	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0
299-W11-107	0.0	0.0	0.0	0.0	0.0	0.0	-34.5	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0
299-W14-75	0.0	0.0	0.0	0.0	0.0	0.0	-38.6	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0
299-W13-5	0.0	0.0	0.0	0.0	0.0	0.0	-59.7	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0
299-W12-5	0.0	0.0	0.0	0.0	0.0	0.0	-35.8	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0
299-W14-28	0.0	0.0	0.0	0.0	0.0	0.0	-43.8	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0
299-W14-31	0.0	0.0	0.0	0.0	0.0	0.0	-34.4	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0
299-W14-29	0.0	0.0	0.0	0.0	0.0	0.0	-28.1	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0
299-W14-32	0.0	0.0	0.0	0.0	0.0	0.0	-59.6	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0
699-40-70A	0.0	0.0	0.0	0.0	0.0	0.0	-41.3	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0
299-W14-30	0.0	0.0	0.0	0.0	0.0	0.0	-36.5	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0

5 Software Applications

MODFLOW, Microsoft® Excel®, ArcGIS®, Python®, and R software programs were used to perform this calculation. MODFLOW is Central Plateau Cleanup Company (CPCCo)-approved software, managed and used in compliance with internal policy regarding software (CP-66776, *MODFLOW and Related Codes: Build 9 Software Management Plan*). A copy of the Software Installation and Checkout Form for the MODFLOW installation used for this calculation is provided in Appendix A to this ECF.

The results of CPCCo acceptance testing (CP-66776) demonstrate that the MODFLOW software is acceptable for its intended use by CPCCo. Installations of the software are operating correctly, as demonstrated by the completed Software Installation and Checkout form.

All model input files, and selected output files, and other relevant files for the development of this ECF are archived to the Hanford Site's Environmental Model Management Archive (EMMA) internal file directory referenced under this ECF number and revision (ECF-HANFORD-24-0090, Rev. 0) in accordance with requirements of CPCCo's quality assurance modeling project plan.

5.1 Approved Software

For approved calculation software used in this calculation, the required descriptions are provided below.

5.1.1 MODFLOW Description

- **Software Title:** MODFLOW
- **Software Version:** CPCCo Build 9 (executable “mf2k-mst-cpcc09dpl.x”), double precision compilation
- **Hanford Information System Inventory (HISI) Identification Number:** 2517 (Safety Software, Level C)
- **Authorized Workstation Type and Property Number:** GAIA Fate and Transport Modeling Platform, property number WD56054
- **Authorized User:** T. Budge
- **CPCCo Software Control Documents:** CP-66776

5.1.2 ArcGIS Pro

ArcGIS Pro (Version 3.2.1) is a Grade D software item that is approved for use under Hanford Mission Integrated Solution (HMIS) Geopsatial & Ops. Site Systems (HISI #1583) under HNF-69989, *ArcGIS Pro Software Management Plan*. The intended use of this software was to create maps. The following describes the ArcGIS Pro-controlled visualization software.

- **Software Title:** ArcGIS Pro
- **Software Version:** Version 3.2.1
- **HISI Identification Number:** 1583

® Microsoft and Excel are registered trademarks of the Microsoft Corporation in the United States and other countries.

® ArcGIS is a registered trademark, or service mark, of ESRI in the United States, the European Community, or certain other jurisdictions.

® Python is a registered trademark of the Python Software Foundation, Wilmington, Delaware.

- **Authorized Workstation Type and Property Number:** [WF51968] Windows 11 Enterprise, 13th Gen Intel Core™ i5-13500,2500 Mhz, 14 Cores, 20 Logical Processor(s), 16 GB RAM.
- **Software Installation and Checkout:** No software installation and checkout for is required for ArcGIS Pro. Per HNF-69989, Installation Plan/Training. “ArcGIS Pro will be installed using an access controlled Software Distribution install. ArcGIS License Manager will be installed by an assigned analyst who has administrator access to the server on which the License Manager runs. The License Manager will be installed following vendor supplied installation instructions.” The workstation ArcGIS Pro was installed on was installed by an HMIS administrator and did not require a software installation and checkout form nor formal installation testing.
- **Authorized User:** T. Budge

5.1.3 Software Installation and Checkout

Copies of the Software Installation and Checkout form for the authorized users and authorized workstations for software used that requires this documentation are provided in Appendix A to this ECF.

5.2 Support Software

In accordance with CP-66776, the following support software were used in the following capacities as part of this calculation:

- Microsoft Excel - Used to tabulate injection and extraction rates for the table documented in Section 4.4.
- MOPATH – Used to produce maps of flow direction from the MODFLOW simulation output.

5.3 Statement of Valid Software Application

The preparers of this calculation attest that the software identified above, and used for the calculations described in this calculation, is appropriate for the application and used within the range of intended uses for which it was tested and accepted by CPCCo. Because MODFLOW is graded as Level C software, use of this software is required to be logged in the HISI. Accordingly, this environmental calculation has been logged by the software owner in the HISI under Identification Number 2517.

6 Calculation

Generating a set of predictive simulations for the full set of ensemble simulations for the P2R Model Version 9.1 is the purpose of this calculation. Model inputs were generated based on the description in Section 4 for producing the predictive simulations. This section will describe the organization of the simulation sets and the figures and charts that are available for each of these simulation sets.

6.1 Simulation Organization

A total of 275 unique model input parameters makes up the entire ensemble of models for the P2R Version 9.1. Each simulation has a unique set of hydraulic properties and recharge files that make up the flow model components for simulations. The specified head, river package, and injection and extraction rates at well locations, and the lateral and temporal discretization of the model are the same for all simulation sets. For each realization a unique number is assigned to act as an identifier for that simulation. While there are only 275 simulations, some of the identifiers have a value greater than 275. This is a characteristic of the model development and is kept as part of model application in order to be consistent with the development of the ensemble model documented in CP-57037. For example, the simulation that has the closest statistical match to the observation data as part of the history-matching

™ Intel Core is a trademark of the Intel Corporation, Santa Clara, California.

process, or minimum phi simulation, has an identifier of “320.” Thus, in the model files stored as part of this calculation, are in a subdirectory named “wf_320.” Other simulations are in subdirectories that are similarly named with the format of “wf_XXX.” where the XXX is a placeholder for the number assigned to identify that realization of the ensemble.

6.2 Variation in Hydraulic Head

To illustrate the variation in hydraulic head between the various simulations, a set of plots were created for wells within the model domain where observation data were used to constrain the P2R Model development. The locations for the wells where plots were made are shown in Figure 5. The plots show the simulated and observed hydraulic head over time. The historic period from 1943 through 2022 is included and was simulated as part of the model development documented in CP-57037. The results for the predictive period are also shown based on the simulation results from this calculation. A set of example plots are provided in Figure 6 through Figure 17, and the locations are shown in Figure 5 based on the wells where the well name is posted next to the well location on the map. A complete set of plots for all wells shown in Figure 5 are found in Appendix B of this calculation.

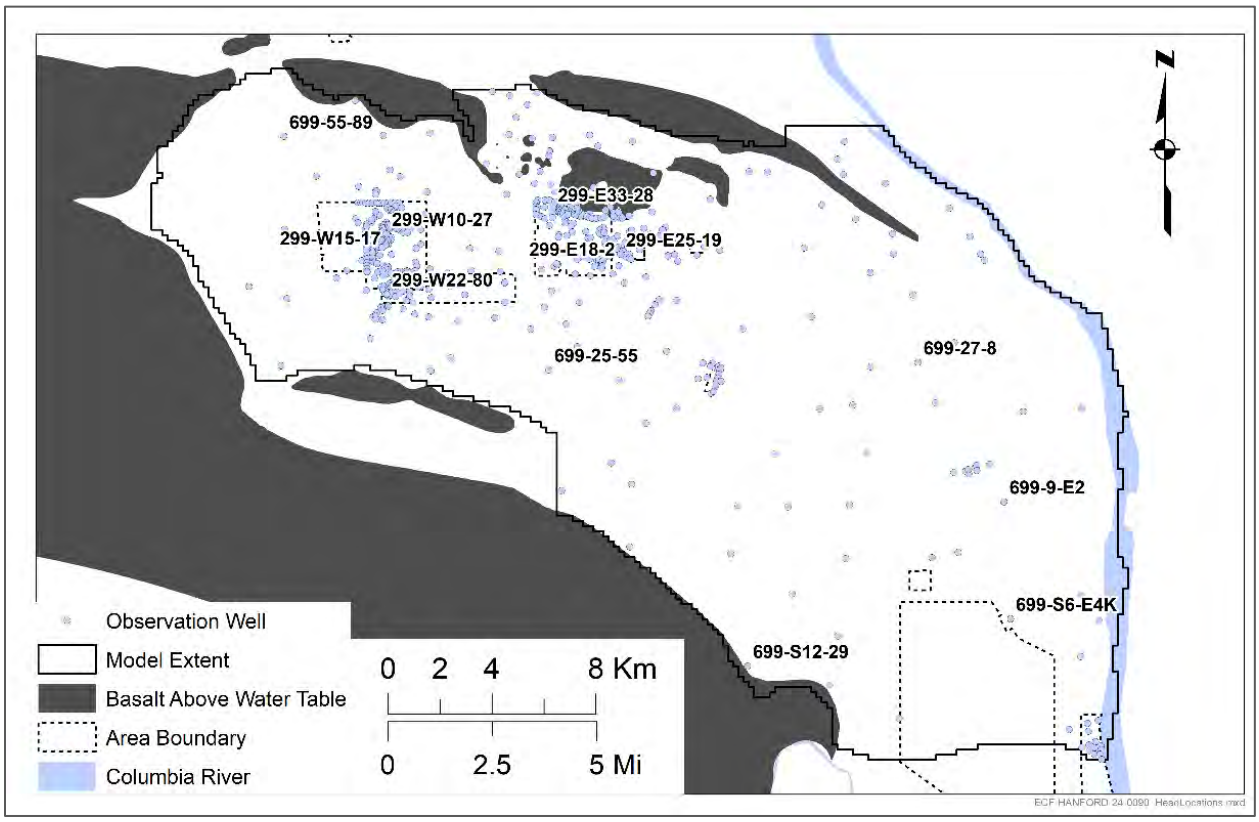

Figure 5. Location of Wells Used to Compare Simulated and Observed Hydraulic Head for Development of the P2R Model Version 9.1

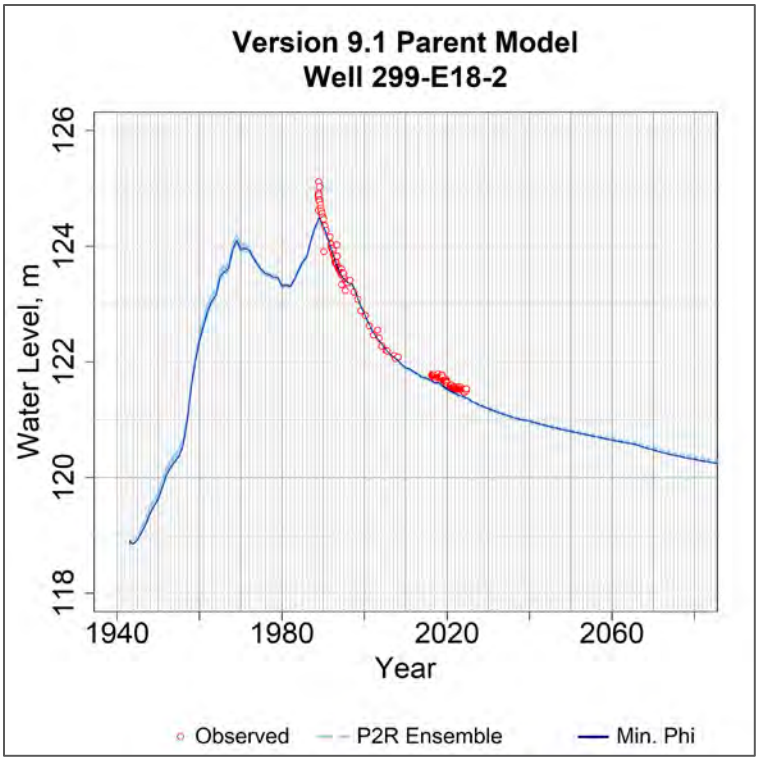

Figure 6. Time Series Plot of Simulated Results Versus Observed Values at Well 299-E18-2 for All Simulations of the P2R Ensemble Model Version 9.1

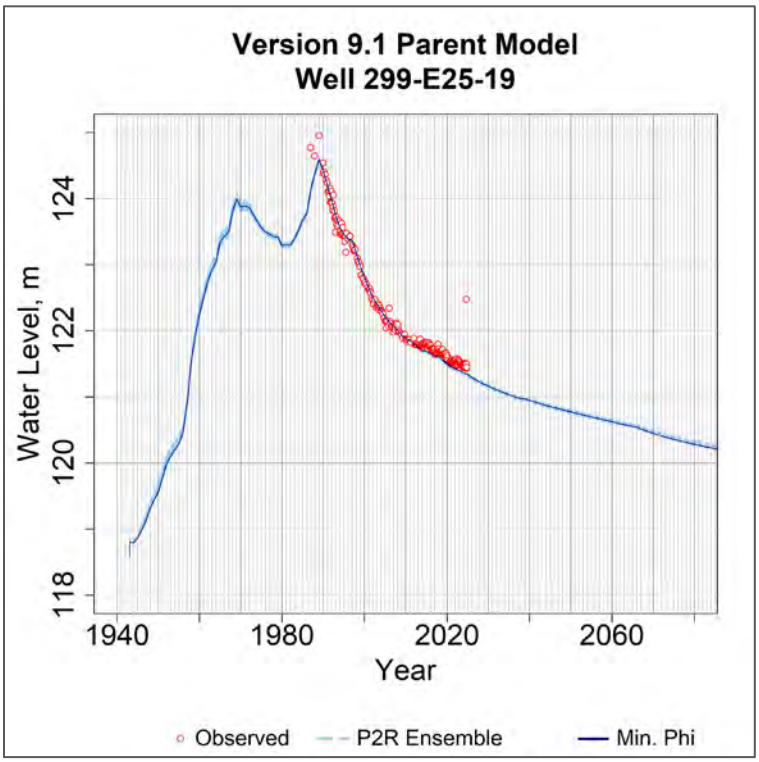

Figure 7. Time Series Plot of Simulated Results Versus Observed Values at Well 299-E25-19 for All Simulations of the P2R Ensemble Model Version 9.1

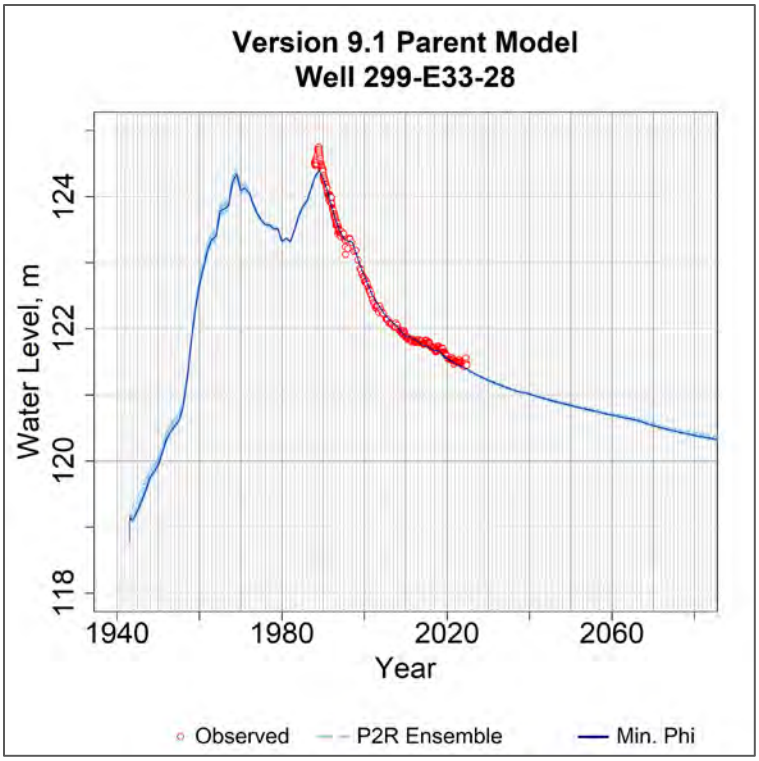

Figure 8. Time Series Plot of Simulated Results Versus Observed Values at Well 299-E33-28 for All Simulations of the P2R Ensemble Model Version 9.1

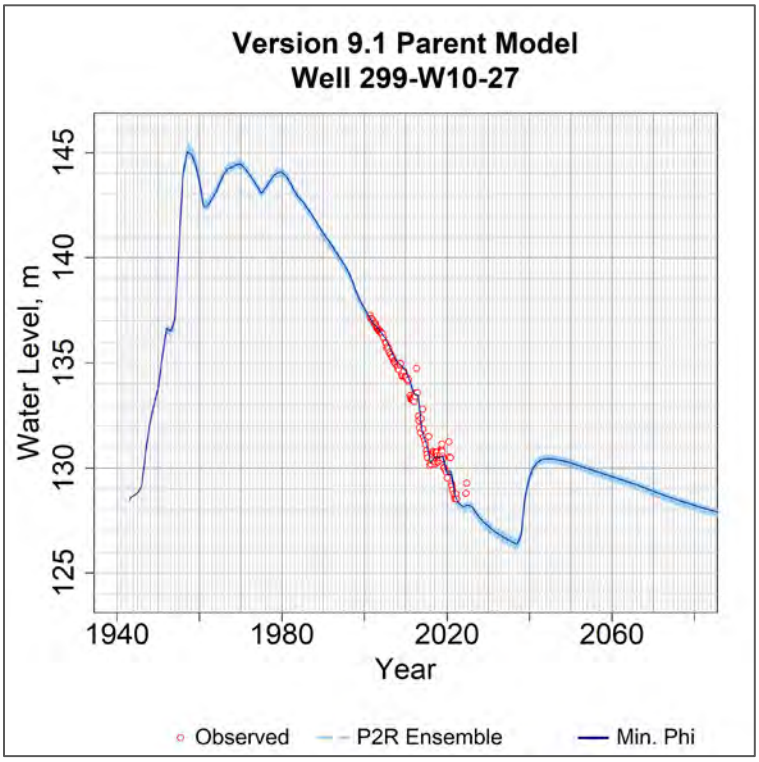

Figure 9. Time Series Plot of Simulated Results Versus Observed Values at Well 299-W10-27 for All Simulations of the P2R Ensemble Model Version 9.1

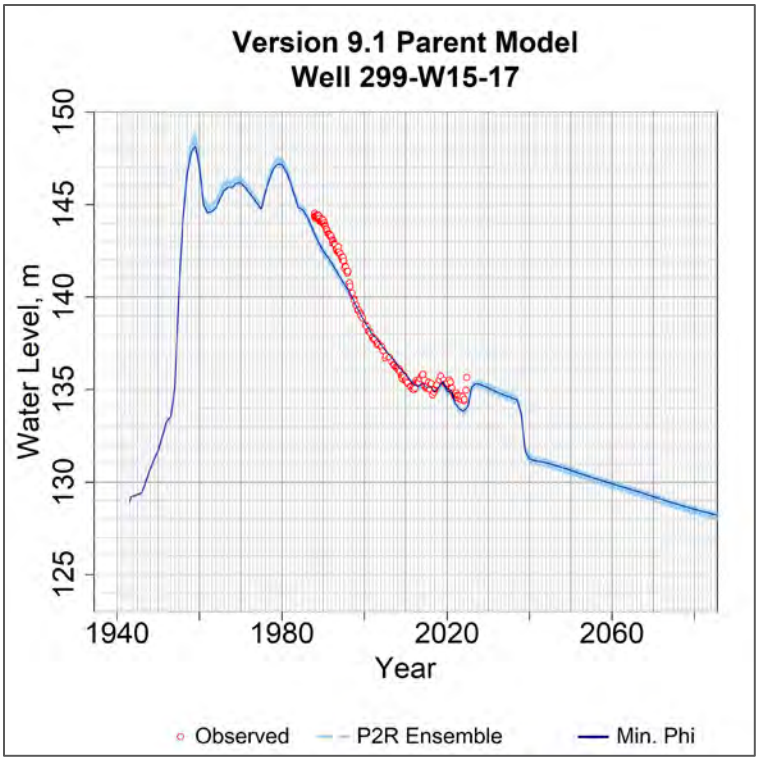

Figure 10. Time Series Plot of Simulated Results Versus Observed Values at Well 299-W15-17 for All Simulations of the P2R Ensemble Model Version 9.1

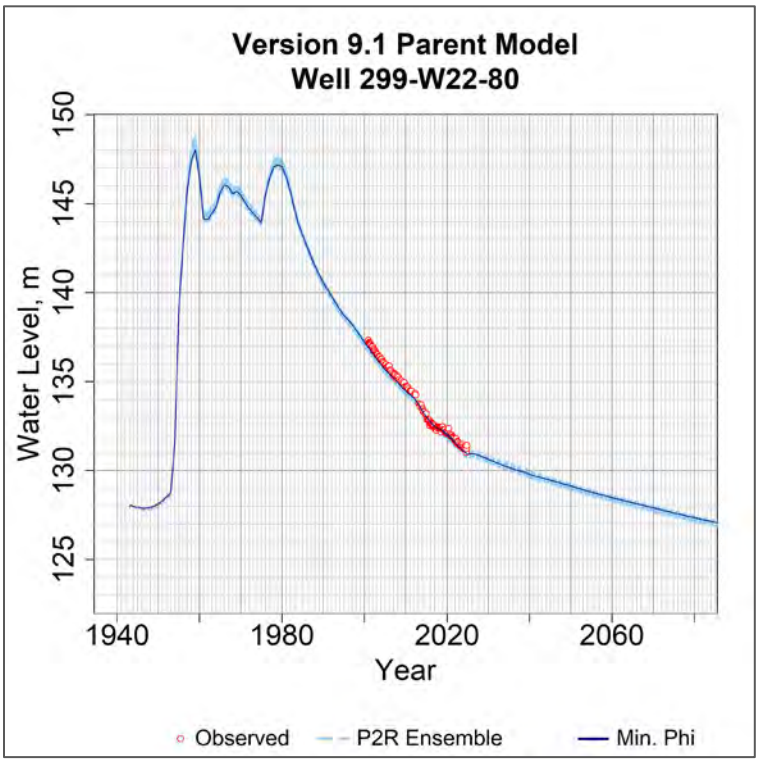

Figure 11. Time Series Plot of Simulated Results Versus Observed Values at Well 299-W22-80 for All Simulations of the P2R Ensemble Model Version 9.1

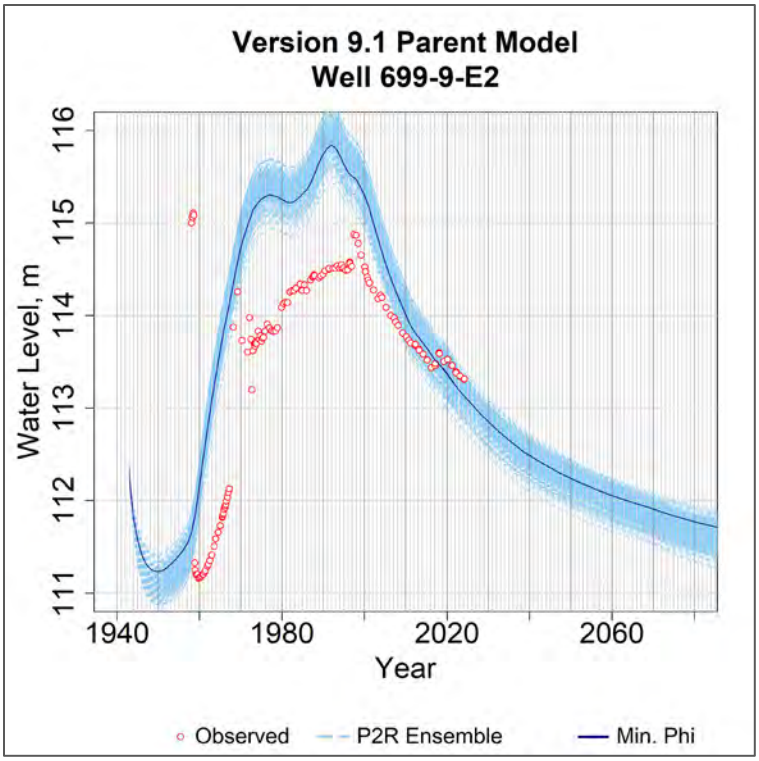

Figure 12. Time Series Plot of Simulated Results Versus Observed Values at Well 699-9-E2 for All Simulations of the P2R Ensemble Model Version 9.1

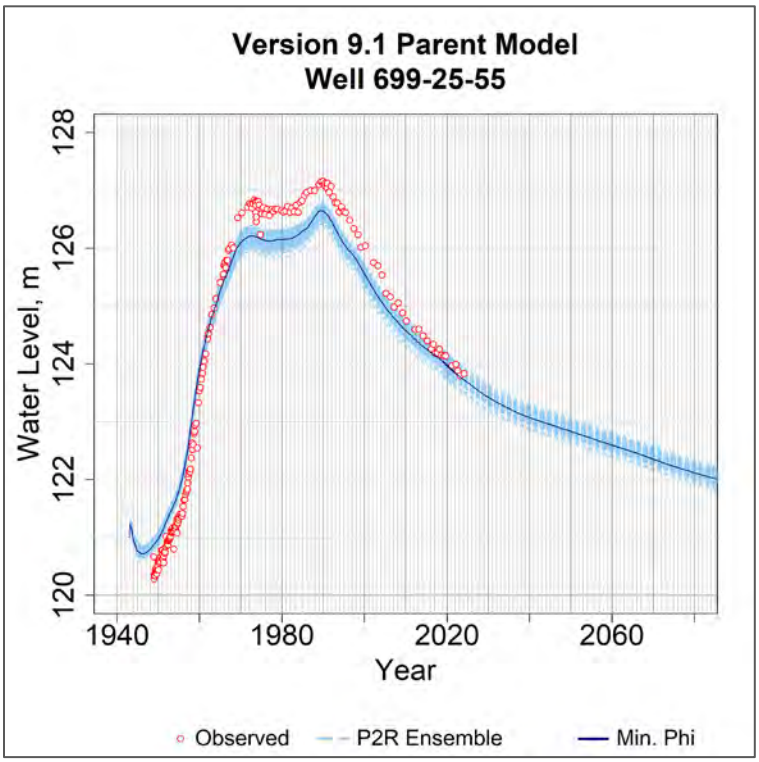

Figure 13. Time Series Plot of Simulated Results Versus Observed Values at Well 699-25-55 for All Simulations of the P2R Ensemble Model Version 9.1

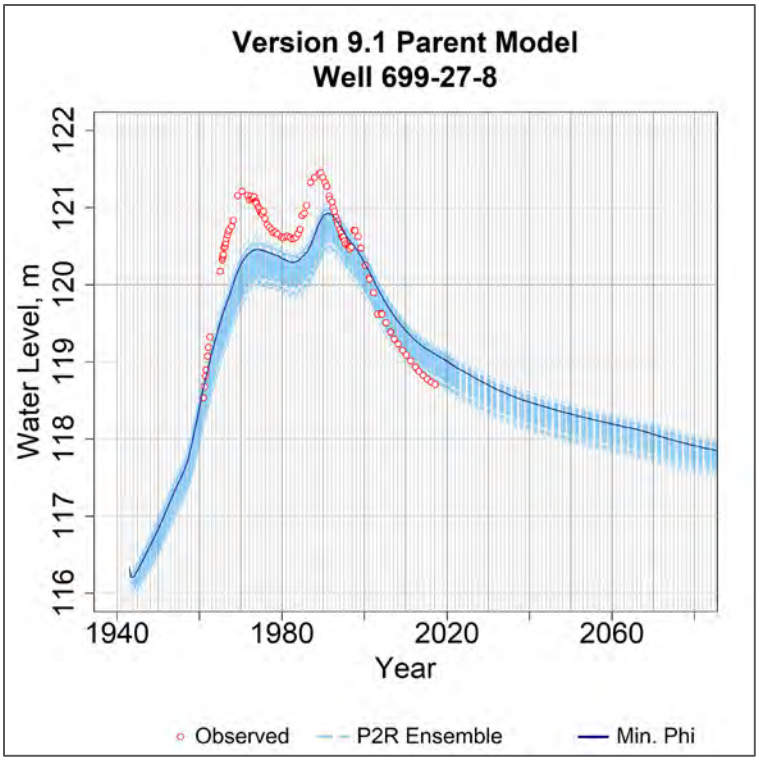

Figure 14. Time Series Plot of Simulated Results Versus Observed Values at Well 699-27-8 for All Simulations of the P2R Ensemble Model Version 9.1

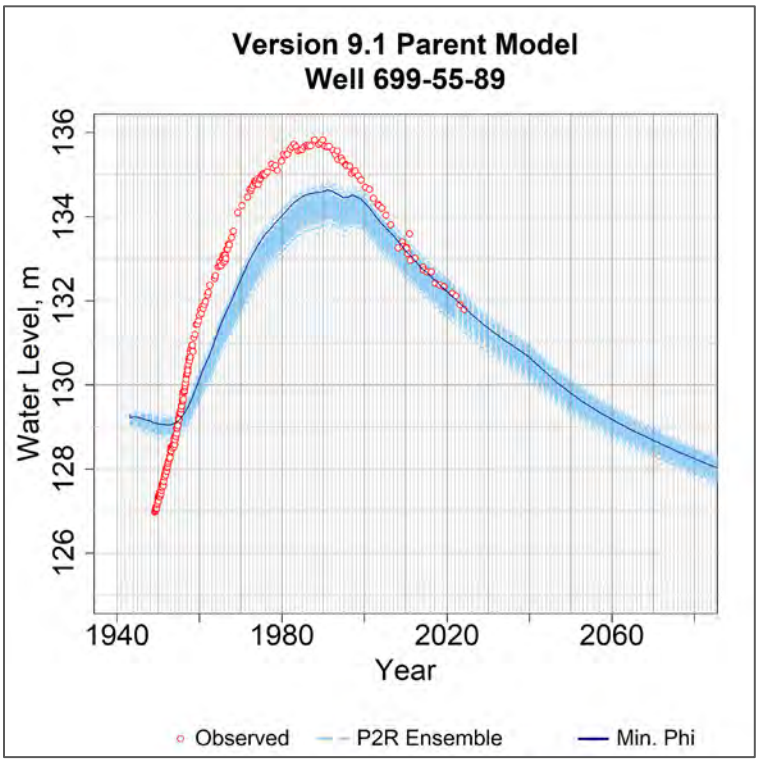

Figure 15. Time Series Plot of Simulated Results Versus Observed Values at Well 699-55-89 for All Simulations of the P2R Ensemble Model Version 9.1

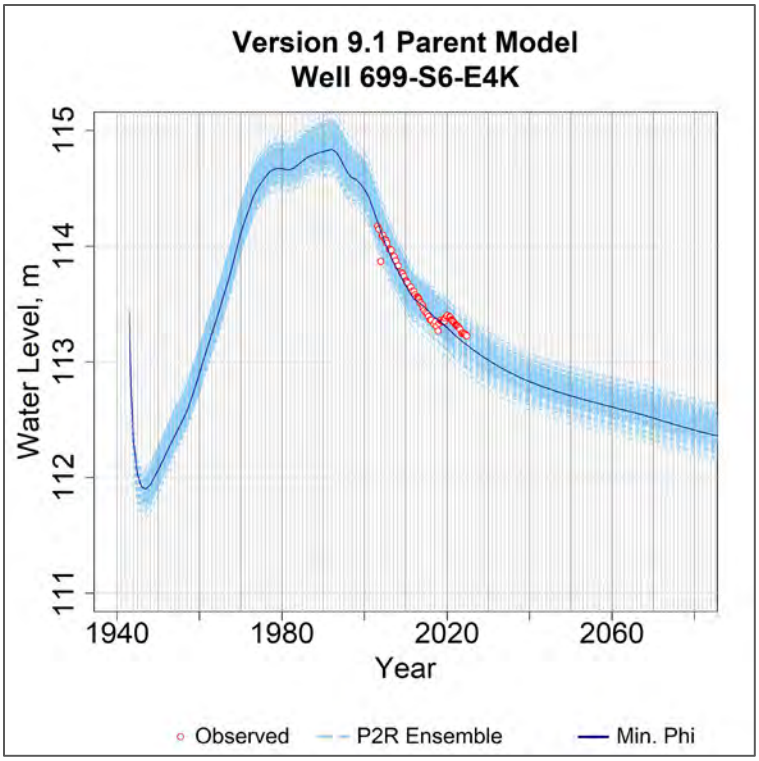

Figure 16. Time Series Plot of Simulated Results Versus Observed Values at Well 699-S6-E4K for All Simulations of the P2R Ensemble Model Version 9.1

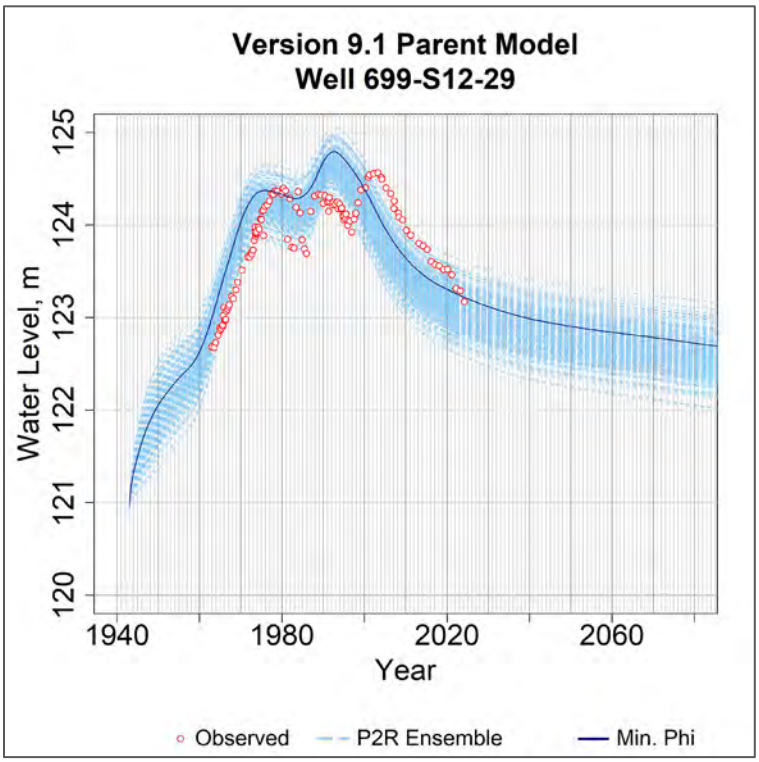

Figure 17. Time Series Plot of Simulated Results Versus Observed Values at Well 699-S12-29 for All Simulations of the P2R Ensemble Model Version 9.1

6.3 Particle Tracks

To evaluate the potential future flow path of groundwater from the 200 East Area toward the Columbia River a set of particle tracks were developed and applied with each realization of the ensemble. Figure 18 shows the location where the particle tracks were initiated within the boundary of 200 East Area. The figure includes the extent of three zones used to estimate travel time of particles to reach those boundaries. The estimate of porosity values used in the particle tracking is the same model inputs that were developed as part of the P2R Model development documented in CP-57037. The particle tracks provide an estimate of the direction and speed at which groundwater moves toward the Columbia River. Because each of the ensemble member simulations were calculated this also provides a method to evaluate the uncertainty of the location and speed of groundwater travel.

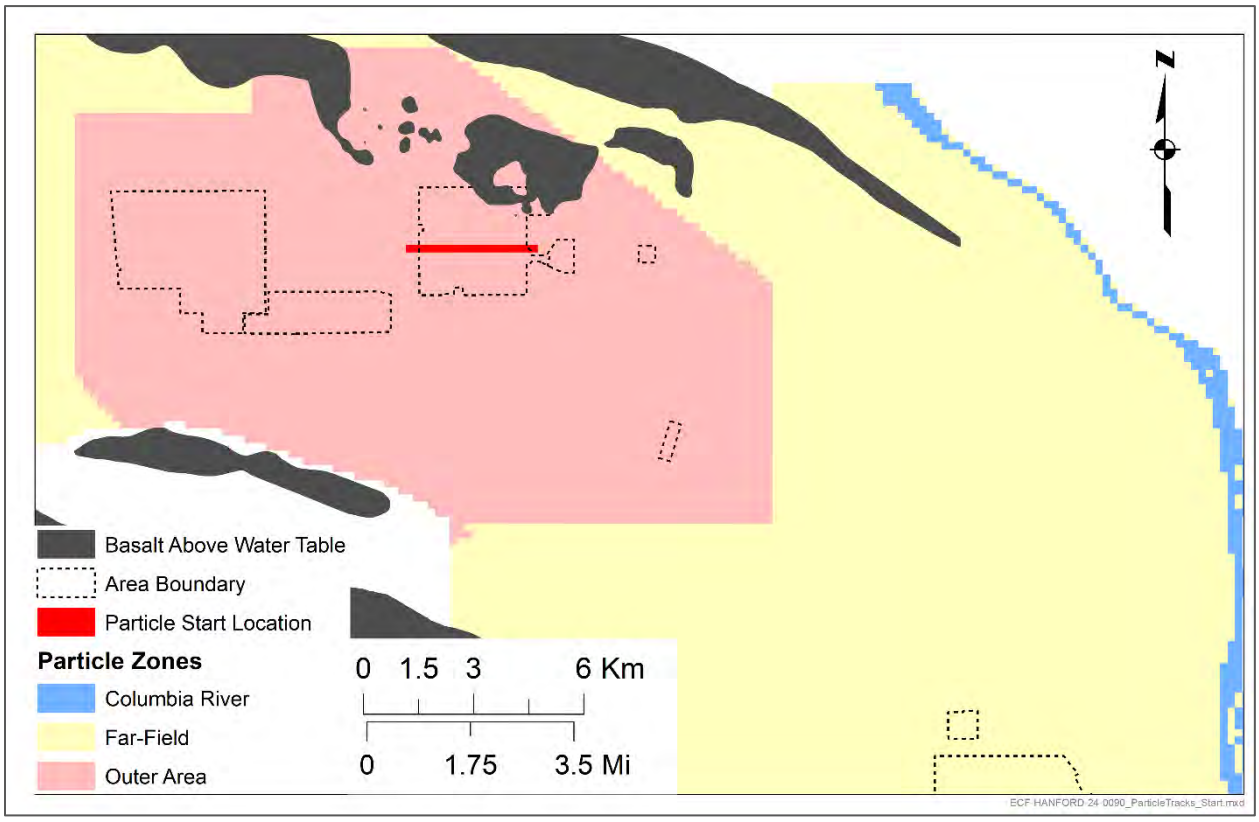

Figure 18. Starting Locations of Particles Used for Particle Tracking Evaluation with Specific Zones for Estimating Travel Times

7 Results/Conclusions

Simulations carried out as part of the calculation provide simulated heads that define the boundary conditions for child models used for applications of the P2R Version 9.1. The simulation results contain 275 members of the P2R Version 9.1 ensemble model. Each simulation has the appropriate hydraulic properties and boundary conditions for the sitewide parent model. The following sections discuss the results of the simulations and some of the major characteristics of the simulated ensemble results. First, the results of hydraulic head are discussed and then the results of particle tracking are summarized.

7.1 Hydraulic Head Response

Plots of hydraulic head over time shown in Chapter 6 and Appendix B illustrate the differences in range of output for different areas in the model. Where data availability is greater, within and near the boundaries

of the 200 West and East Areas, the range of hydraulic head is more constrained (see Figures 8 and 9) than in the far field where available data are less numerous (see Figures 15 and 16).

7.2 Particle Tracking

Particle tracks were used to illustrate the direction and velocity of groundwater movement for the predictive period (2018 to 3070). Figure 19 shows the general direction of flow using a measure of the number of particles that traveled through the given location of the P2R parent model grid as part of the ensemble. A total of 576 particles were simulated and the average number of particles that traveled through that location for any of the ensemble models is color-coded according to the legend in the figure. Most of the groundwater flow from 200 East Area is expected to eastward toward the Columbia River and discharge near the historic Hanford Townsite. The travel time of the groundwater is illustrated in a set of empirical cumulative distribution functions showing the range of travel times of each ensemble member to reach the Columbia River (see Figure 20) and the boundary of the Central Plateau Outer Area Boundary (see Figure 21). For travel to the Columbia River, initial arrival ranges from 36 to 52 years with the median arrival time ranging from 48 to 71 years. The travel time from the center of the 200 East Area to the edge of the outer area boundary ranges from 14 to 21 years for the initial arrival and 21 to 30 years for the median arrival time.

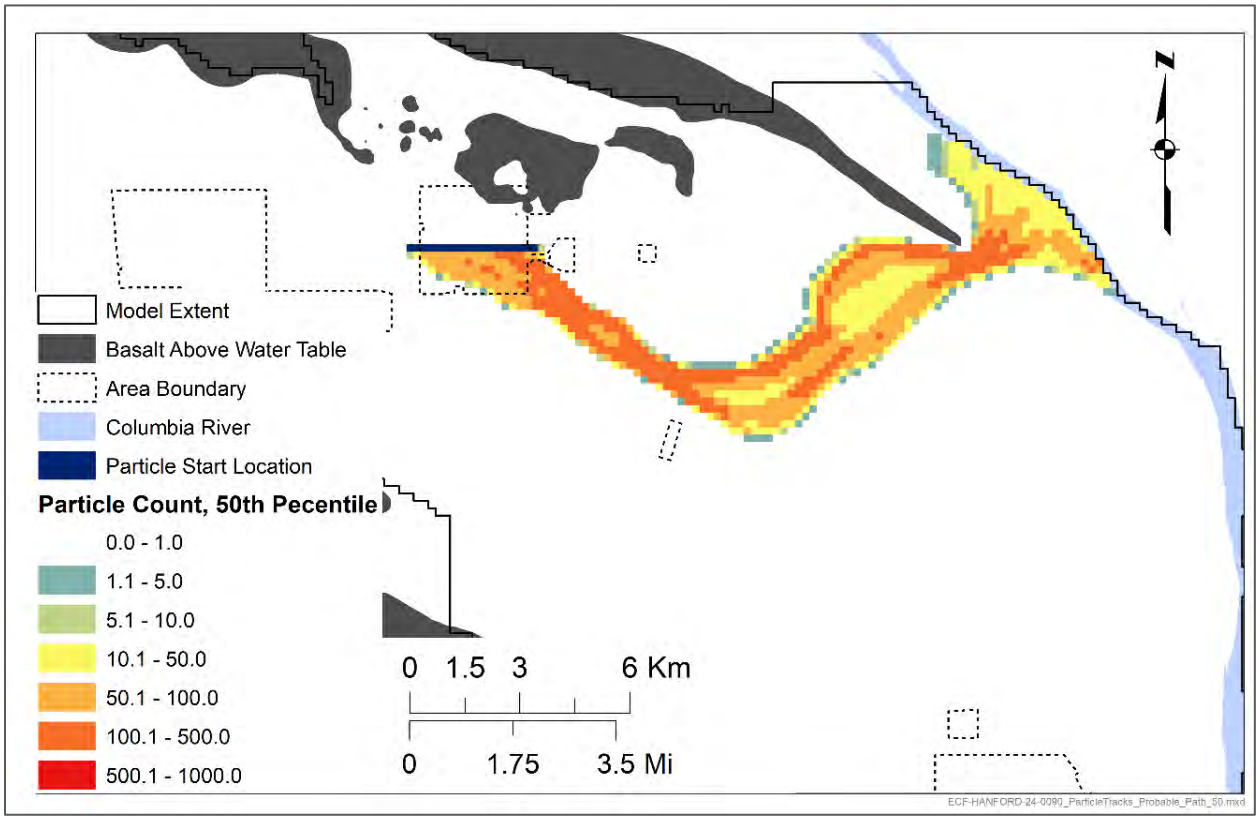

Figure 19. Simulated Flow Direction for the Predictive Period (2018 to 3070) for the P2R Model Parent Model Shown as the Median Number of Particles that Travel through the Model Grid Cell for All 275 Ensemble Members

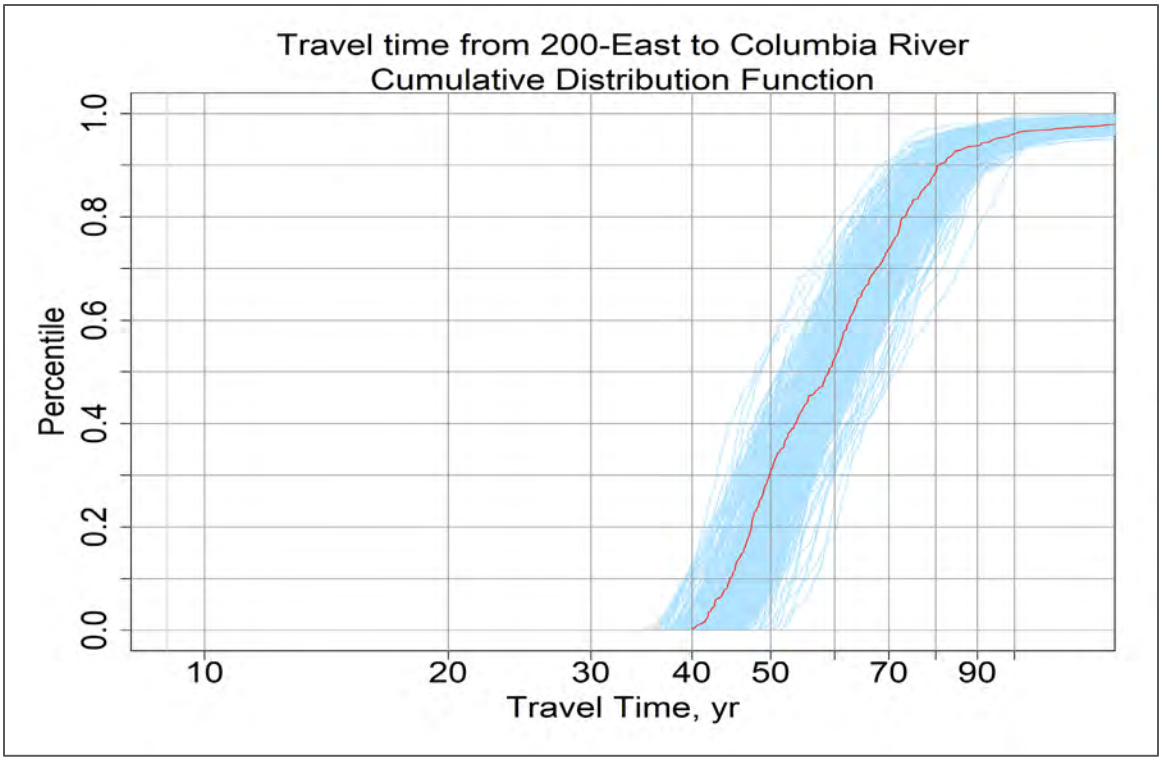

Figure 20. Empirical Cumulative Distribution Function of Travel Time for All Ensemble Realizations from the Center of the 200 East Area to the Boundary of the Columbia River

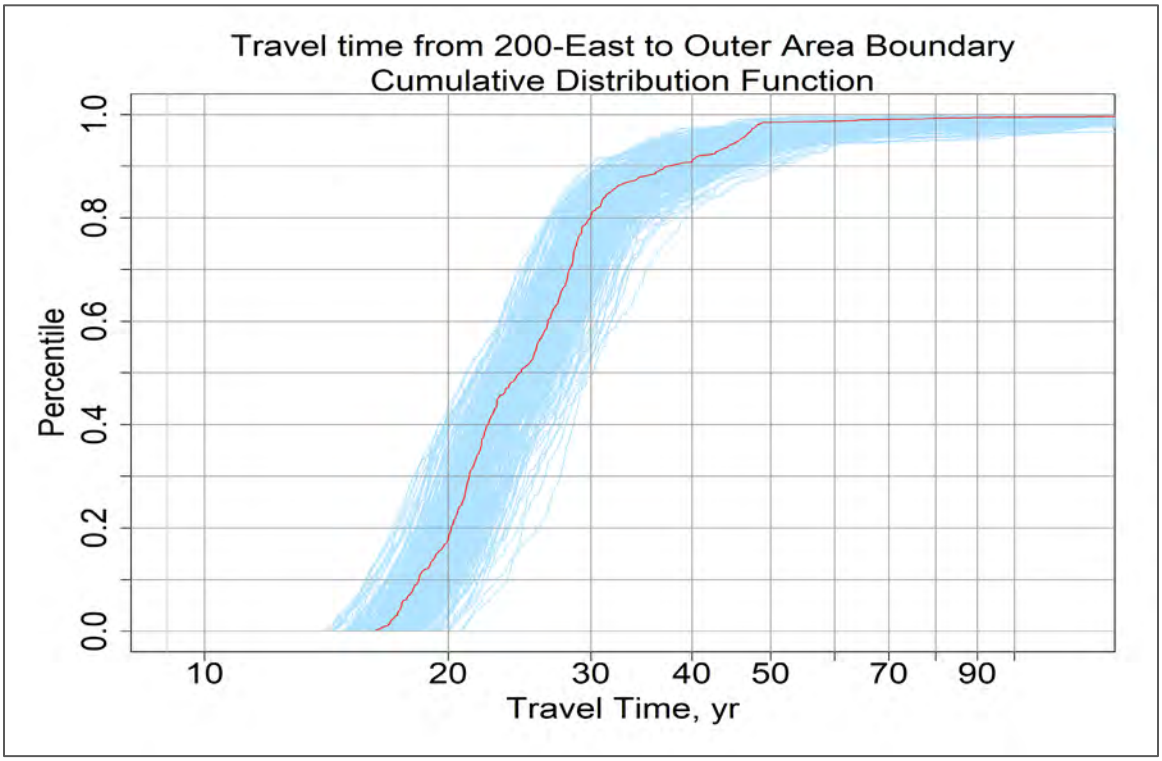

Figure 21. Empirical Cumulative Distribution Function of Travel Time for All Ensemble Realizations from the Center of the 200 East Area to the Boundary of the Central Plateau Outer Area

8 References

CP-57037, 2024, *Model Package Report: Plateau to River Model Version 9.1*, Rev. 3, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-31096.

CP-66776, 2022, *MODFLOW and Related Codes: Build 9 Software Management Plan*, Rev. 0, Central Plateau Cleanup Company, Richland Washington.

ECF-HANFORD-15-0019, 2020, *Hanford Site-wide Natural Recharge Boundary Condition for Groundwater Models*, Rev. 3, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-17434.

ECF-HANFORD-20-0049, *Description of Groundwater Calculations to Support Performance Assessment for the Calendar Year 2019 (CY 2019) 200 Areas Pump-and-Treat Report,* CH2M HILL Plateau Remediation Company, Richland Washington. Available at: https://pdw.hanford.gov/document/AR-04153.

ECF-HANFORD-22-0092, *Predictive Flow Simulation with the P2R Model for the Cumulative Impact Evaluation Using Alternate Anthropogenic Recharge Estimates*. Rev. 0, Central Plateau Cleanup Company, Richland, Washington.

HNF-69989, 2024, *ArcGIS Pro Software Management Plan,* U.S. Department of Energy, Richland Operations Office, Richland, Washington.

NAD83, 1991, *North American Datum of 1983*, as revised, National Geodetic Survey, Federal Geodetic Control Committee, Silver Spring, Maryland. Available at: https://www.ngs.noaa.gov/datums/horizontal/north-american-datum-1983.shtml.

USGS, 2000, *MODFLOW-2000, The U.S. Geological Survey Modular Ground-Water Model—User Guide to Modularization Concepts and the Ground-Water Flow Process*, Open-File Report 00-92, U.S. Geological Survey, Reston, Virginia. Available at: https://pubs.usgs.gov/of/2000/0092/report.pdf.

Zheng, C., and P.P. Wang, 1999, *MT3DMS: A Modular Three-Dimensional Multispecies Transport Model for Simulation of Advection, Dispersion, and Chemical Reactions of Contaminants in Groundwater Systems; Documentation and User's Guide*, Contract Report SERDP-99-1, U.S. Army Engineer Research and Development Center, U.S. Army Corps of Engineers, Vicksburg, Mississippi. Available at: https://apps.dtic.mil/sti/pdfs/ADA373474.pdf.

This page intentionally left blank.

Appendix A

Software Installation and Checkout Form

This page intentionally left blank.

SOFTWARE INSTALLATION AND CHECKOUT FORM

Software Owner Instructions:
Complete Fields 1-13, then run test cases in Field 14. Compare test case results listed in Field 15 to corresponding Test Report outputs. If results are the same, sign and date Field 19. If not, resolve differences and repeat above steps.

Software Subject Matter Expert Instructions:
Assign test personnel. Approve the installation of the code by signing and dating Field 21, then maintain form as part of the software support documentation.

GENERAL INFORMATION

1. Software Name: MODFLOW and Related Codes Version No.: Bld 9

EXECUTABLE INFORMATION

2. Executable Name *(include path)*:
Following executable files in directory: [redacted] on head node and each compute node (compute-0-0 through compute-0-10, inclusive).

MD5 Signature (unique ID)	Executable File Name	Code
2fade33e27978063a9a70ff8605e4c0c	mf2k-cpcc09dpl.x	MODFLOW-2000MODFLOW-2000 double precision
80d670658425653bf5bcbb97ad2a2730	mf2k-mst-cpcc09dpl.x	MODFLOW-2000-MST double precision
c7d90a02e11a02e851f4a4b1fc8f94fa	mf6-cpcc09.x	MODFLOW 6
682f0b1e9fcd6ac0b885f52a7ddfe821	mfusg-cpcc09dpl.x	MODFLOW-USG double precision
1be4b7d3fc81881ff0b97ff7e67bd3ff	mt3d-cpcc09dpl.x	MT3D double precision
1e468c4409ac913843ce783aabed819c	mt3d-mst-cpcc09dpl.x	MT3DMS-MST double precision

3. Executable Size *(bytes)*: MD5 signatures above uniquely identify each executable file

COMPILATION INFORMATION

4. Hardware System *(i.e., property number or ID)*:
Tellus Subsurface Modeling Platform - Linux® Cluster (tellusmgmt.rl.gov')
Frontend Hardware (Controller Node) is a Dell PowerEdge™ M710 with Intel Xeon® X5670 dual CPU processors with 6 cores per CPU at 2.93 GHz (12 MB Cache)
96 GB of RAM

5. Operating System *(include version number)*:
Linux compute-0-10.local 3.10.0-693.5.2.el7.x86_64 #1 SMP Fri Oct 20 20:32:50 UTC 2017 x86_64 x86_64 x86_64 GNU/Linux

INSTALLATION AND CHECKOUT INFORMATION

6. Hardware System *(i.e., property number or ID)*:
GAIA Subsurface Flow and Transport Modeling Platform
Server: 12 Dell PowerEdge R740 Servers in Standard 2U Rack
Processors: 28-core Intel 4 Xeon Platinum 8 180m @ 2.50GHz
768 GB of RAM

7. Operating System *(include version number)*:
Linux gaia1.rl.gov 3.10.0-1160.114.2.el7.x86_64 #1 SMP Wed March 20 15:54:52 UTC 2-24 x86_64 x86_64 x86_64 GNU/Linux

8. Open Problem Report? ☐ Yes ☒ No PR/CR No.: _____

TEST CASE INFORMATION

9. Directory/Path:
[redacted] on head node and each compute node of GAIA (except node 1).

10. Procedures:
per CP-66776 Rev. 3 (MODFLOW and Related Codes Software Management Plan), Section 10 and Section 15

11. Libraries:
N/A (static linking)

12. Input Files:

SOFTWARE INSTALLATION AND CHECKOUT FORM (Continued)

per CP-66776 Rev. 3; in test directories.

13. Output Files:
Found in test output directories

14. Test Cases:
MF-ITC-1 and MT-ITC-1 for all versions of MODFLOW and MT3D.

15. Test Case Results:
All PASS, All Tests, on compute nodes 0 through 10, except node 1.

16. Test Performed By: Christopher Farrow

17. Test Results: [x] Satisfactory, Accepted for Use [ ] Unsatisfactory

18. Disposition *(include HISI update)*:
Pass; HISI updated accordingly.

SOFTWARE INSTALLATION AND CHECKOUT FORM (Continued)

19. Prepared By *(Software Owner)*:

Christopher Farrow
Print First and Last Name

CHRISTOPHER FARROW (Affiliate)
Signature / Date

20. Test Personnel:

Title:

Christopher Farrow
Print First and Last Name

CHRISTOPHER FARROW (Affiliate)
Signature / Date

Title:

Print First and Last Name

Signature / Date

Title:

Print First and Last Name

Signature / Date

21. Approved By *(Software SME)*:

Donna Morgans
Print First and Last Name

DONNA MORGANS (Affiliate)
Digitally signed by DONNA MORGANS (Affiliate)
Date: 2024.04.02 12:39:15 -07'00'
Signature / Date

Page 3 of 3

A-6005-140 (REV 1)

This page intentionally left blank.

Appendix B

Plan View Maps and Time-Series Charts for 200-BC-1 Sensitivity Scenarios

This page intentionally left blank.

Contents

Figures

B1 Plan View Maps and Time-Series Charts for 200-BC-1 Sensitivity Scenarios

This appendix provides plan view maps of simulated Tc-99 concentrations and total activity passed from the vadose zone to the saturated zone along with concentration time-series for all 28 200-BC-1 sensitivity scenarios.

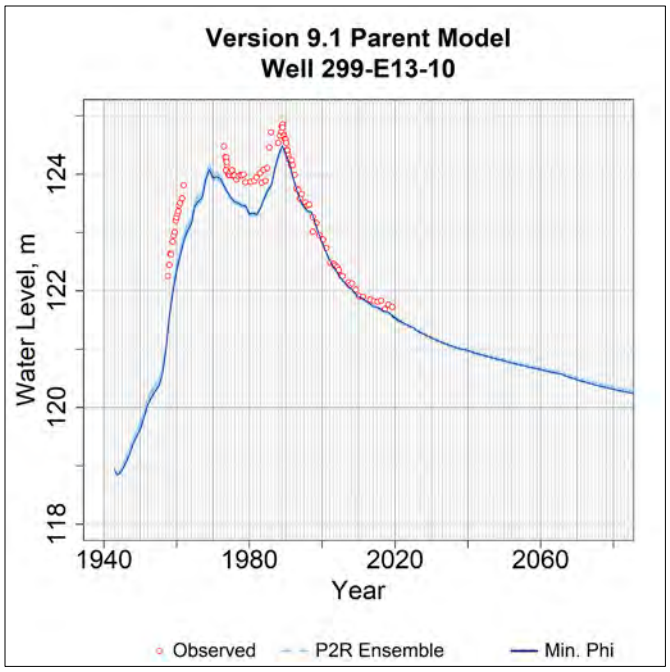

Figure B-1. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E13-10.

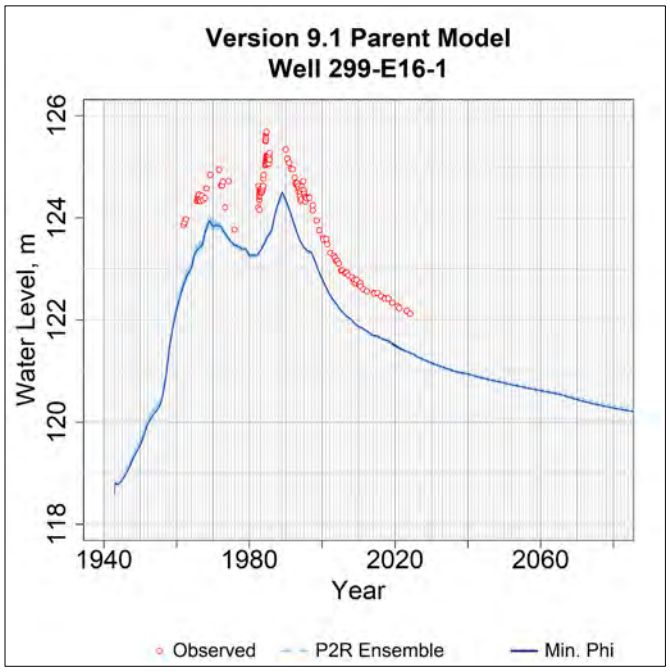

Figure B-2. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E16-1.

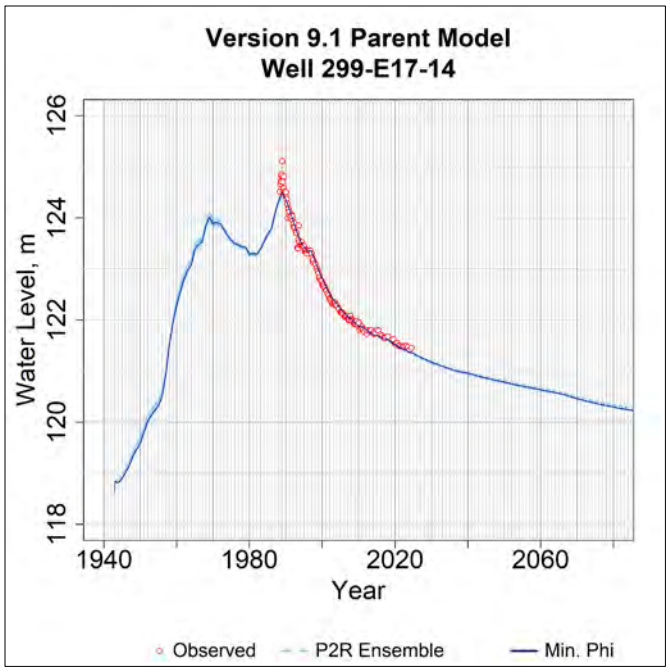

Figure B-3. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E17-14.

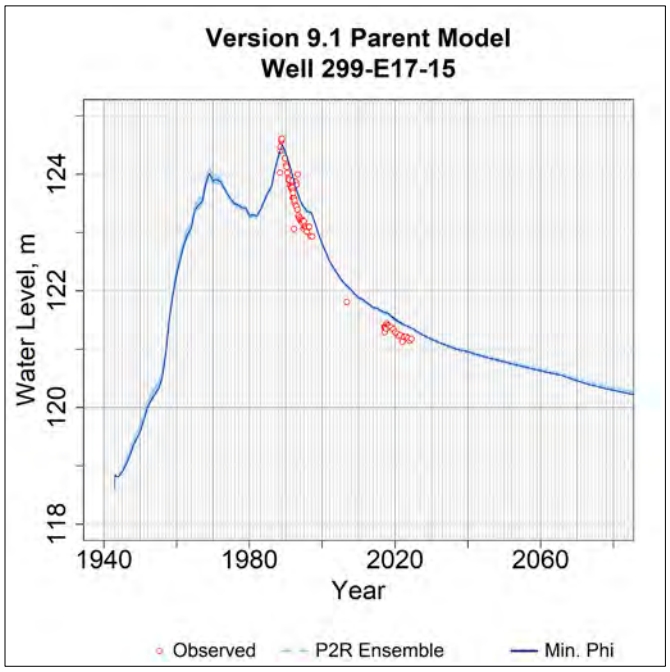

Figure B-4. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E17-15.

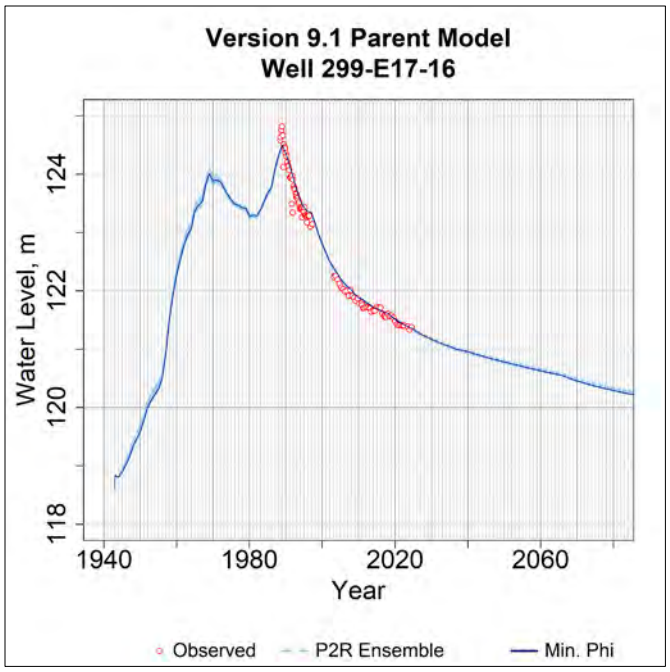

Figure B-5. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E17-16.

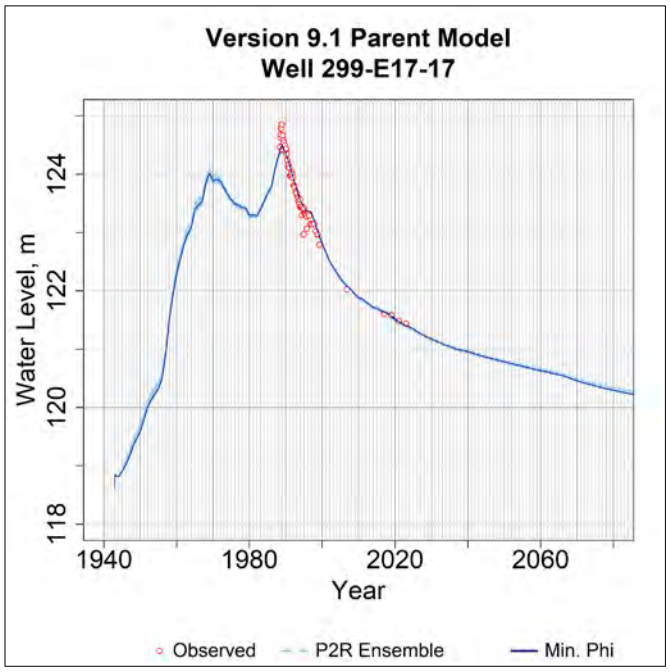

Figure B-6. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E17-17.

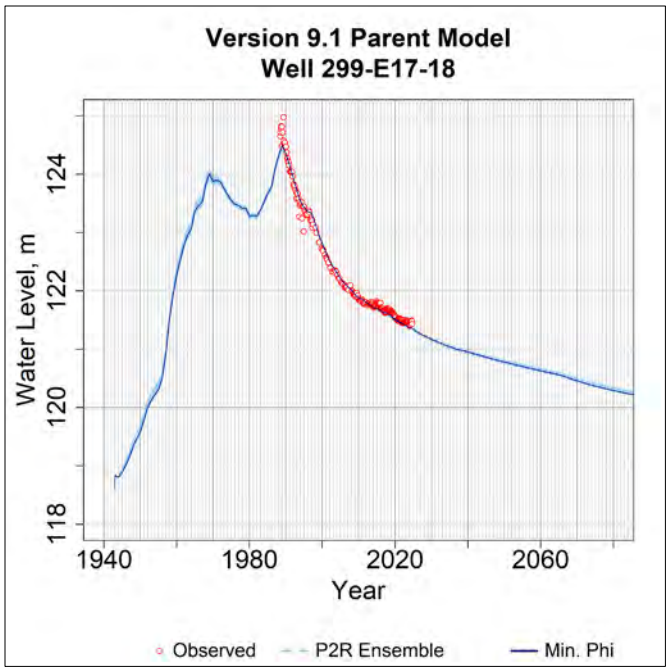

Figure B-7. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E17-18.

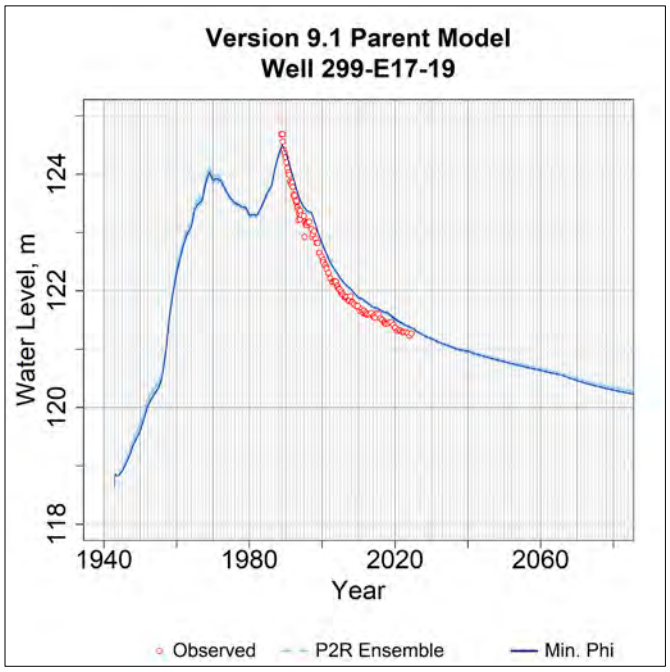

Figure B-8. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E17-19.

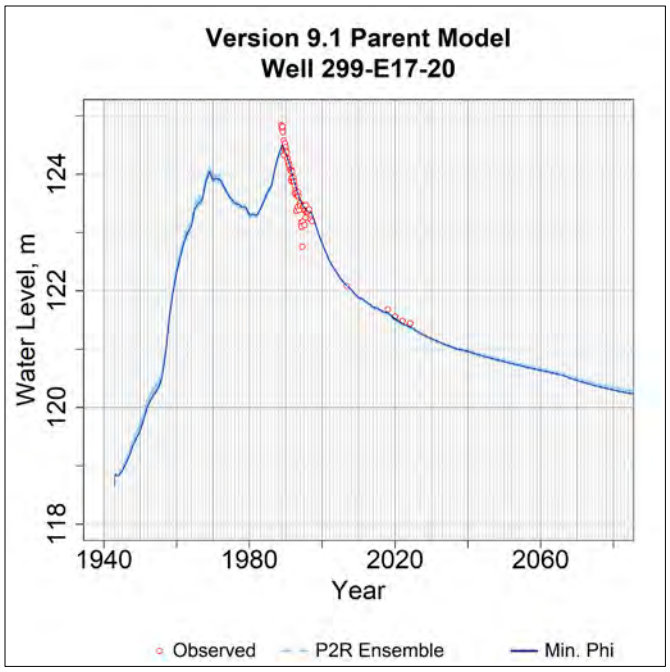

Figure B-9. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E17-20.

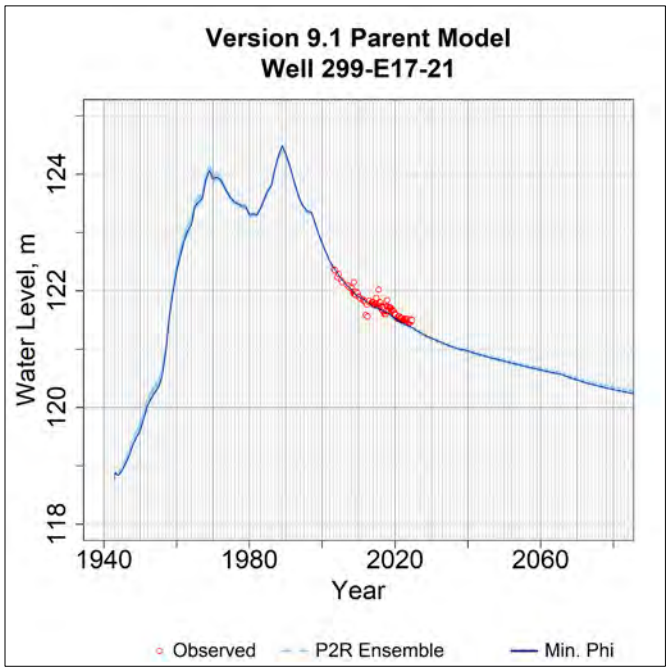

Figure B-10. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E17-21.

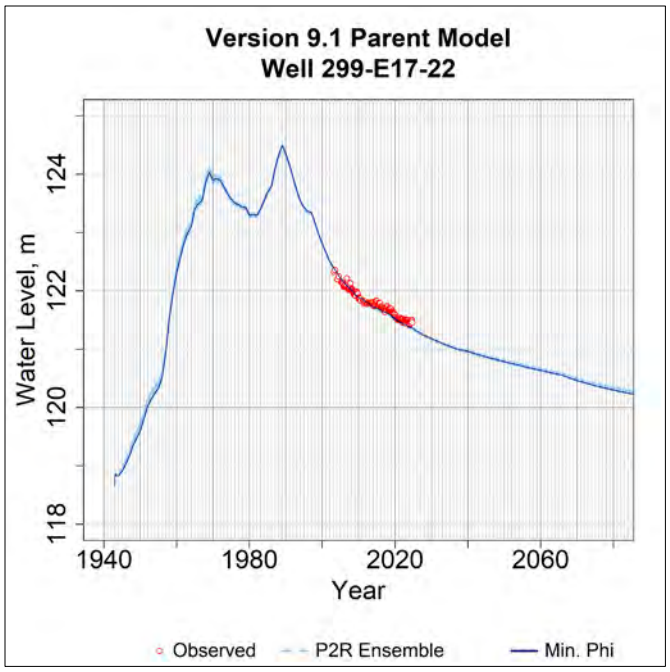

Figure B-11. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E17-22.

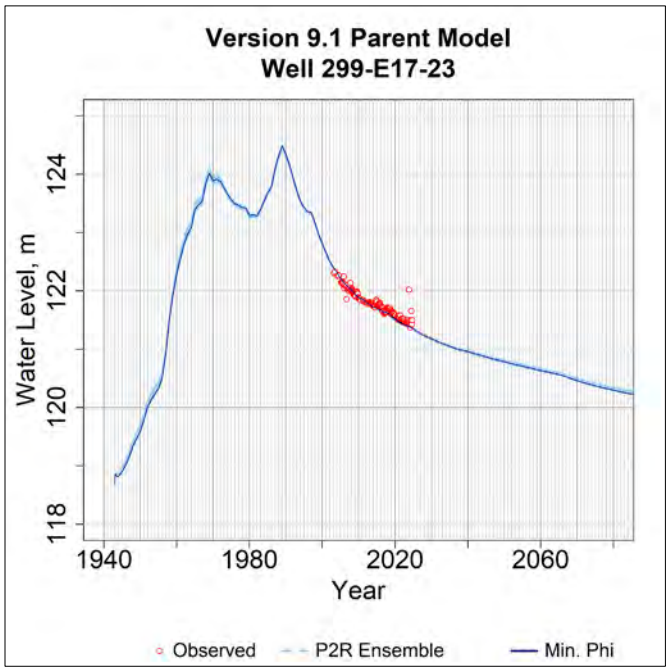

Figure B-12. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E17-23.

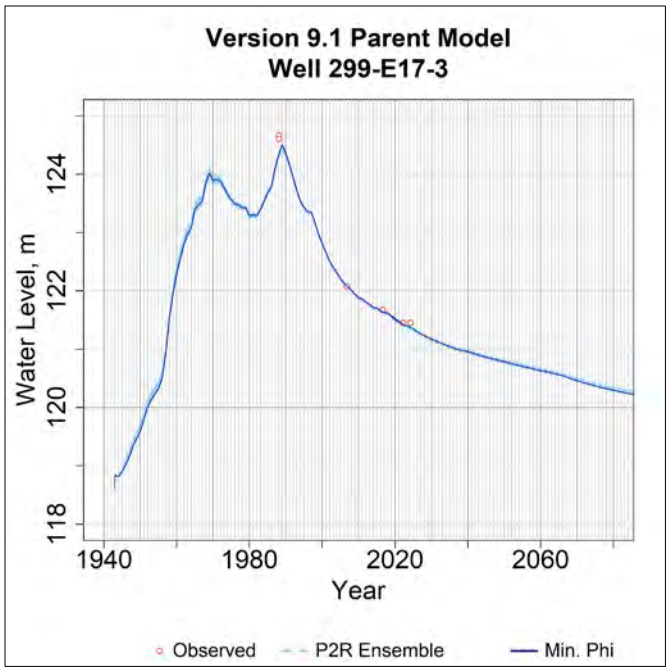

Figure B-13. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E17-3.

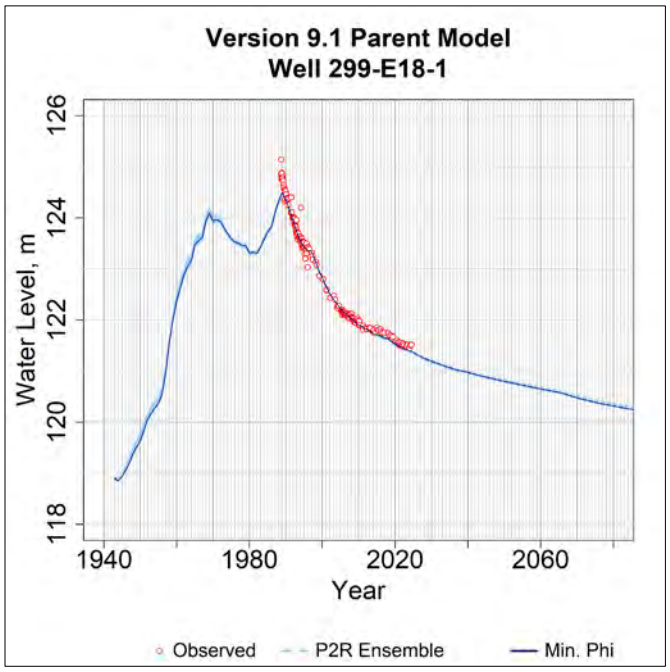

Figure B-14. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E18-1.

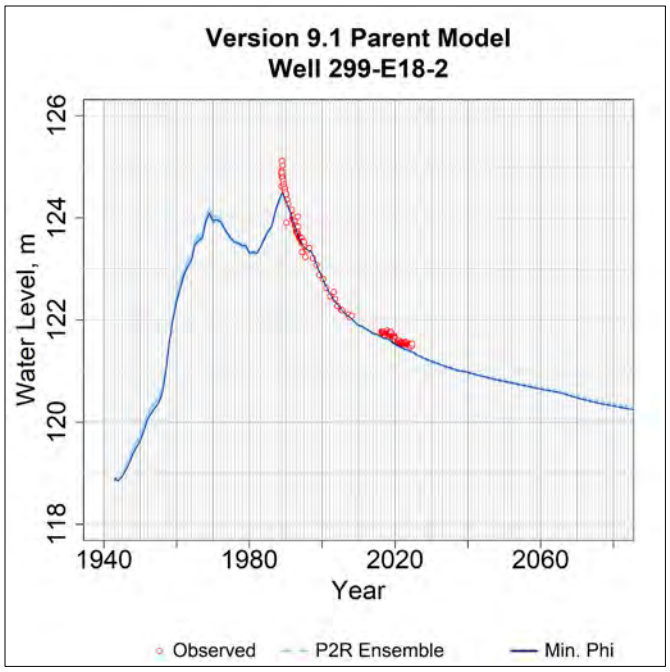

Figure B-15. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E18-2.

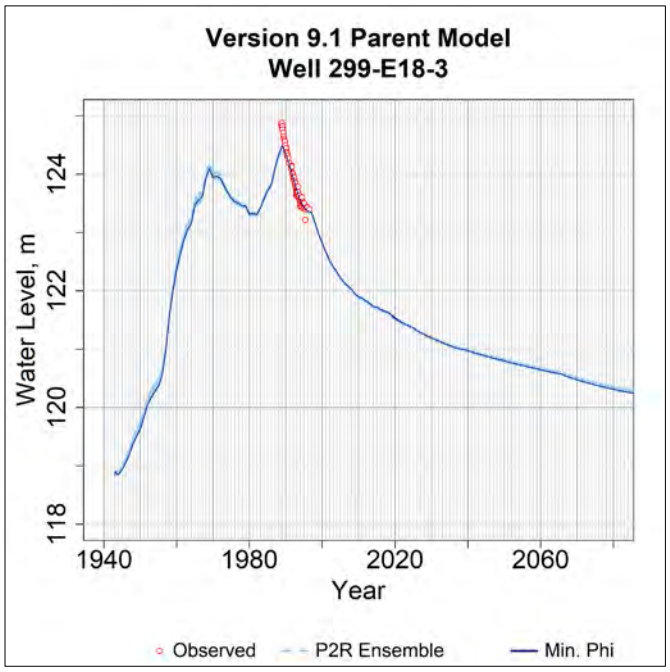

Figure B-16. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E18-3.

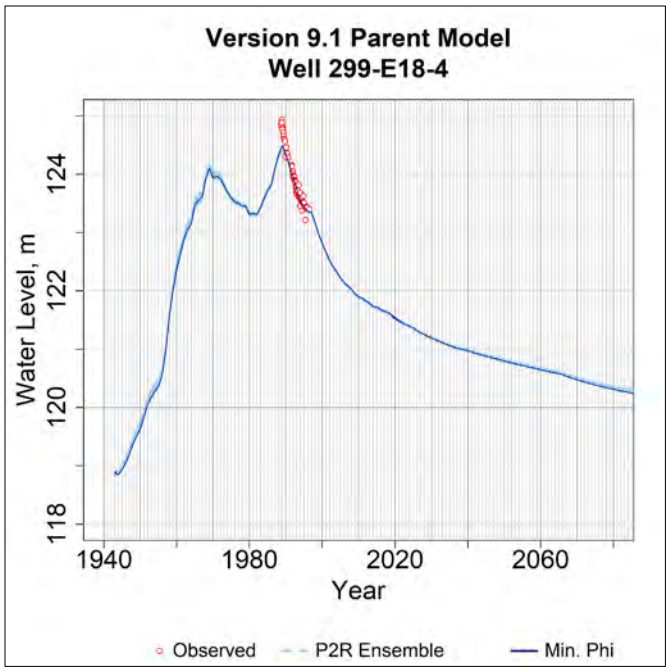

Figure B-17. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E18-4.

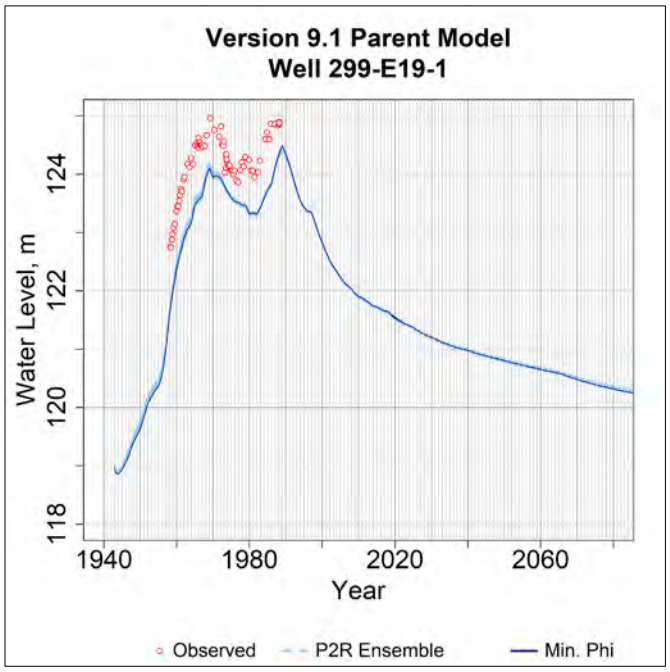

Figure B-18. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E19-1.

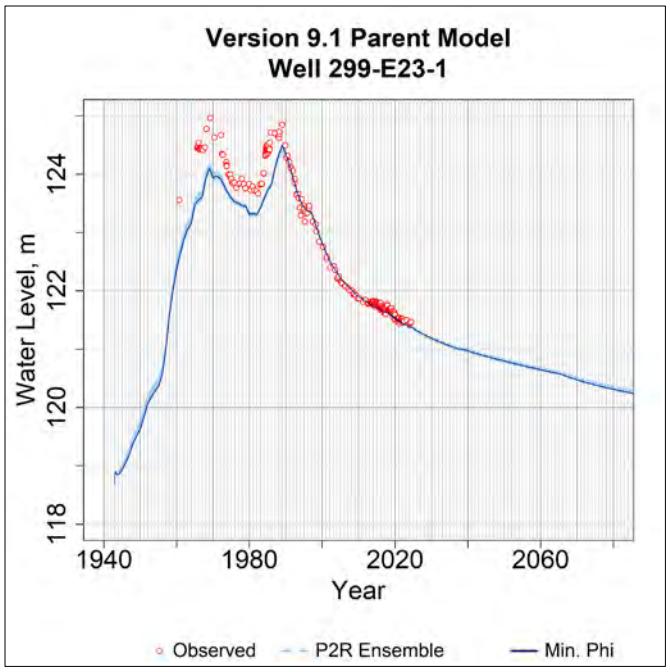

Figure B-19. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E23-1.

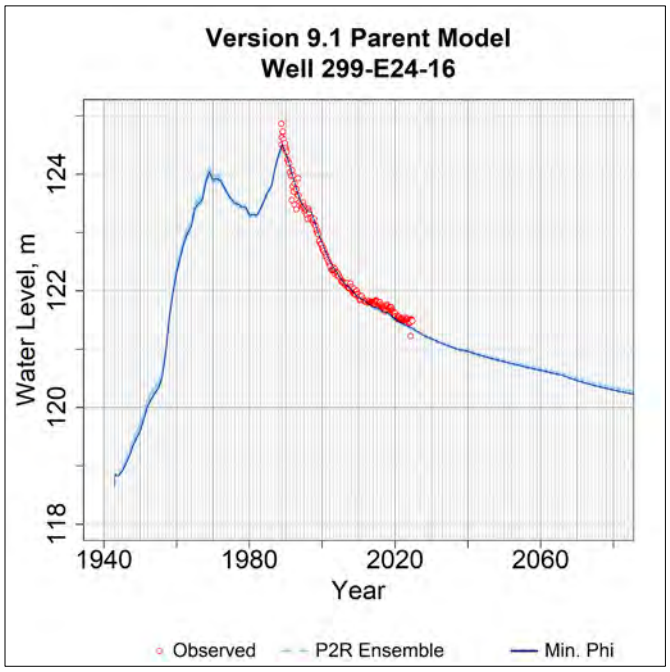

Figure B-20. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E24-16.

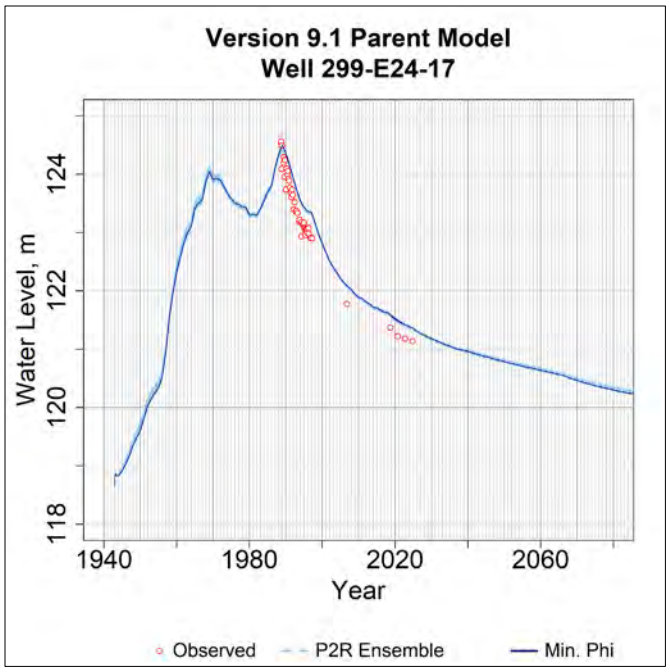

Figure B-21. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E24-17.

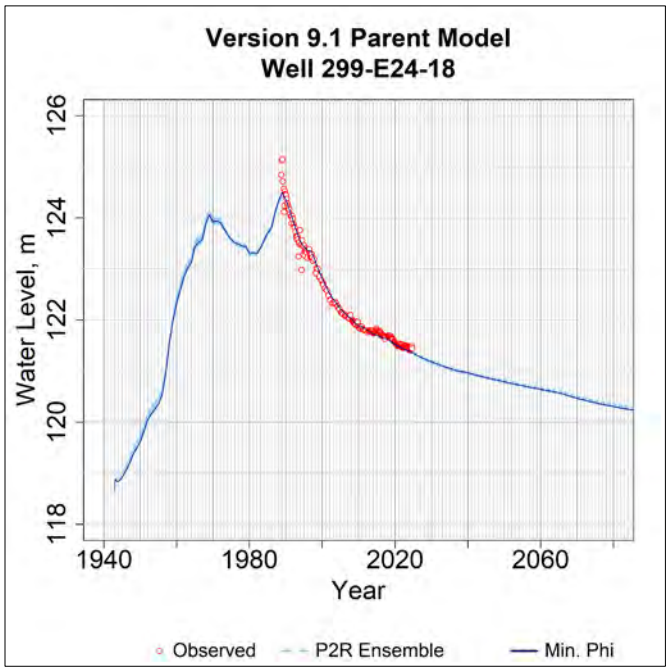

Figure B-22. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E24-18.

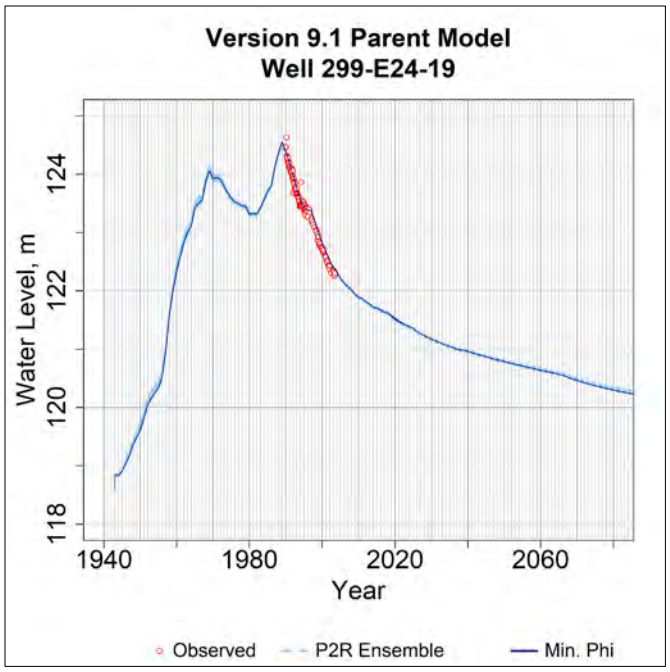

Figure B-23. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E24-19.

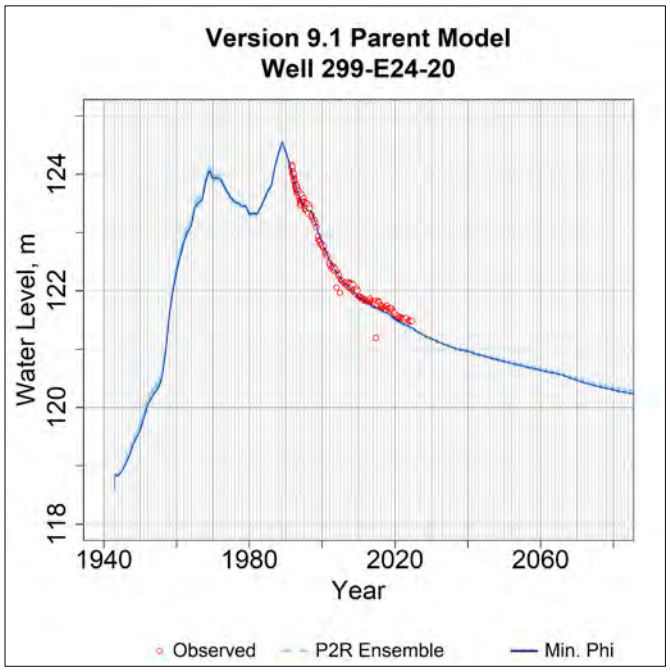

Figure B-24. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E24-20.

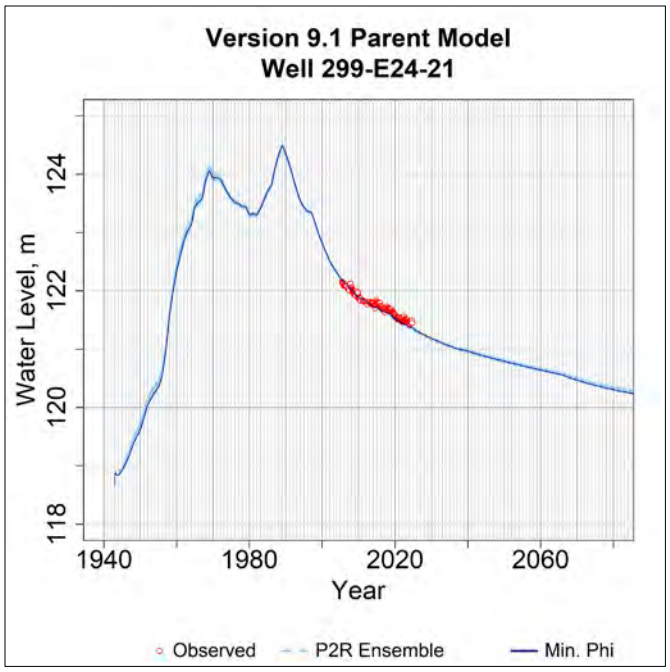

Figure B-25. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E24-21.

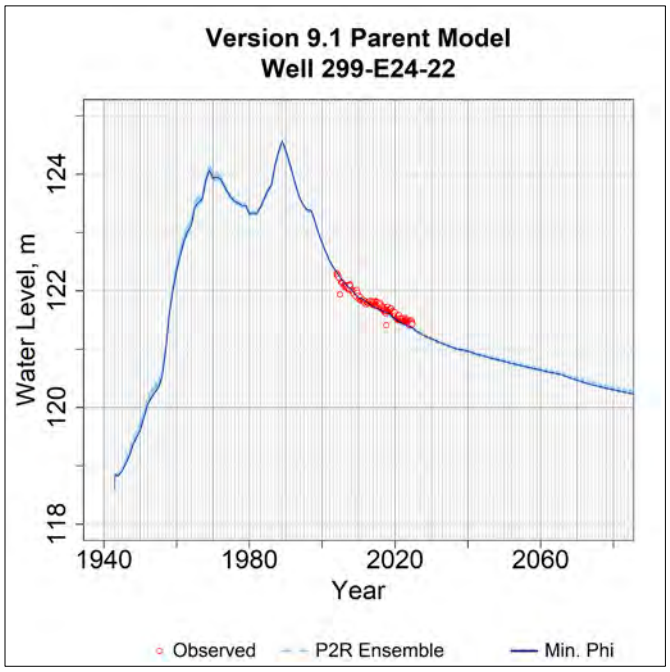

Figure B-26. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E24-22.

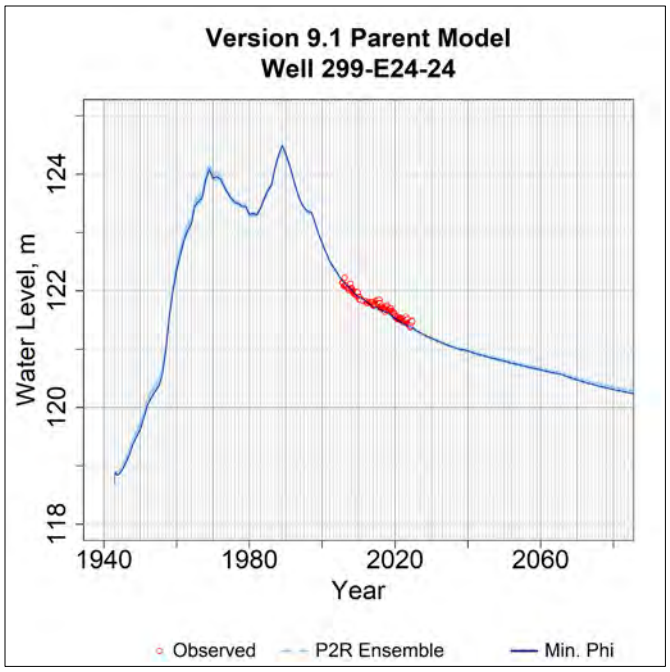

Figure B-27. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E24-24.

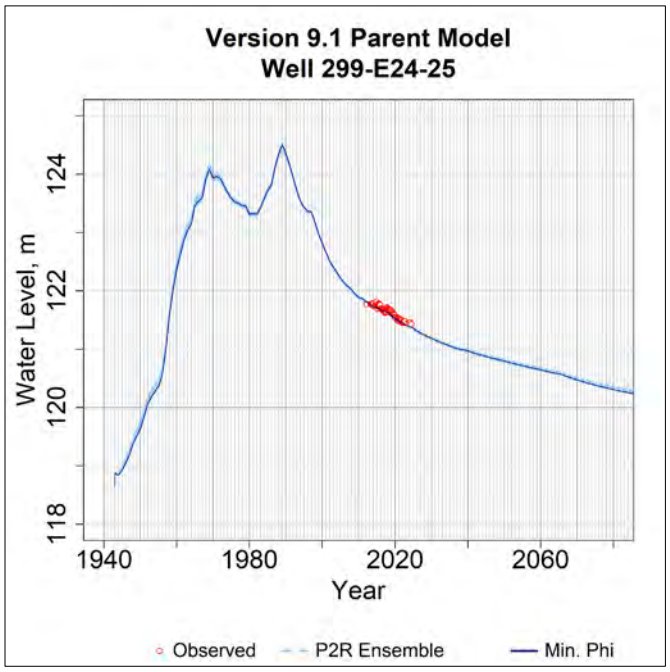

Figure B-28. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E24-25.

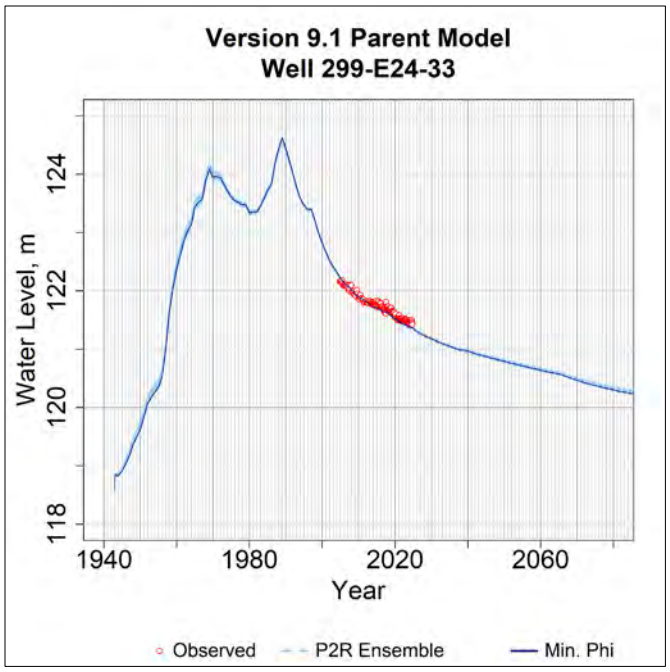

Figure B-29. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E24-33.

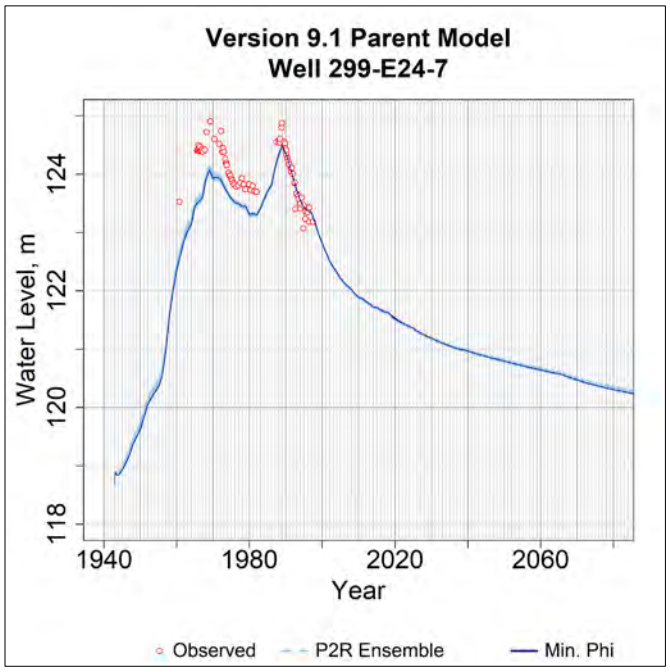

Figure B-30. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E24-7.

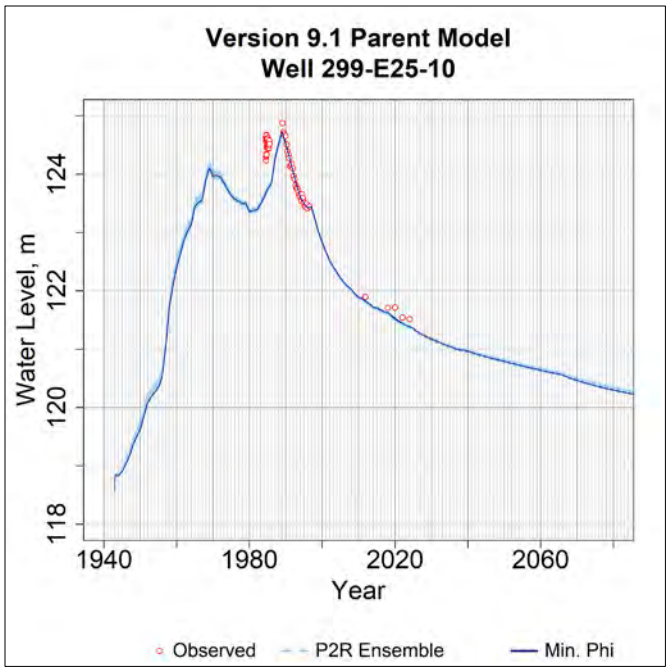

Figure B-31. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-10.

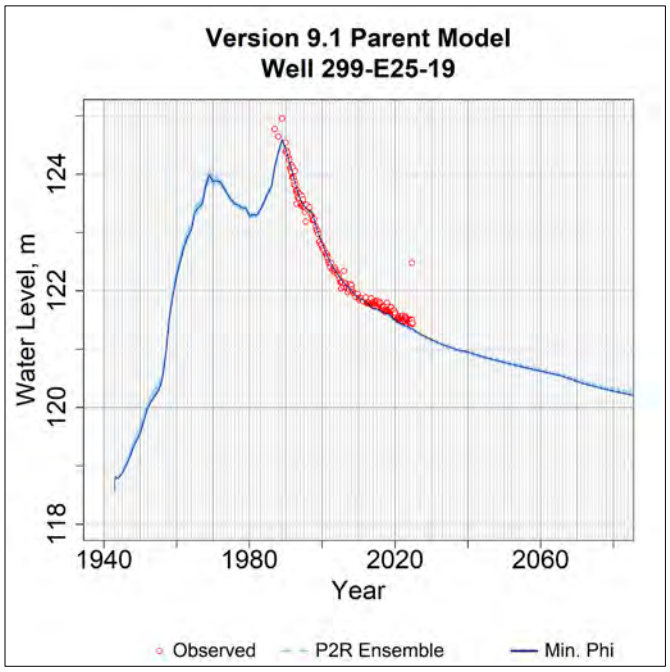

Figure B-32. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-19.

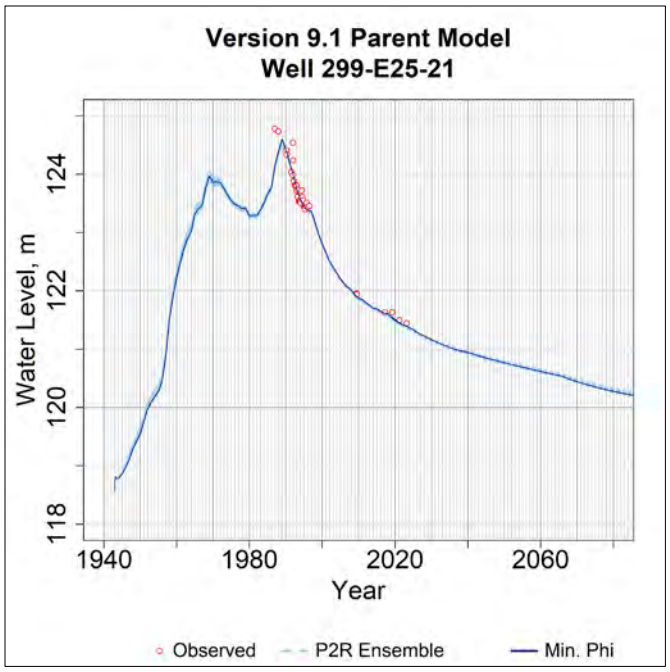

Figure B-33. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-21.

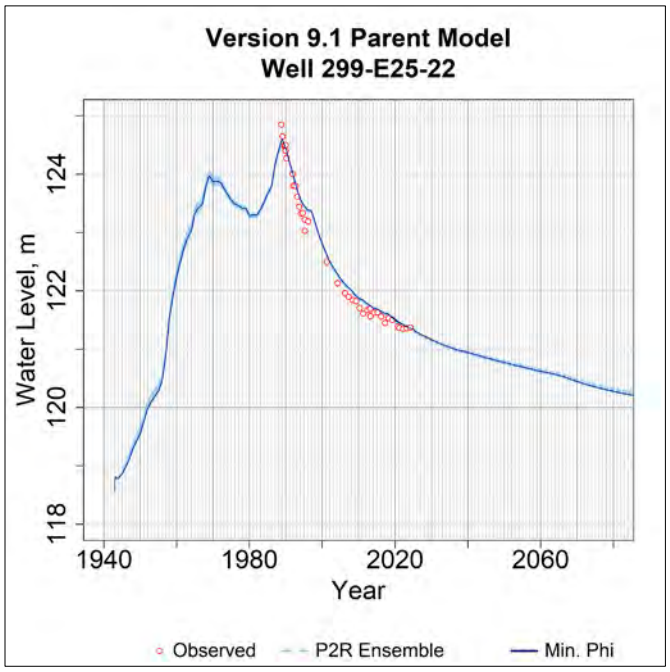

Figure B-34. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-22.

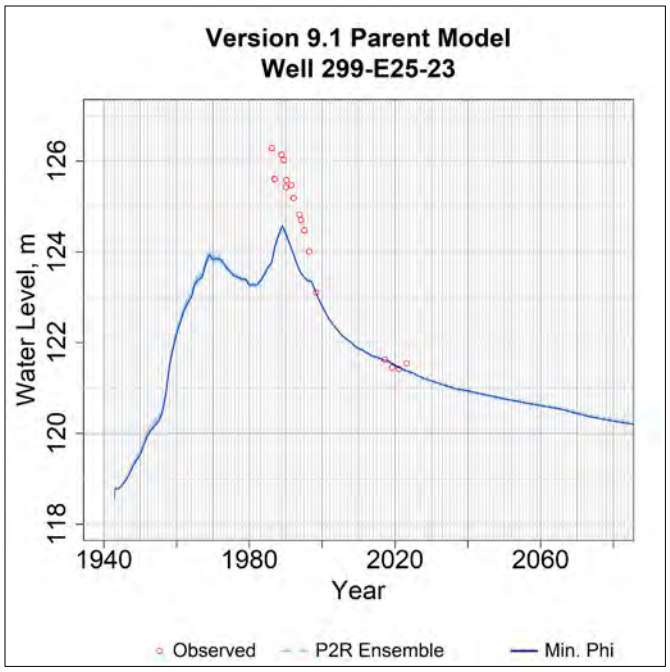

Figure B-35. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-23.

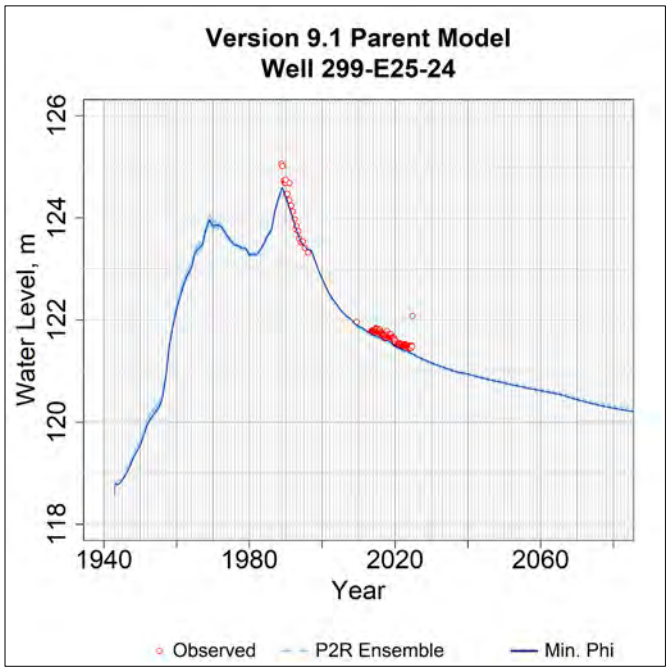

Figure B-36. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-24.

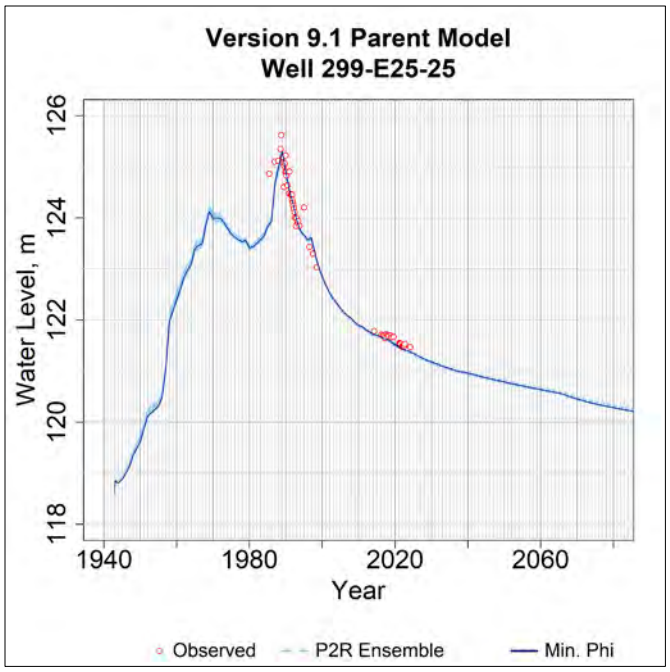

Figure B-37. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-25.

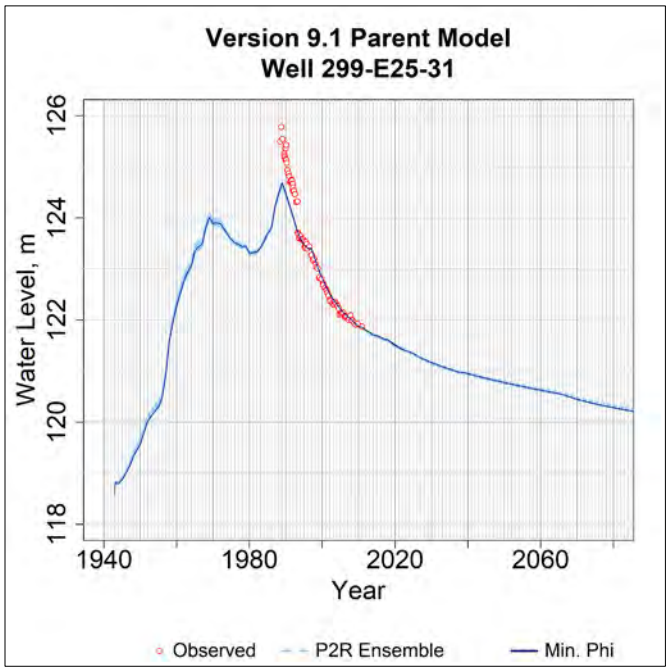

Figure B-38. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-31.

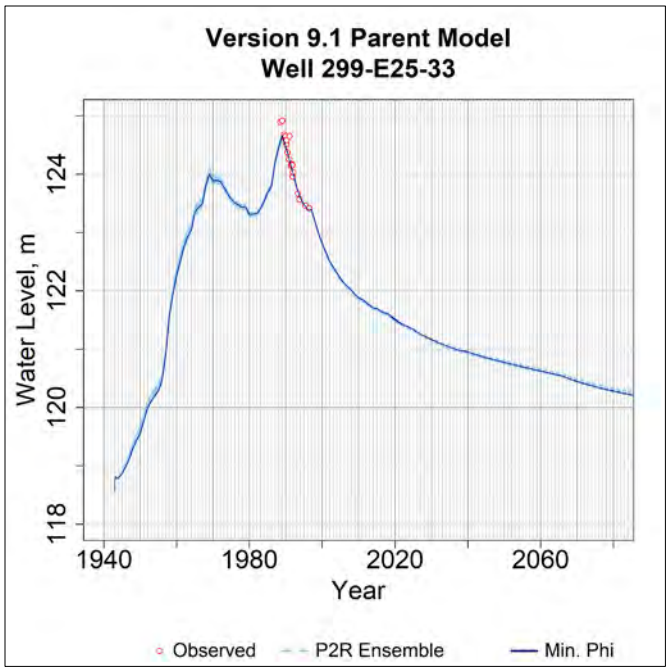

Figure B-39. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-33.

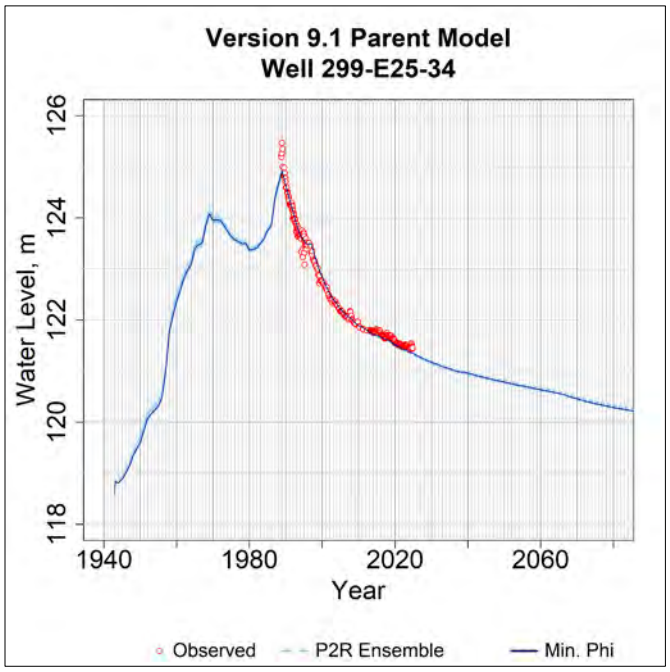

Figure B-40. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-34.

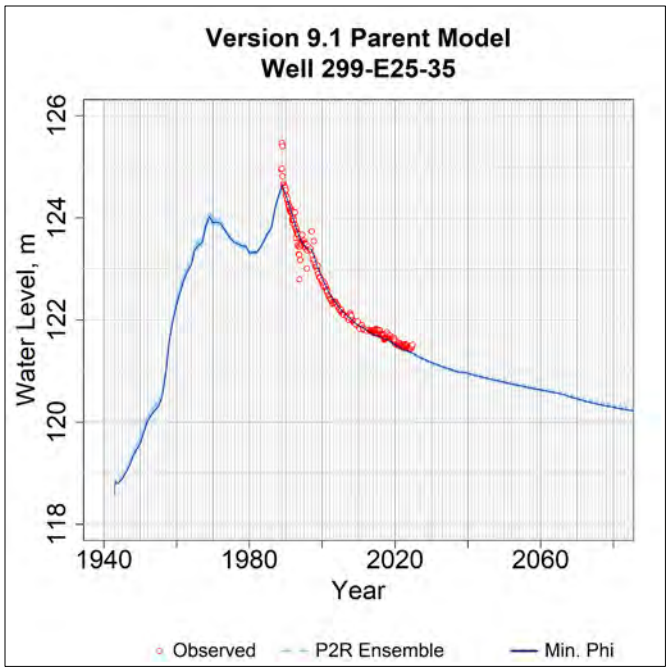

Figure B-41. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-35.

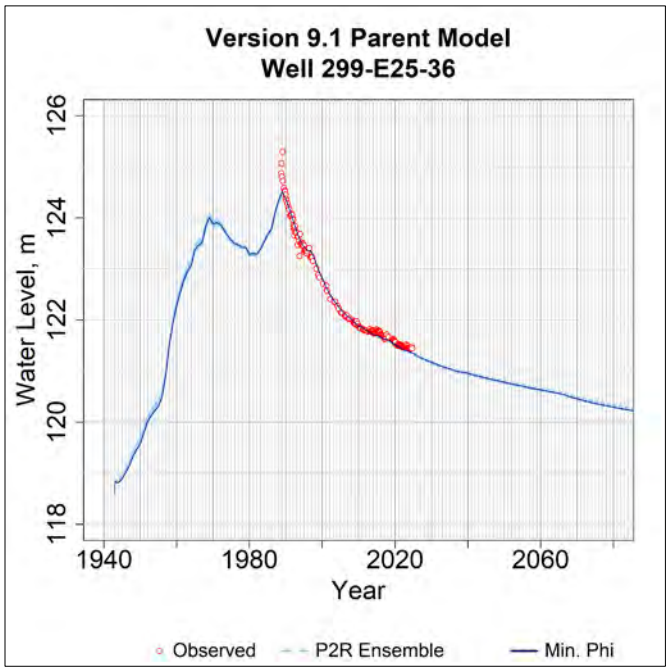

Figure B-42. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-36.

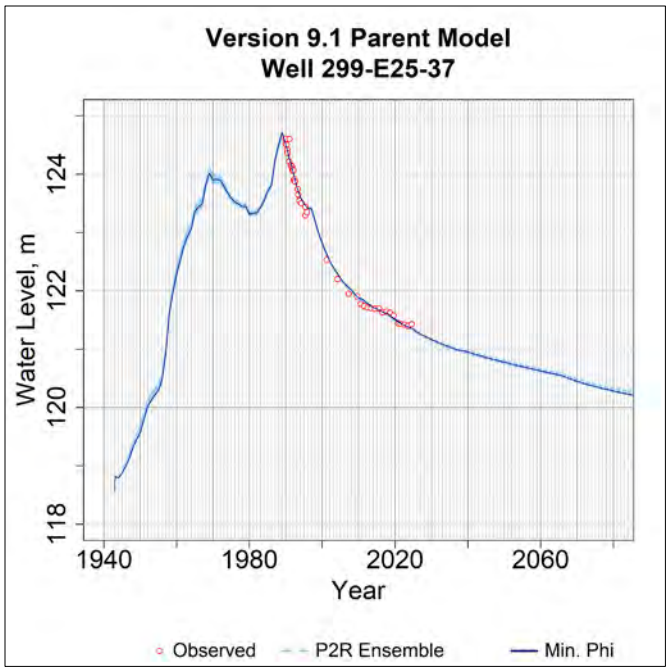

Figure B-43. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-37.

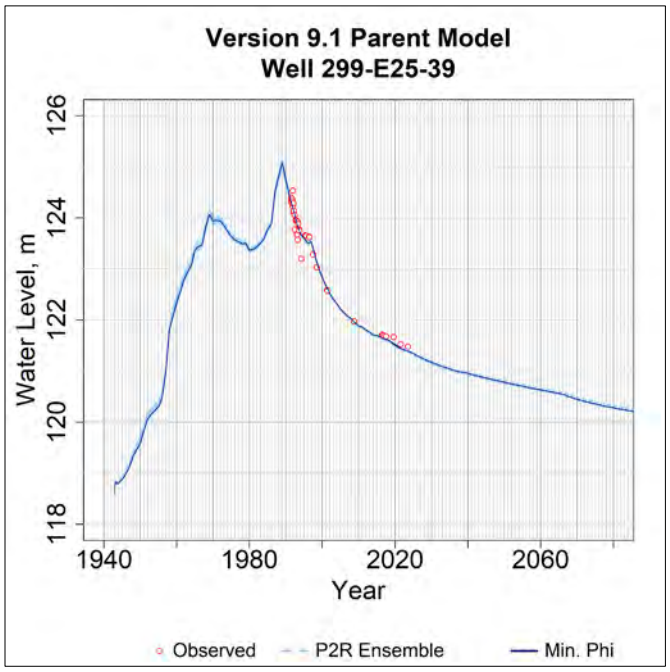

Figure B-44. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-39.

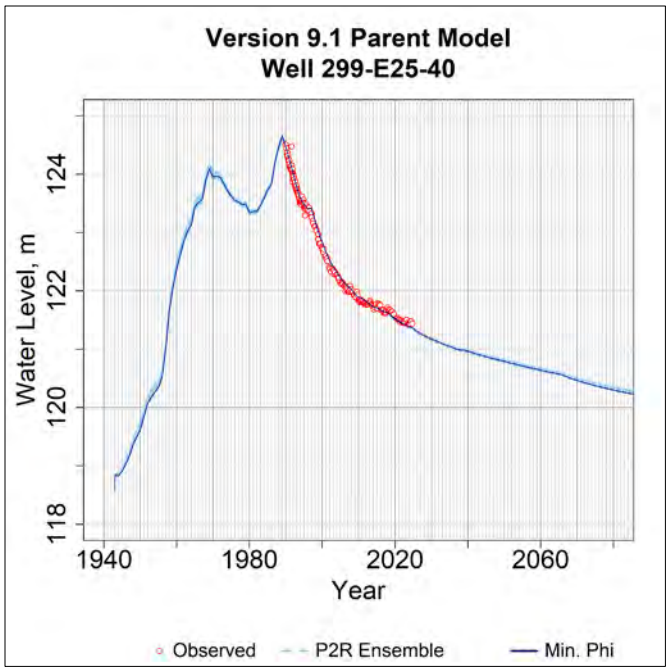

Figure B-45. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-40.

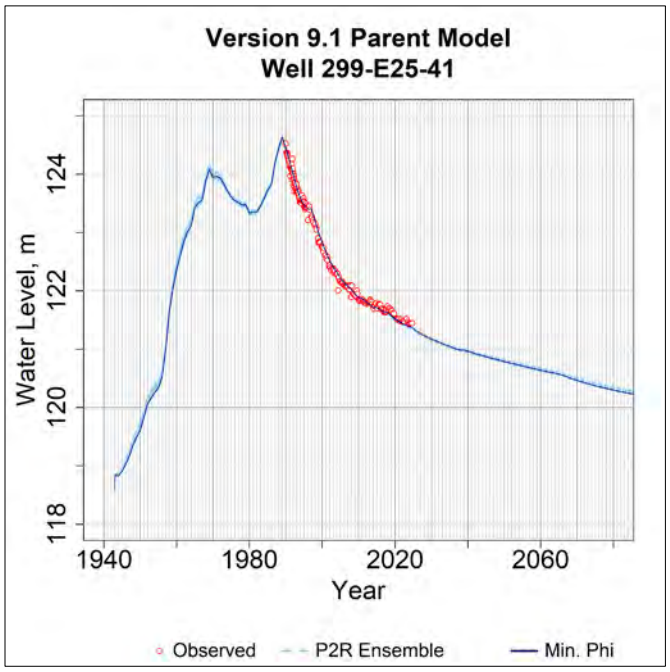

Figure B-46. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-41.

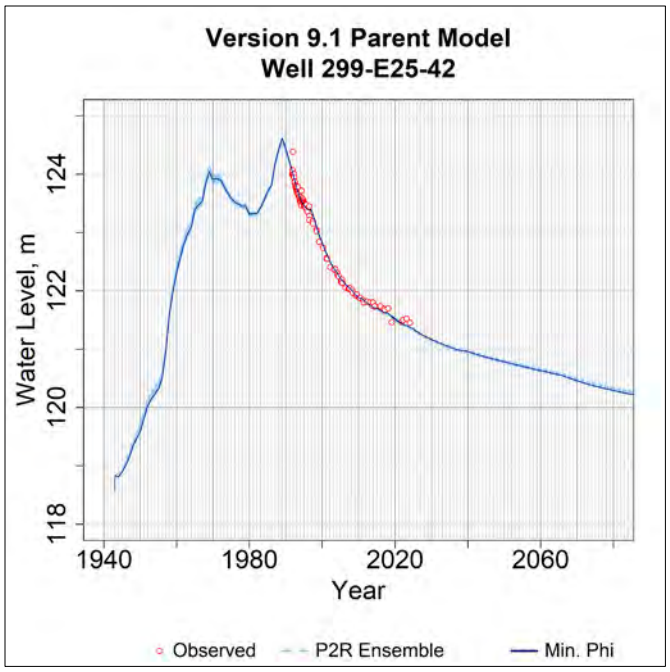

Figure B-47. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-42.

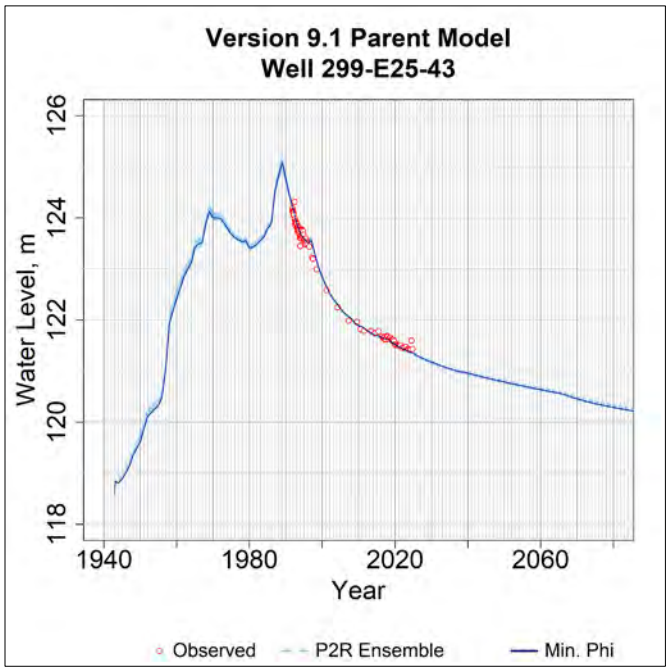

Figure B-48. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-43.

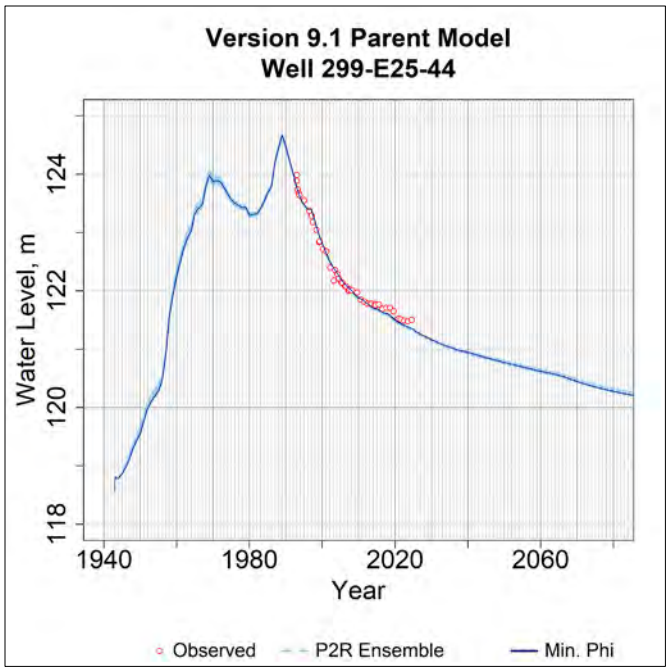

Figure B-49. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-44.

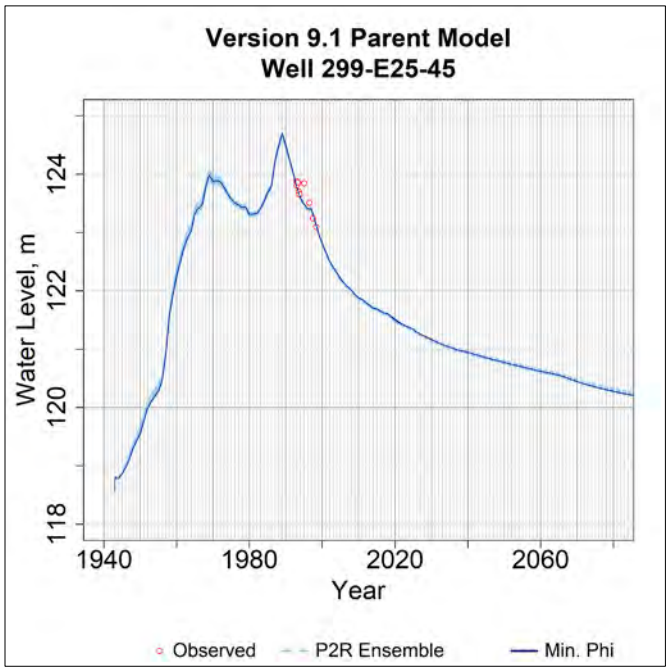

Figure B-50. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-45.

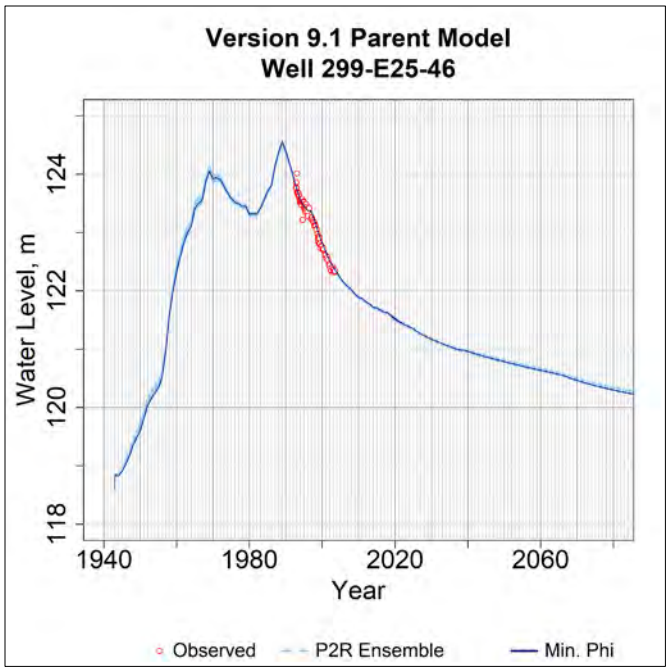

Figure B-51. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-46.

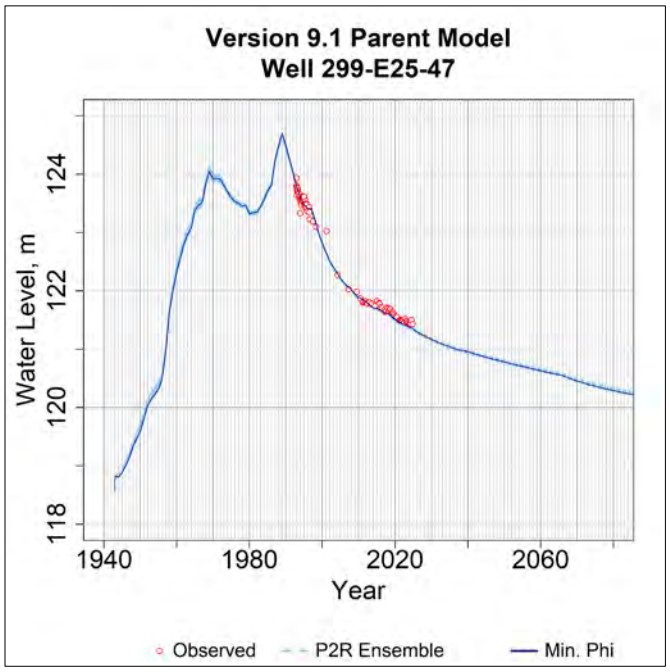

Figure B-52. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-47.

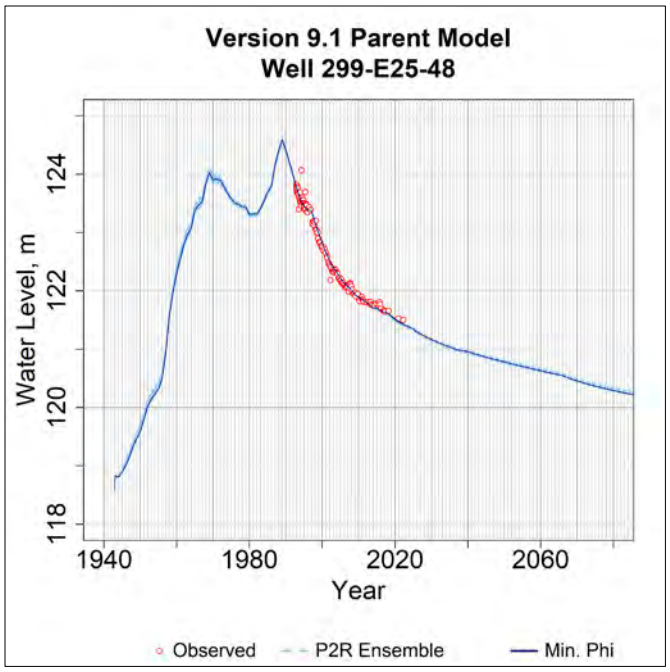

Figure B-53. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-48.

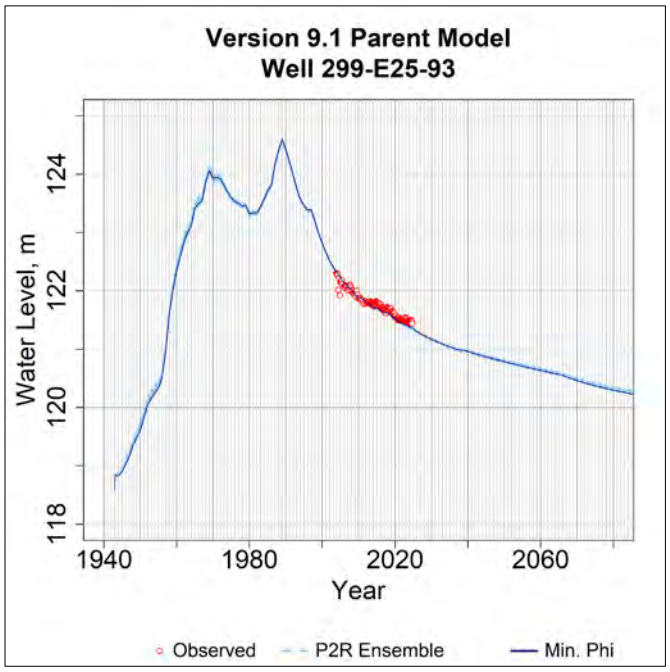

Figure B-54. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E25-93.

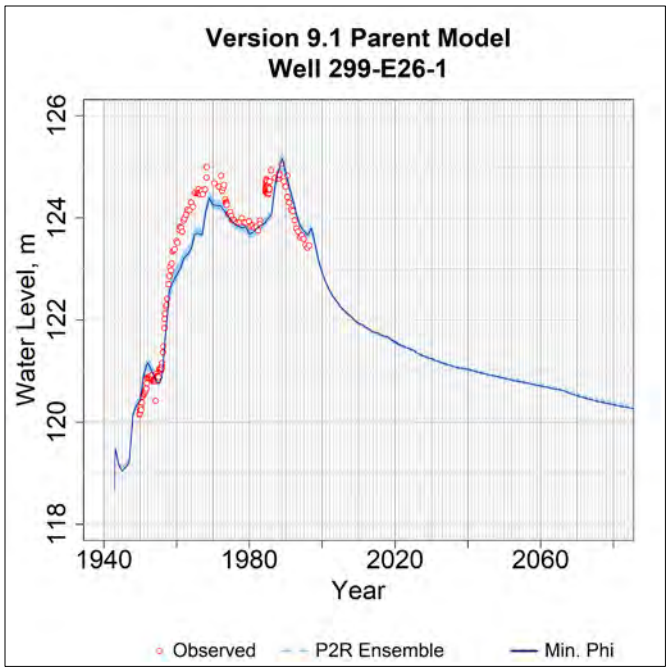

Figure B-55. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E26-1.

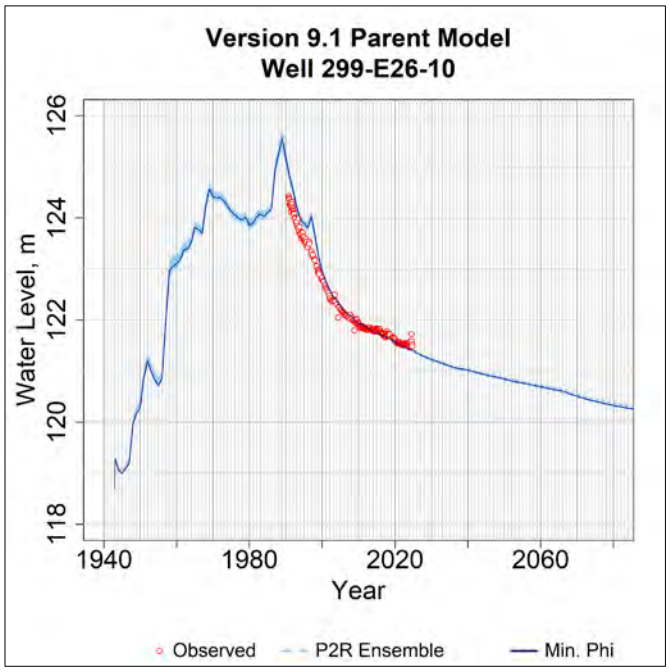

Figure B-56. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E26-10.

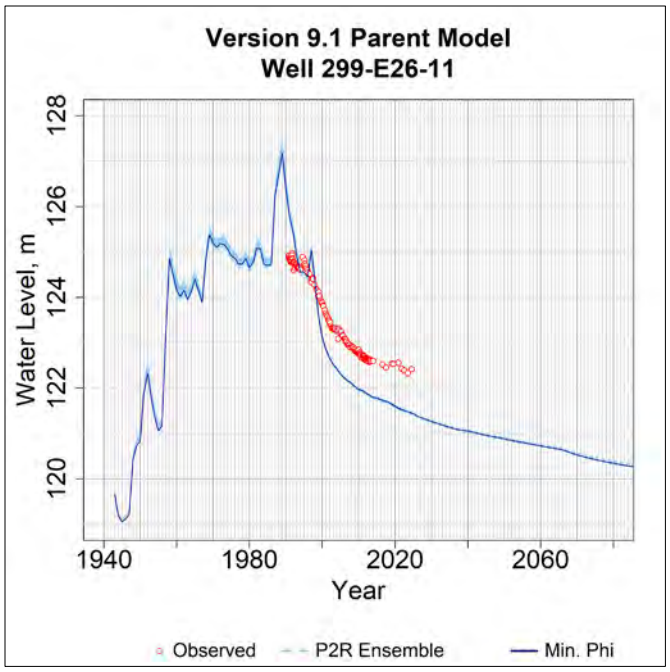

Figure B-57. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E26-11.

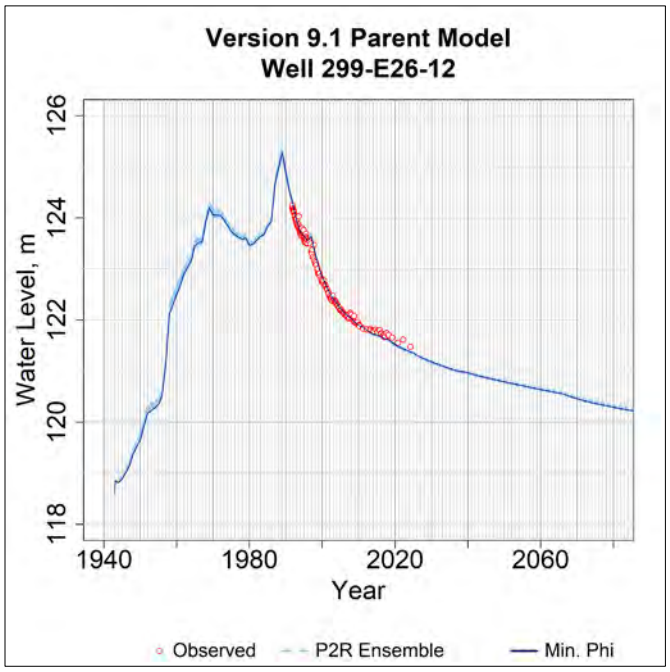

Figure B-58. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E26-12.

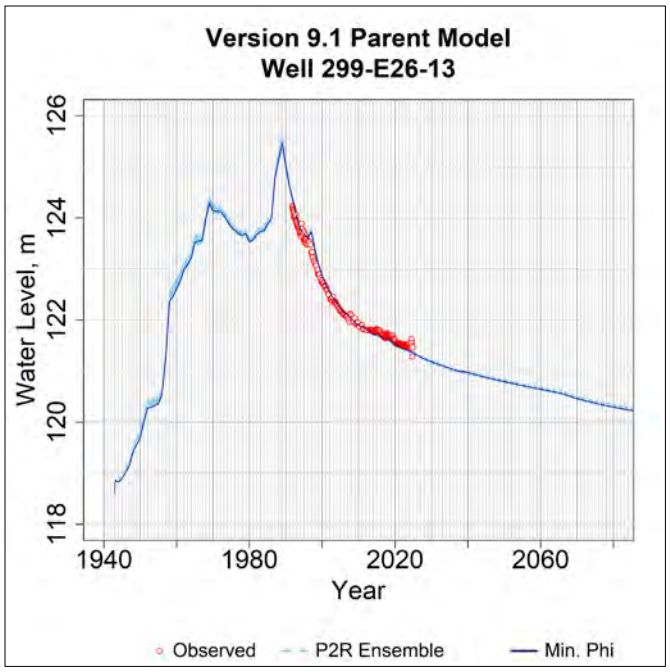

Figure B-59. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E26-13.

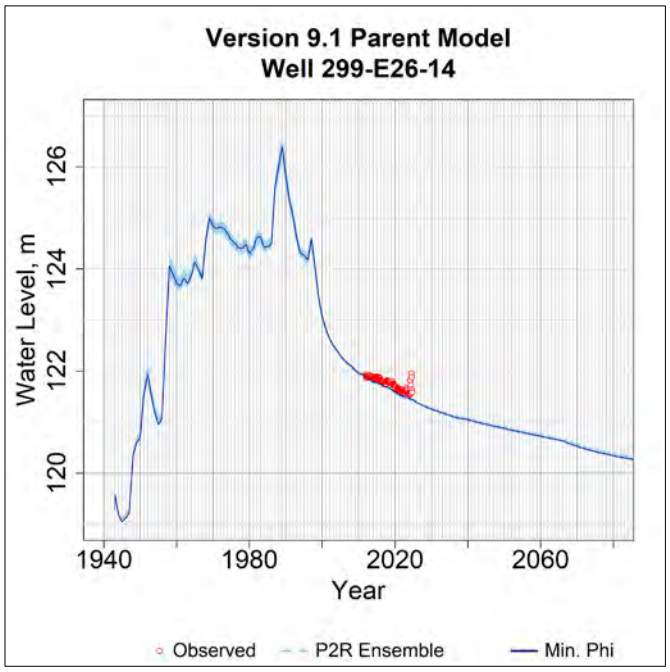

Figure B-60. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E26-14.

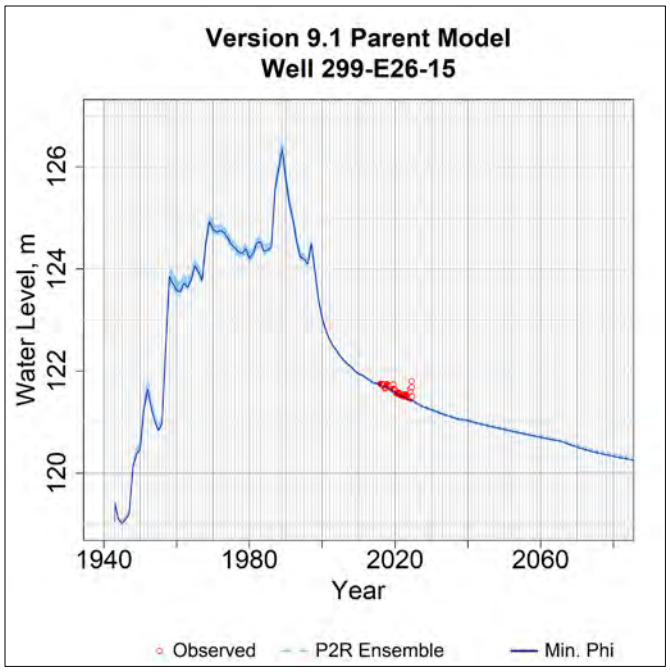

Figure B-61. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E26-15.

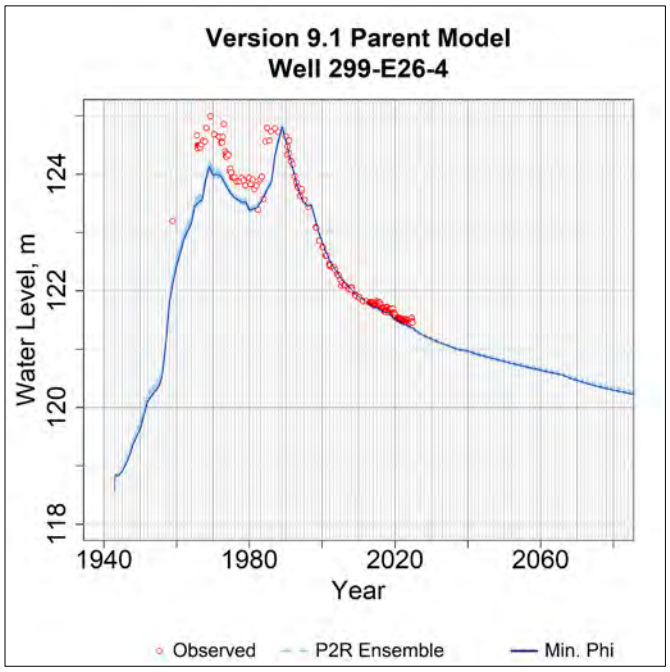

Figure B-62. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E26-4.

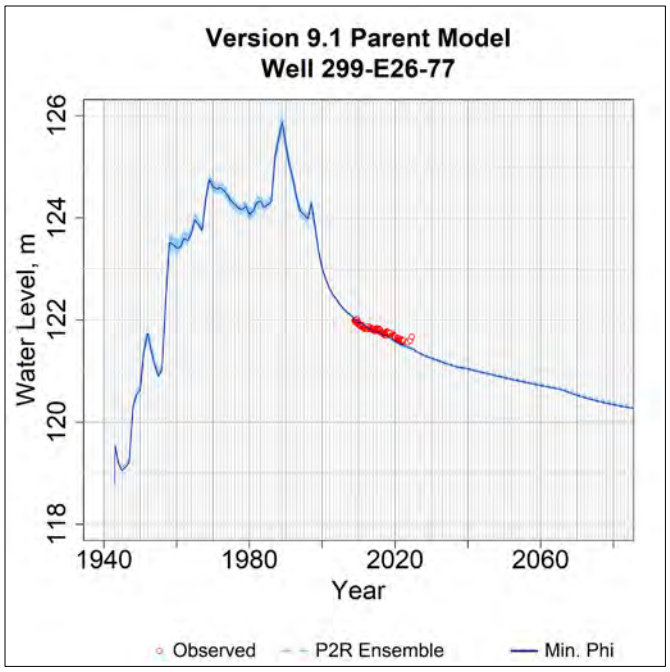

Figure B-63. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E26-77.

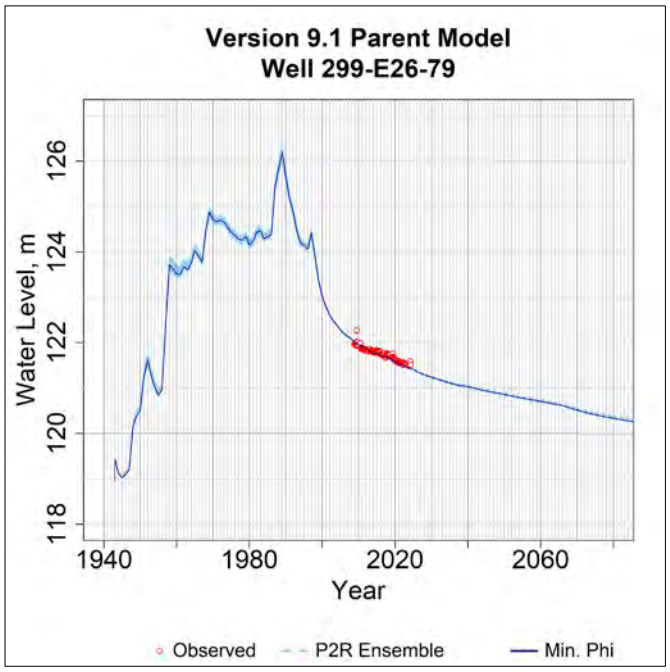

Figure B-64. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E26-79.

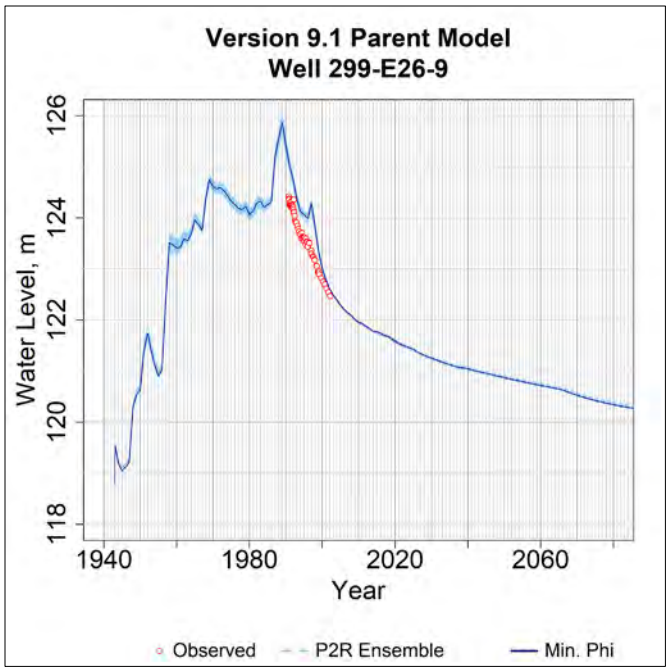

Figure B-65. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E26-9.

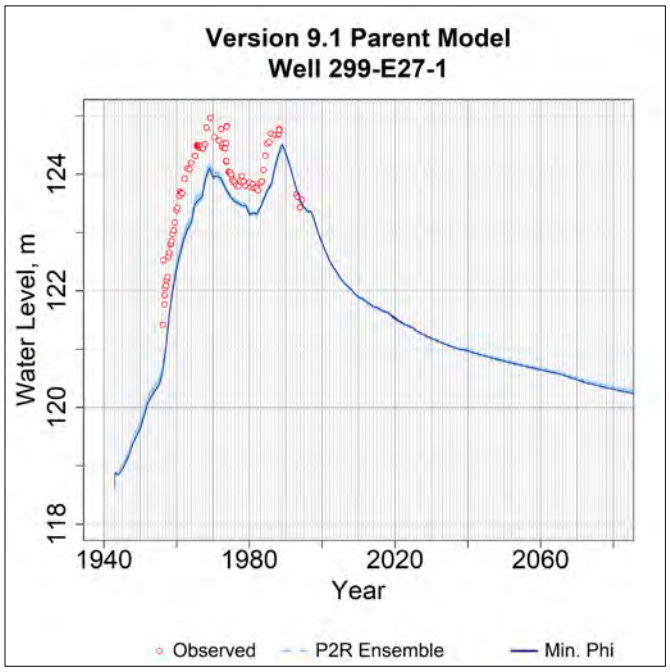

Figure B-66. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-1.

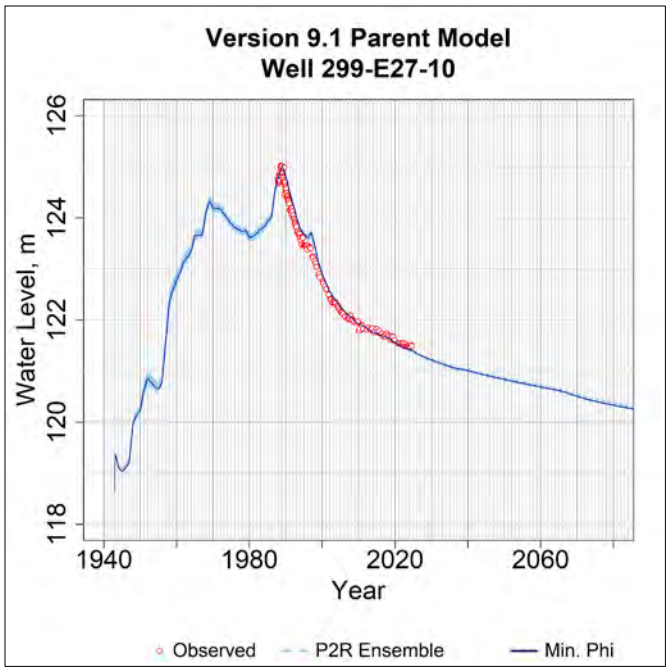

Figure B-67. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-10.

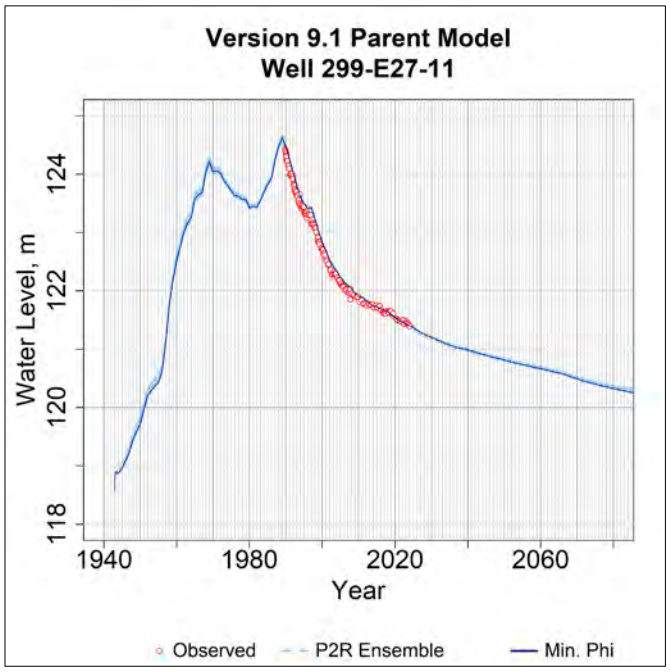

Figure B-68. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-11.

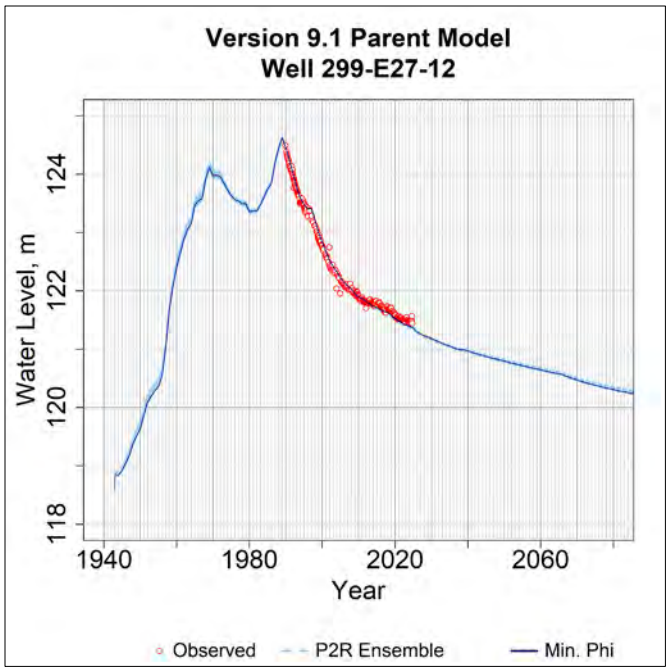

Figure B-69. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-12.

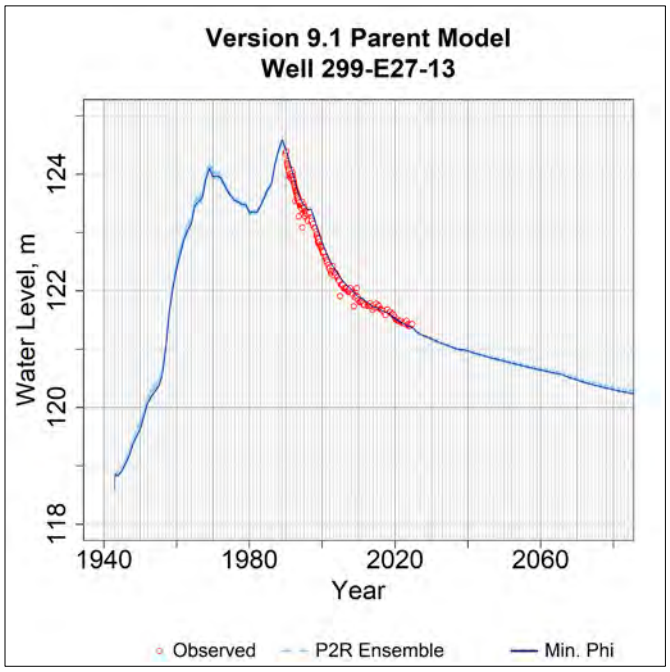

Figure B-70. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-13.

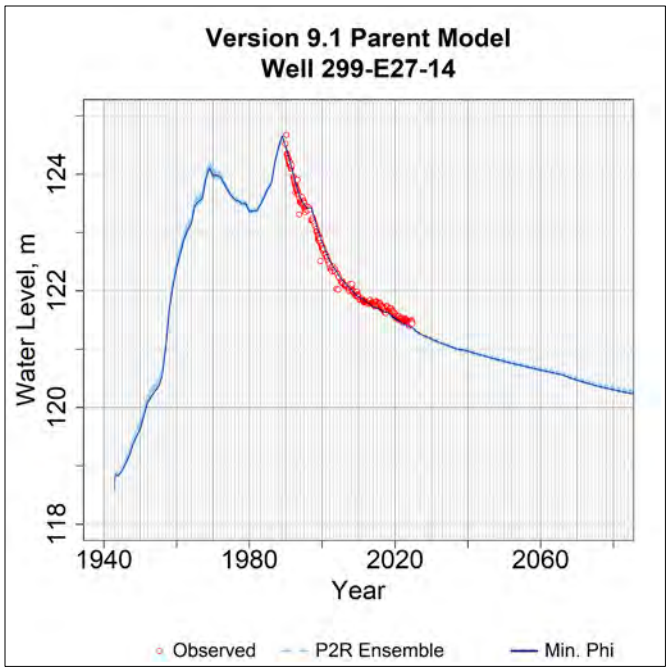

Figure B-71. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-14.

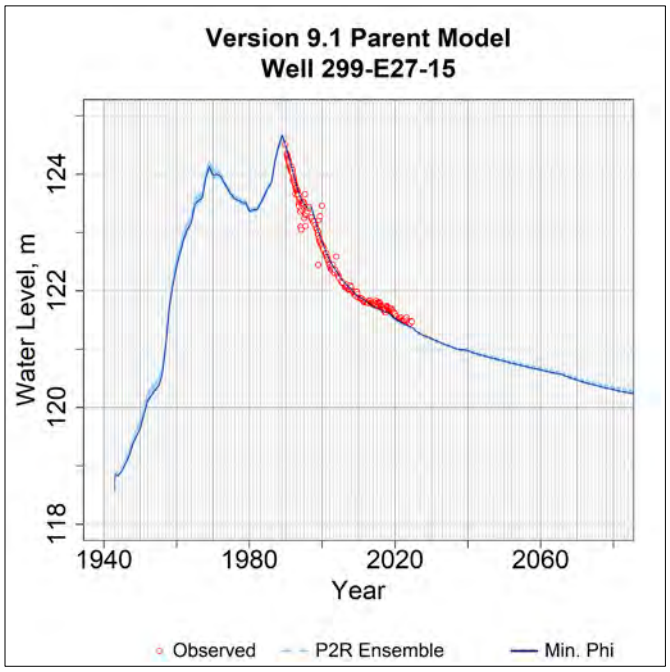

Figure B-72. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-15.

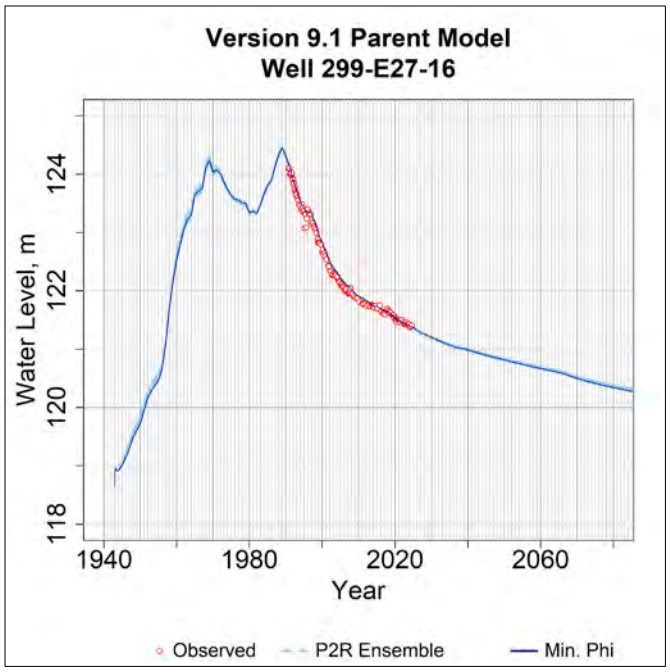

Figure B-73. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-16.

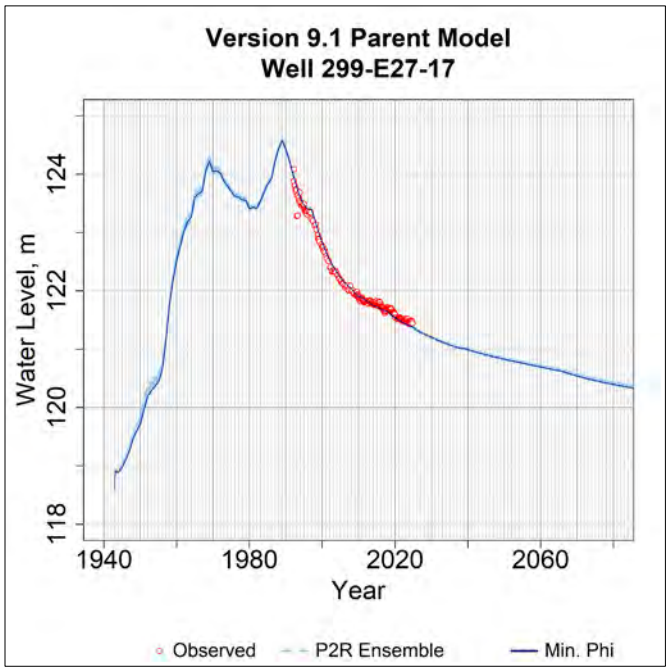

Figure B-74. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-17.

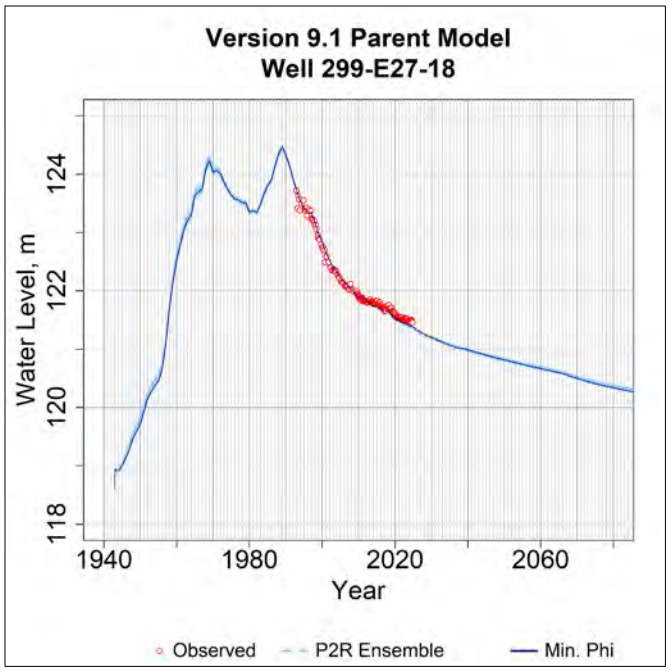

Figure B-75. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-18.

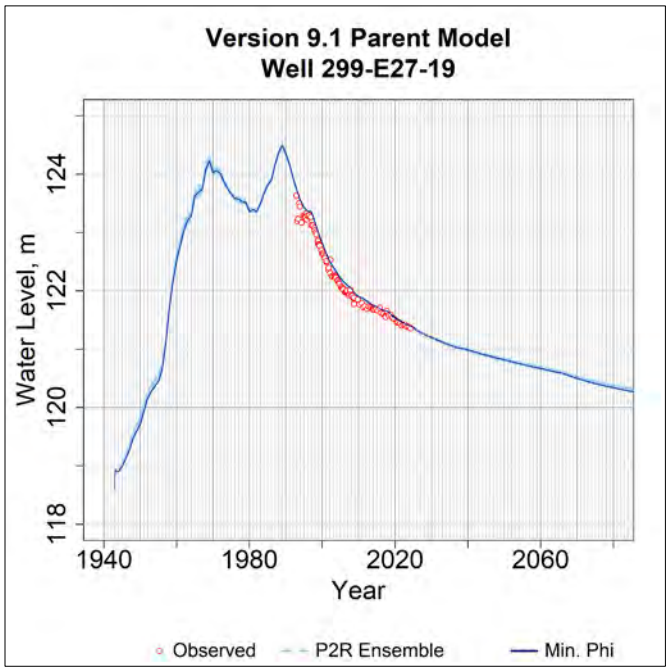

Figure B-76. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-19.

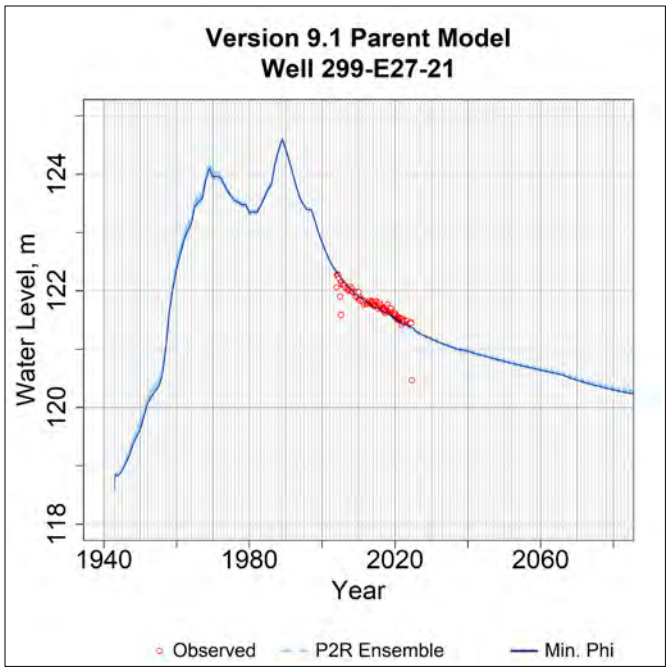

Figure B-77. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-21.

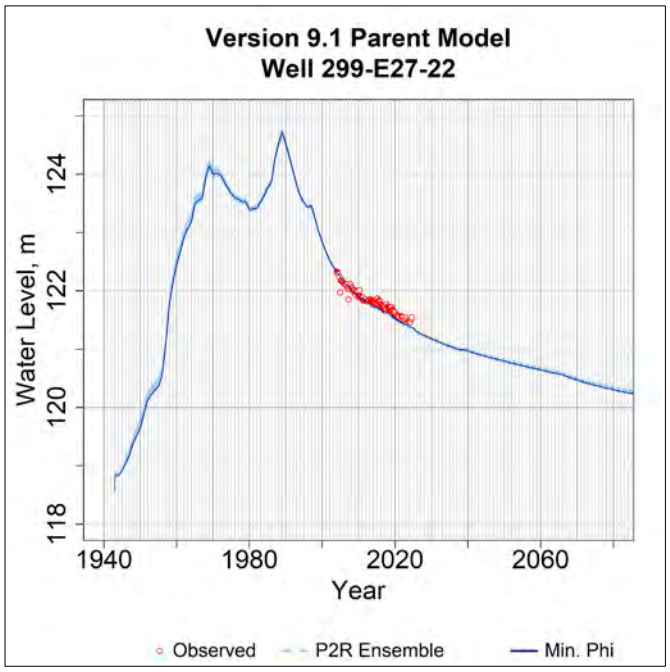

Figure B-78. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-22.

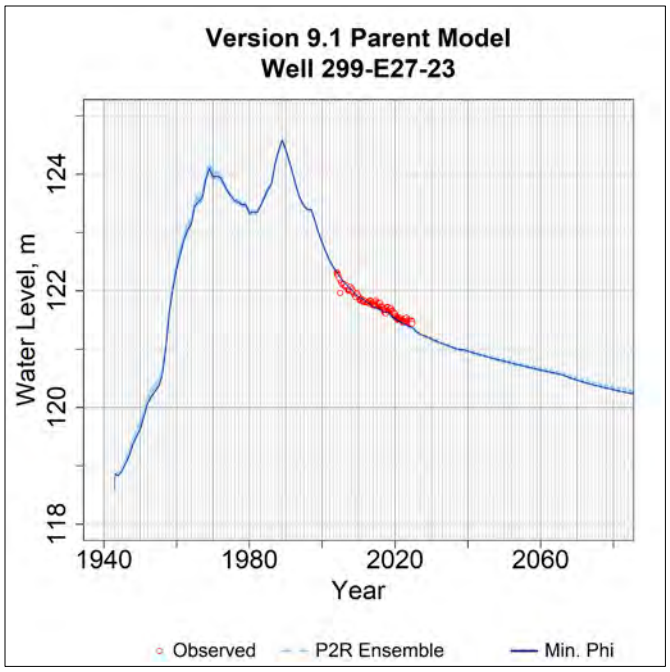

Figure B-79. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-23.

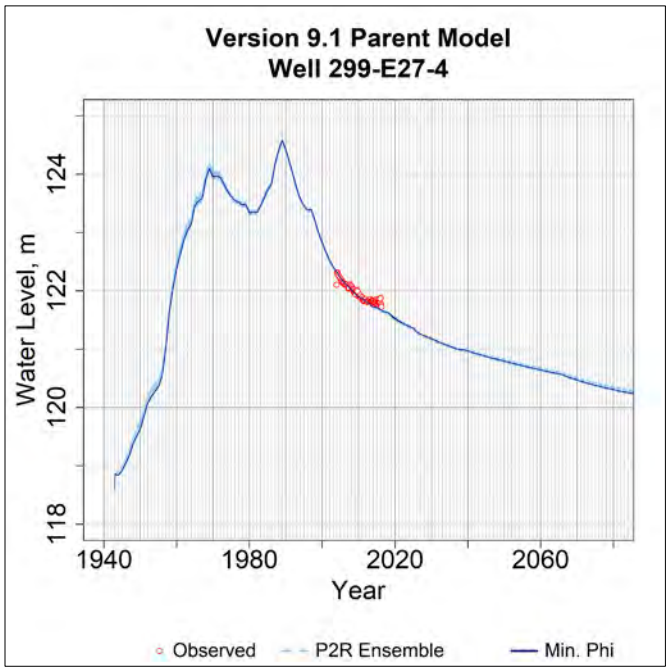

Figure B-80. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-4.

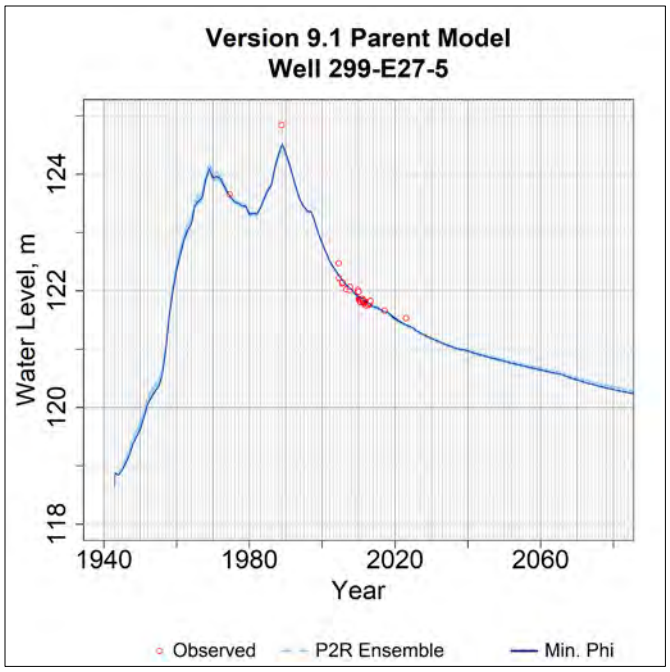

Figure B-81. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-5.

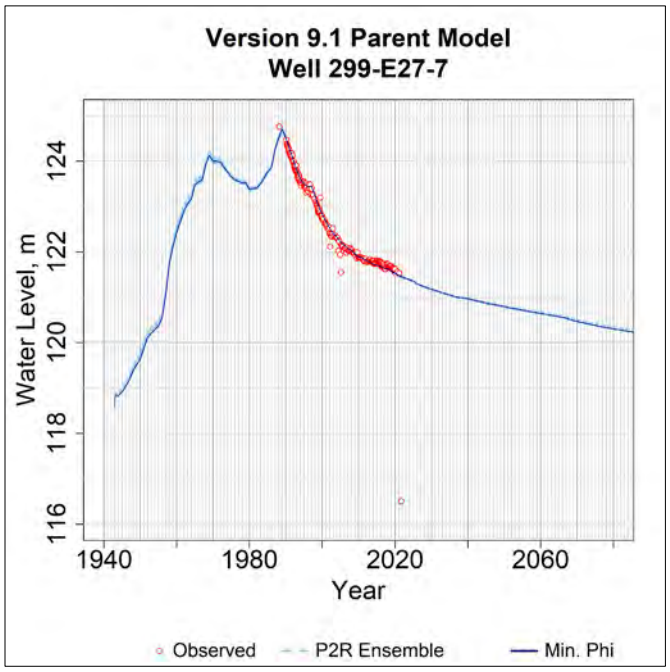

Figure B-82. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-7.

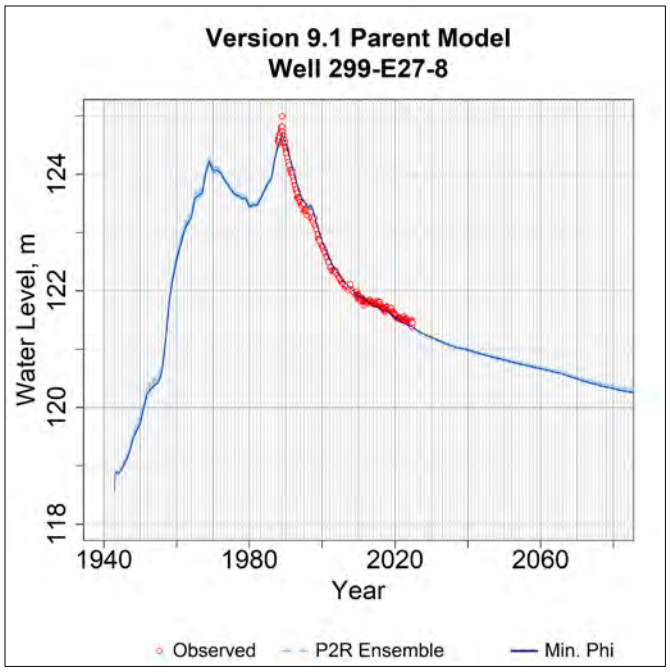

Figure B-83. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-8.

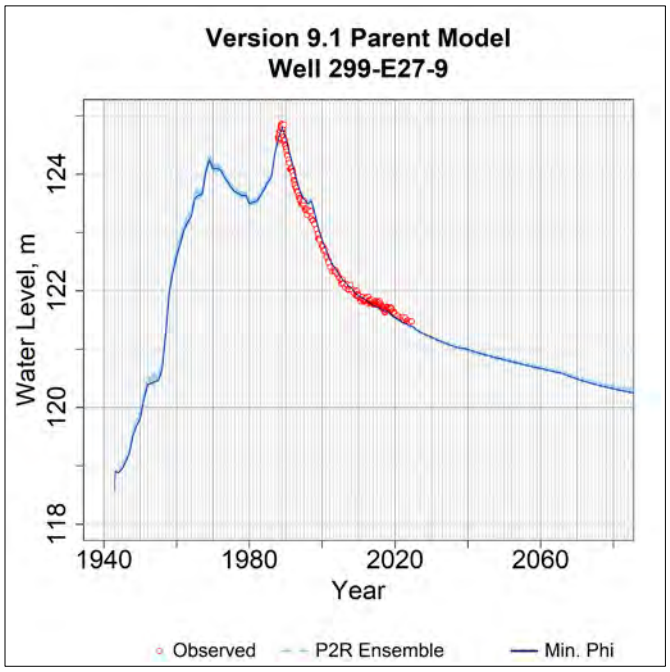

Figure B-84. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E27-9.

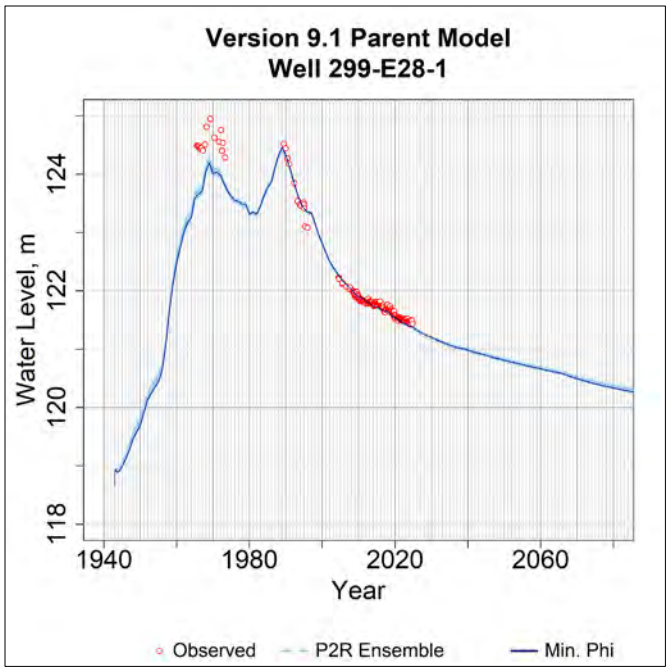

Figure B-85. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E28-1.

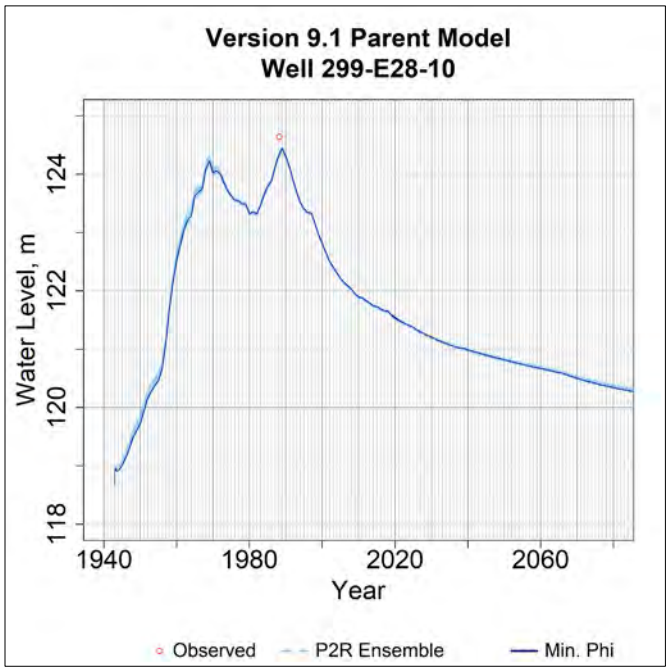

Figure B-86. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E28-10.

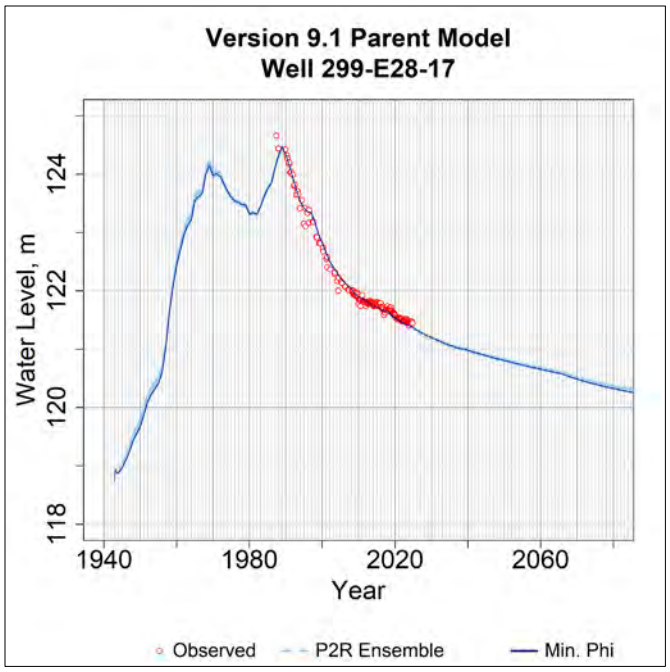

Figure B-87. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E28-17.

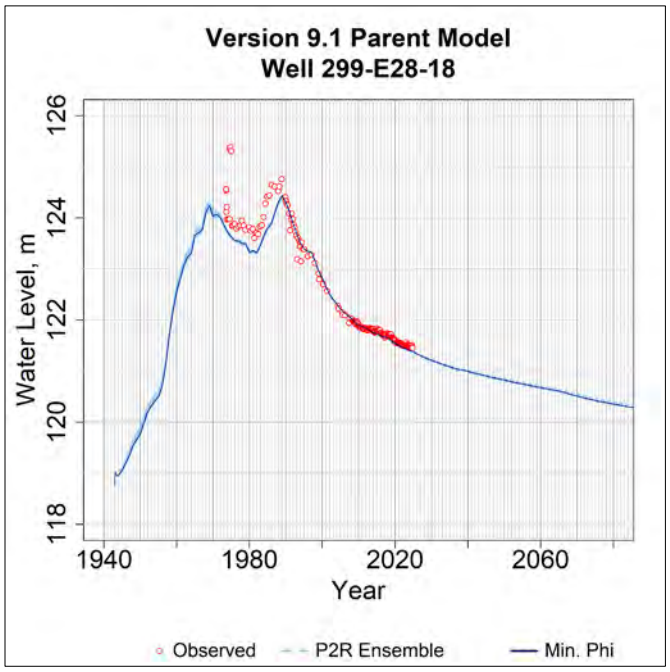

Figure B-88. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E28-18.

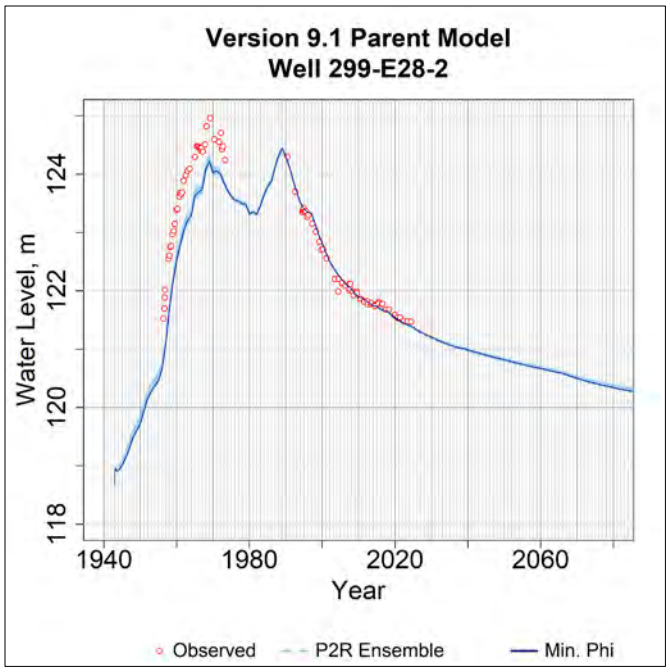

Figure B-89. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E28-2.

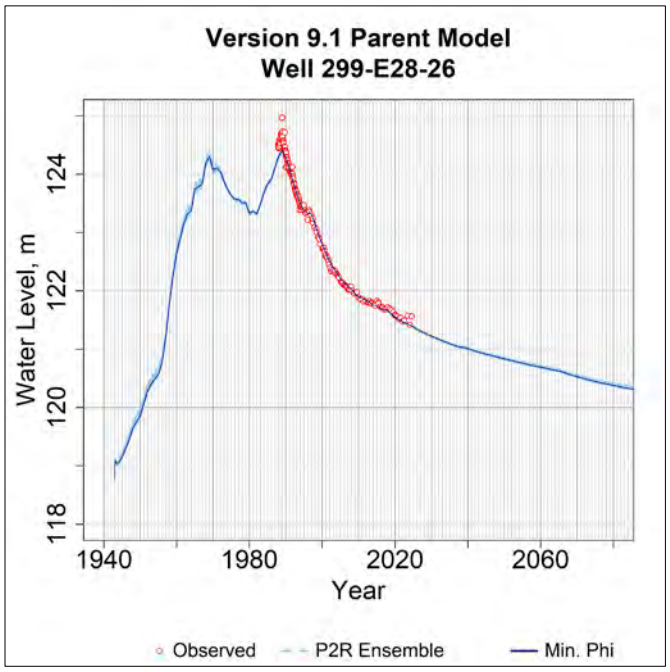

Figure B-90. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E28-26.

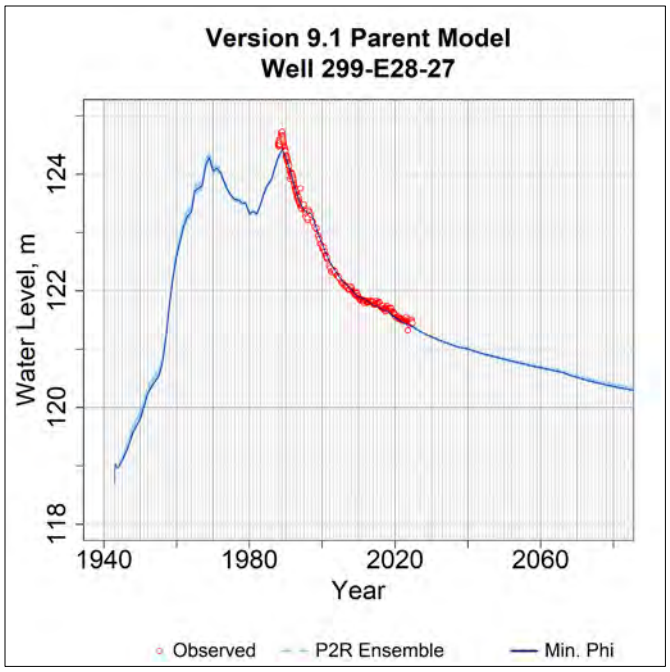

Figure B-91. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E28-27.

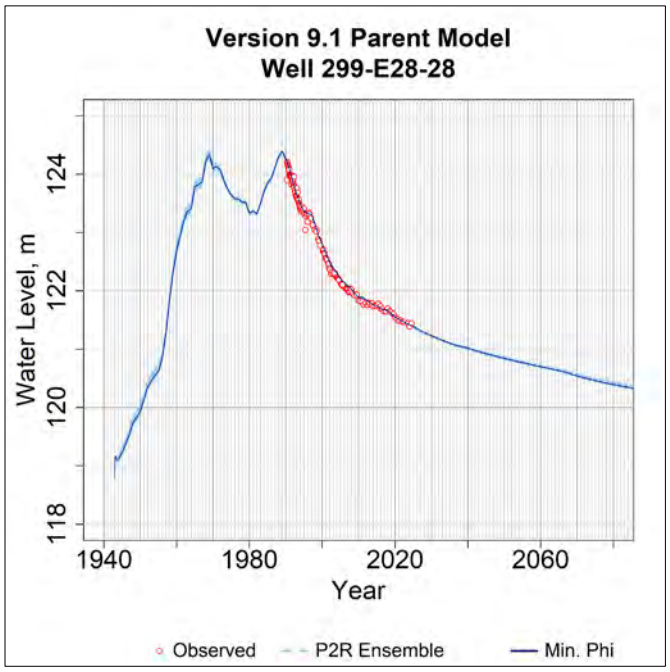

Figure B-92. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E28-28.

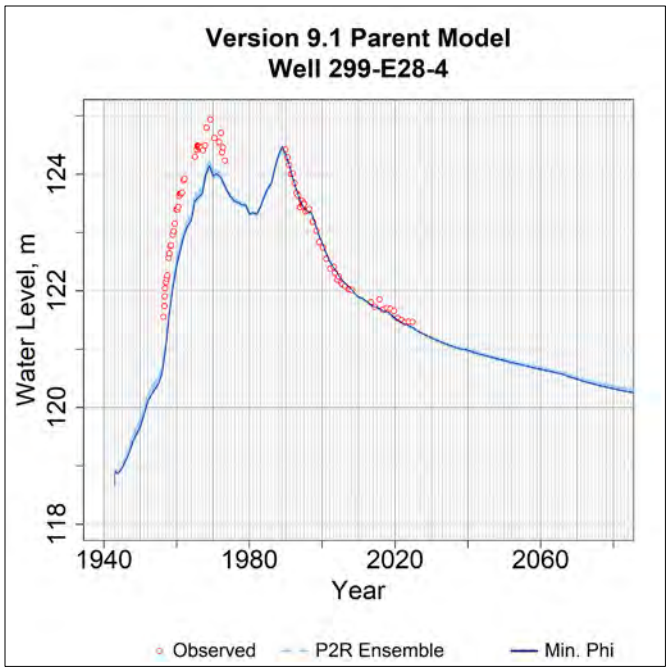

Figure B-93. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E28-4.

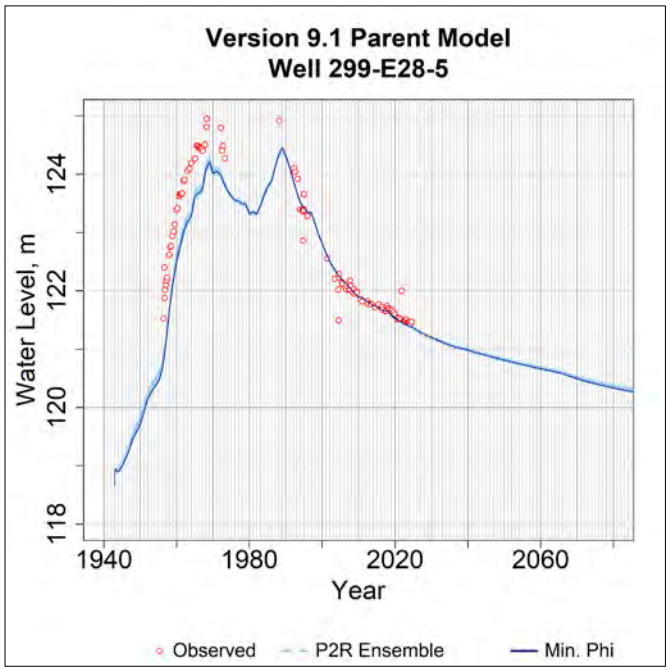

Figure B-94. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E28-5.

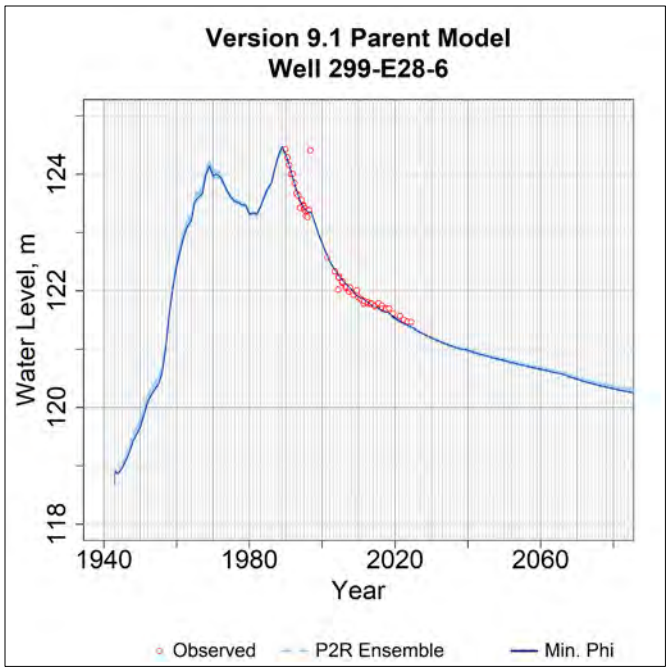

Figure B-95. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E28-6.

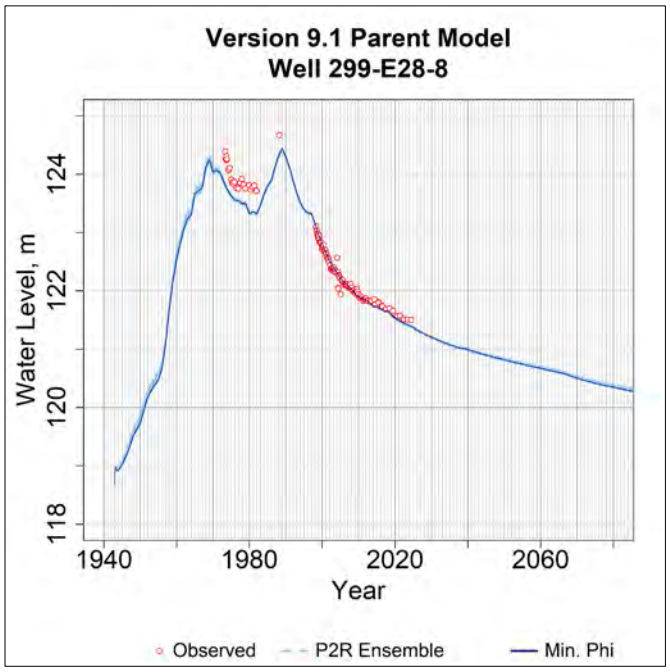

Figure B-96. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E28-8.

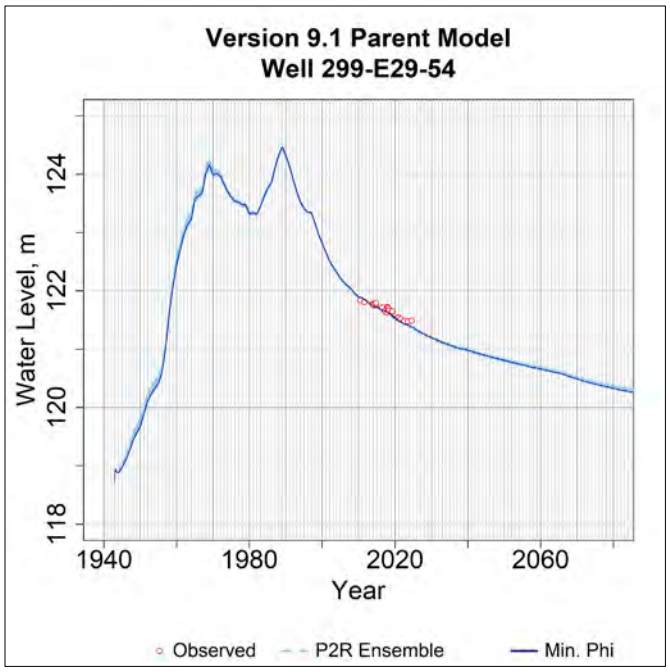

Figure B-97. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E29-54.

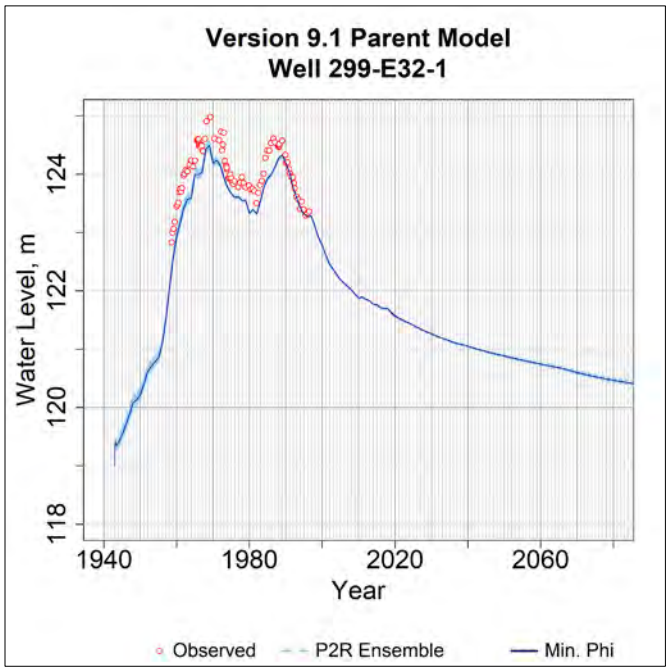

Figure B-98. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E32-1.

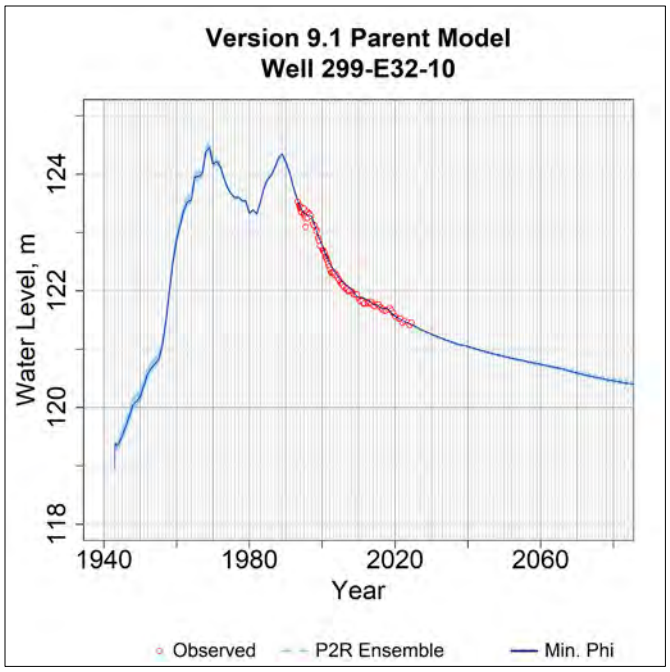

Figure B-99. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E32-10.

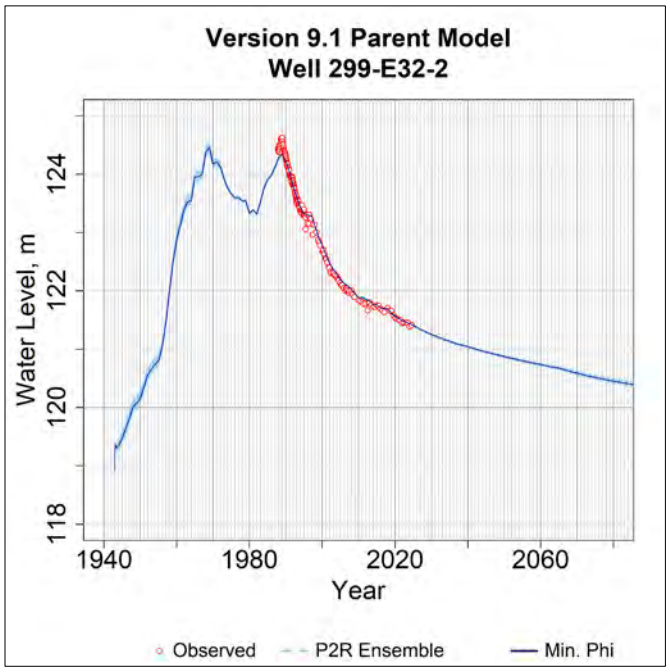

Figure B-100. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E32-2.

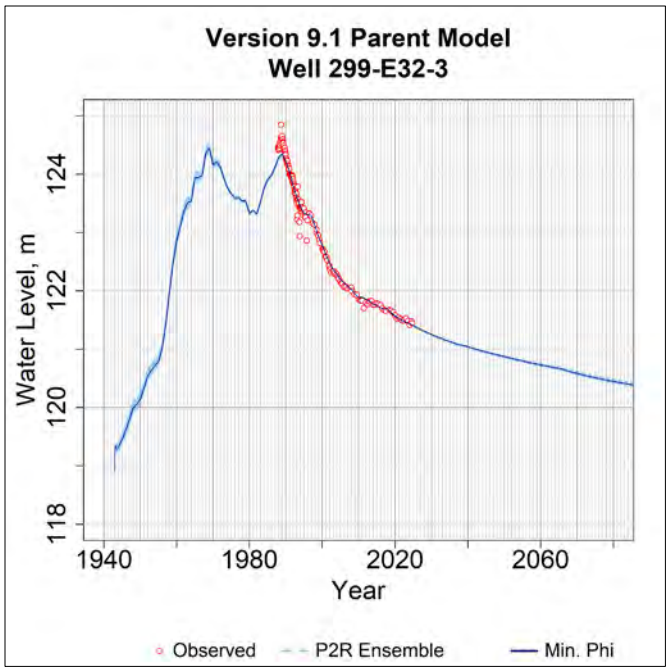

Figure B-101. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E32-3.

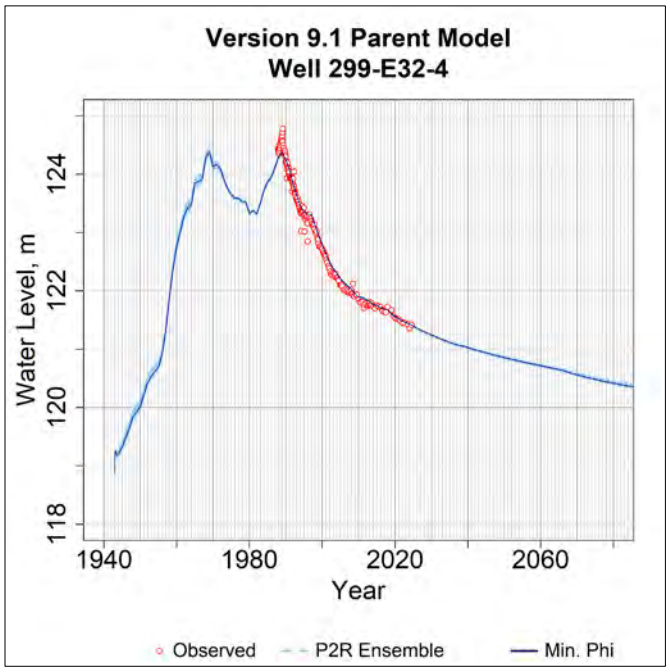

Figure B-102. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E32-4.

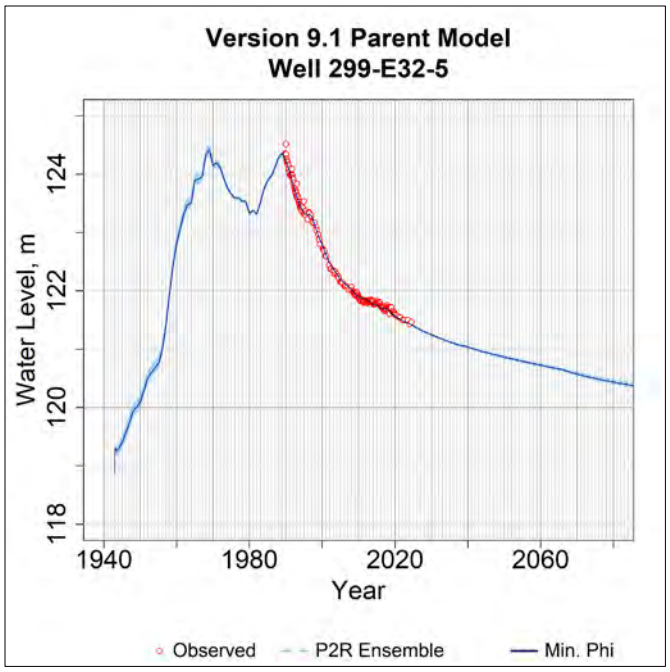

Figure B-103. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E32-5.

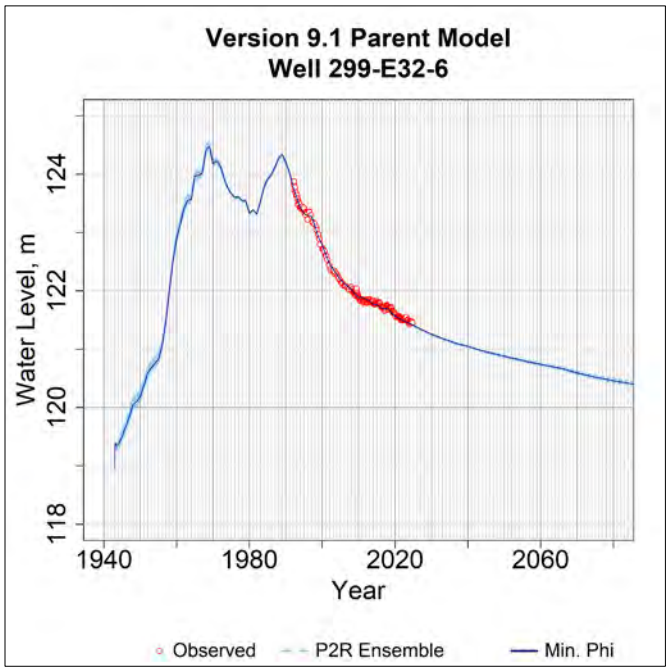

Figure B-104. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E32-6.

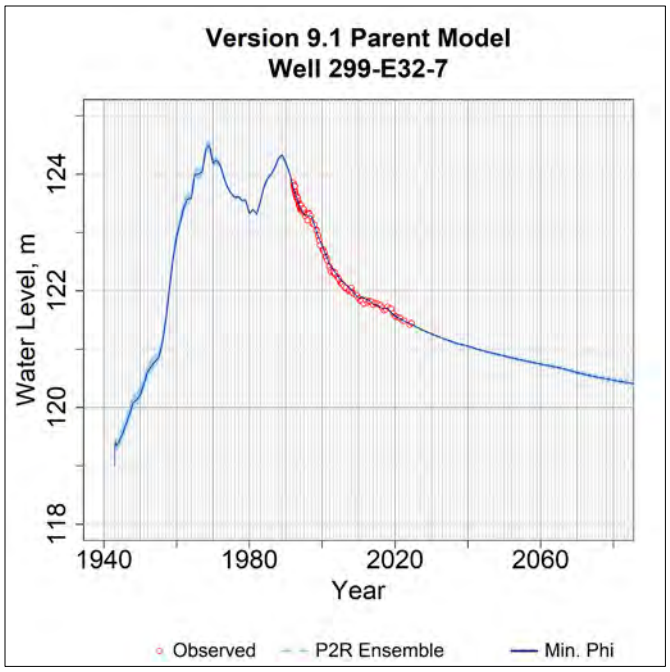

Figure B-105. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E32-7.

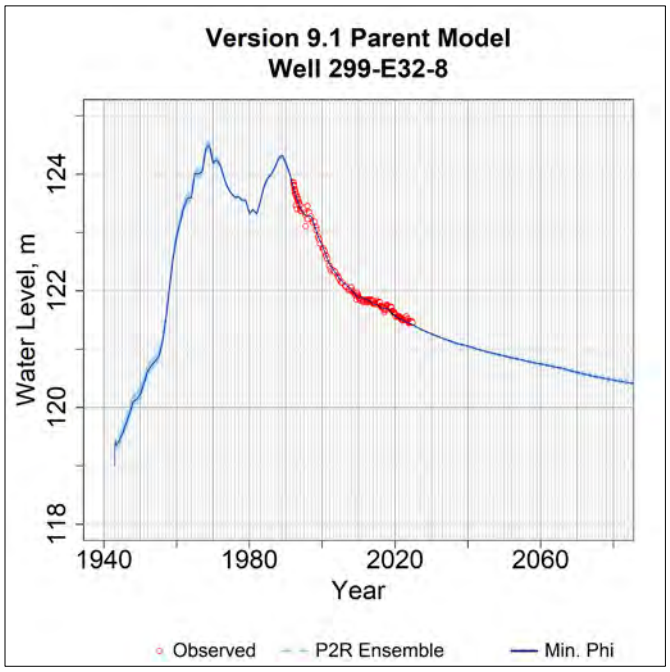

Figure B-106. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E32-8.

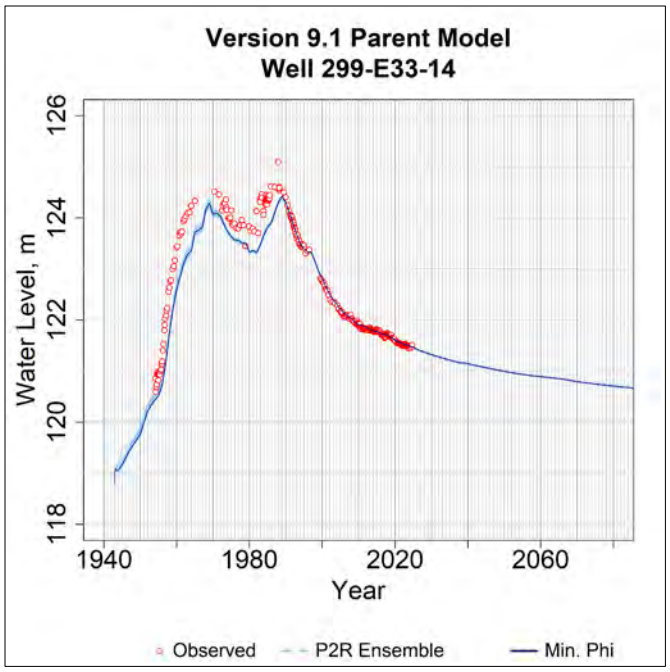

Figure B-107. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-14.

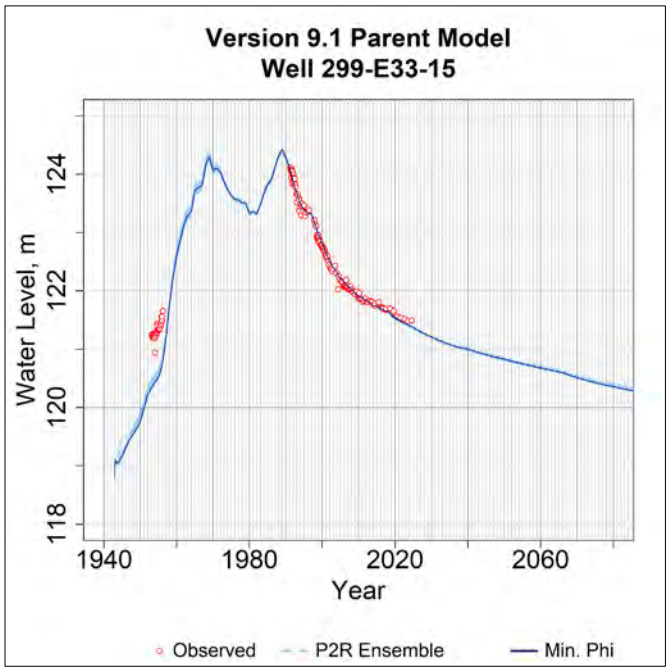

Figure B-108. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-15.

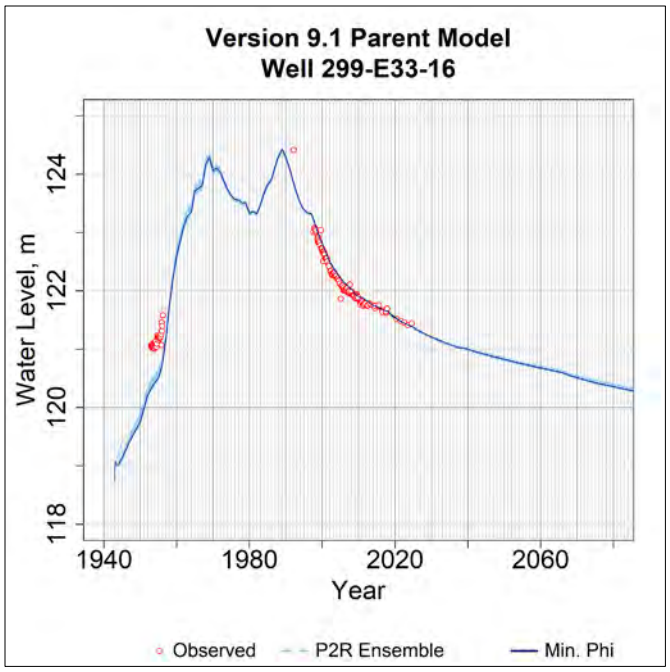

Figure B-109. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-16.

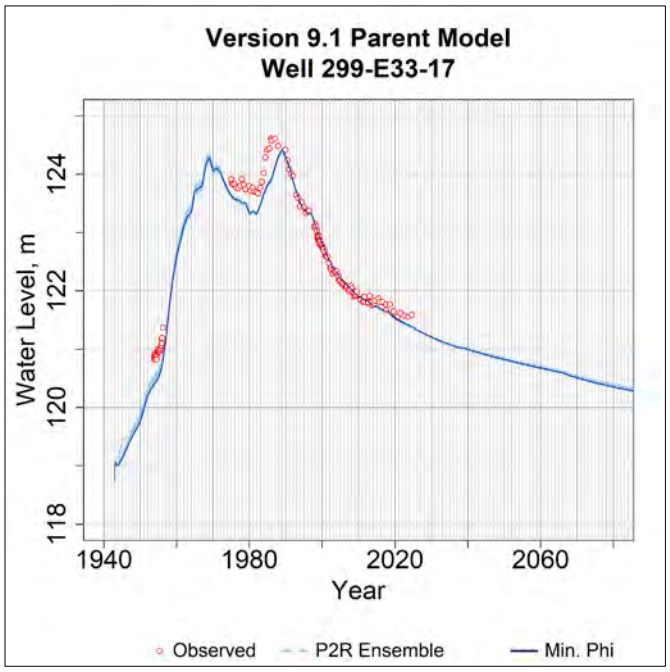

Figure B-110. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-17.

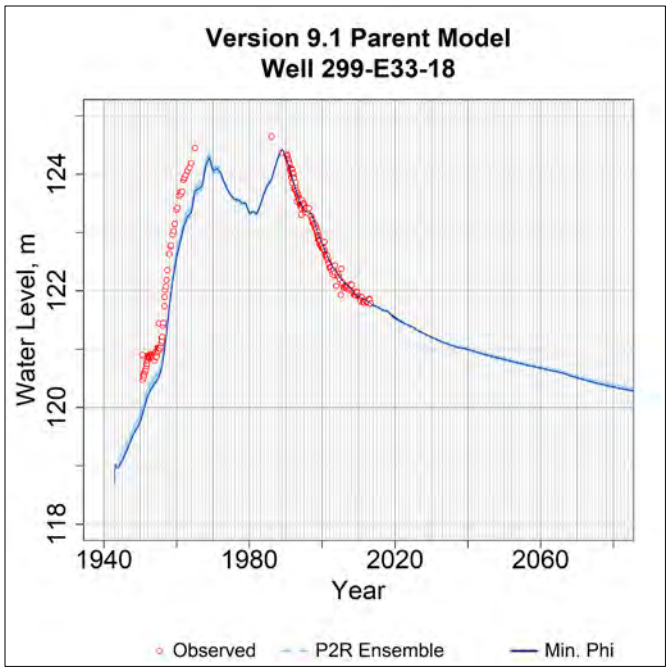

Figure B-111. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-18.

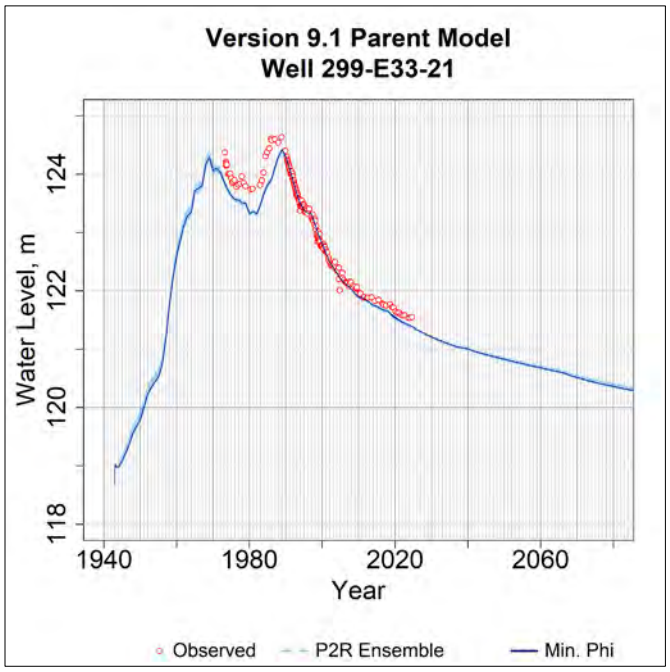

Figure B-112. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-21.

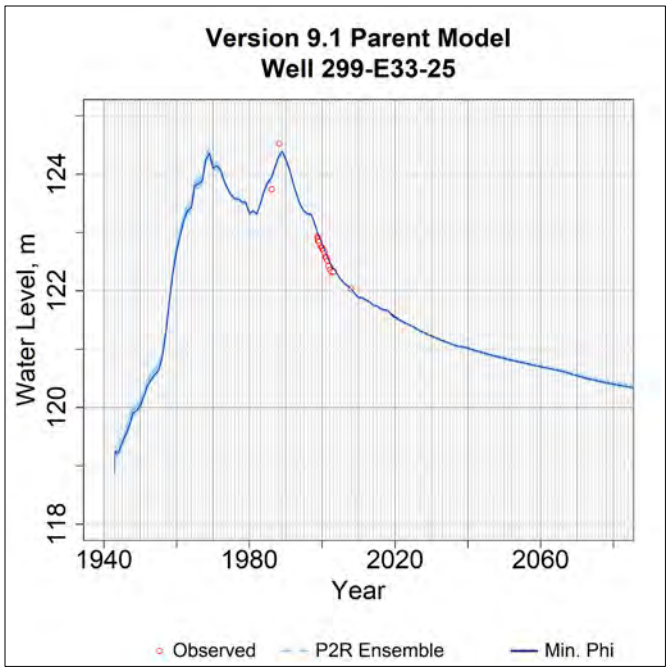

Figure B-113. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-25.

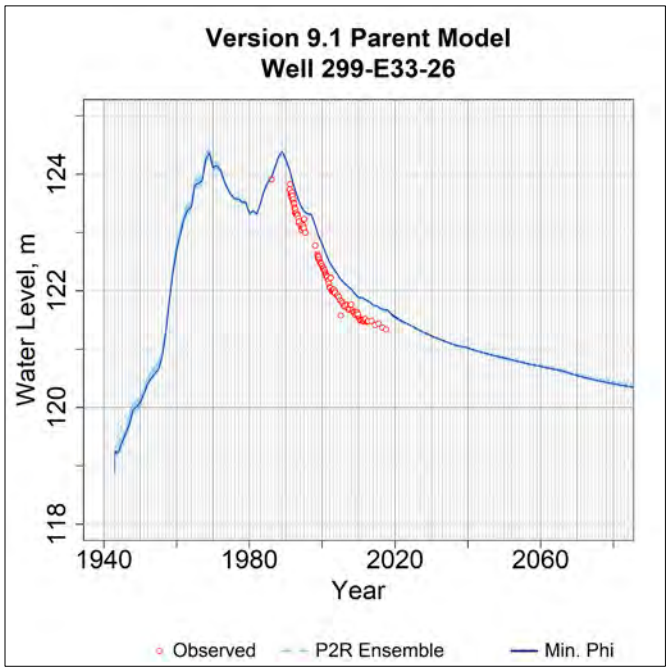

Figure B-114. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-26.

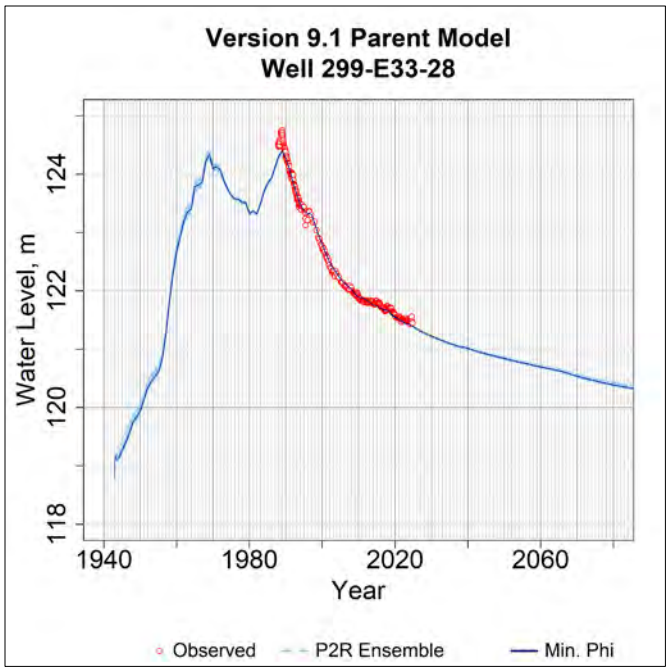

Figure B-115. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-28.

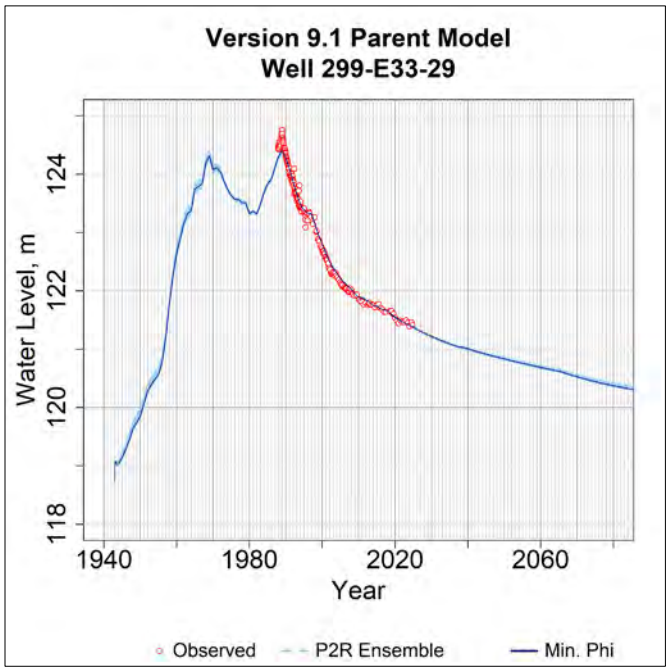

Figure B-116. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-29.

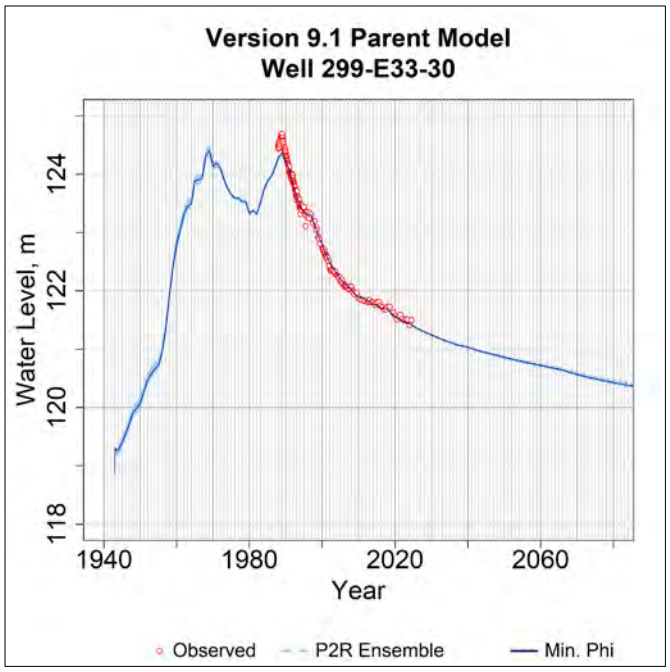

Figure B-117. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-30.

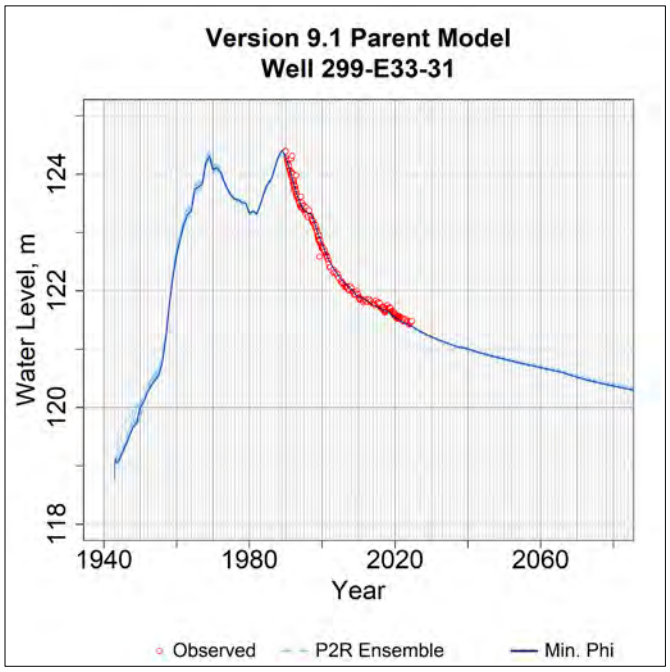

Figure B-118. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-31.

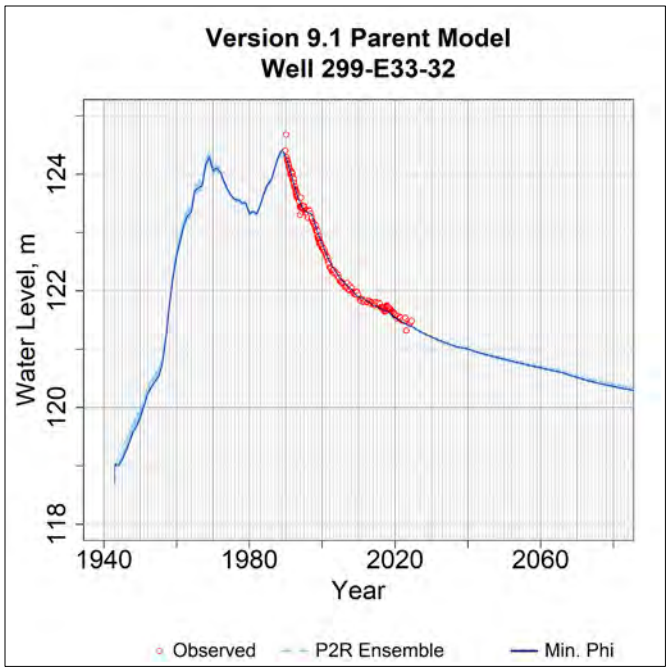

Figure B-119. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-32.

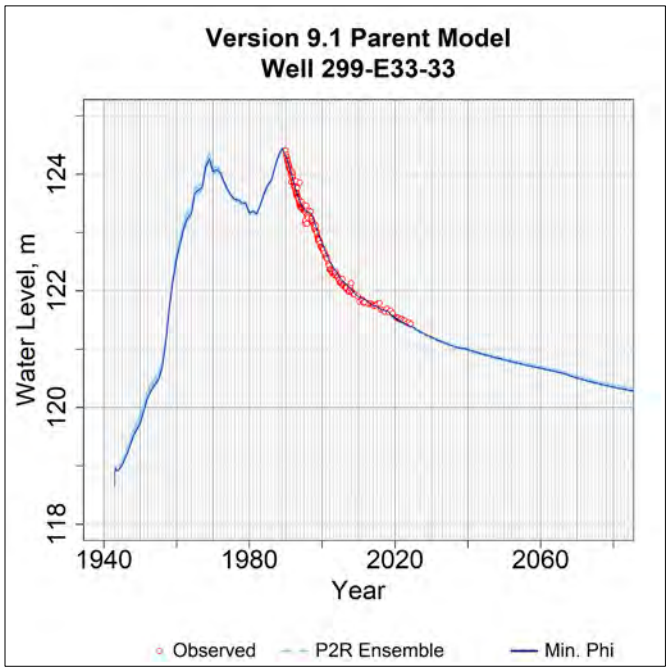

Figure B-120. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-33.

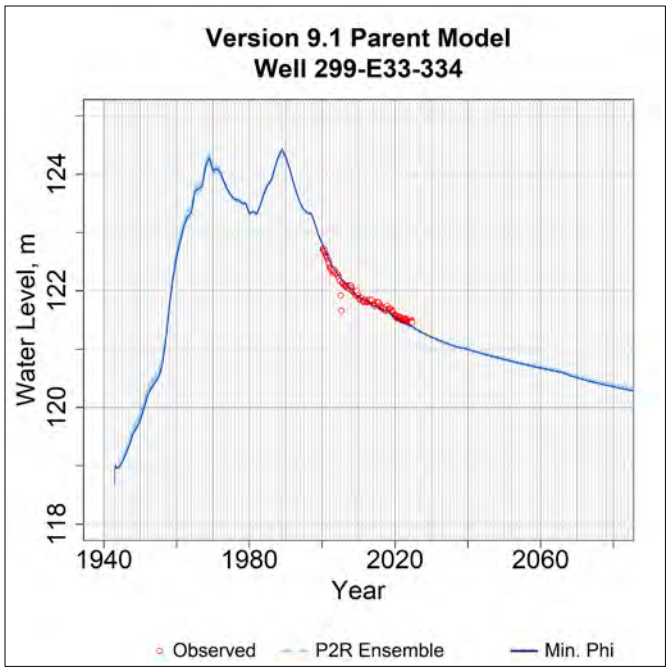

Figure B-121. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-334.

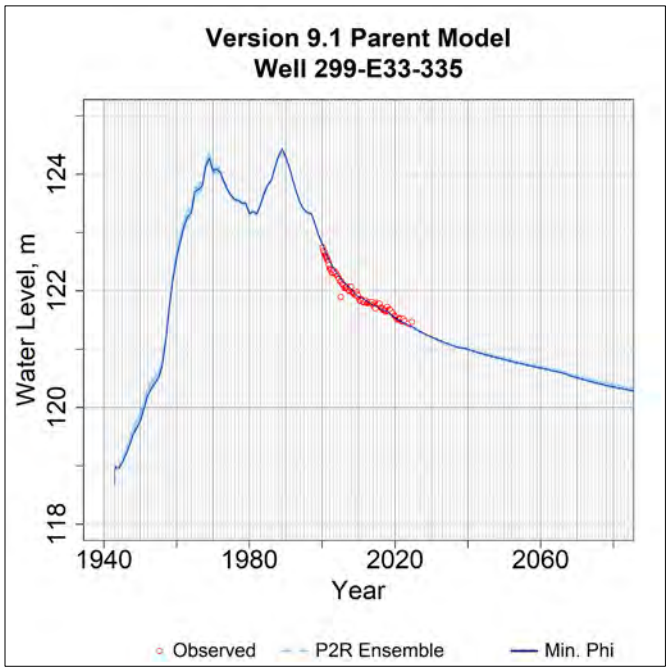

Figure B-122. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-335.

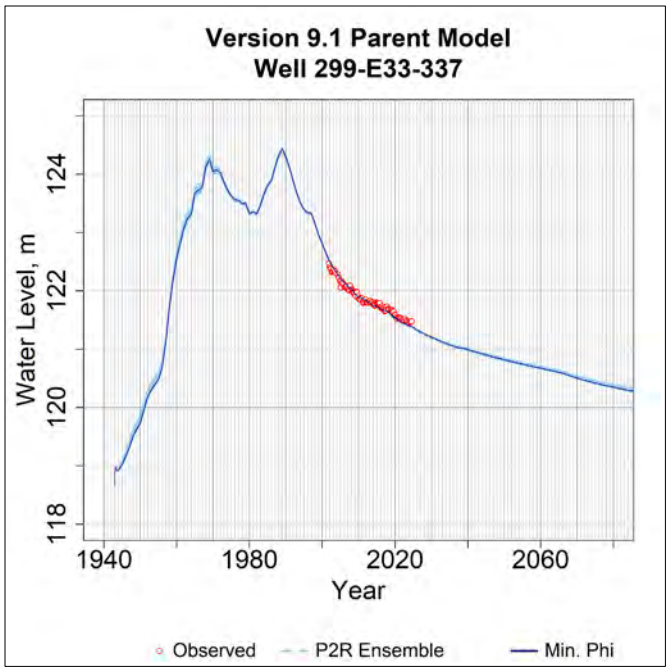

Figure B-123. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-337.

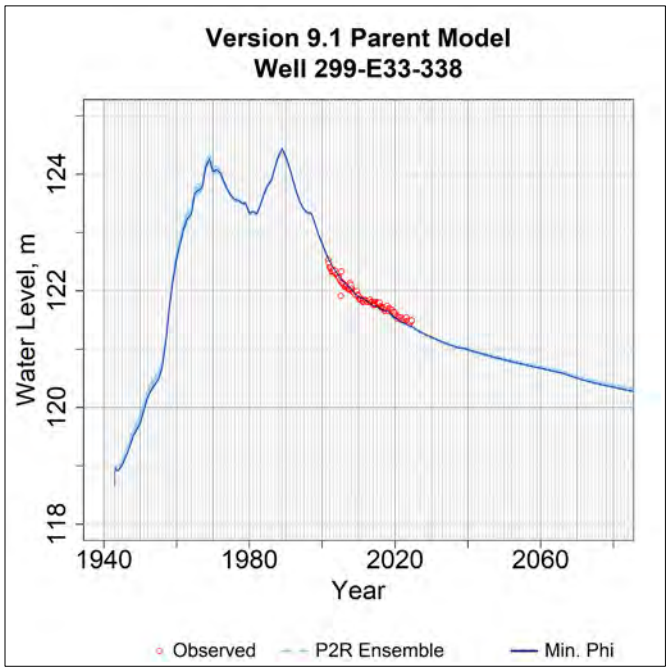

Figure B-124. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-338.

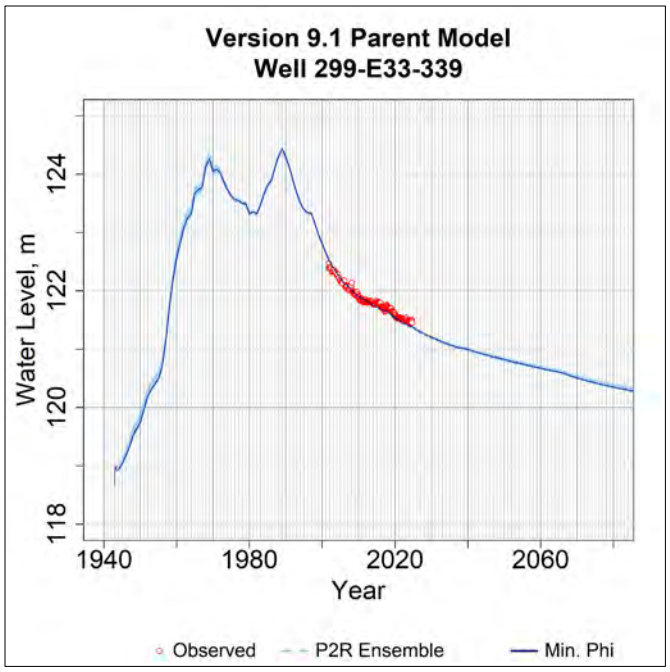

Figure B-125. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-339.

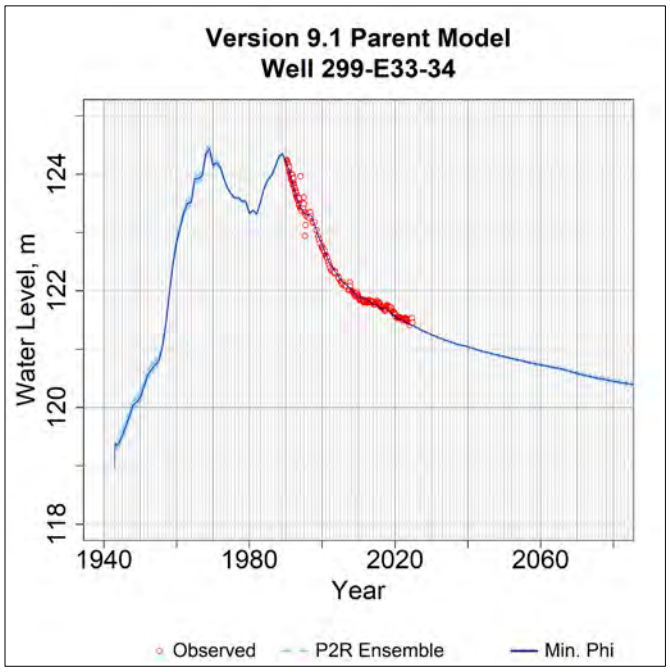

Figure B-126. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-34.

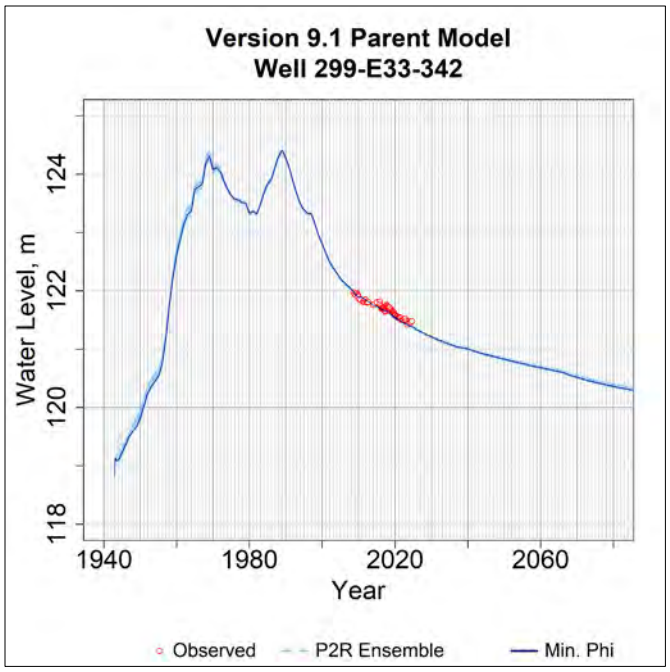

Figure B-127. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-342.

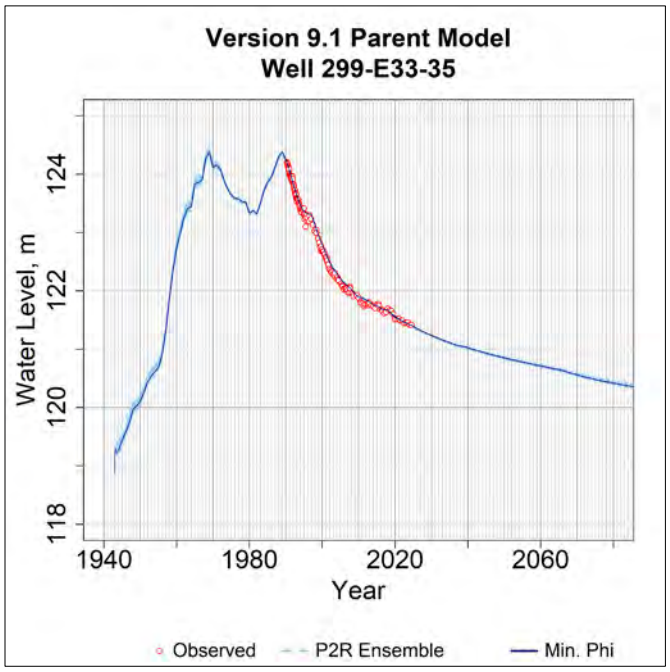

Figure B-128. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-35.

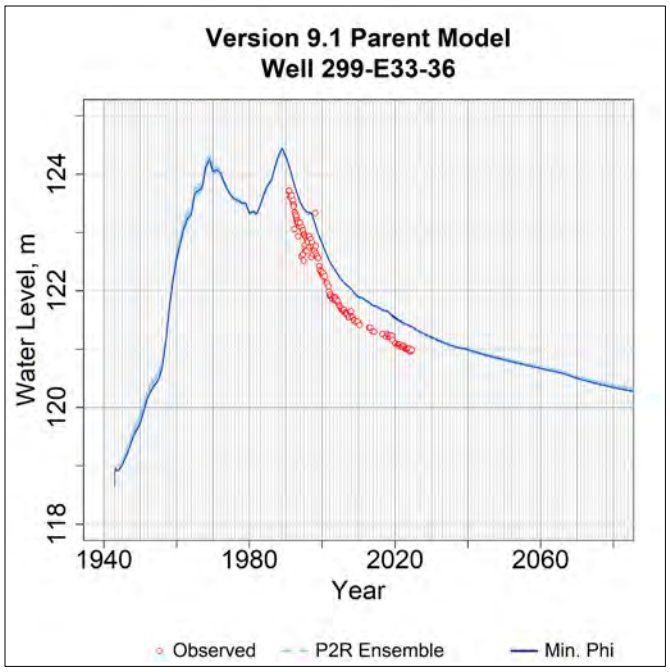

Figure B-129. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-36.

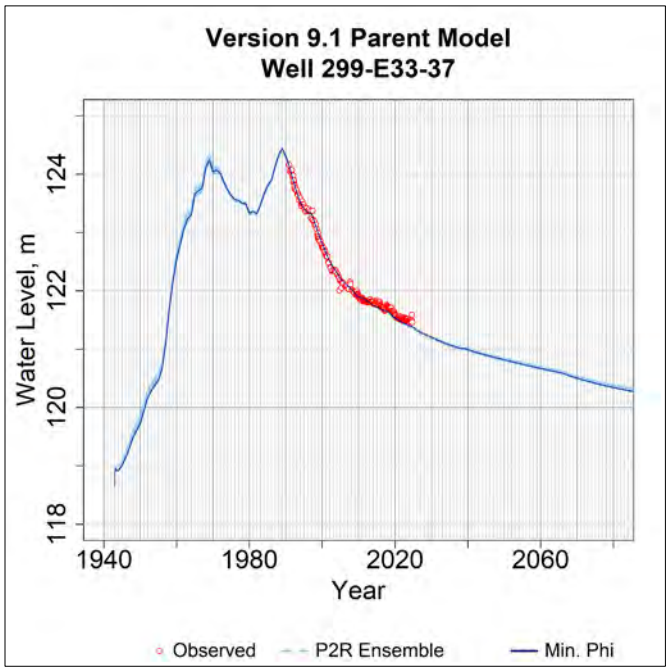

Figure B-130. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-37.

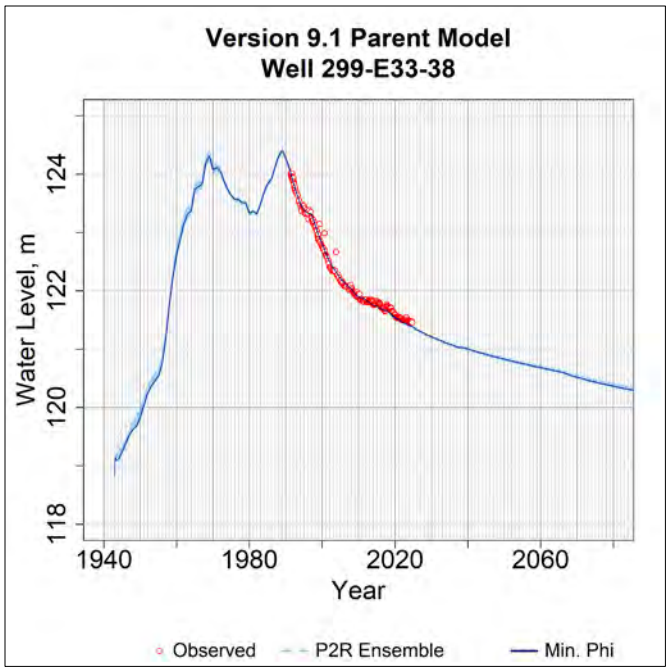

Figure B-131. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-38.

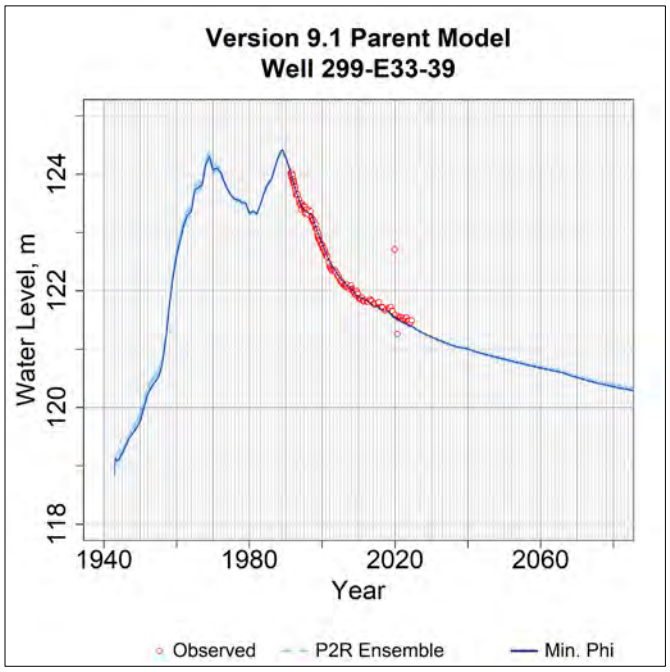

Figure B-132. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-39.

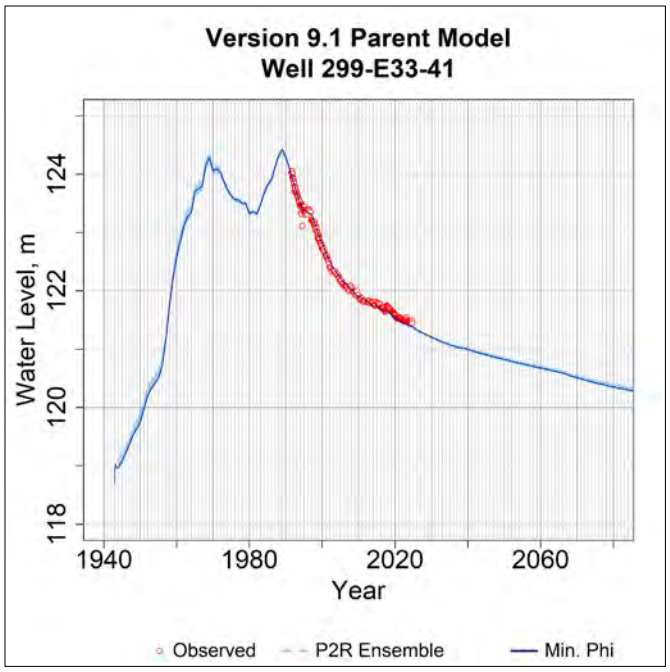

Figure B-133. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-41.

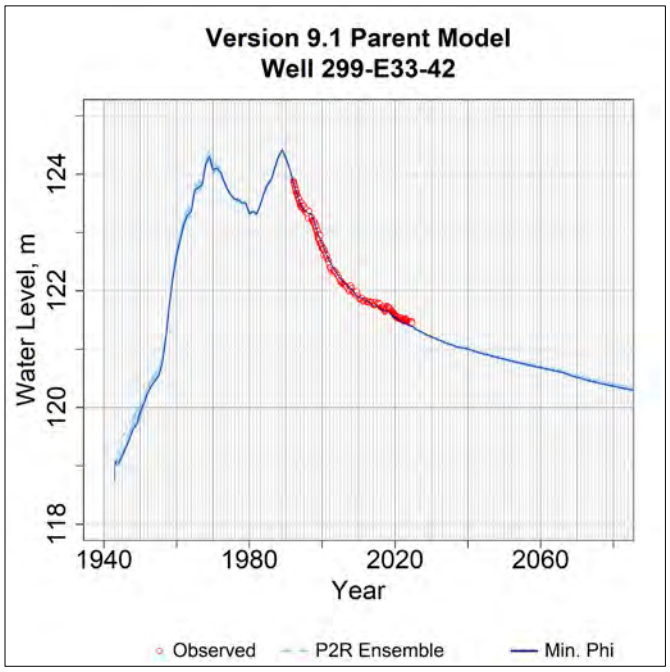

Figure B-134. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-42.

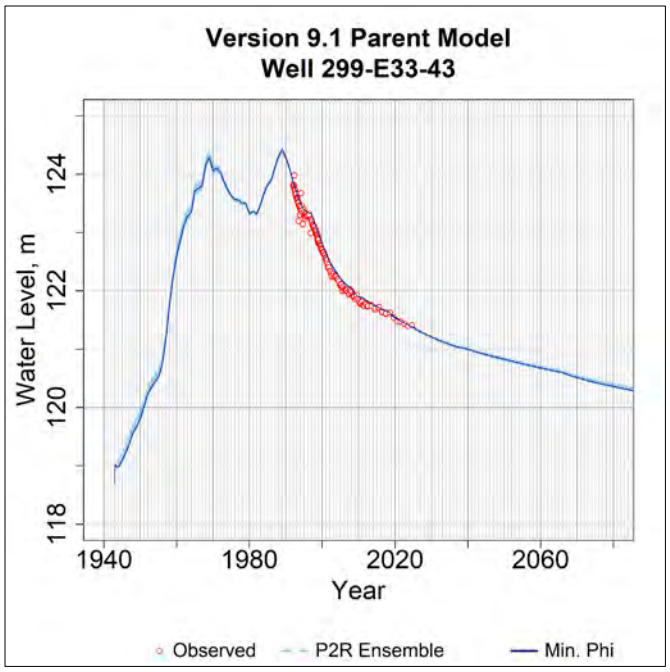

Figure B-135. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-43.

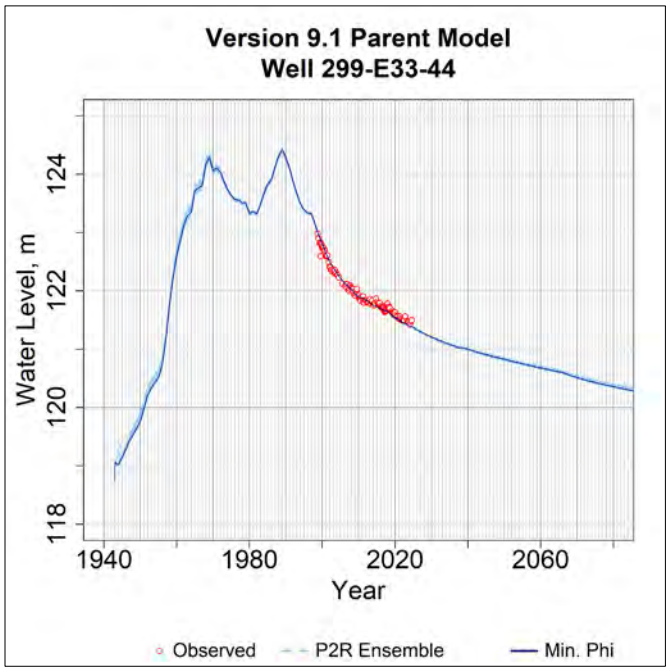

Figure B-136. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-44.

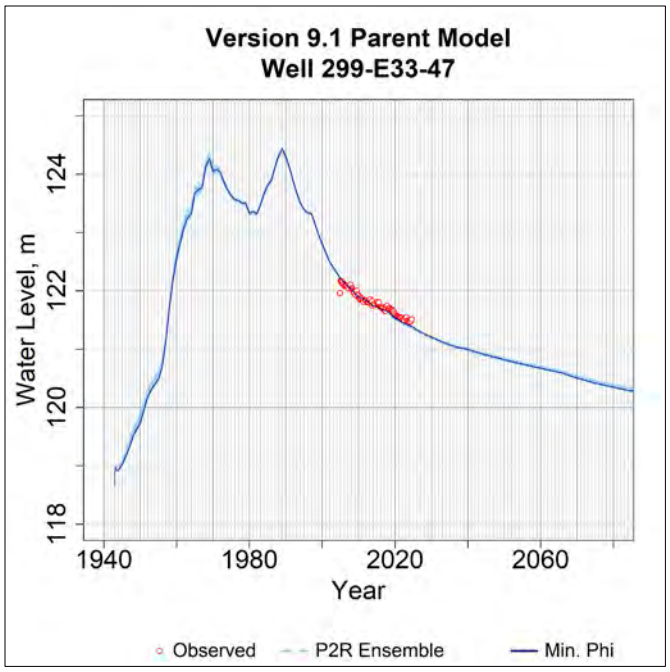

Figure B-137. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-47.

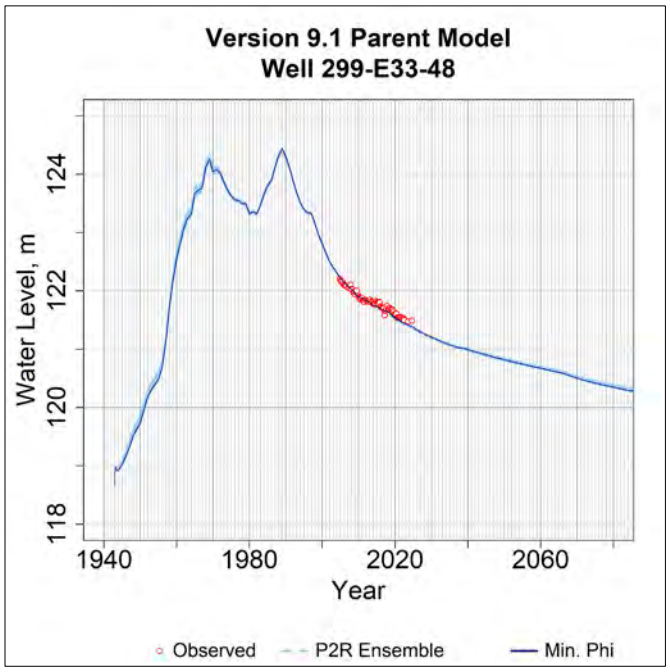

Figure B-138. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-48.

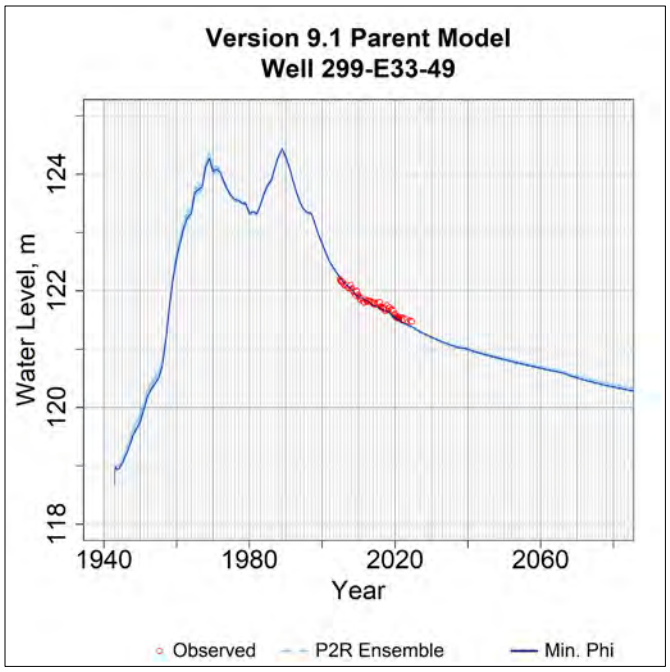

Figure B-139. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-49.

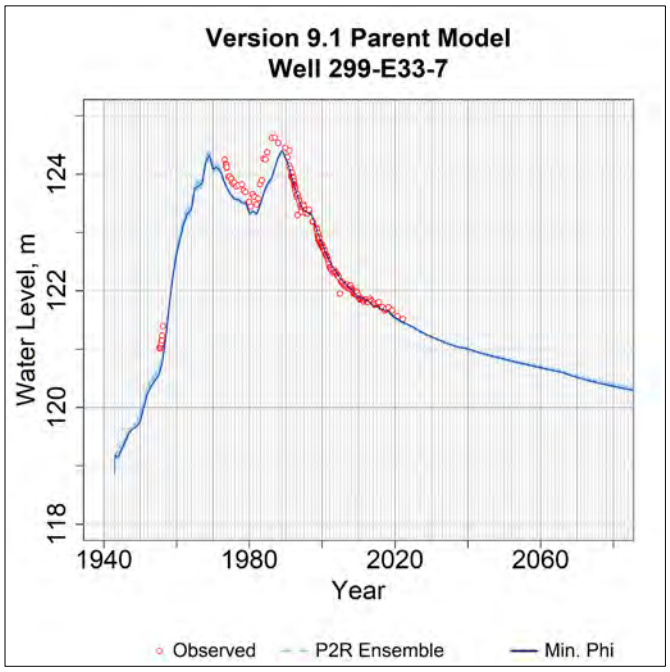

Figure B-140. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-7.

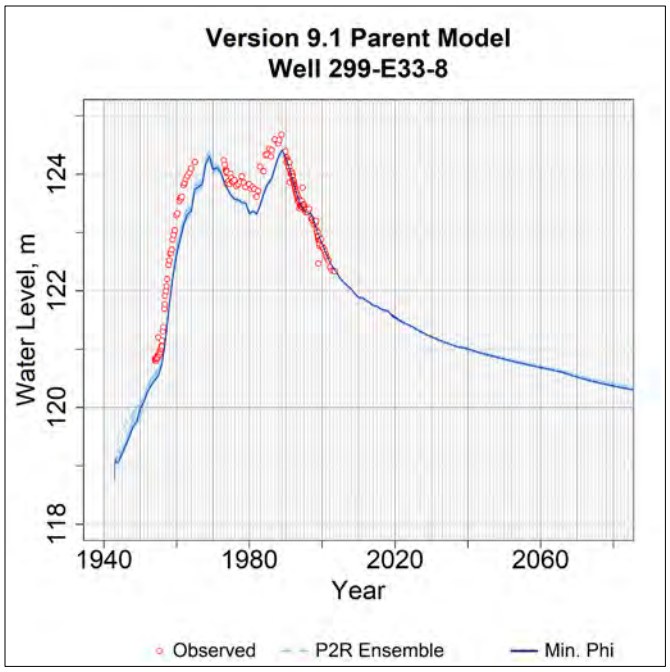

Figure B-141. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E33-8.

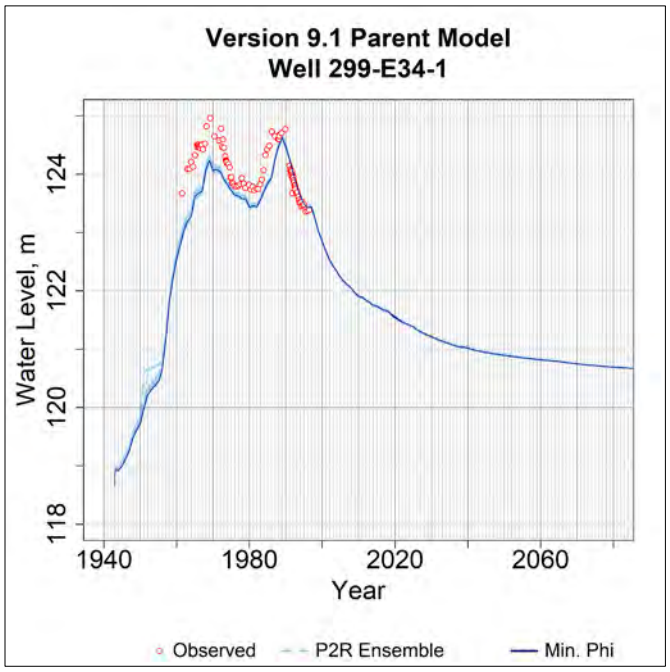

Figure B-142. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E34-1.

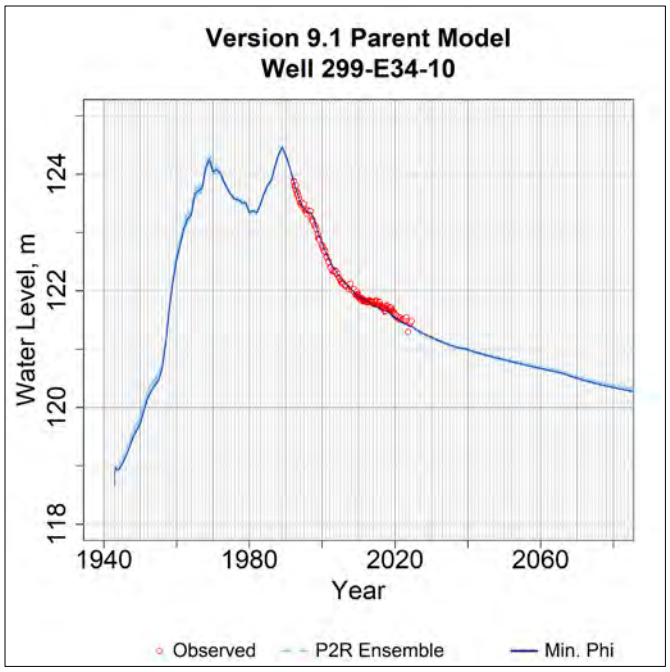

Figure B-143. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E34-10.

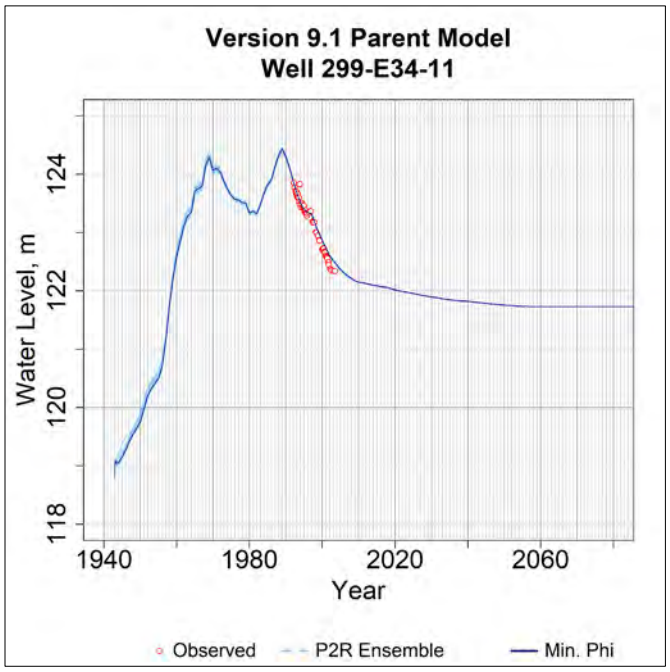

Figure B-144. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E34-11.

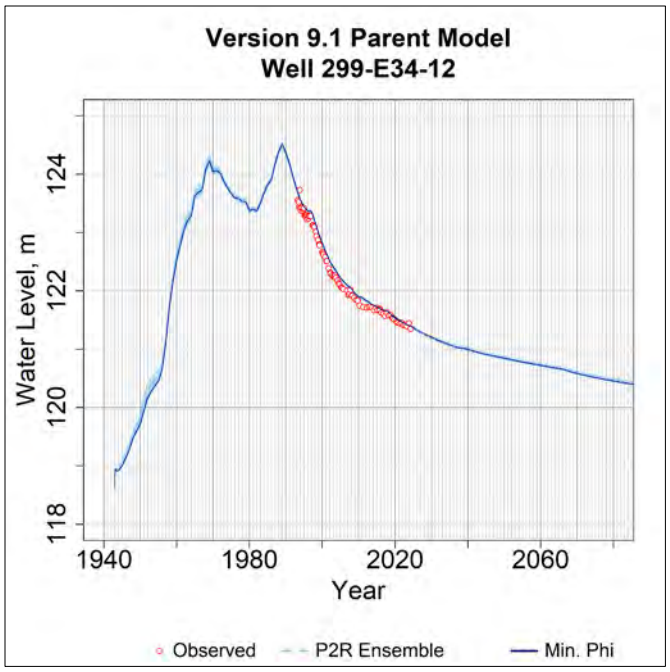

Figure B-145. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E34-12.

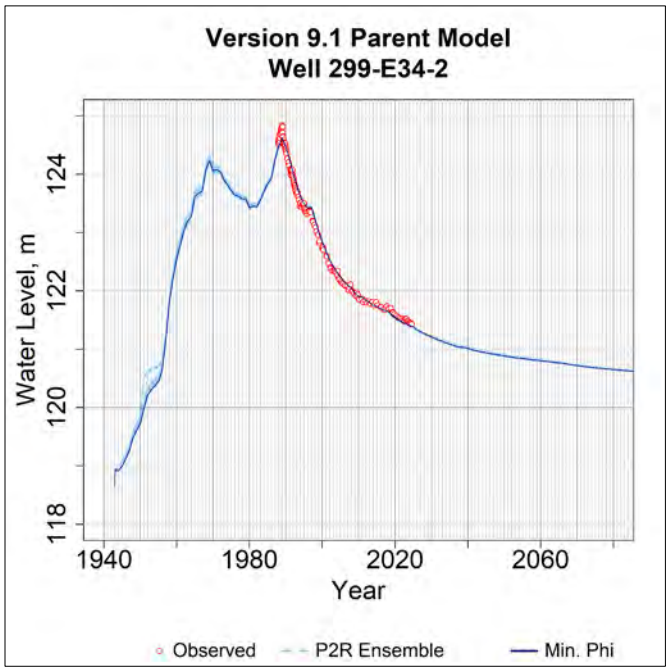

Figure B-146. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E34-2.

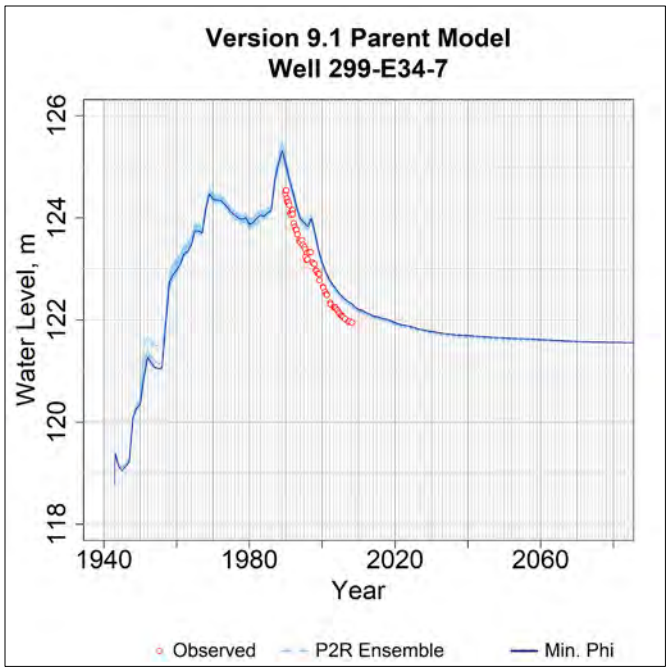

Figure B-147. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E34-7.

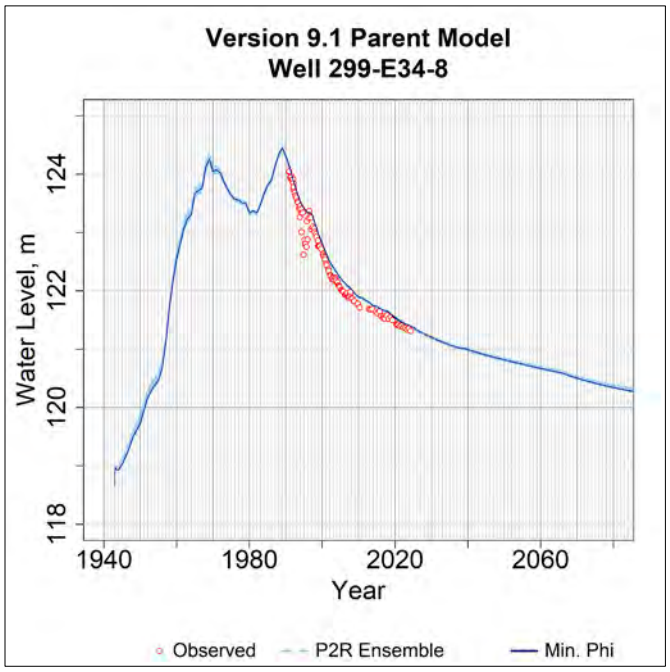

Figure B-148. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E34-8.

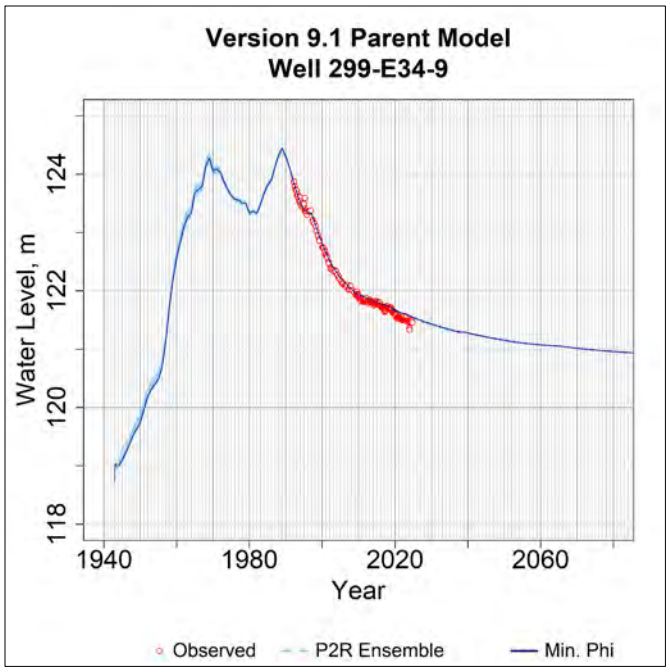

Figure B-149. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E34-9.

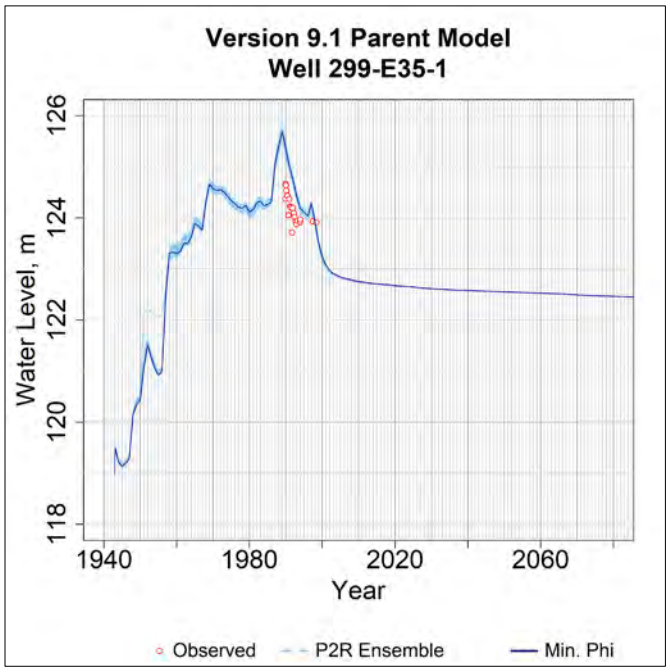

Figure B-150. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E35-1.

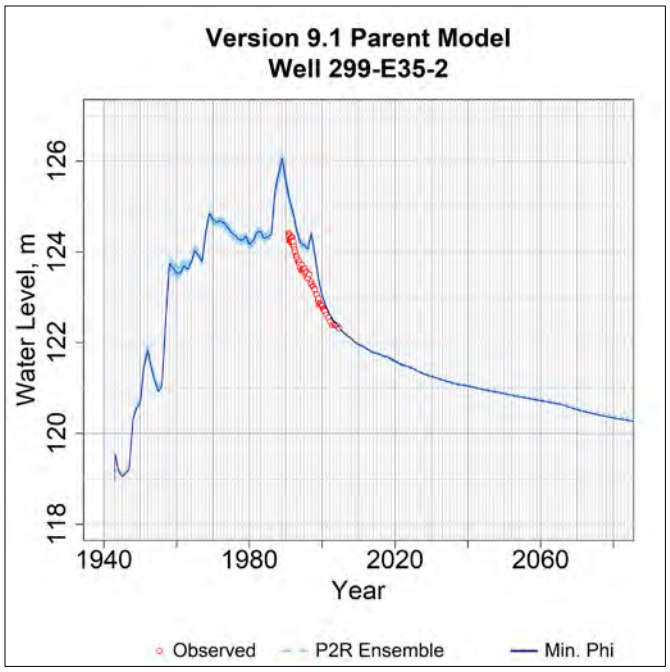

Figure B-151. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-E35-2.

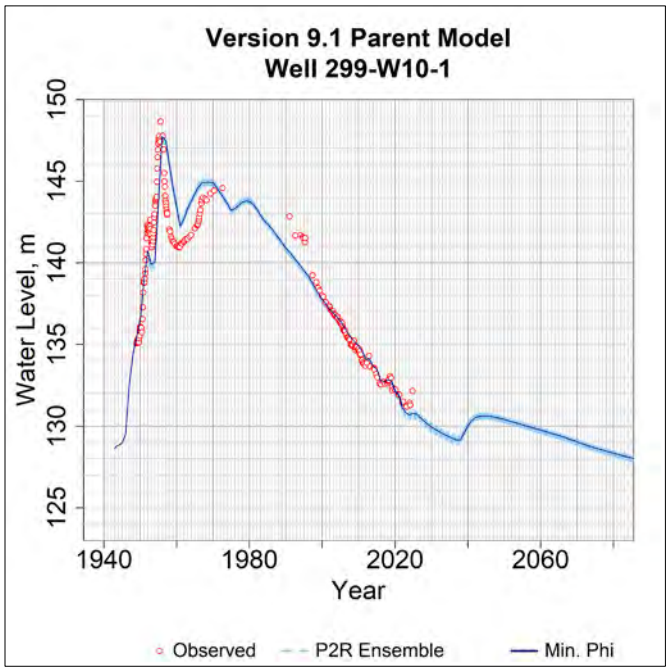

Figure B-152. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-1.

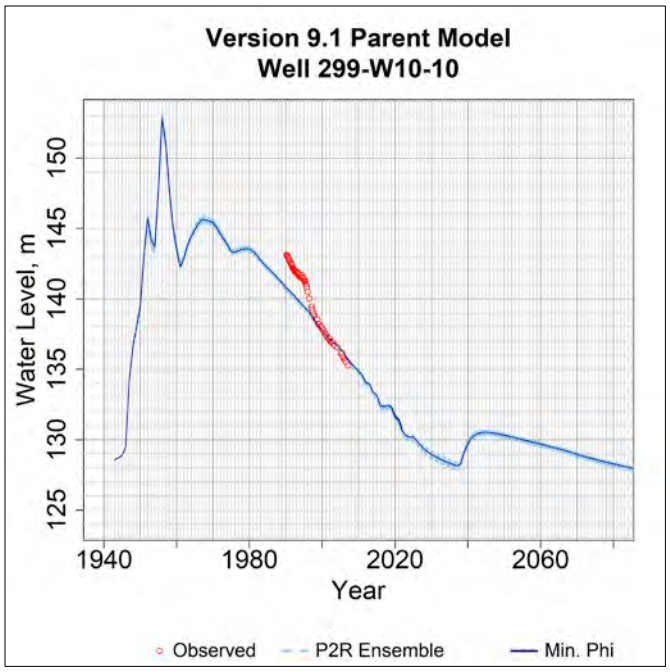

Figure B-153. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-10.

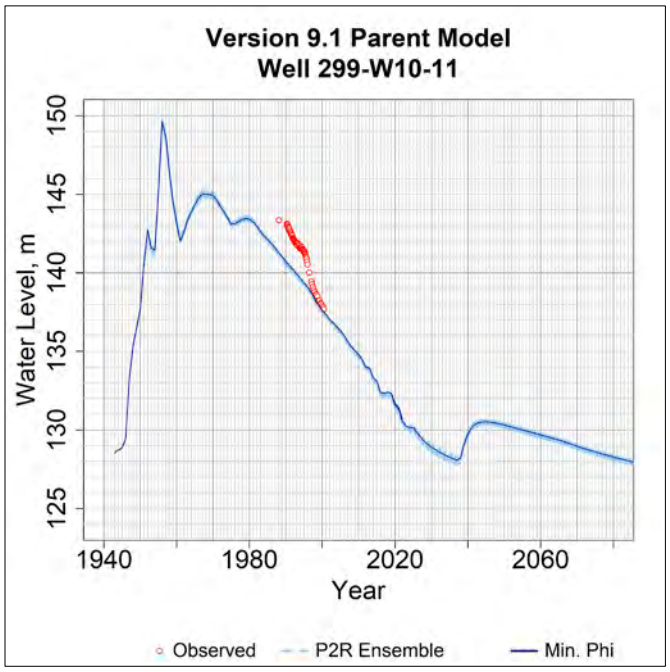

Figure B-154. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-11.

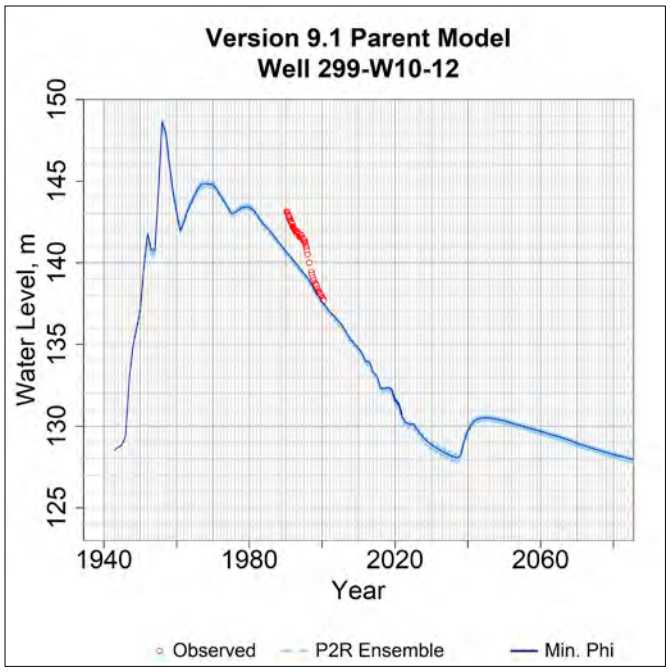

Figure B-155. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-12.

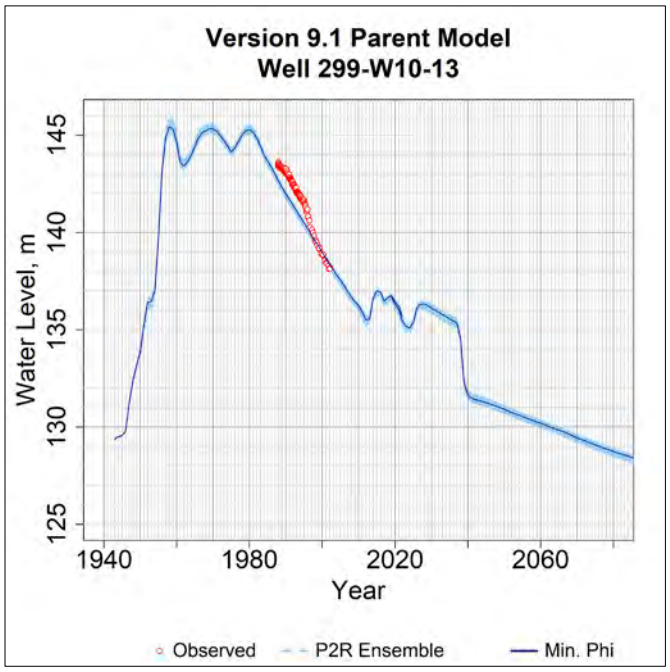

Figure B-156. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-13.

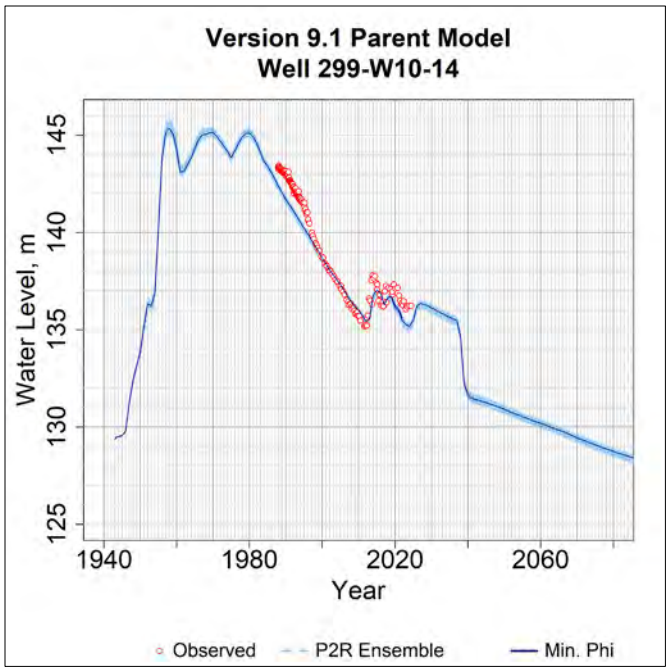

Figure B-157. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-14.

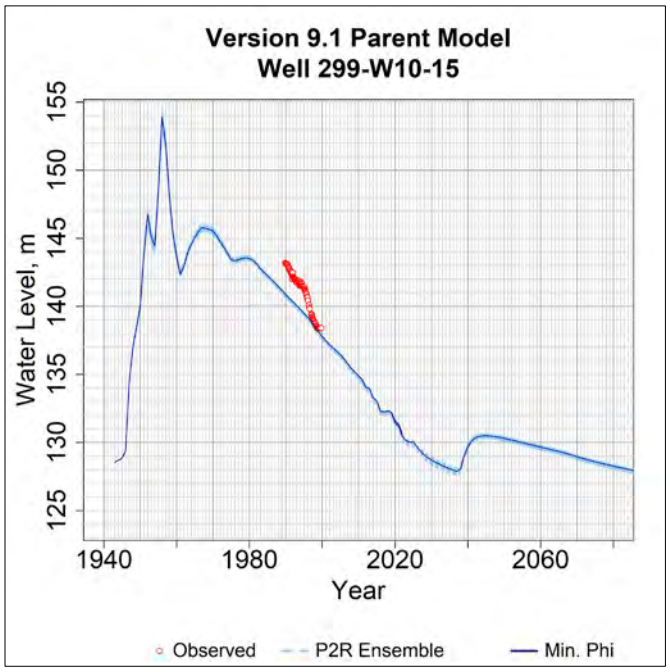

Figure B-158. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-15.

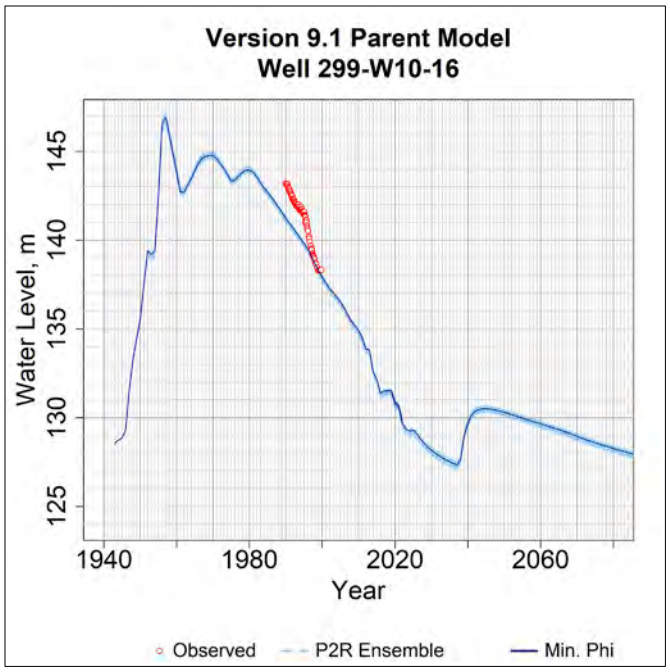

Figure B-159. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-16.

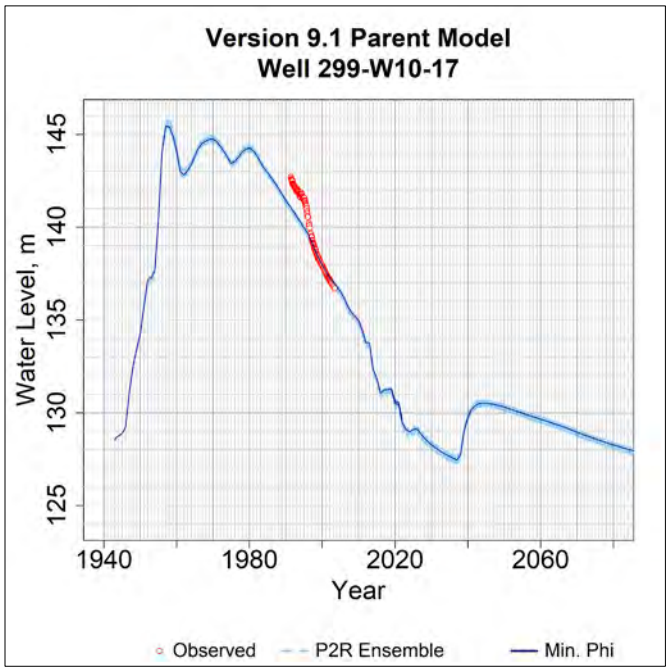

Figure B-160. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-17.

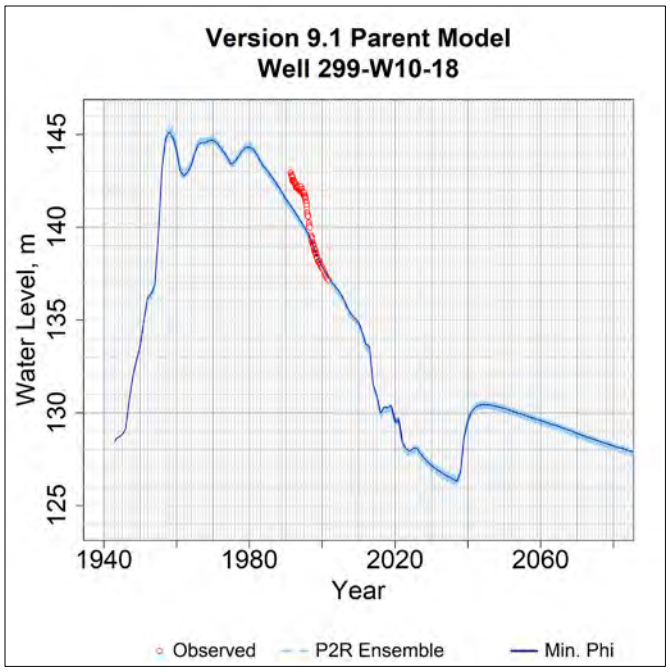

Figure B-161. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-18.

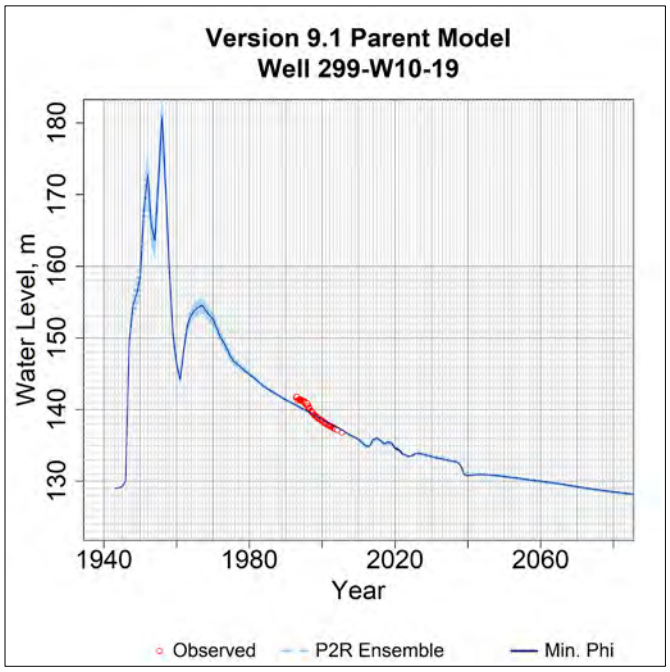

Figure B-162. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-19.

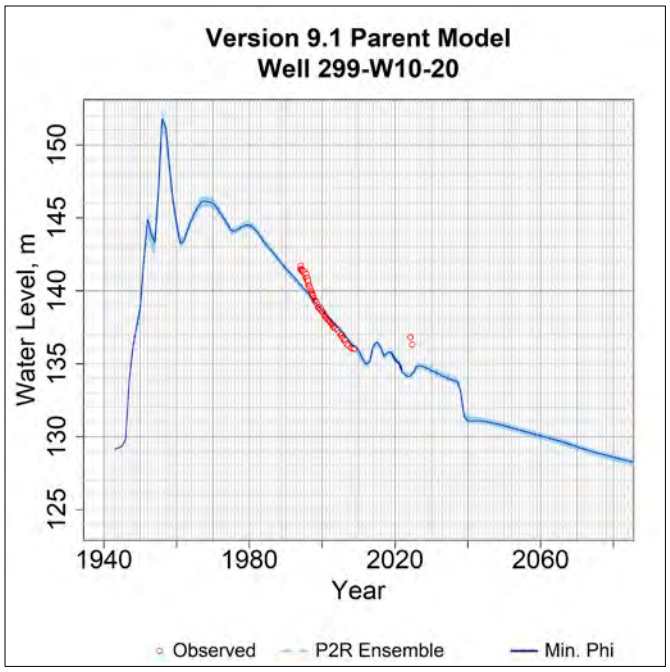

Figure B-163. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-20.

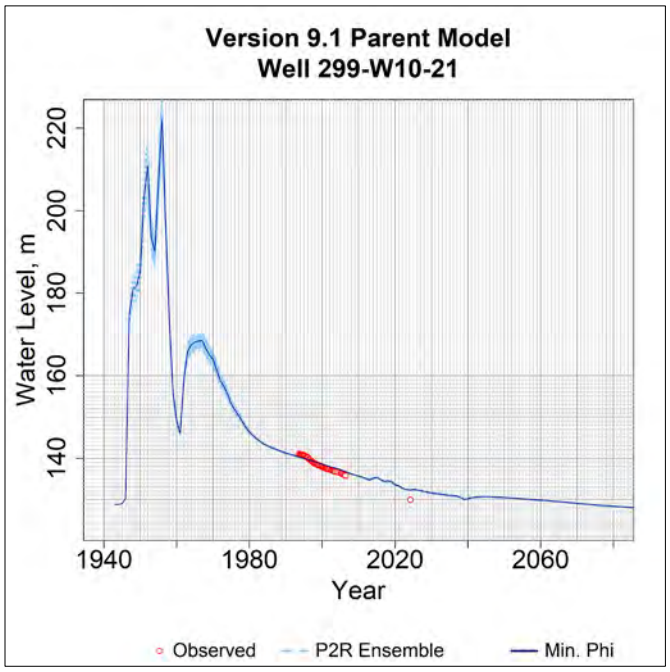

Figure B-164. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-21.

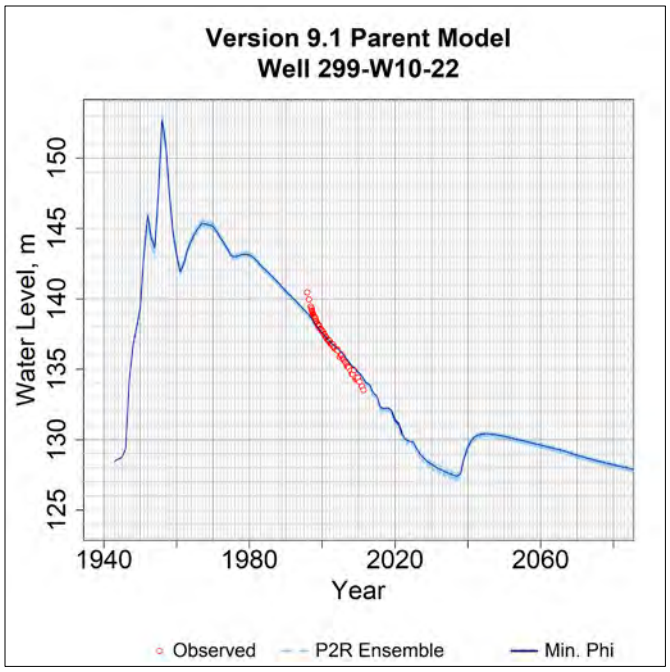

Figure B-165. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-22.

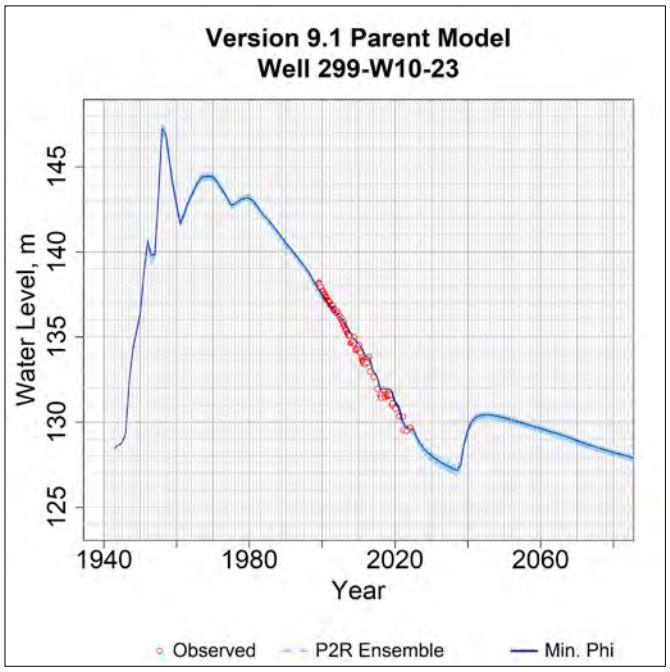

Figure B-166. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-23.

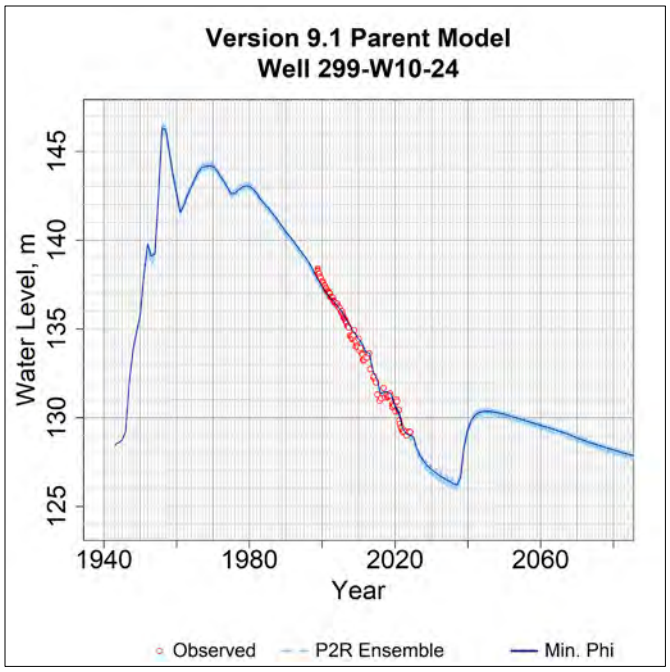

Figure B-167. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-24.

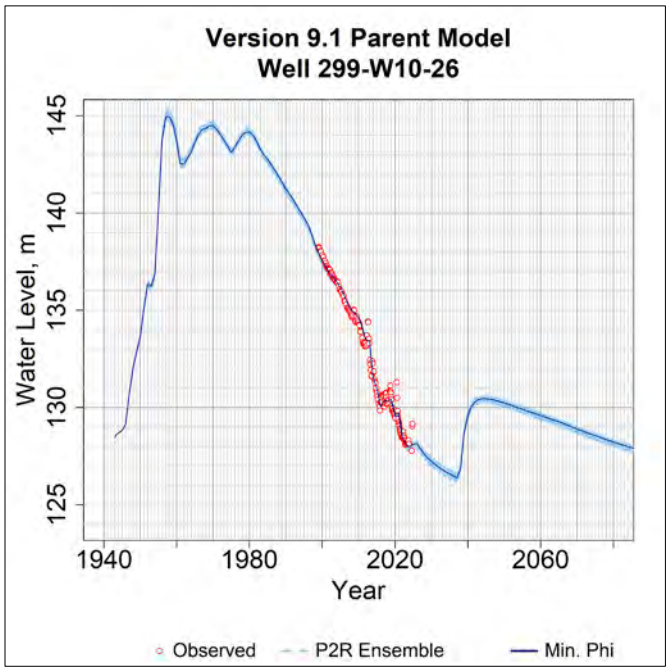

Figure B-168. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-26.

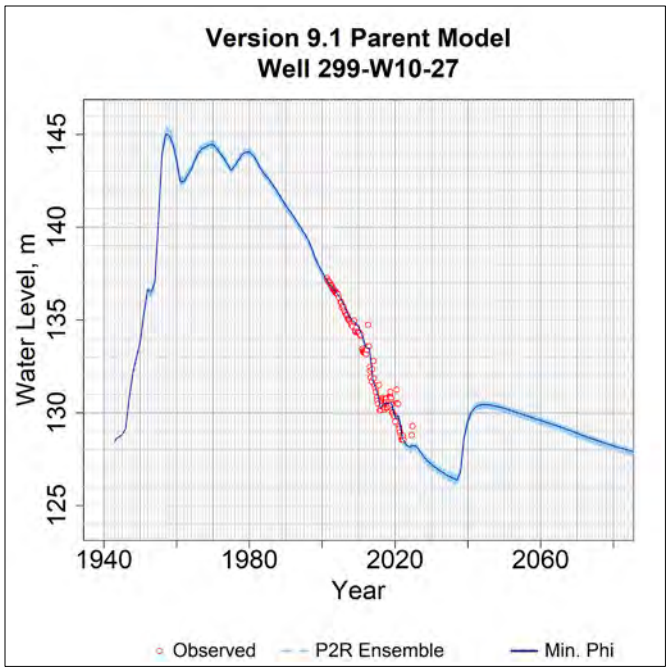

Figure B-169. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-27.

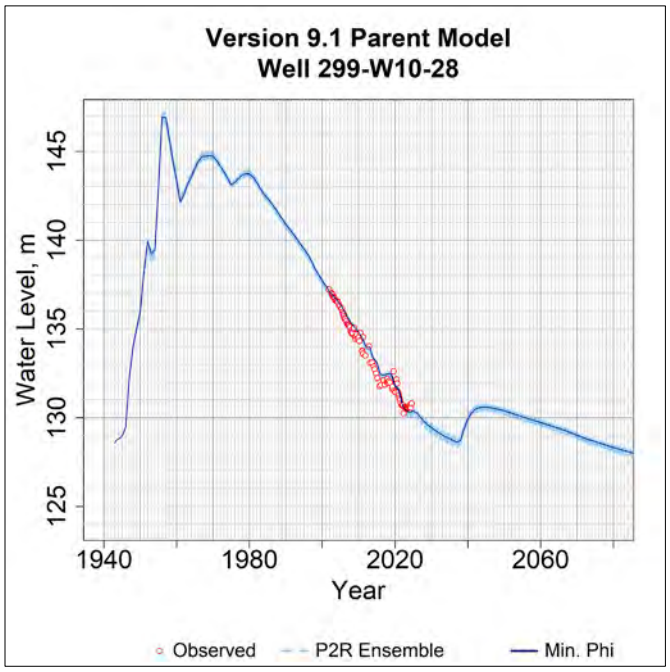

Figure B-170. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-28.

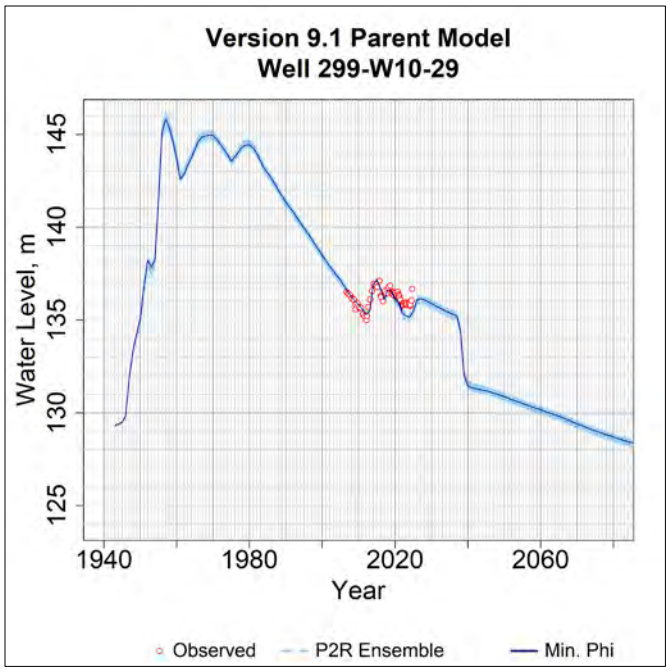

Figure B-171. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-29.

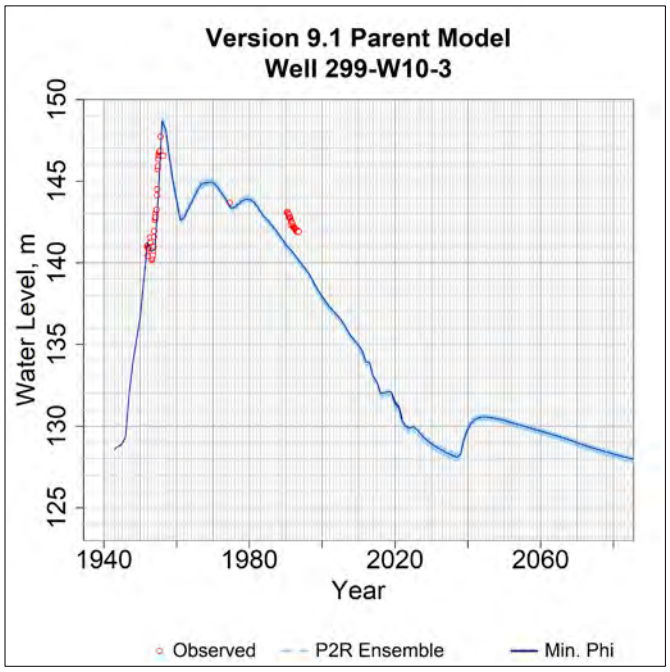

Figure B-172. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-3.

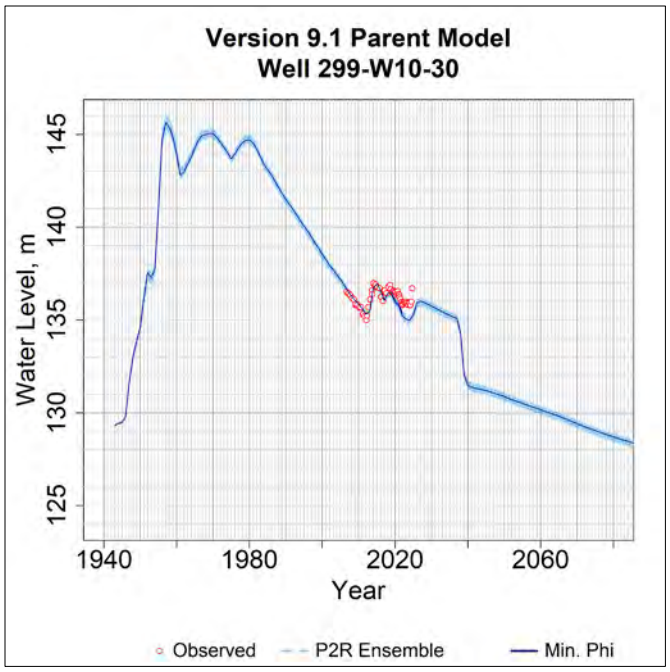

Figure B-173. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-30.

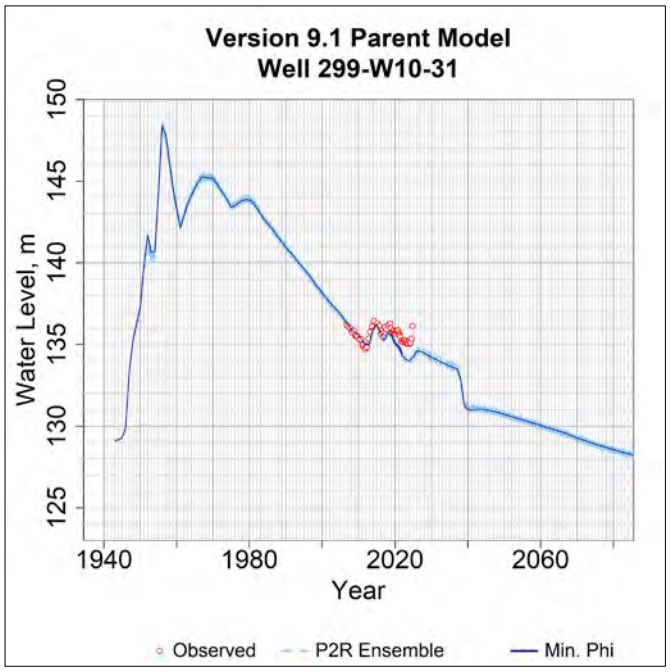

Figure B-174. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-31.

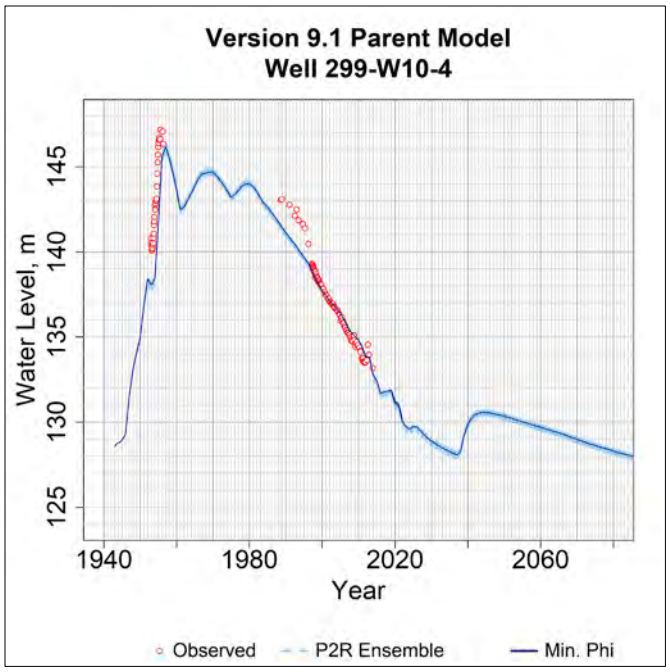

Figure B-175. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-4.

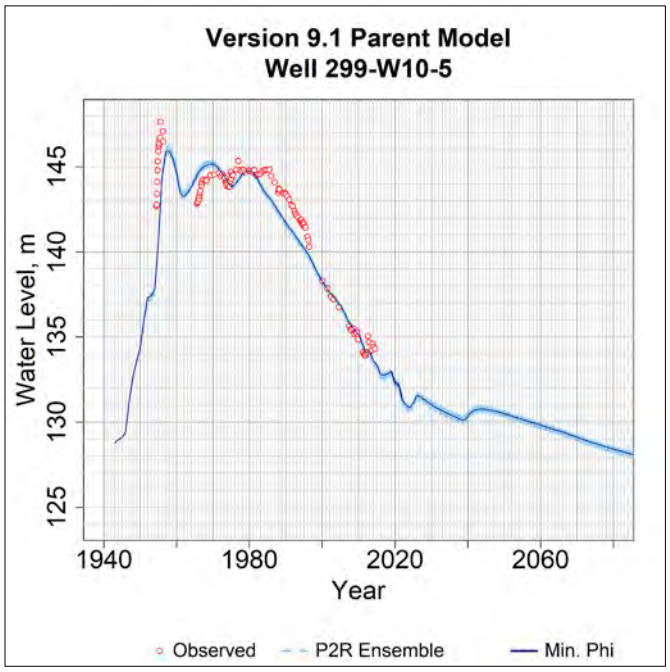

Figure B-176. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-5.

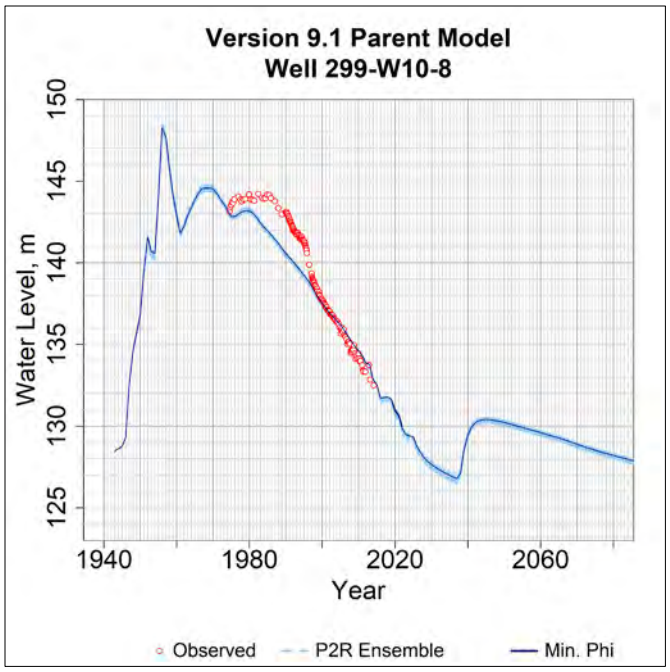

Figure B-177. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-8.

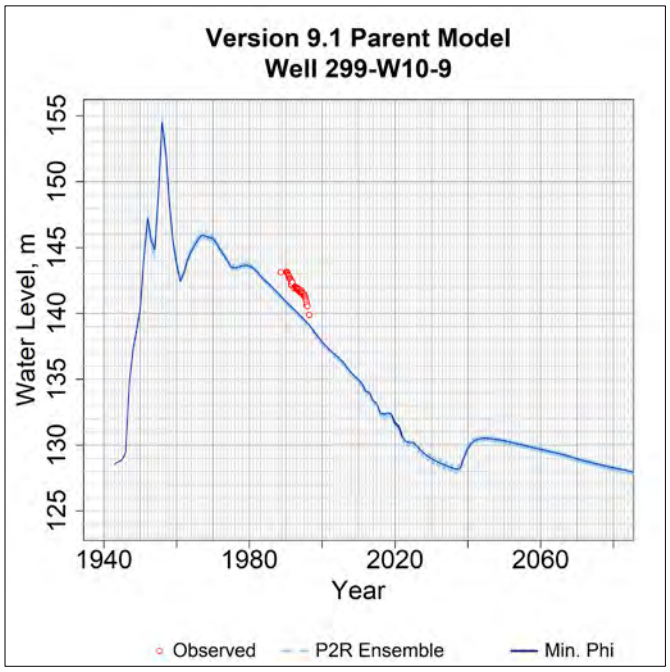

Figure B-178. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W10-9.

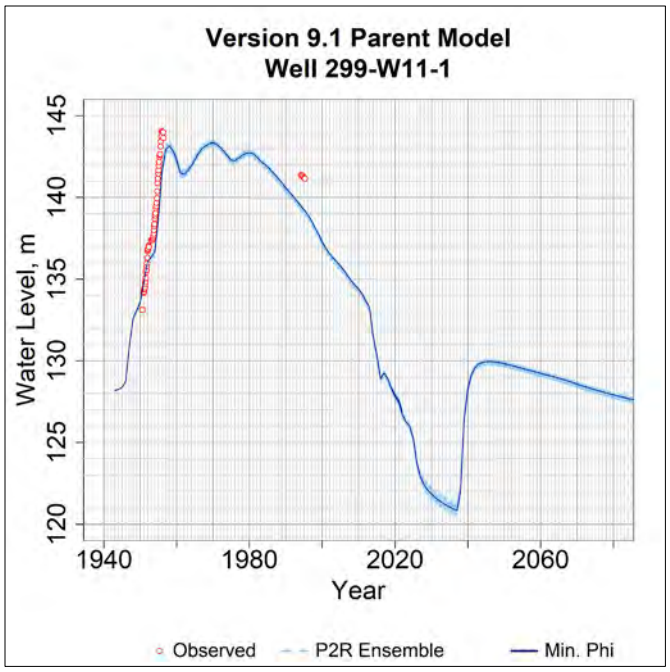

Figure B-179. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-1.

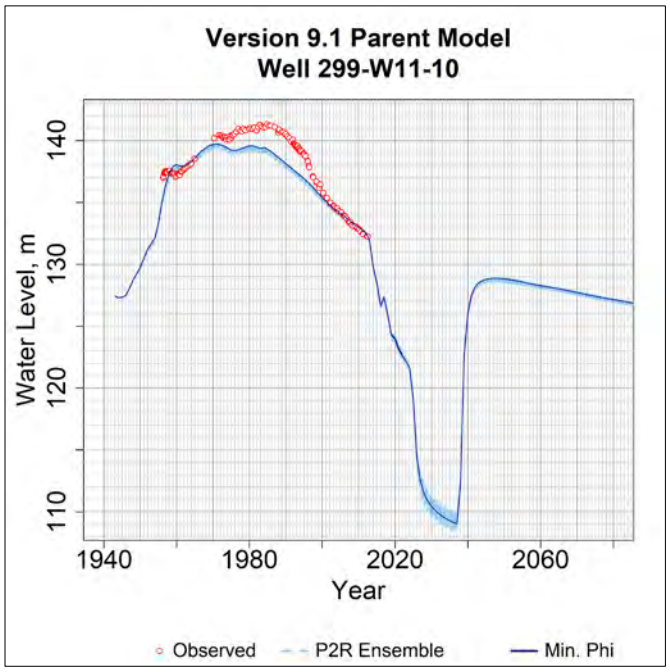

Figure B-180. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-10.

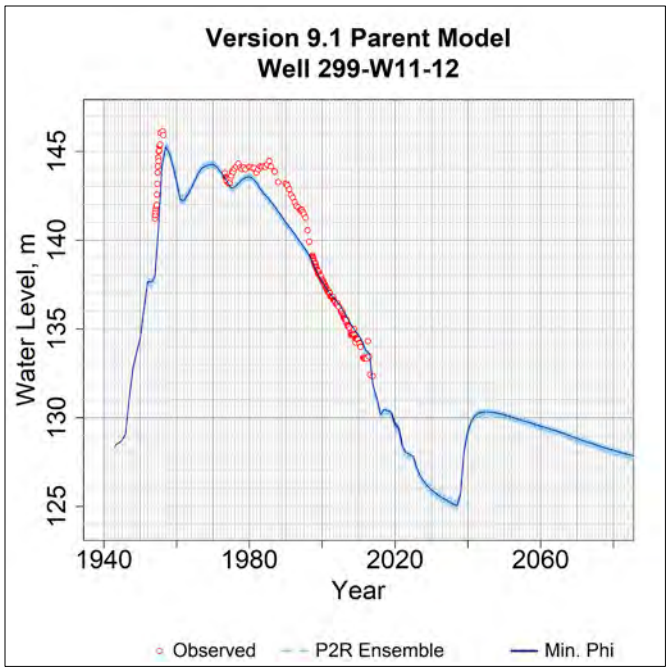

Figure B-181. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-12.

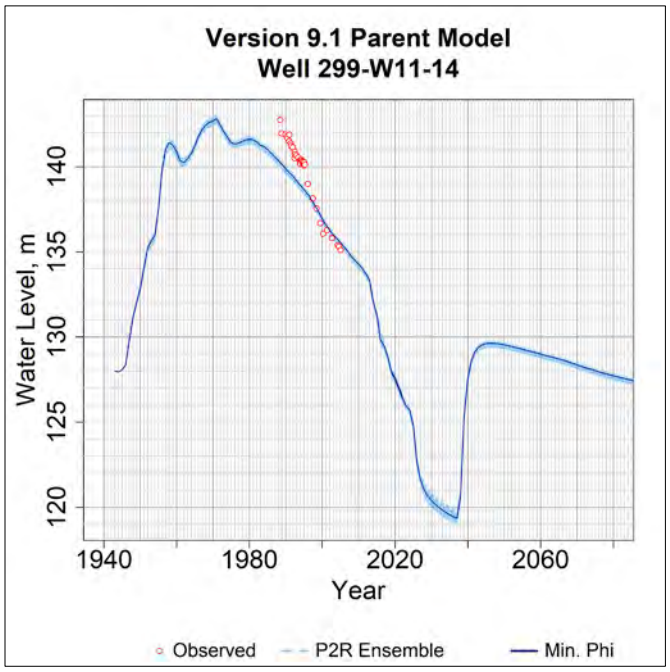

Figure B-182. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-14.

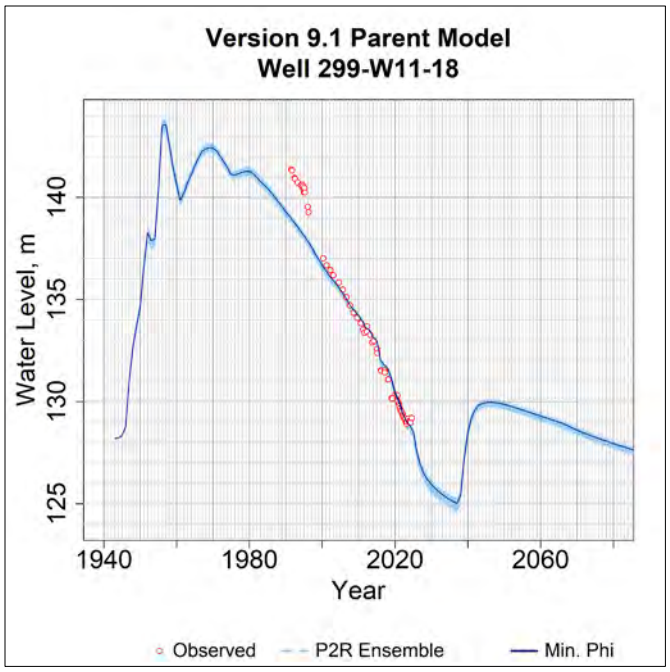

Figure B-183. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-18.

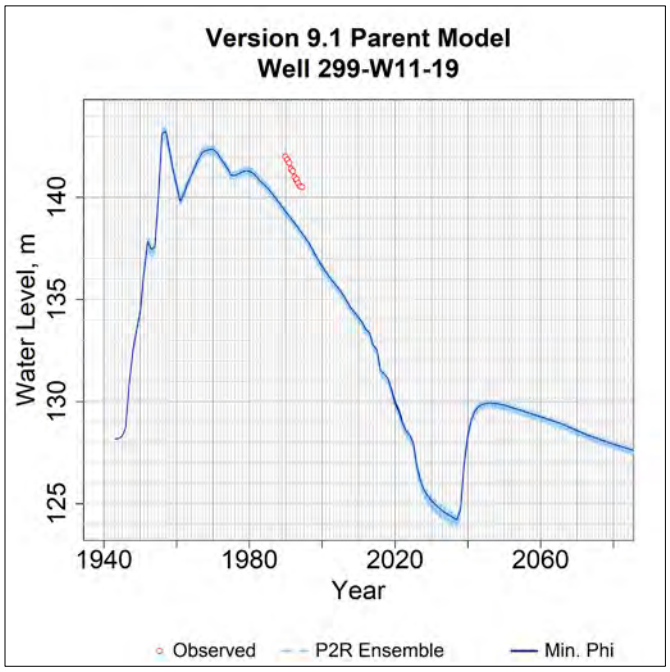

Figure B-184. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-19.

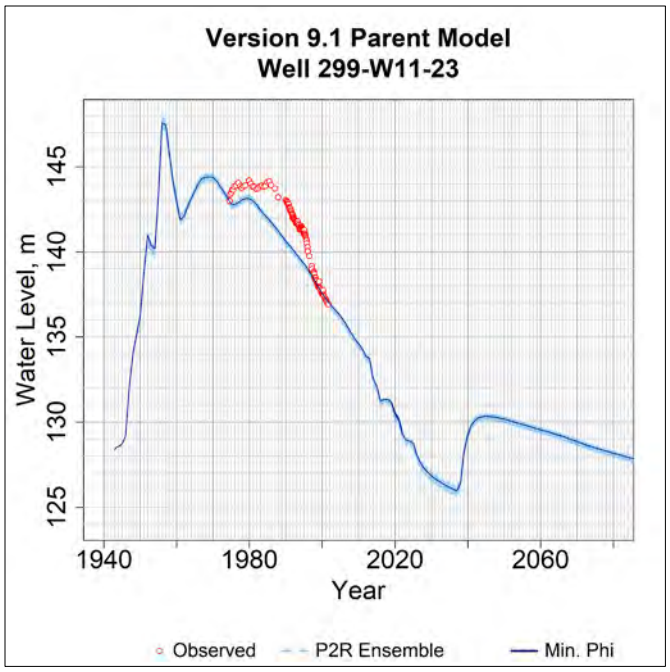

Figure B-185. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-23.

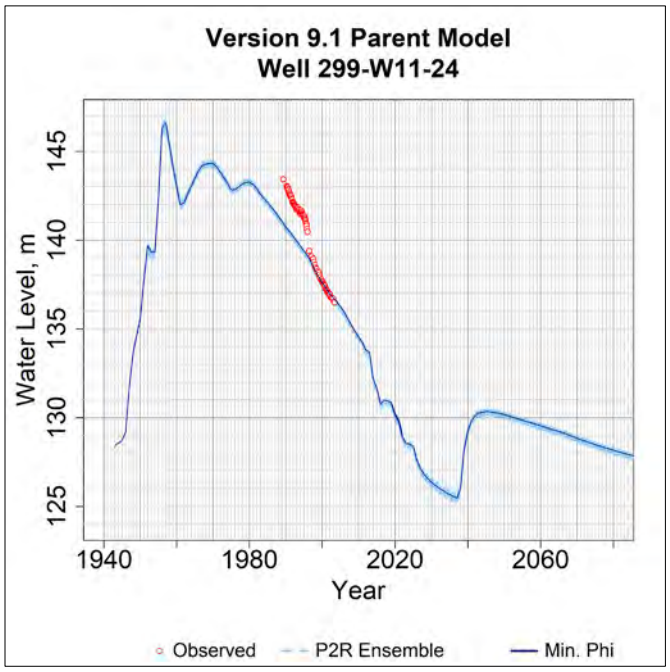

Figure B-186. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-24.

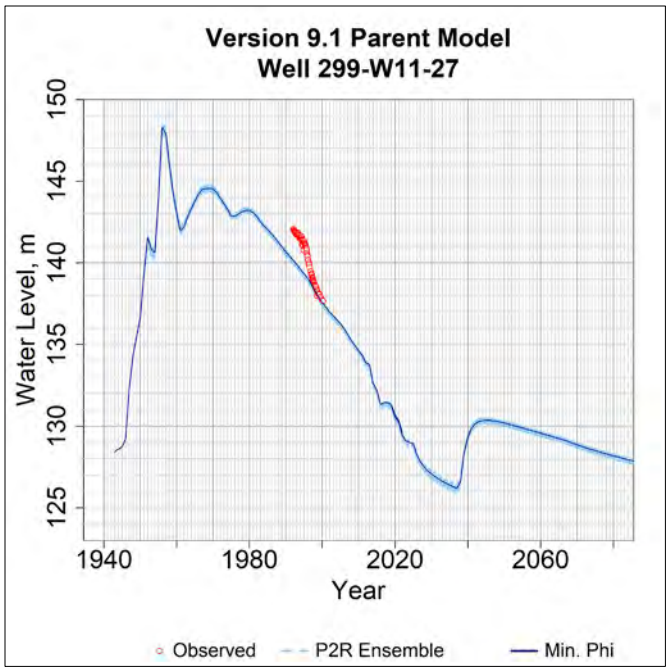

Figure B-187. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-27.

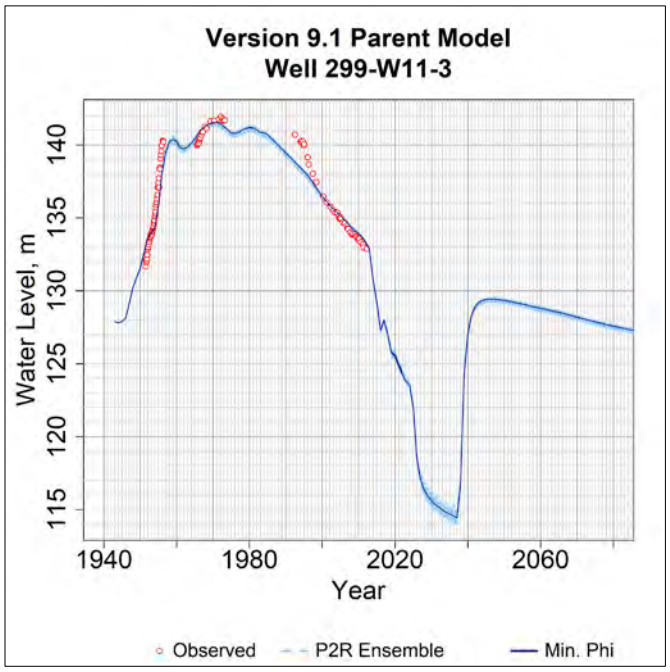

Figure B-188. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-3.

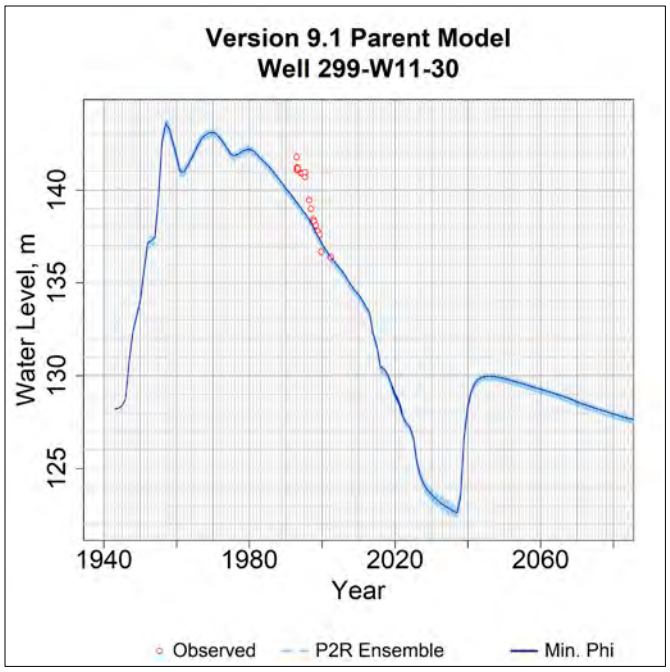

Figure B-189. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-30.

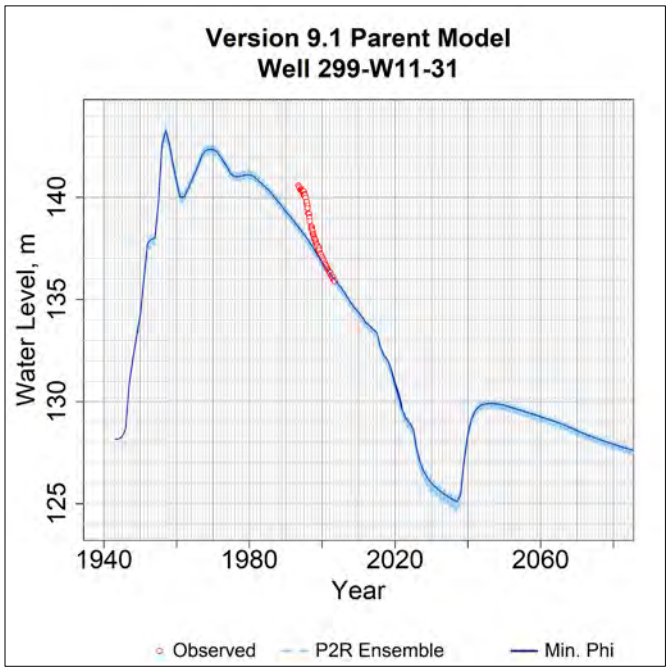

Figure B-190. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-31.

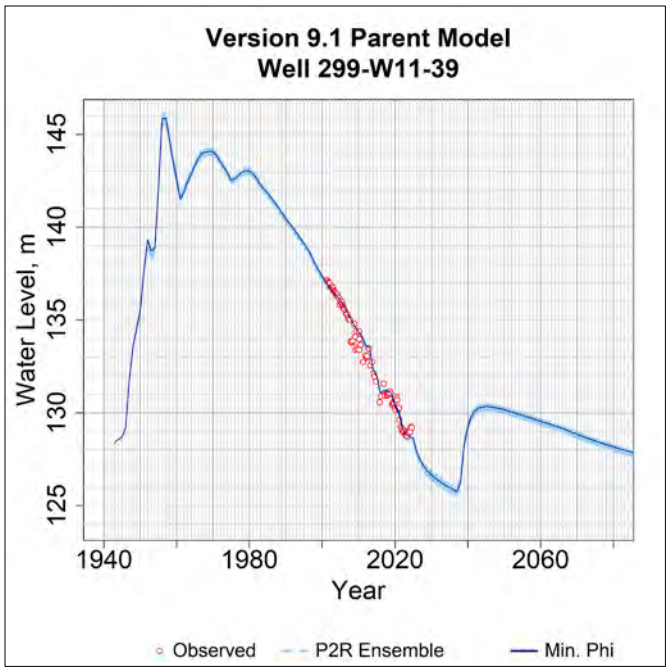

Figure B-191. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-39.

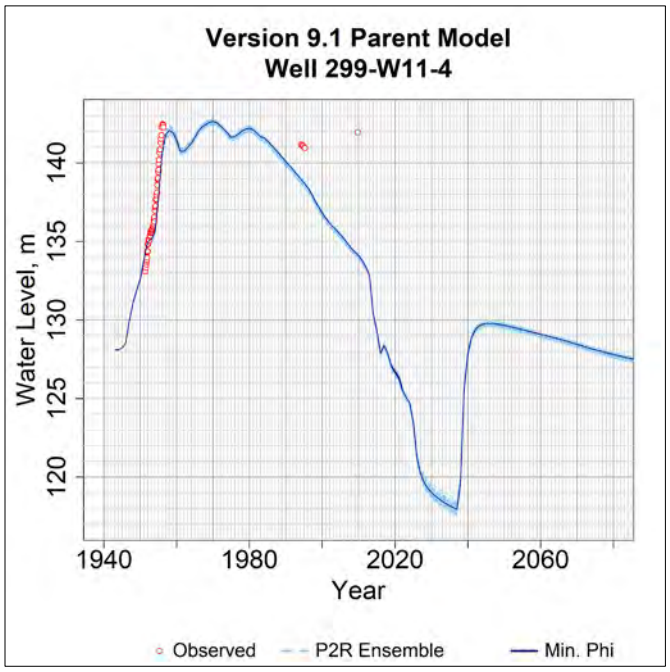

Figure B-192. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-4.

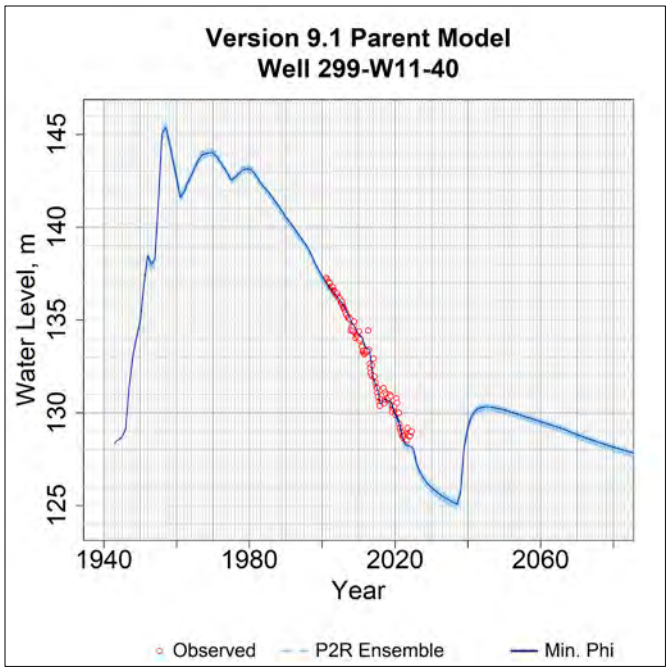

Figure B-193. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-40.

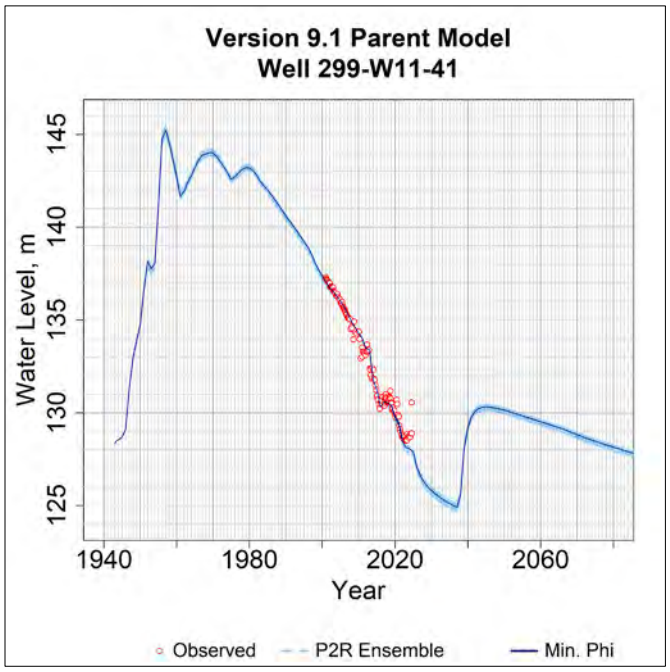

Figure B-194. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-41.

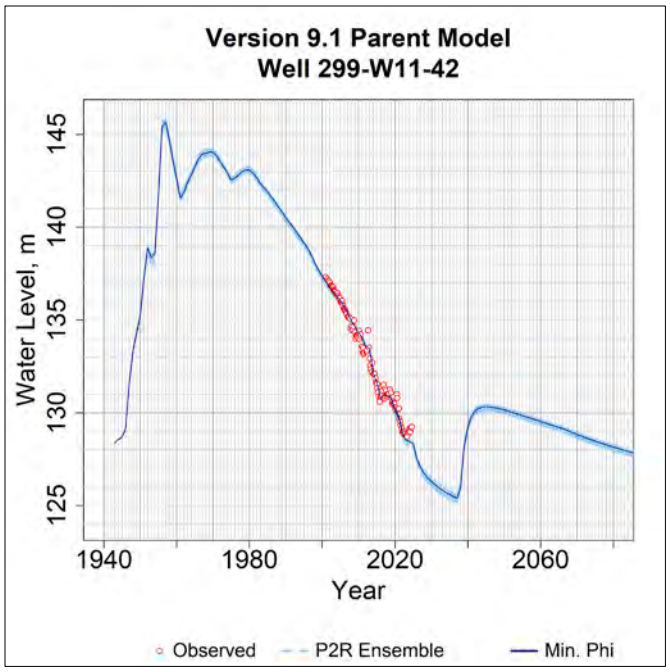

Figure B-195. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-42.

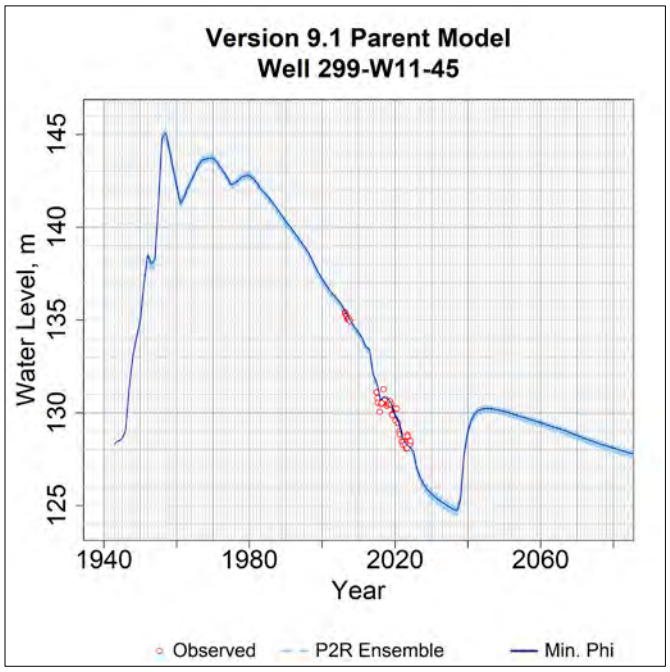

Figure B-196. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-45.

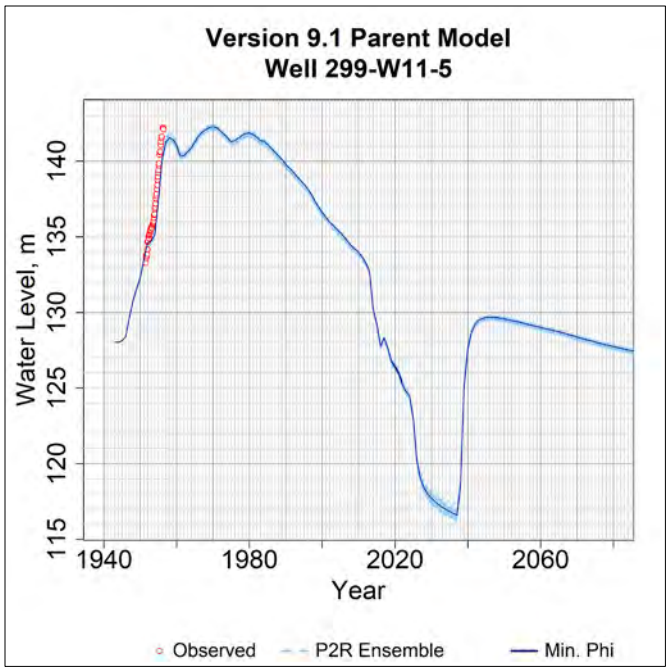

Figure B-197. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-5.

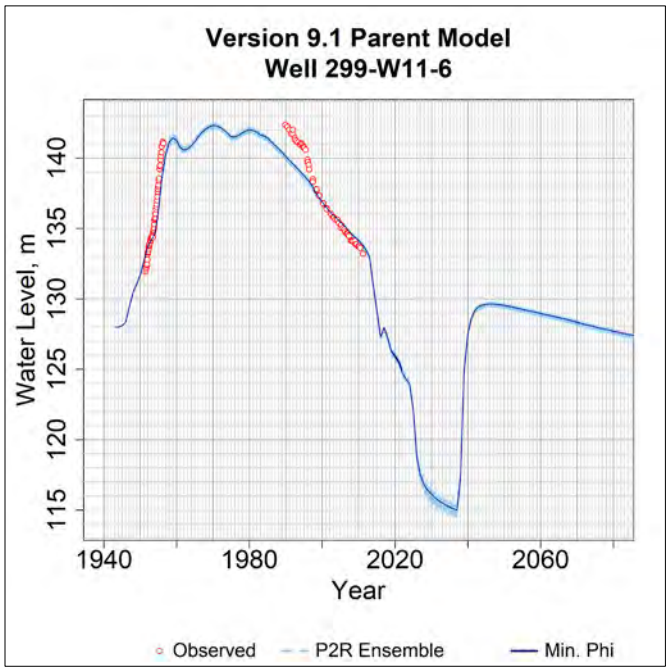

Figure B-198. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-6.

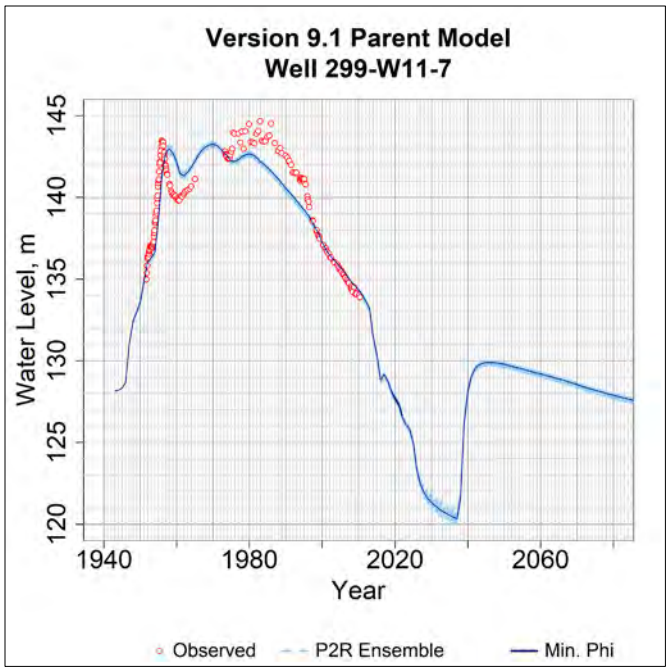

Figure B-199. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-7.

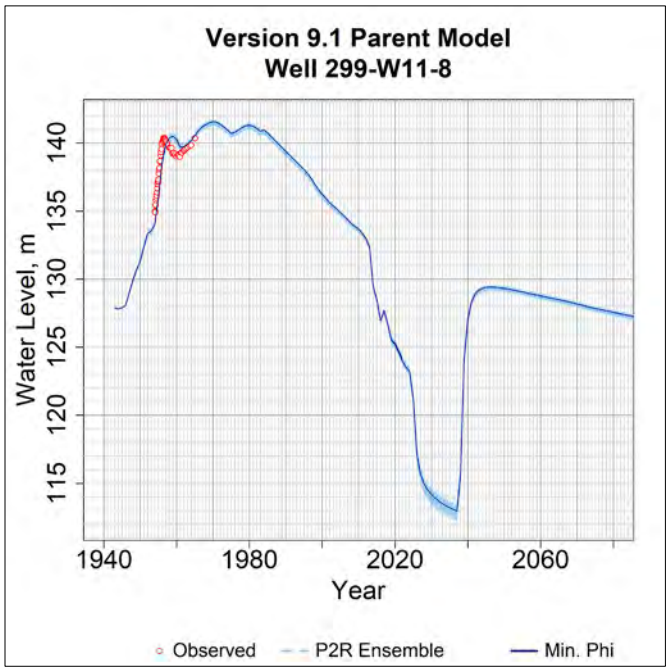

Figure B-200. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-8.

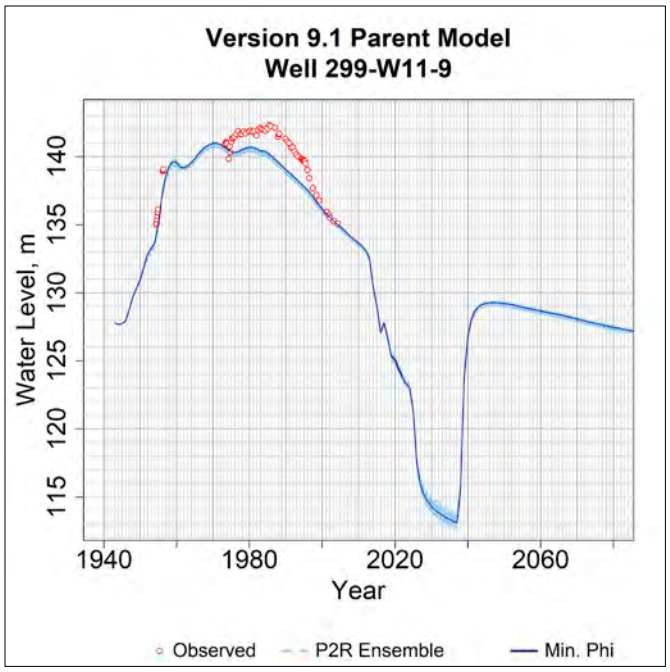

Figure B-201. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W11-9.

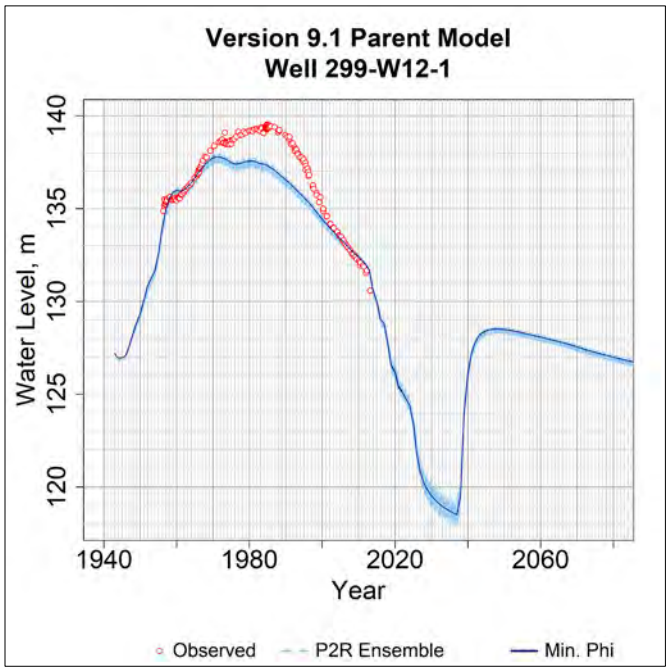

Figure B-202. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W12-1.

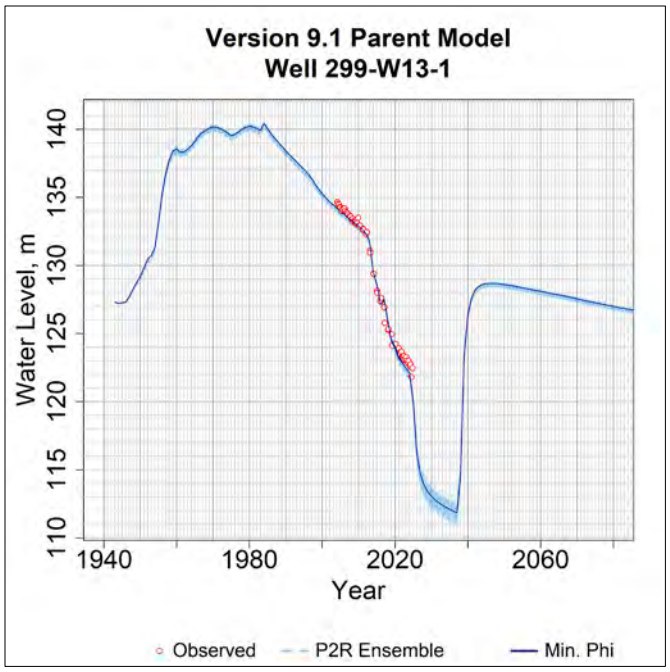

Figure B-203. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W13-1.

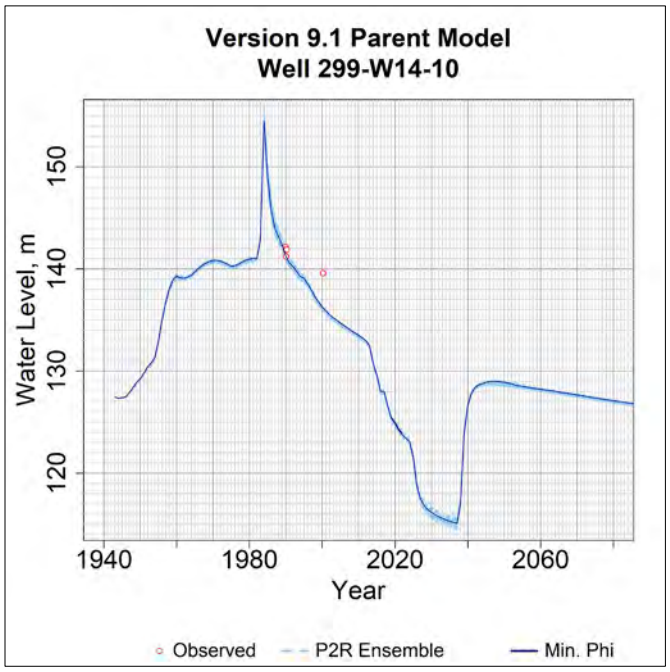

Figure B-204. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W14-10.

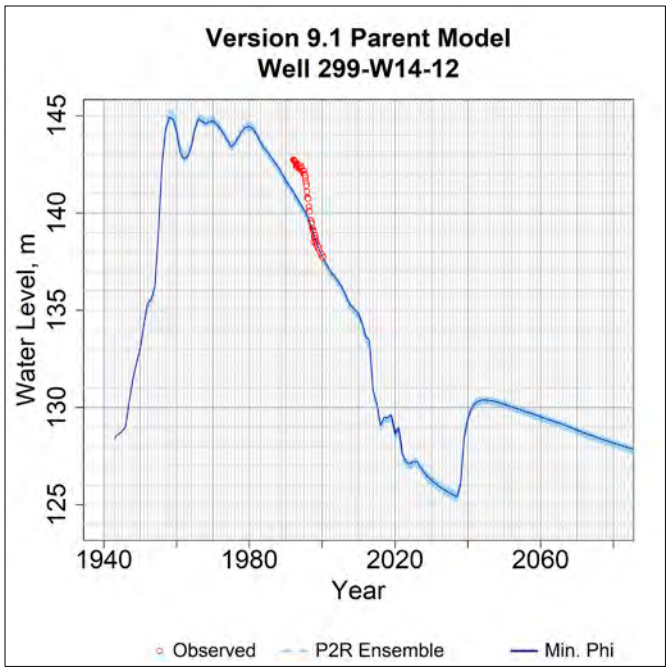

Figure B-205. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W14-12.

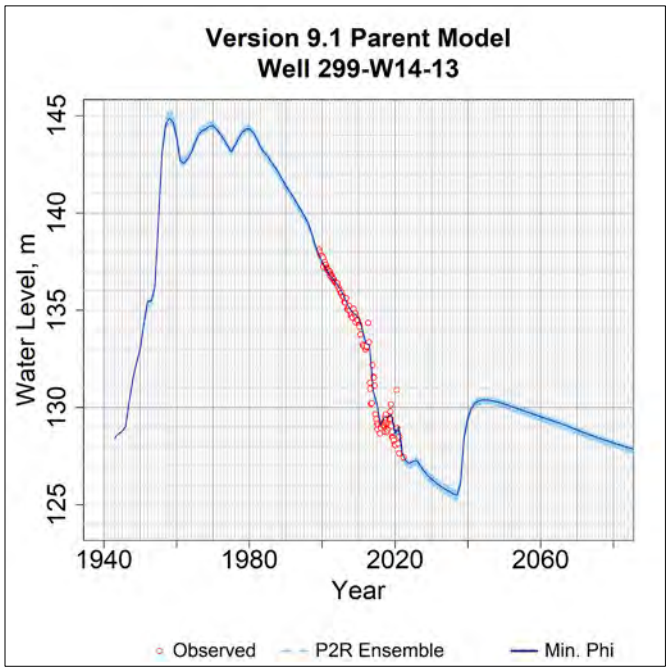

Figure B-206. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W14-13.

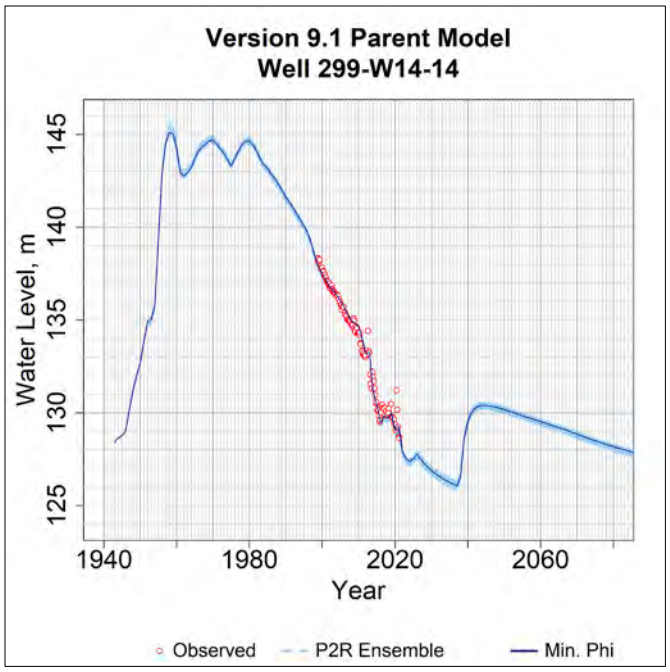

Figure B-207. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W14-14.

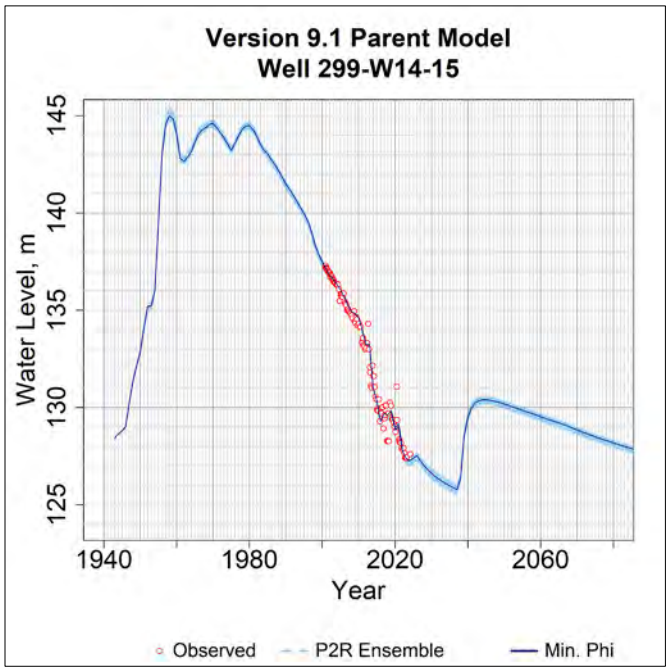

Figure B-208. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W14-15.

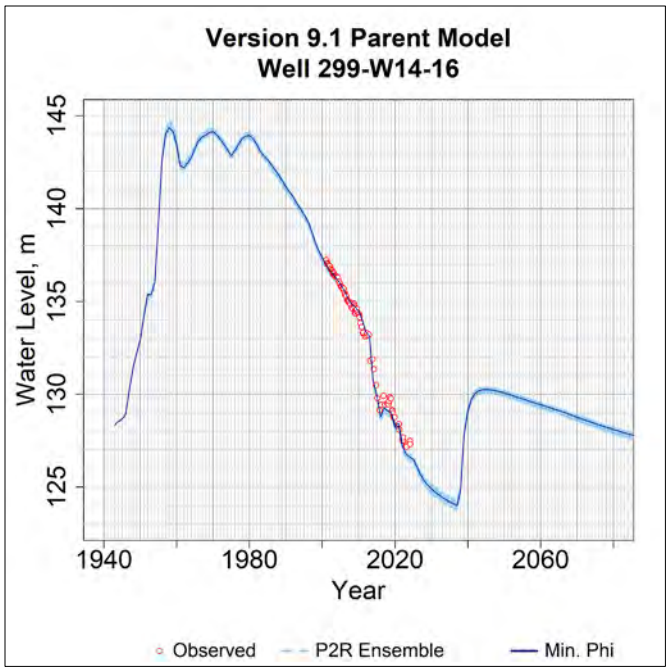

Figure B-209. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W14-16.

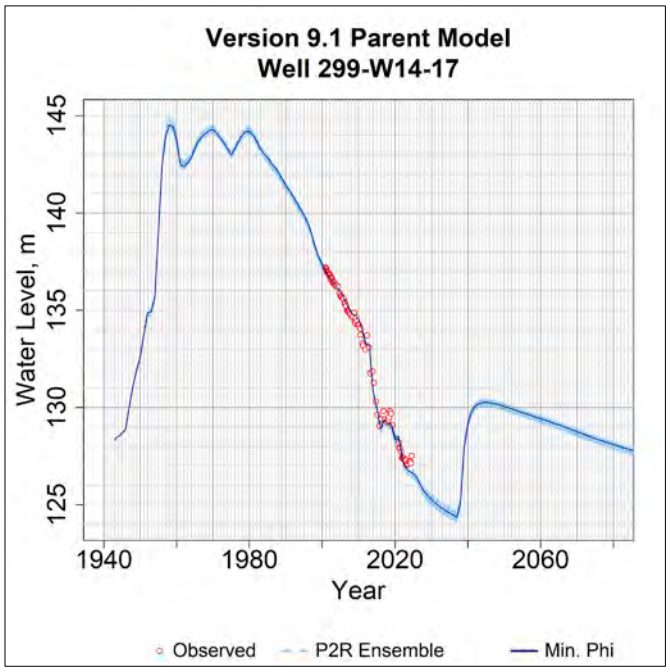

Figure B-210. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W14-17.

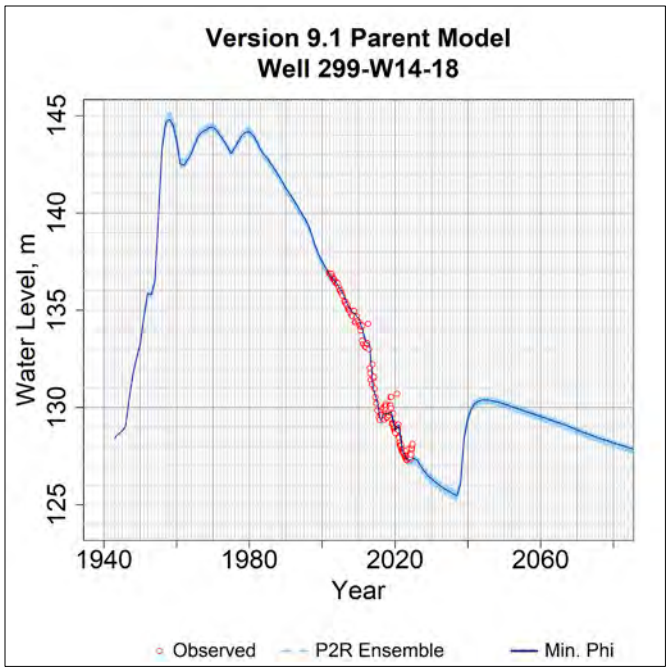

Figure B-211. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W14-18.

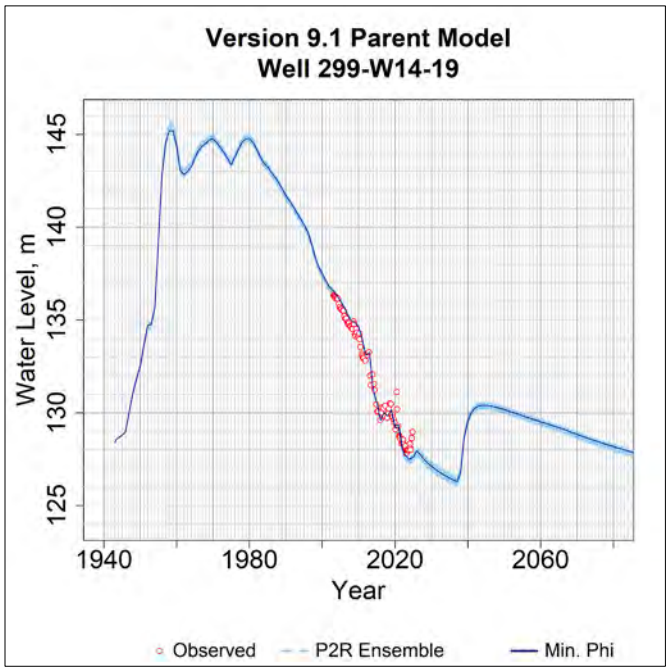

Figure B-212. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W14-19.

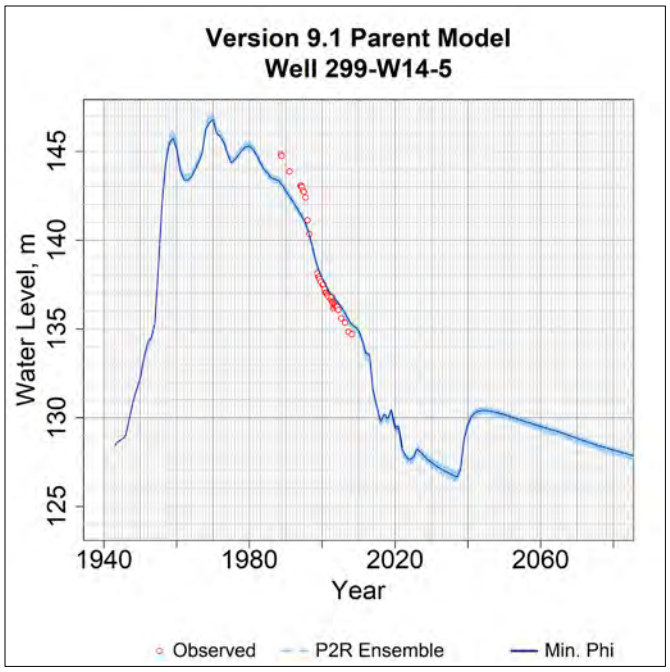

Figure B-213. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W14-5.

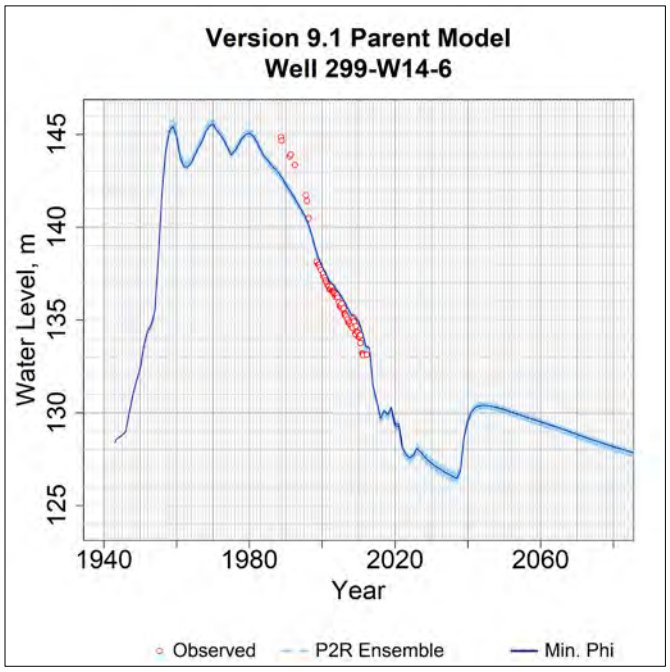

Figure B-214. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W14-6.

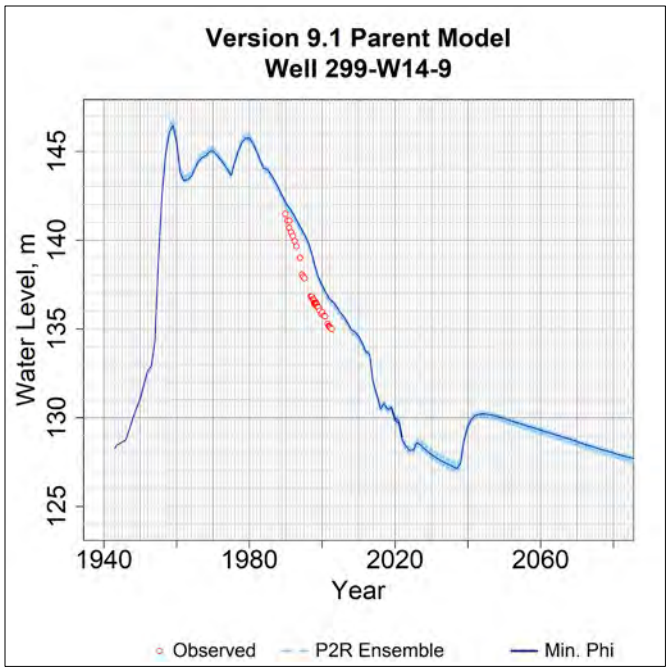

Figure B-215. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W14-9.

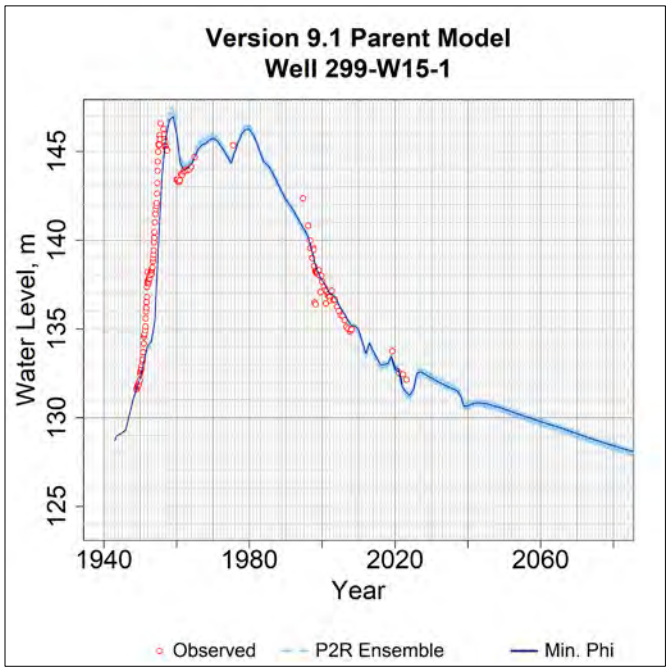

Figure B-216. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-1.

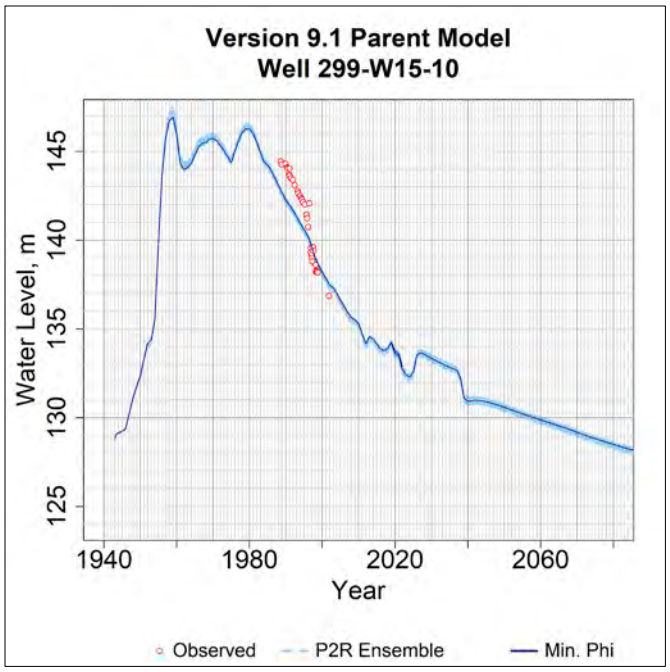

Figure B-217. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-10.

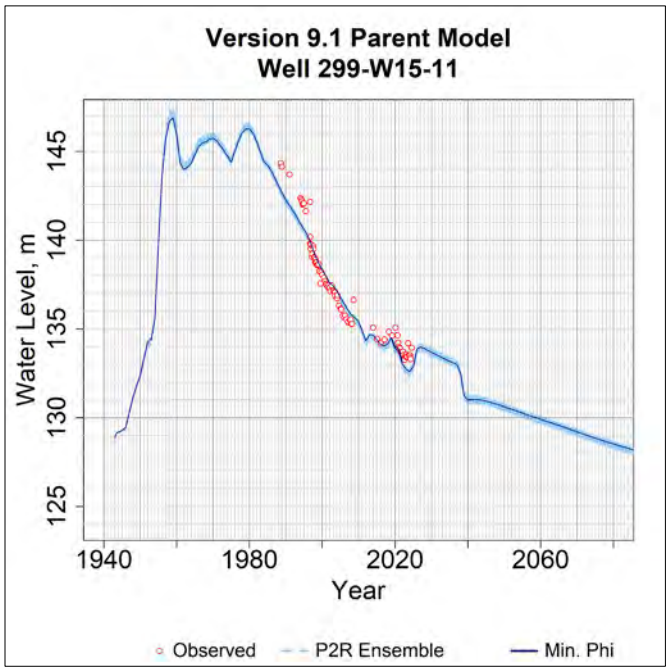

Figure B-218. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-11.

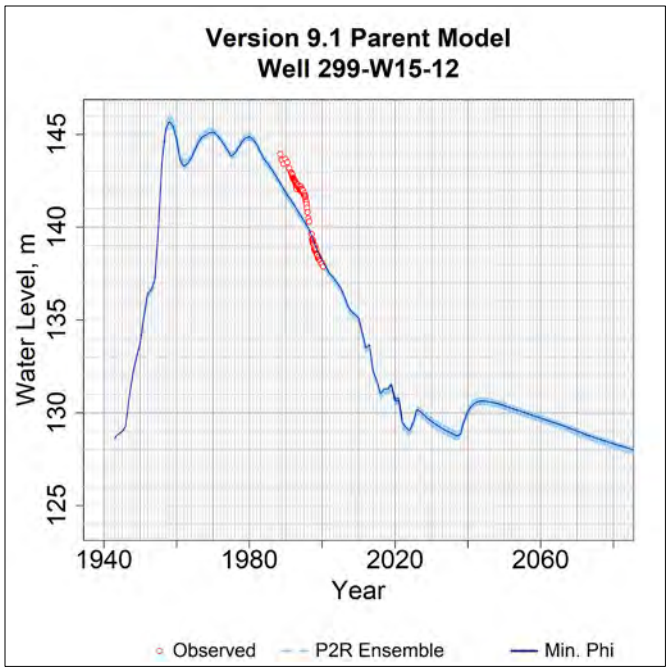

Figure B-219. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-12.

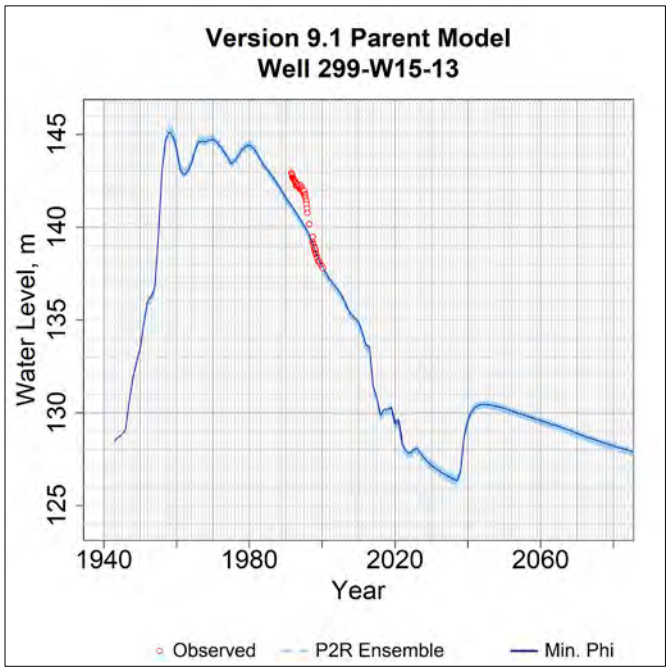

Figure B-220. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-13.

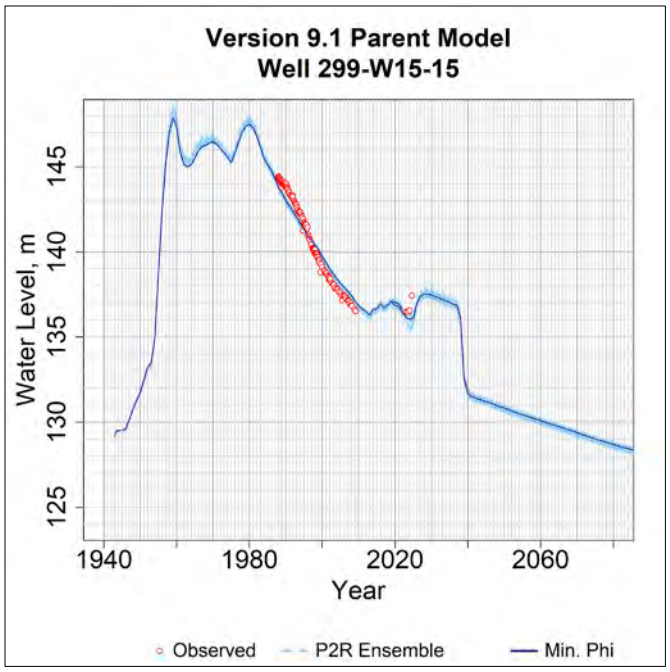

Figure B-221. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-15.

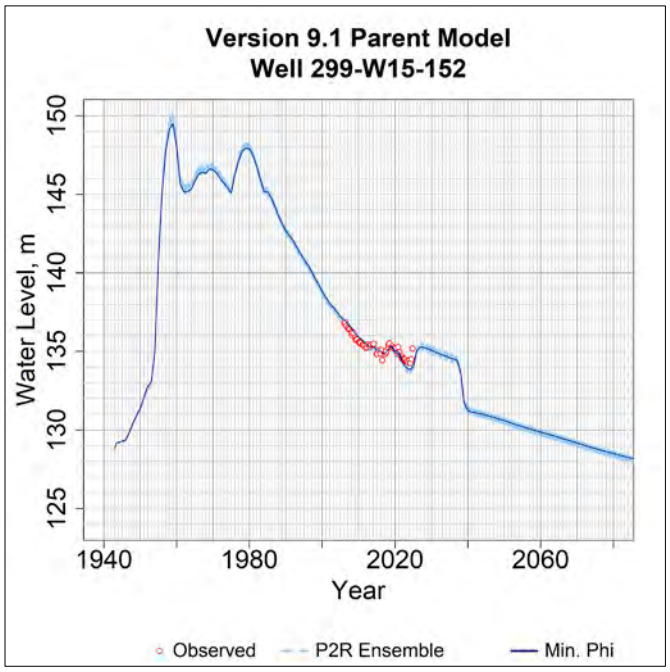

Figure B-222. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-152.

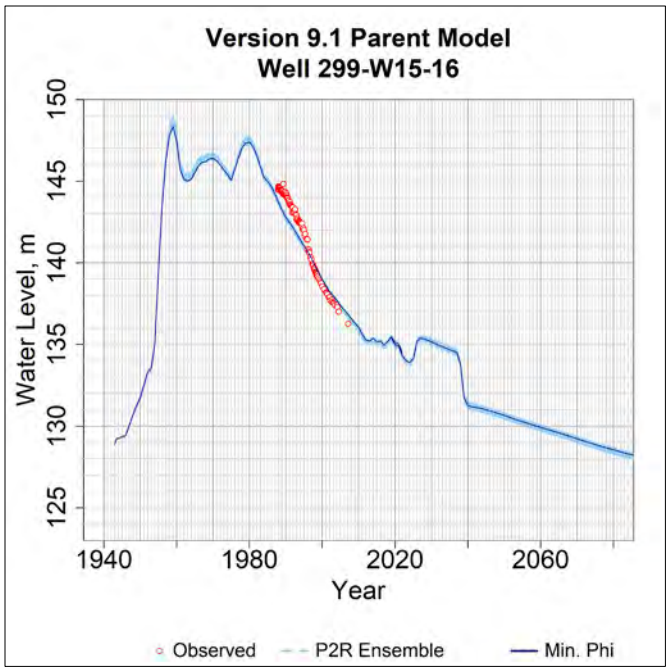

Figure B-223. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-16.

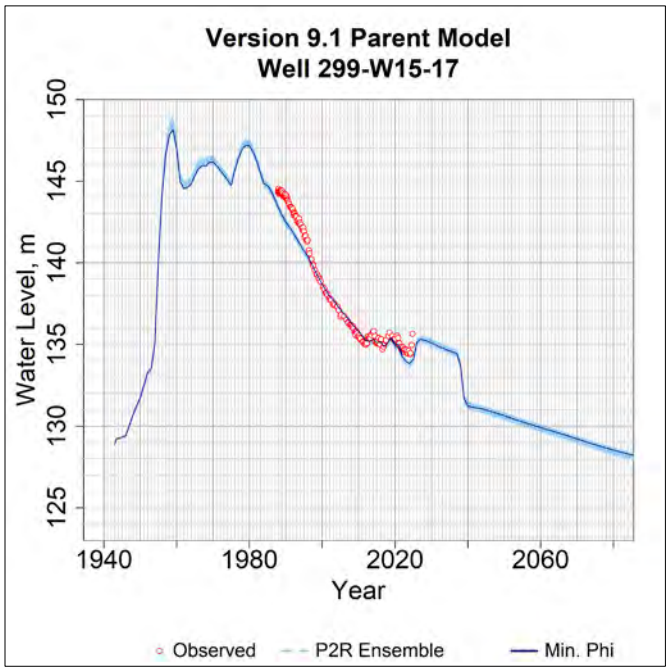

Figure B-224. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-17.

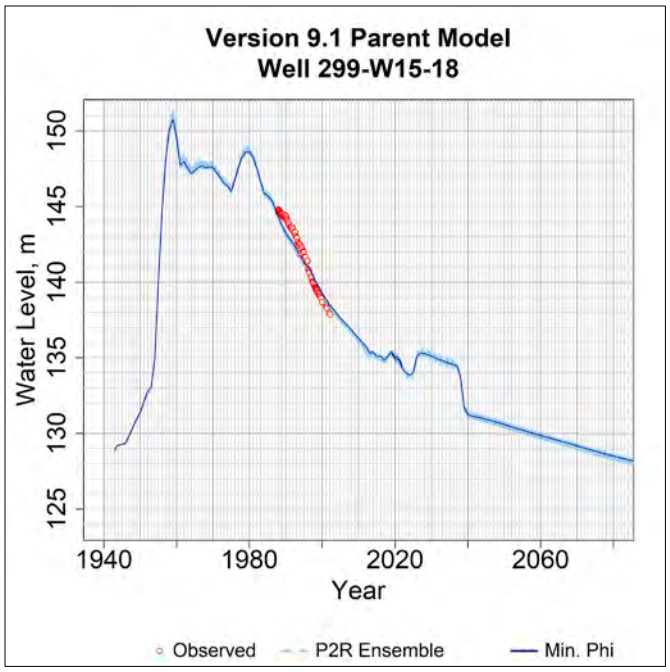

Figure B-225. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-18.

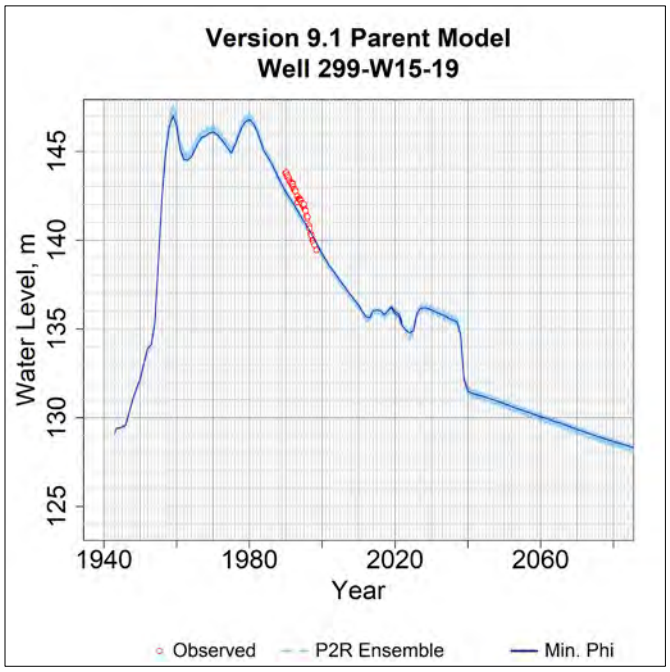

Figure B-226. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-19.

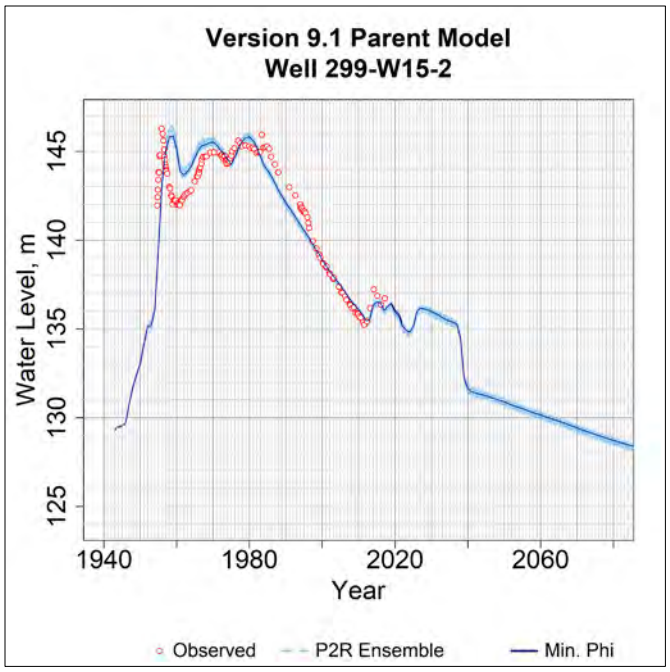

Figure B-227. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-2.

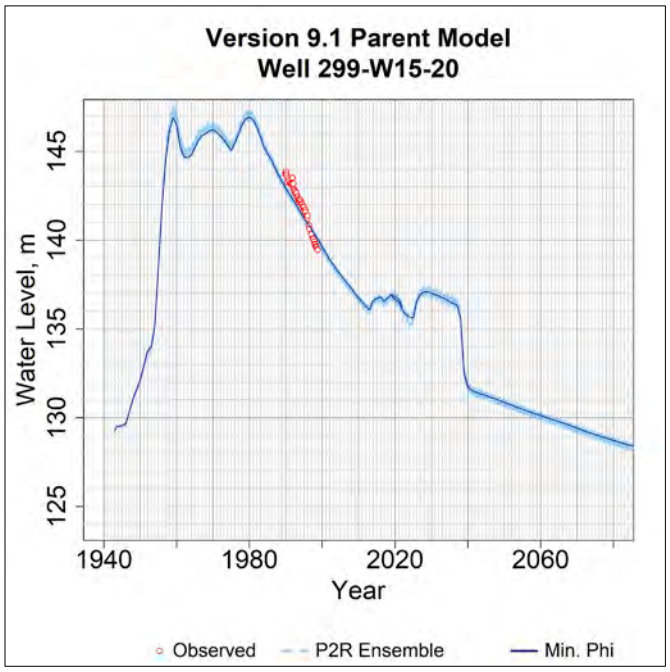

Figure B-228. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-20.

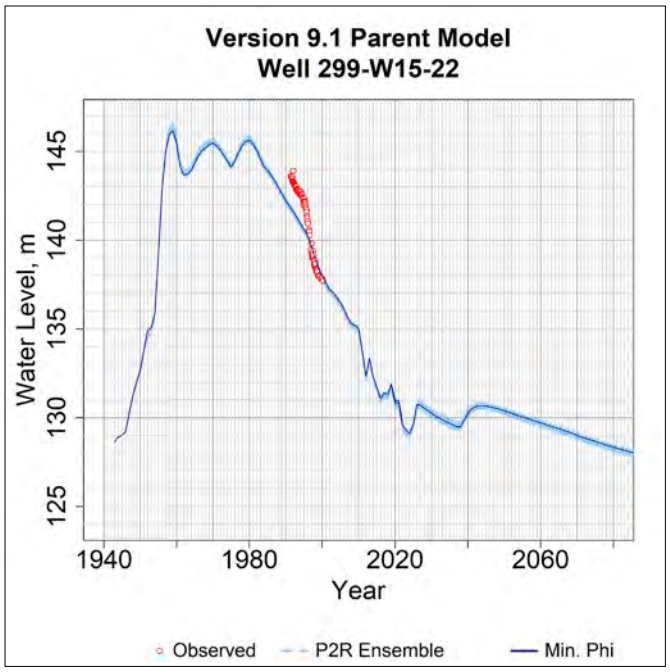

Figure B-229. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-22.

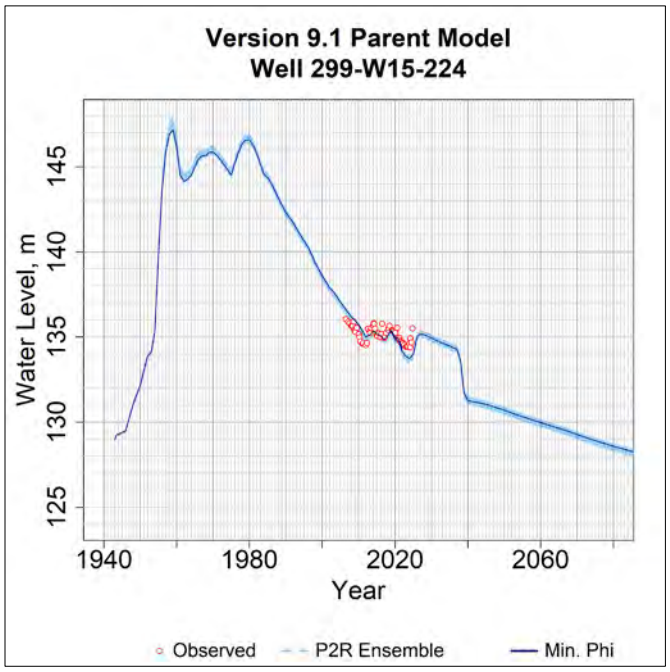

Figure B-230. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-224.

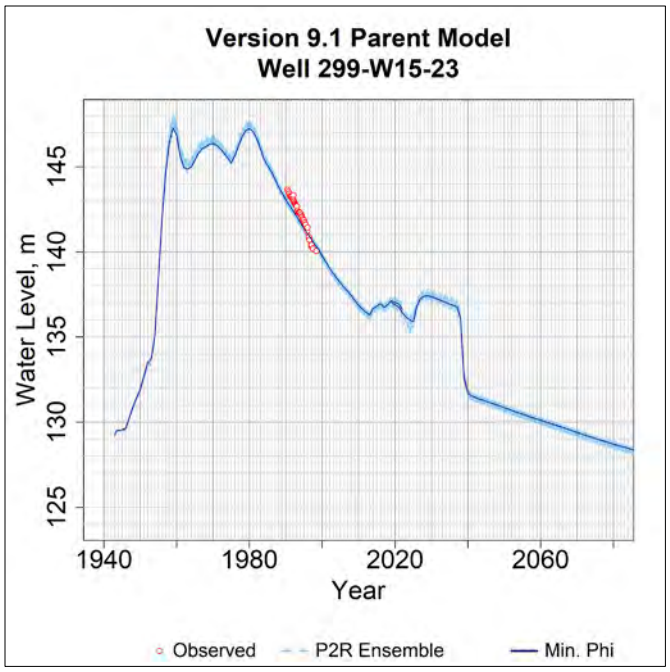

Figure B-231. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-23.

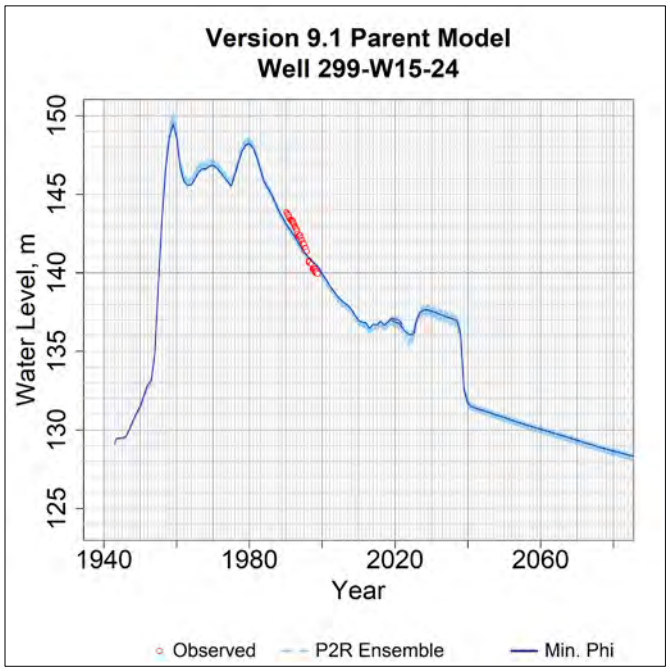

Figure B-232. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-24.

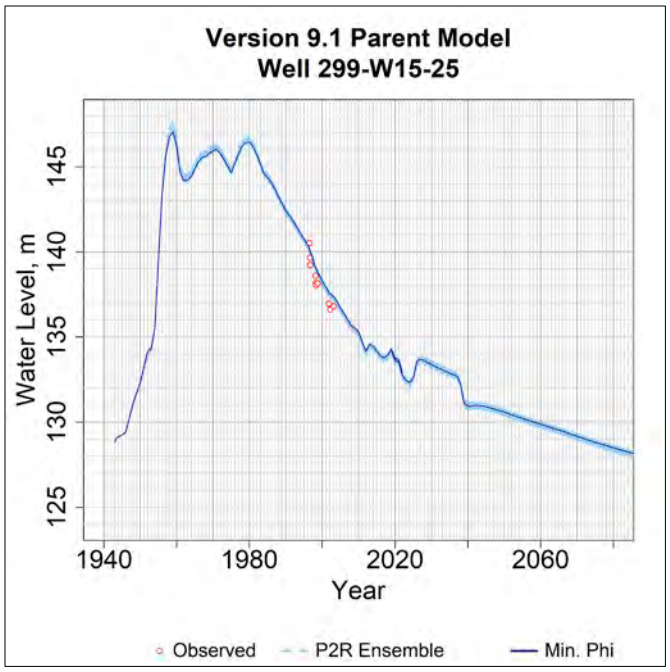

Figure B-233. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-25.

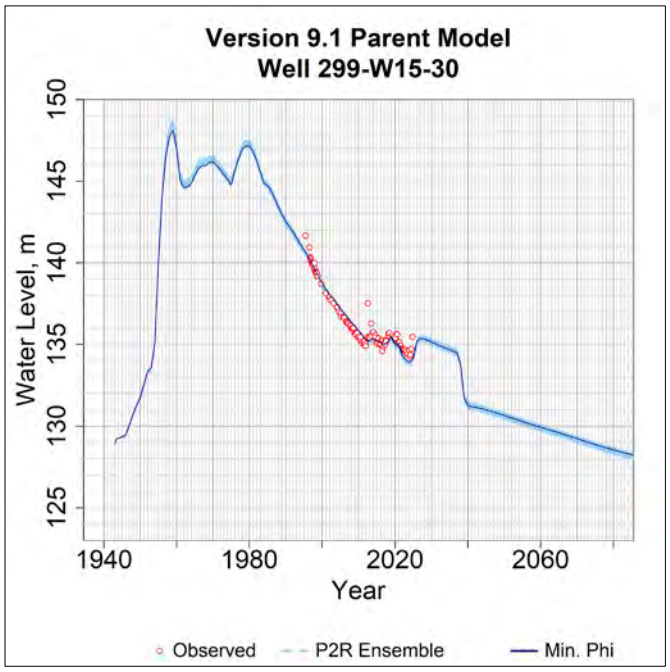

Figure B-234. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-30.

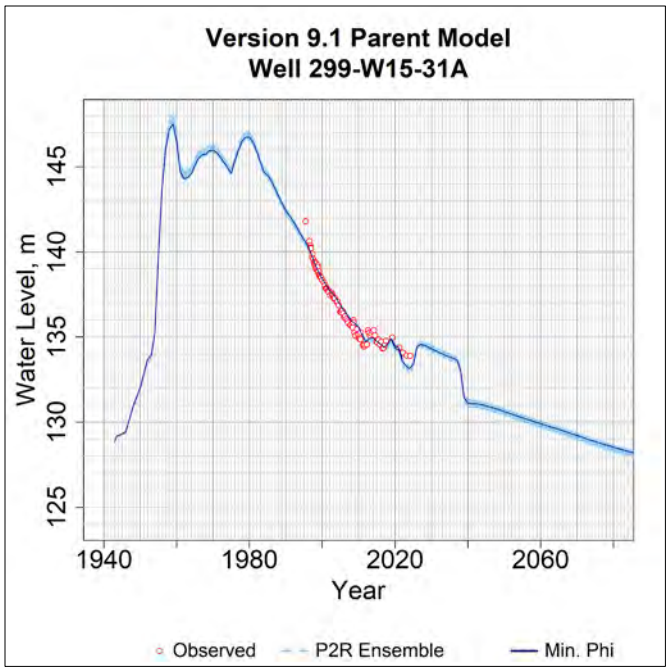

Figure B-235. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-31A.

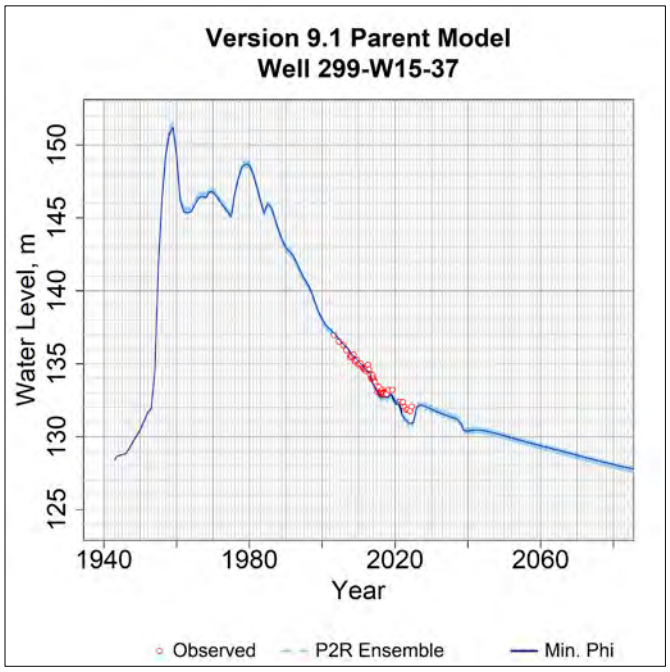

Figure B-236. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-37.

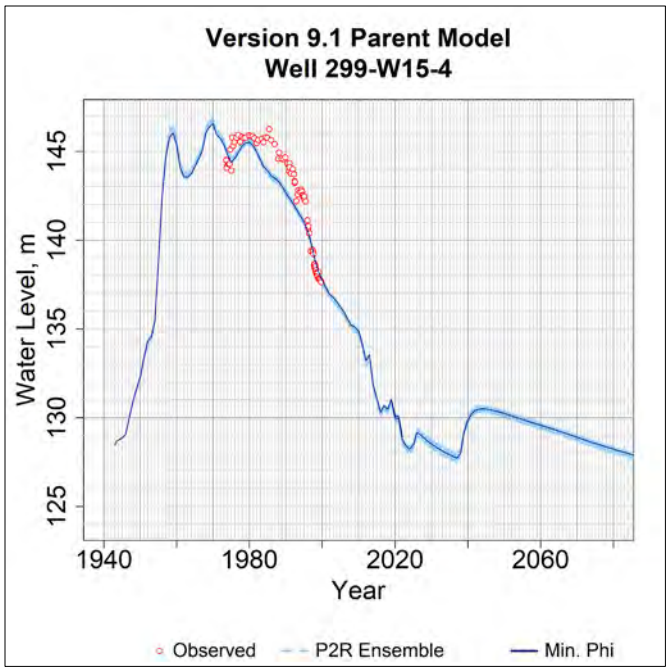

Figure B-237. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-4.

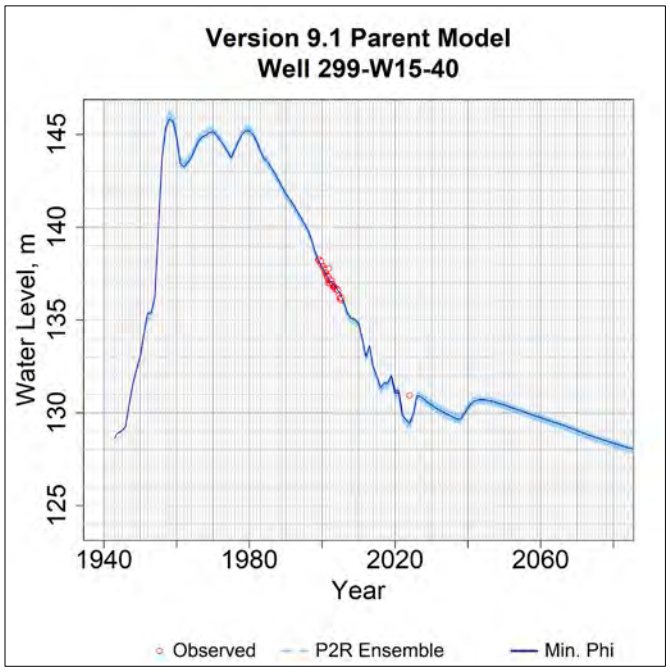

Figure B-238. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-40.

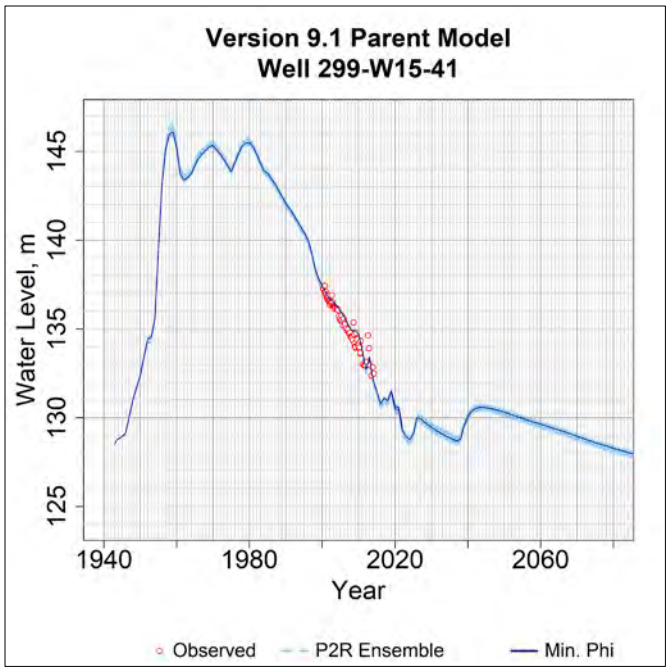

Figure B-239. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-41.

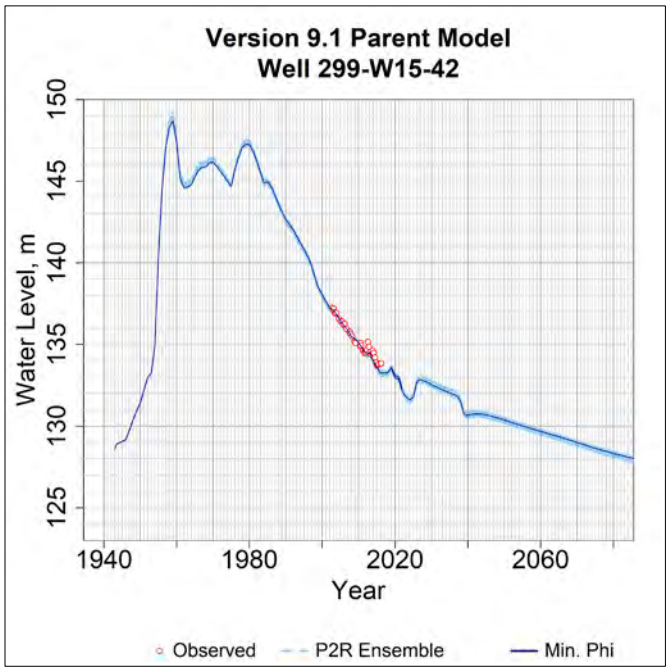

Figure B-240. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-42.

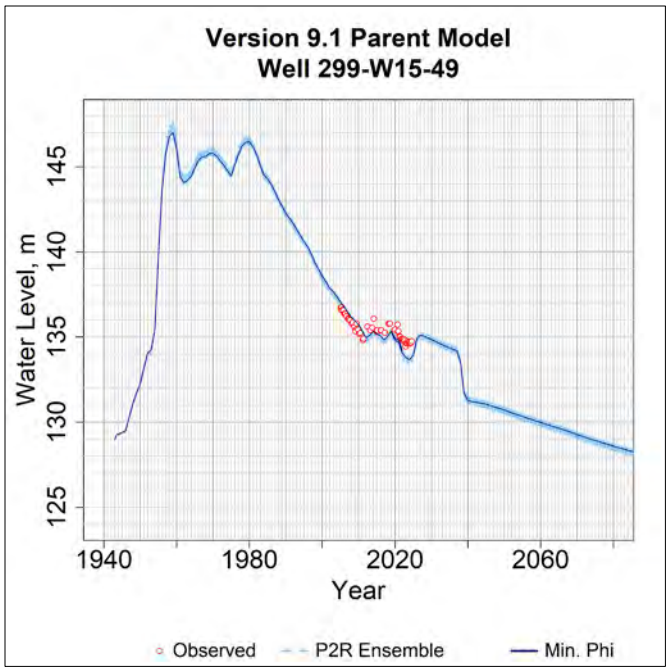

Figure B-241. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-49.

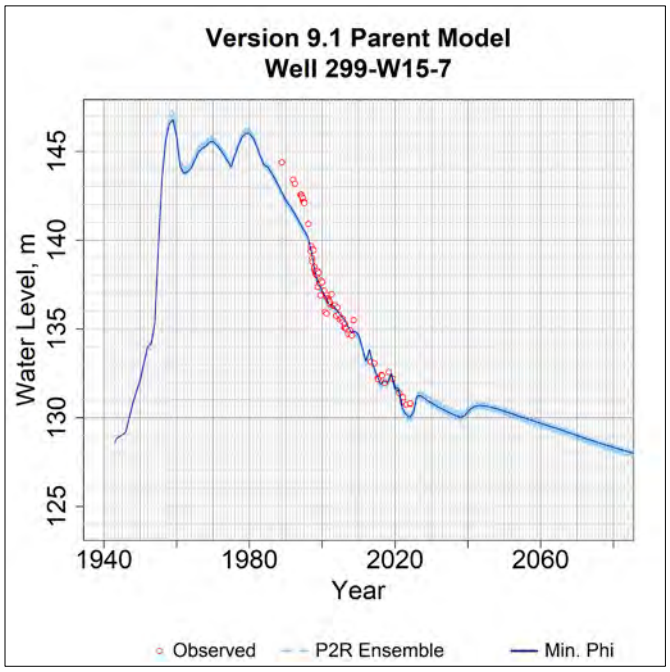

Figure B-242. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-7.

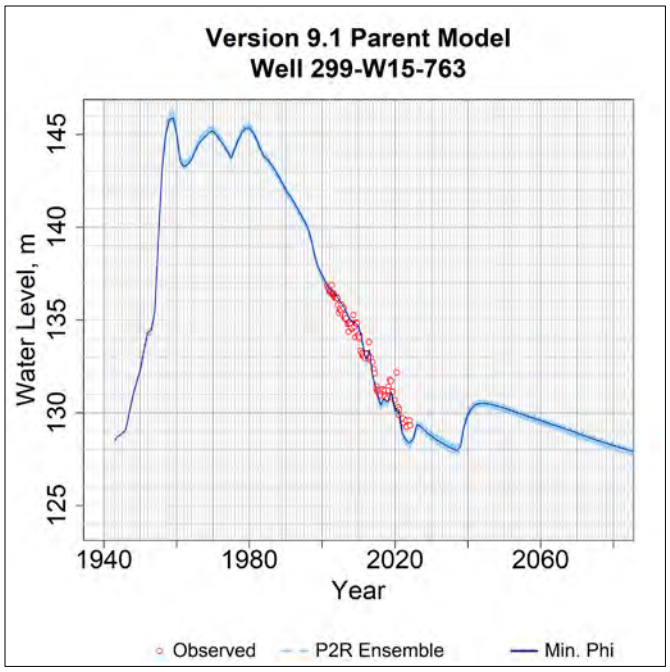

Figure B-243. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-763.

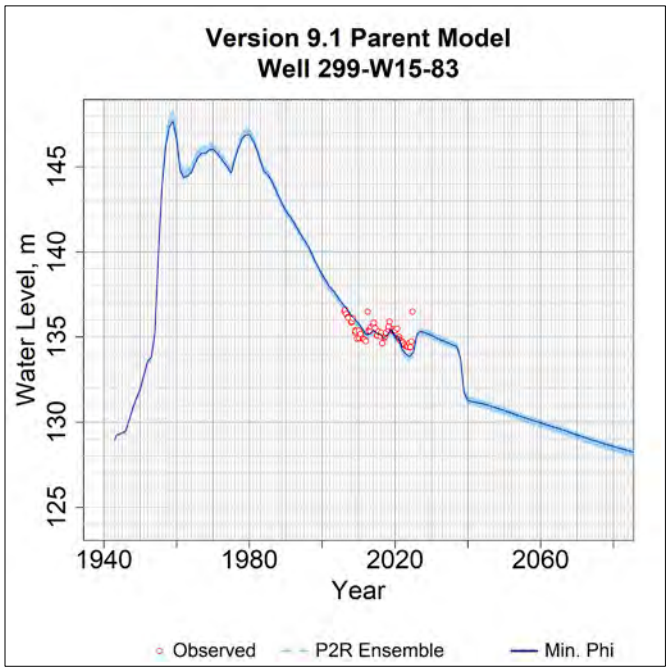

Figure B-244. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-83.

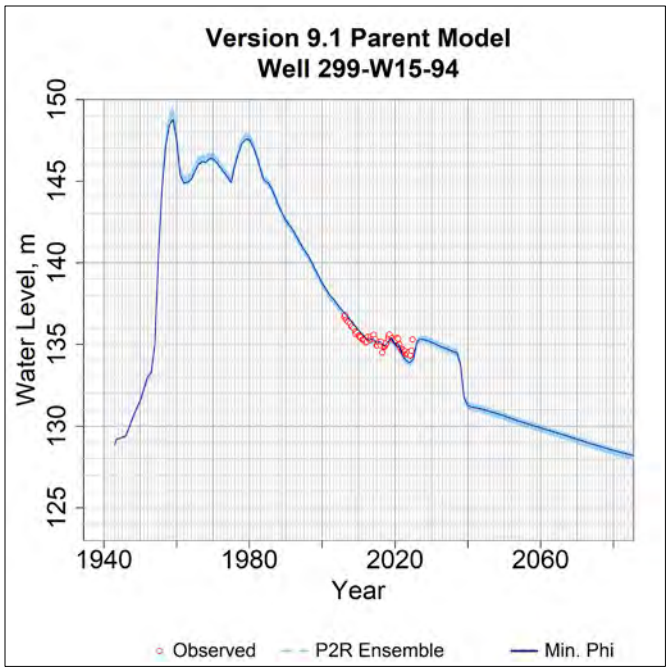

Figure B-245. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W15-94.

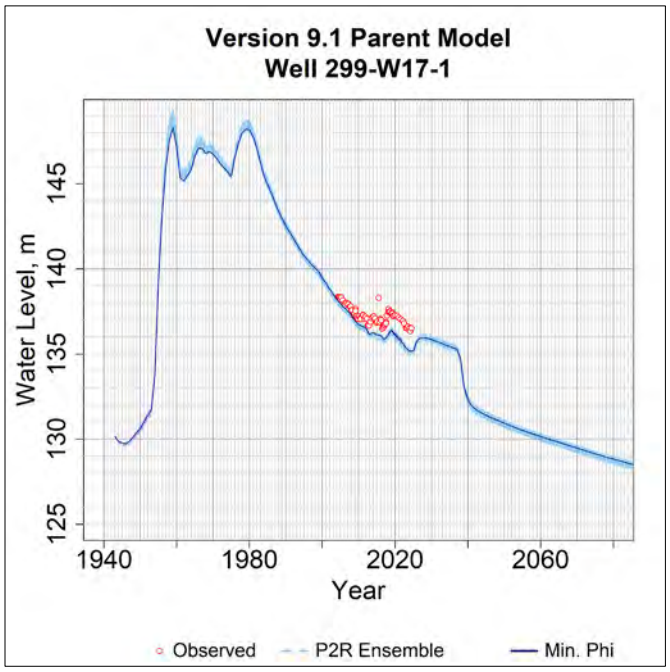

Figure B-246. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W17-1.

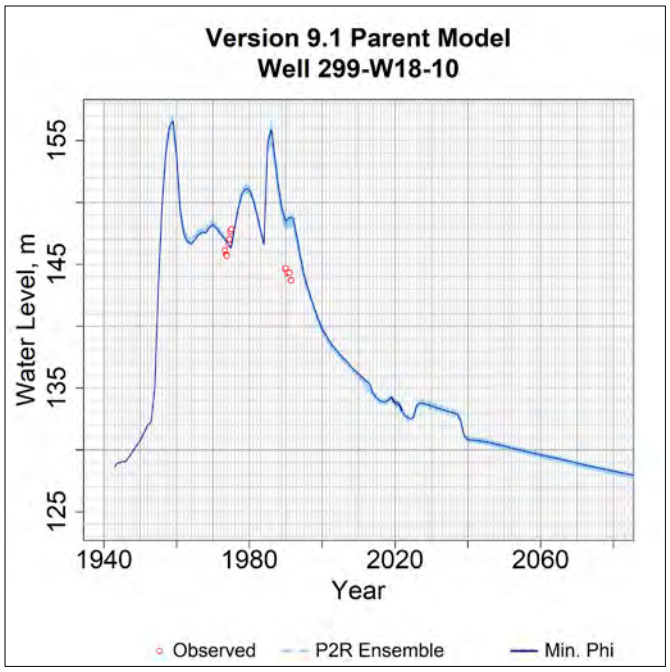

Figure B-247. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-10.

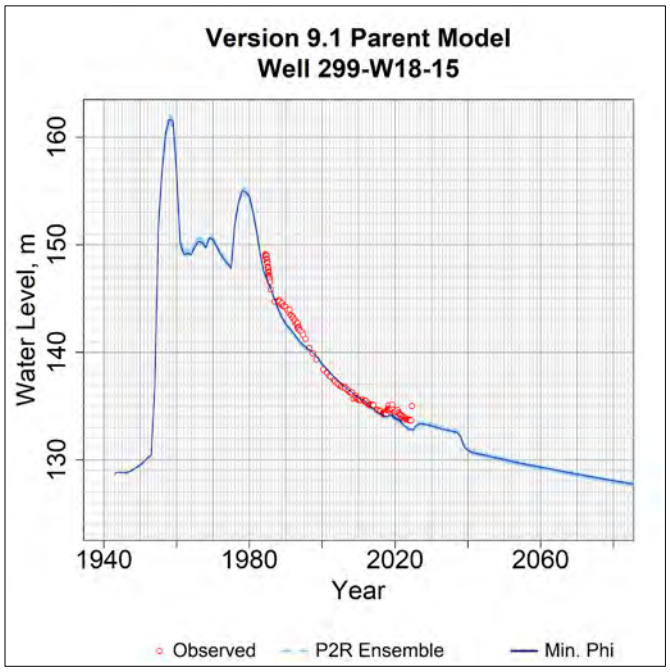

Figure B-248. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-15.

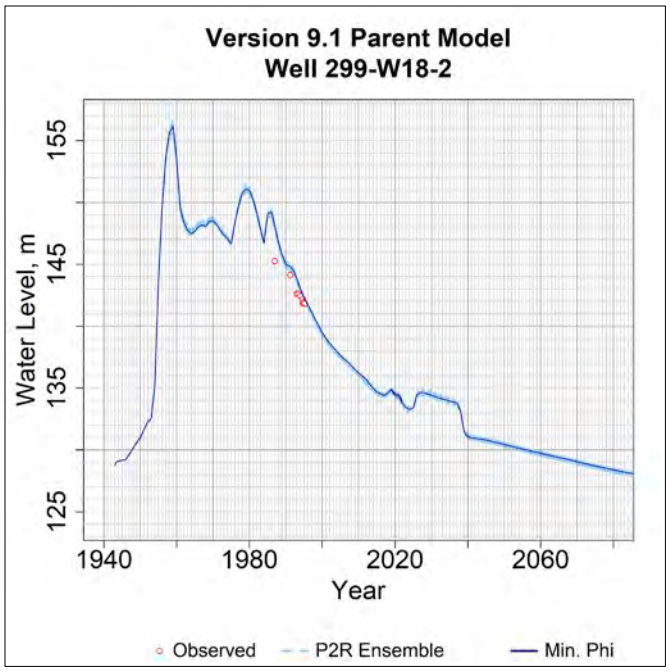

Figure B-249. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-2.

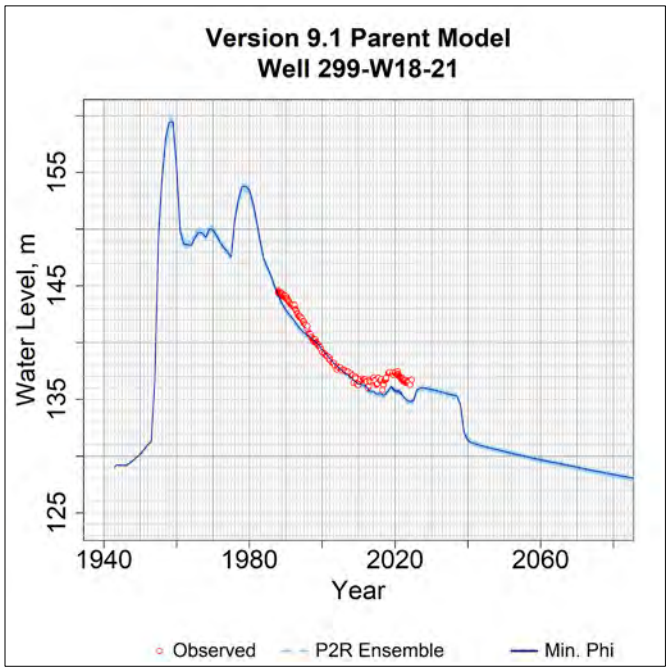

Figure B-250. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-21.

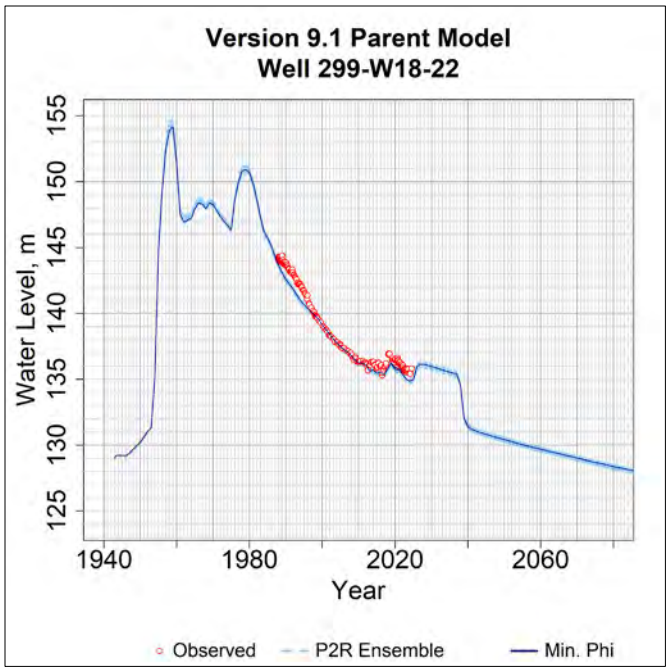

Figure B-251. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-22.

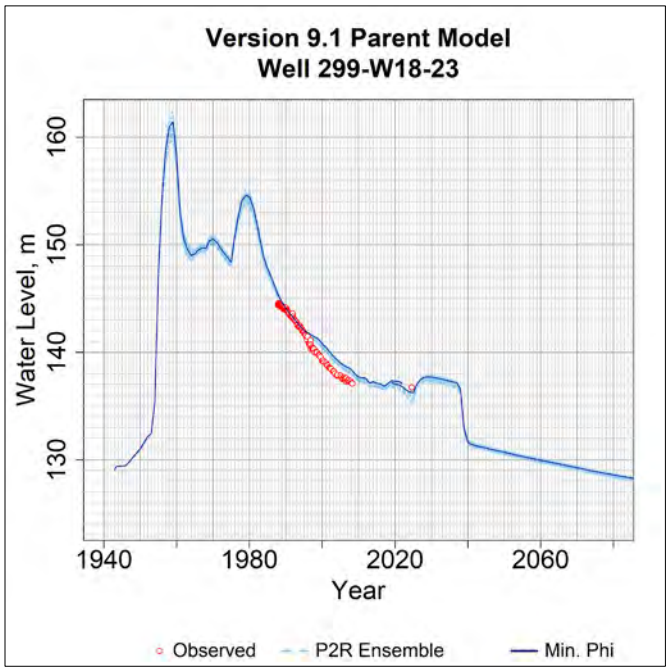

Figure B-252. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-23.

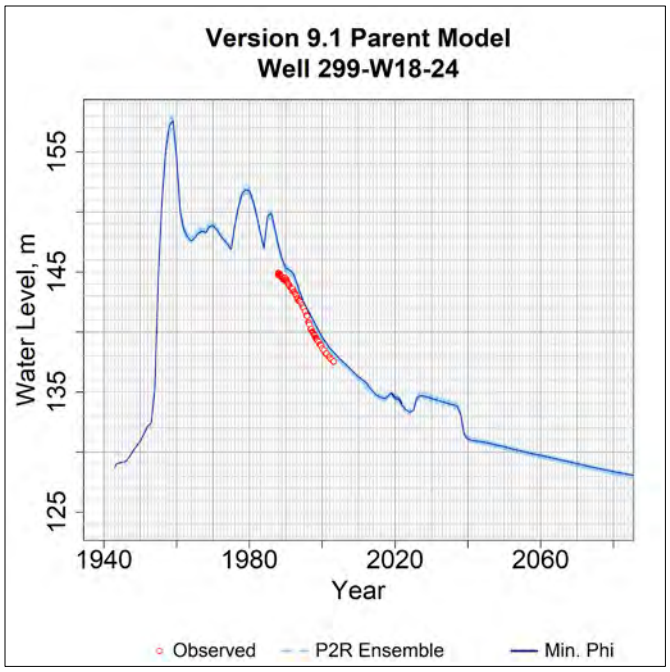

Figure B-253. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-24.

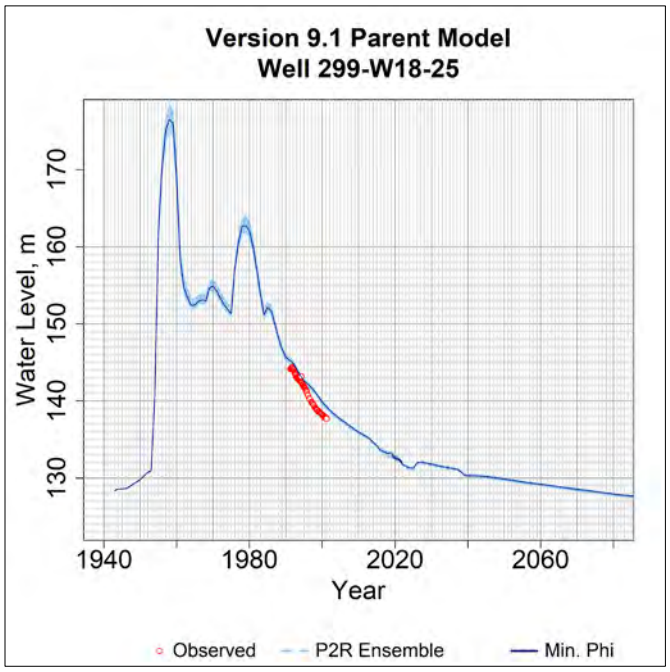

Figure B-254. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-25.

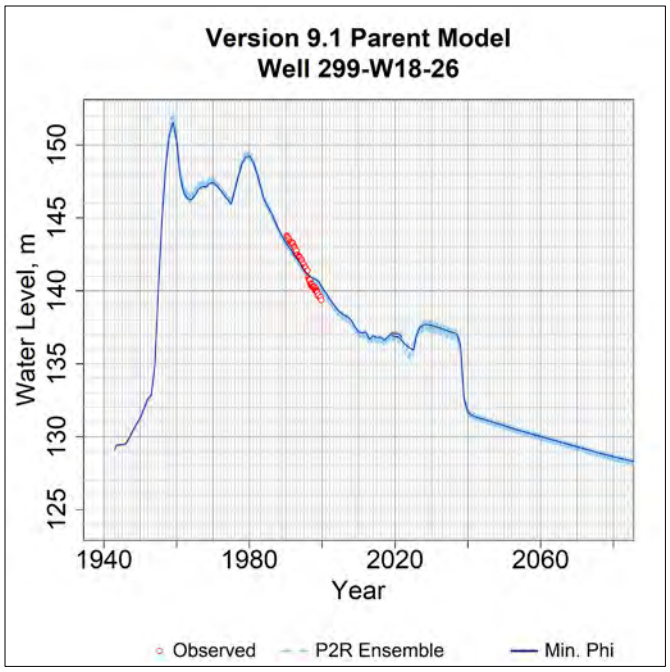

Figure B-255. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-26.

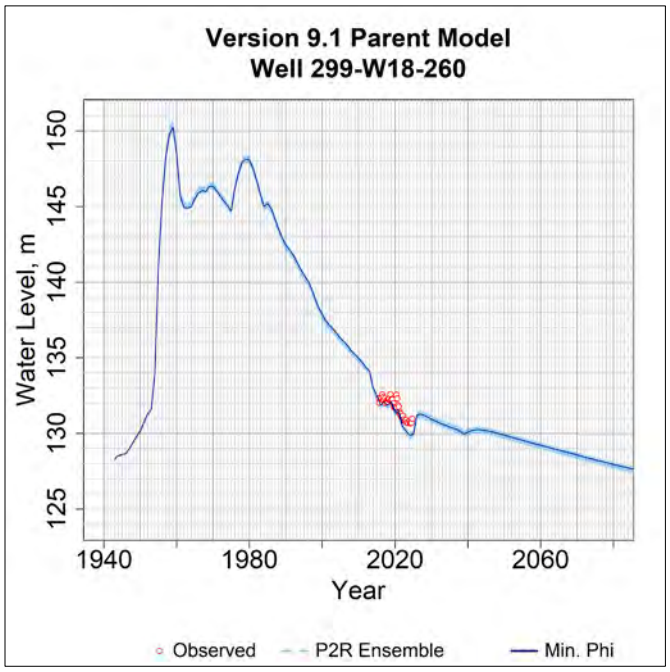

Figure B-256. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-260.

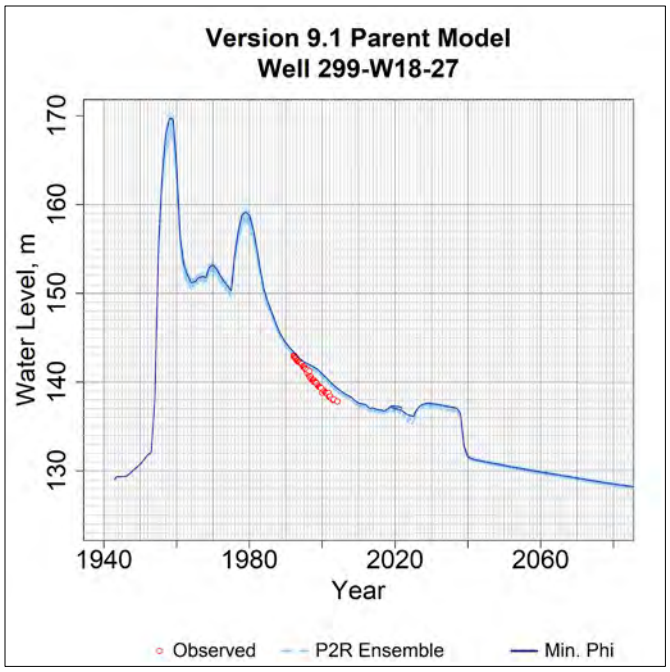

Figure B-257. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-27.

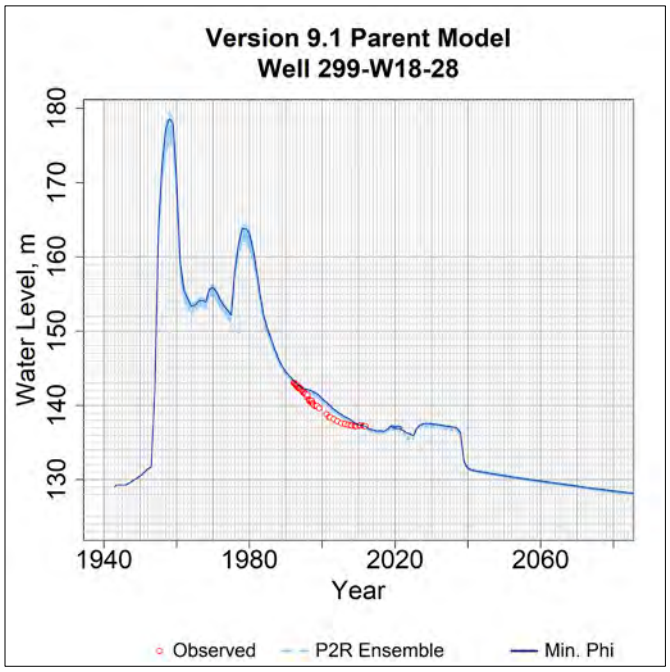

Figure B-258. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-28.

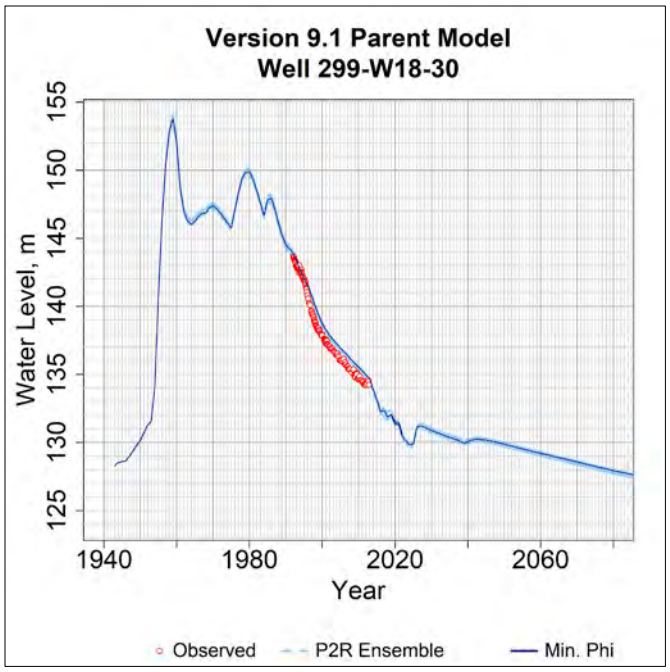

Figure B-259. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-30.

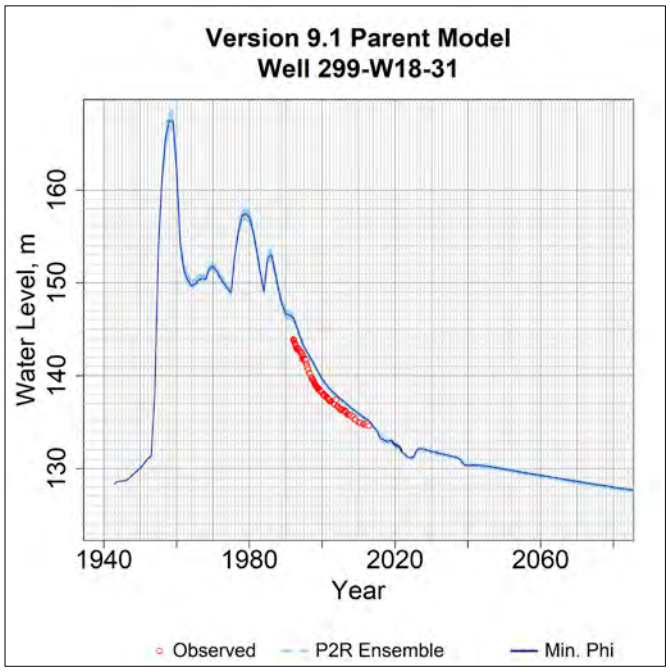

Figure B-260. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-31.

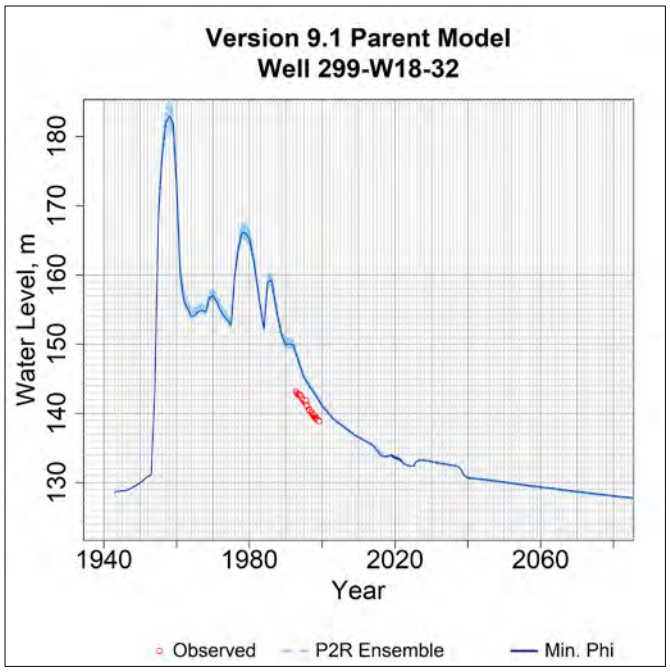

Figure B-261. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-32.

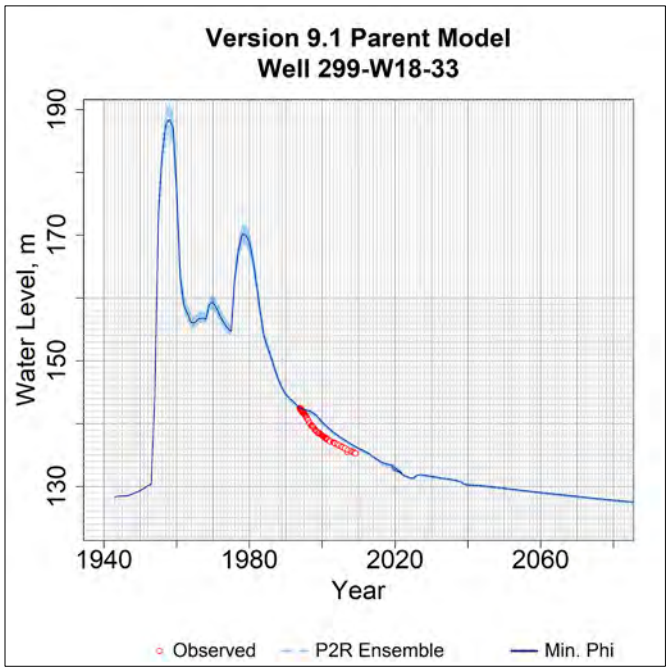

Figure B-262. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-33.

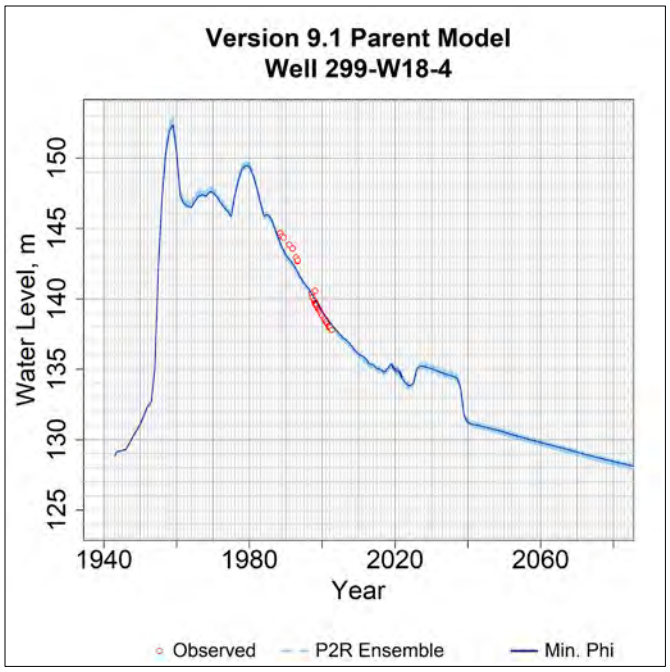

Figure B-263. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-4.

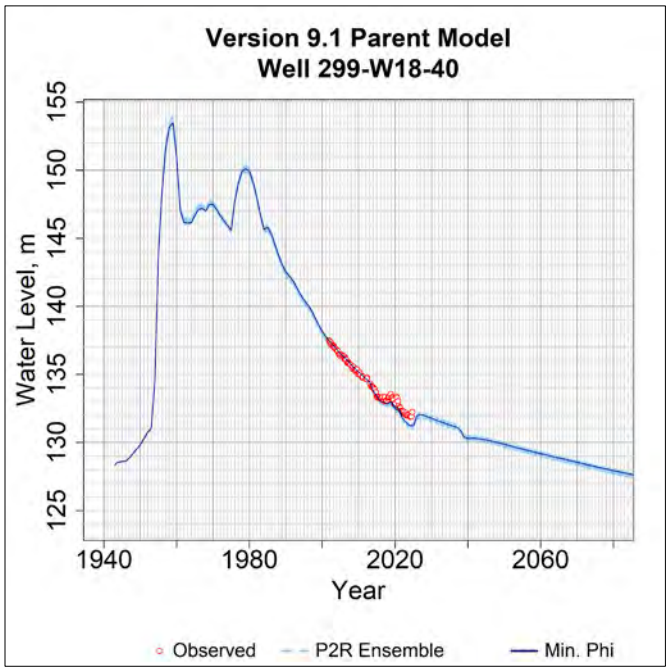

Figure B-264. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-40.

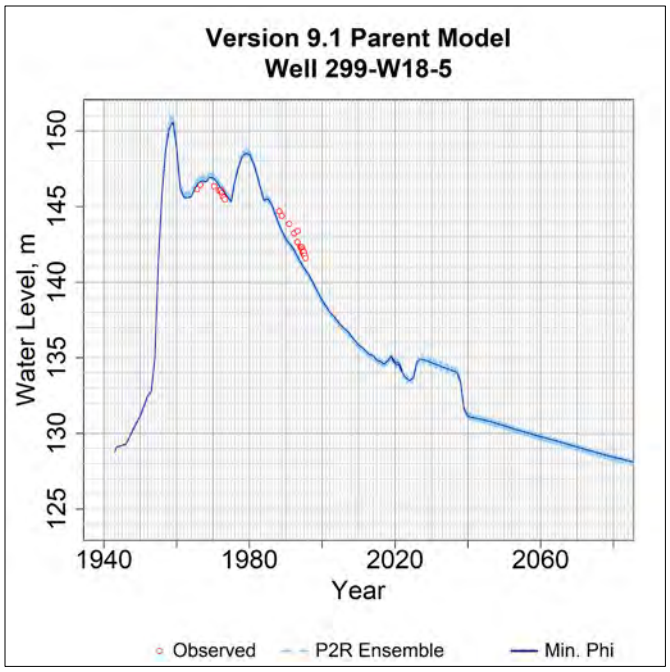

Figure B-265. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-5.

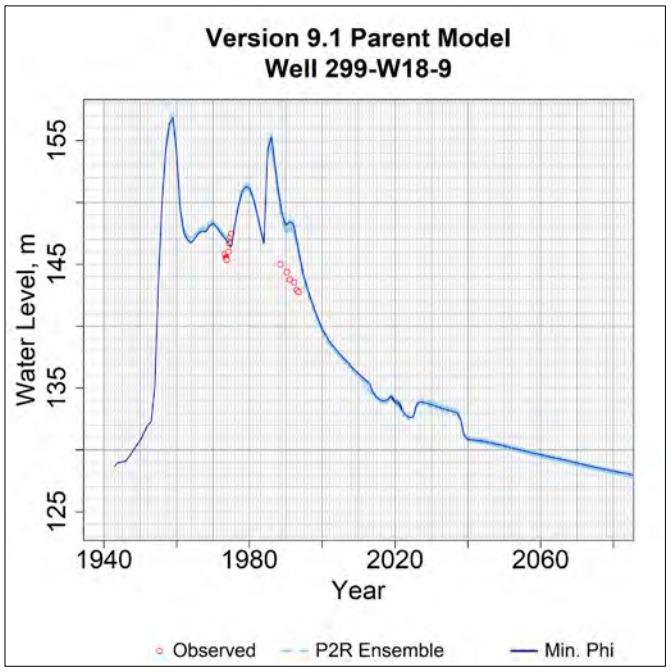

Figure B-266. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W18-9.

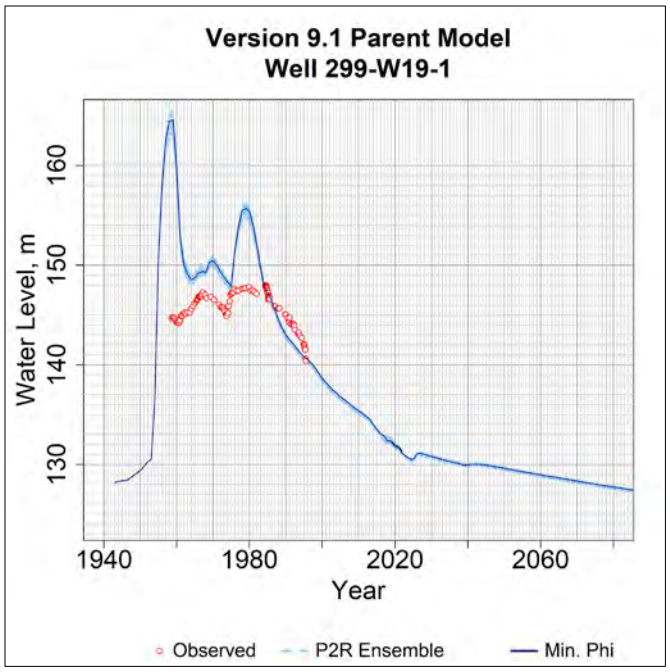

Figure B-267. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-1.

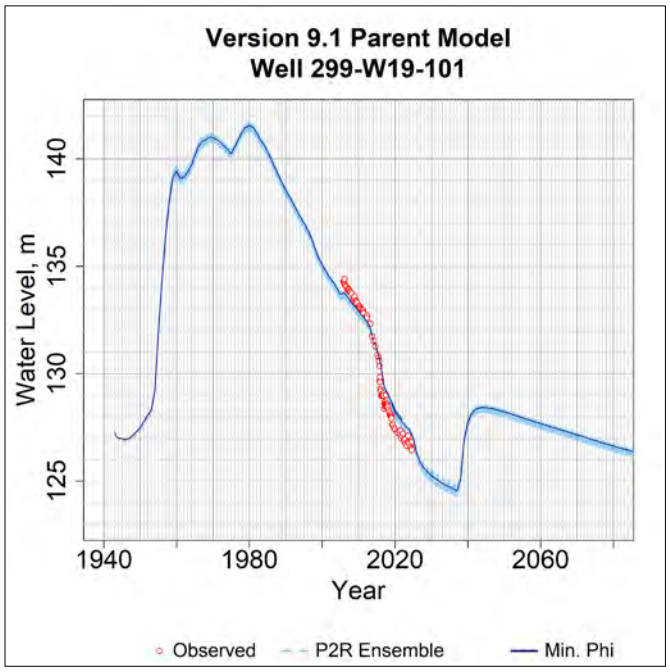

Figure B-268. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-101.

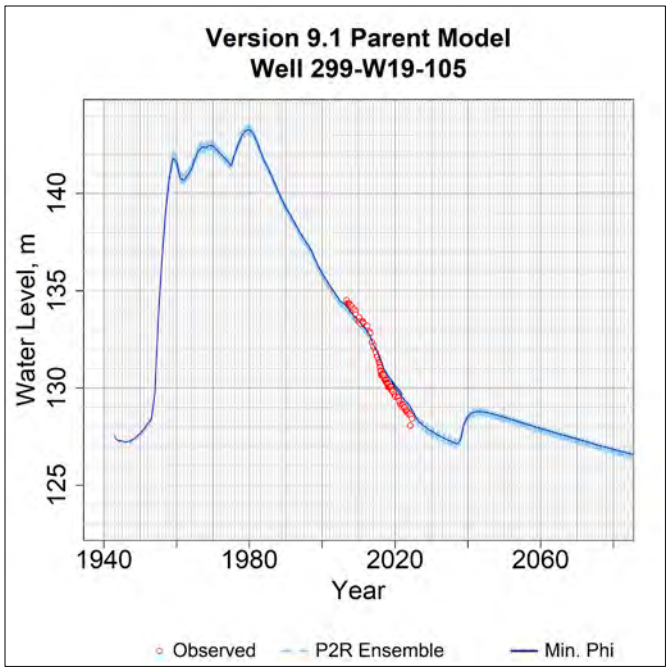

Figure B-269. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-105.

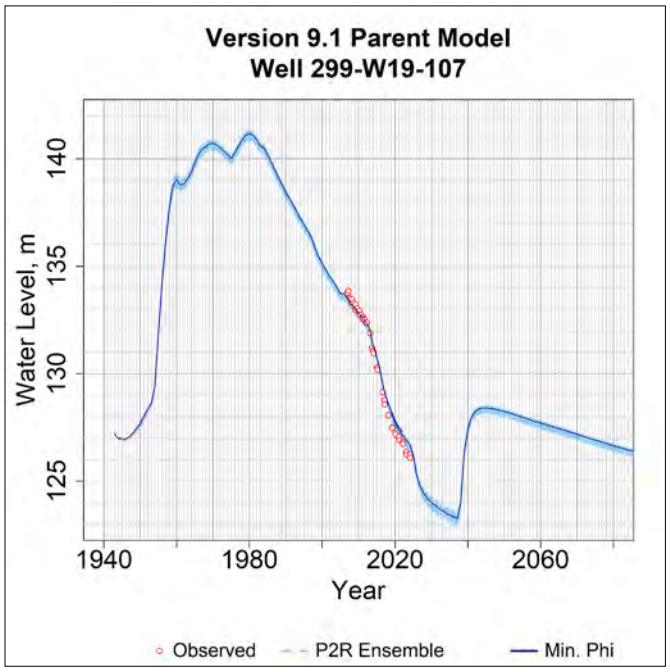

Figure B-270. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-107.

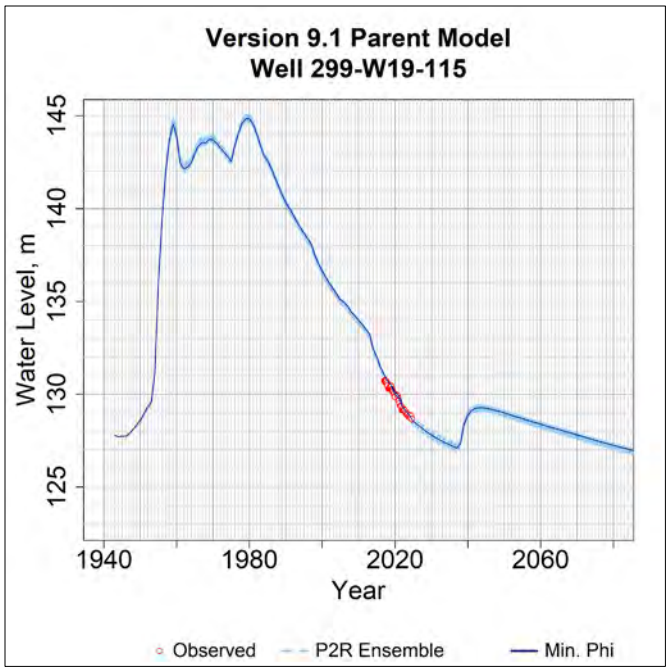

Figure B-271. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-115.

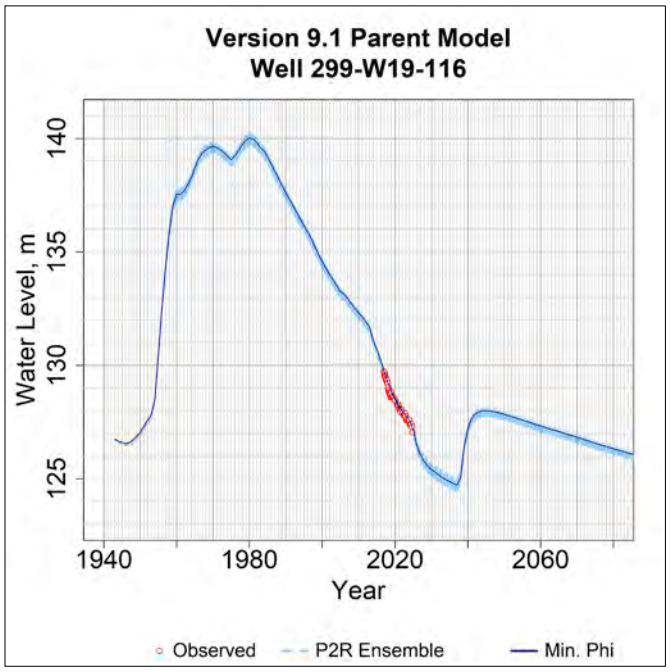

Figure B-272. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-116.

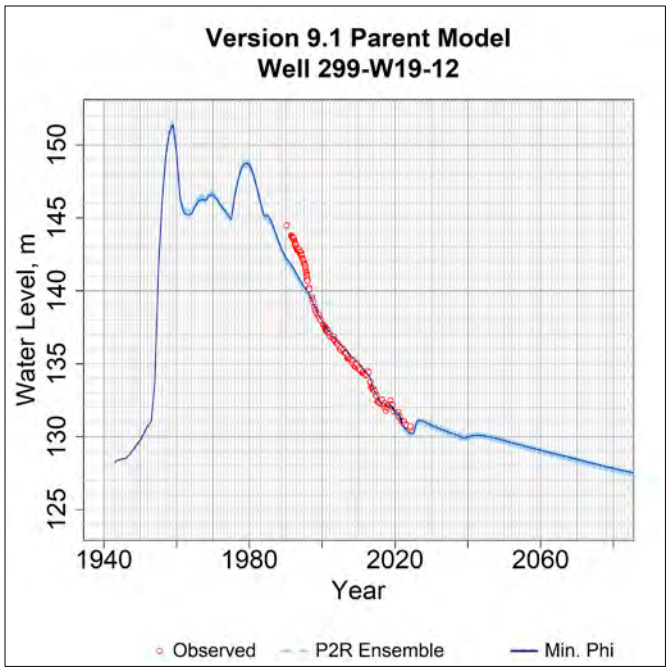

Figure B-273. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-12.

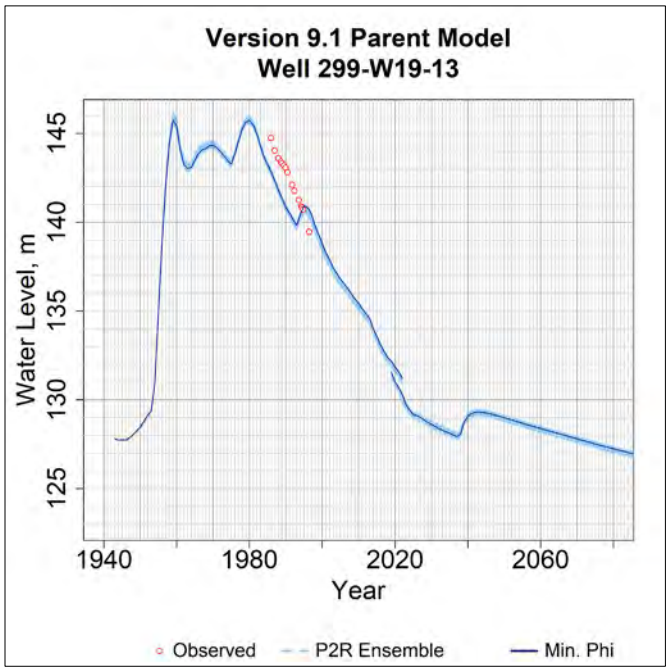

Figure B-274. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-13.

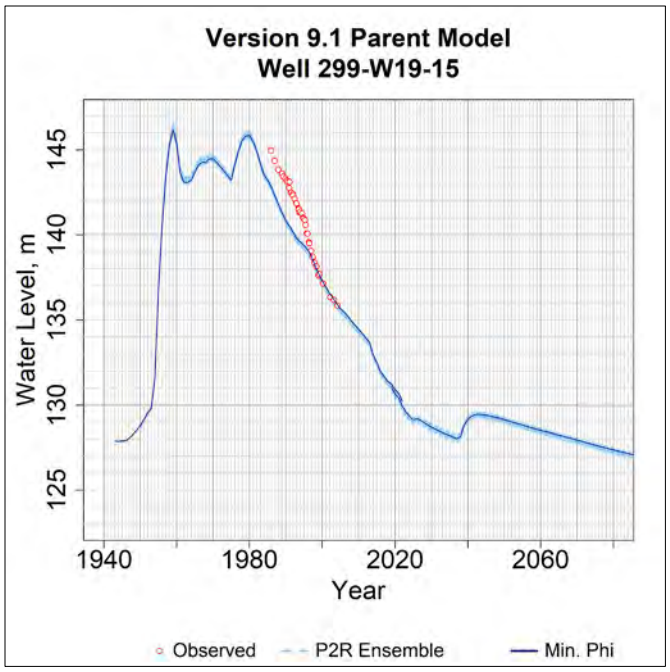

Figure B-275. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-15.

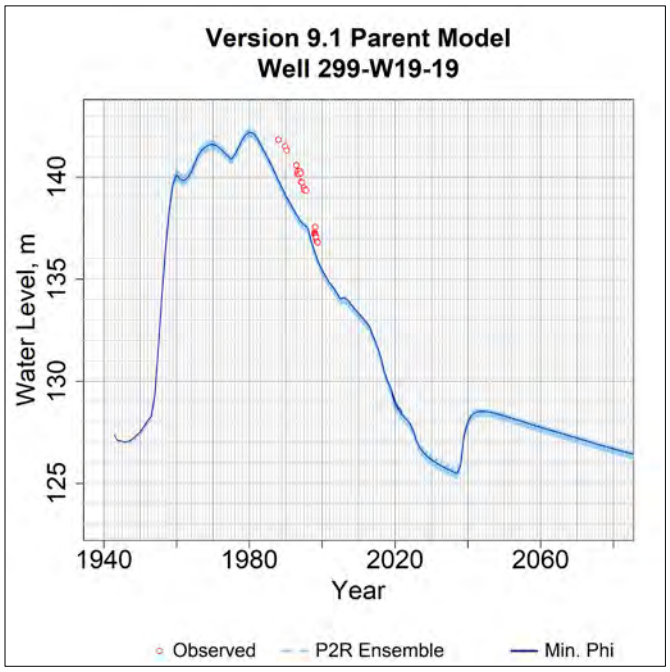

Figure B-276. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-19.

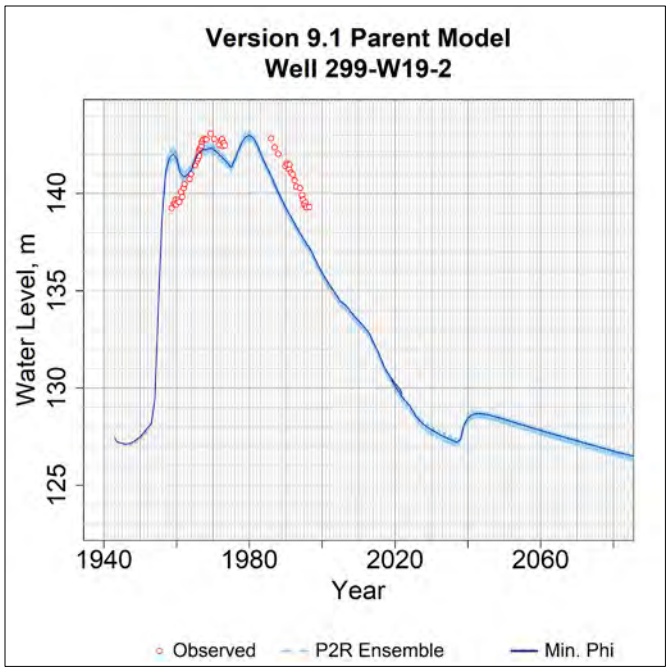

Figure B-277. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-2.

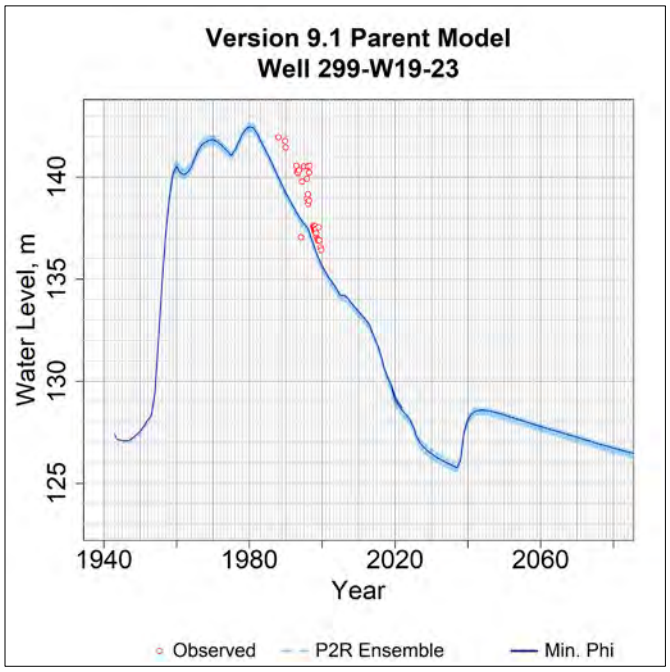

Figure B-278. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-23.

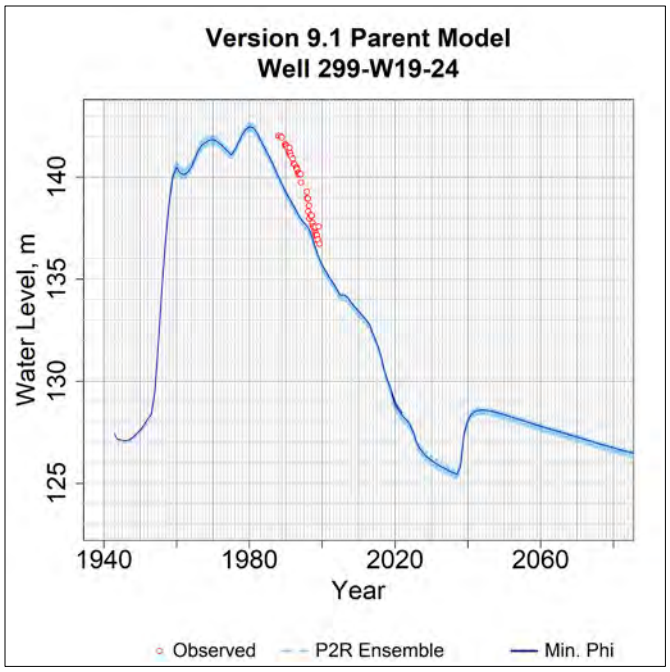

Figure B-279. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-24.

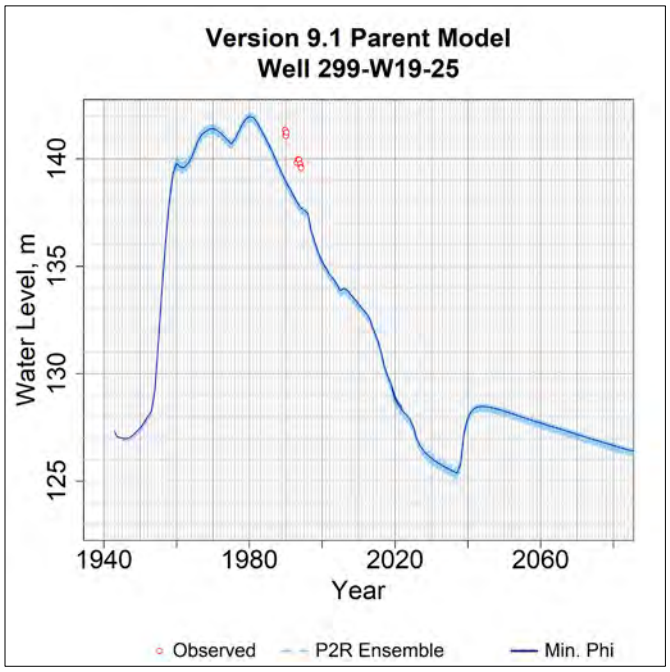

Figure B-280. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-25.

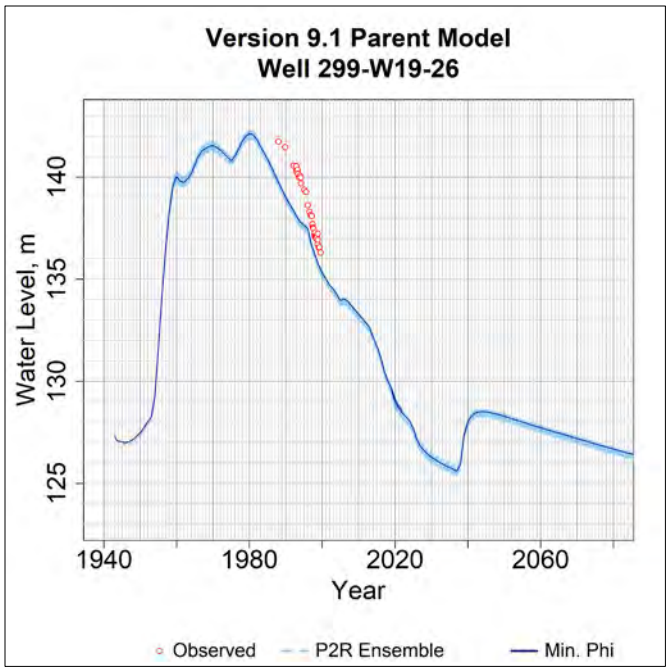

Figure B-281. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-26.

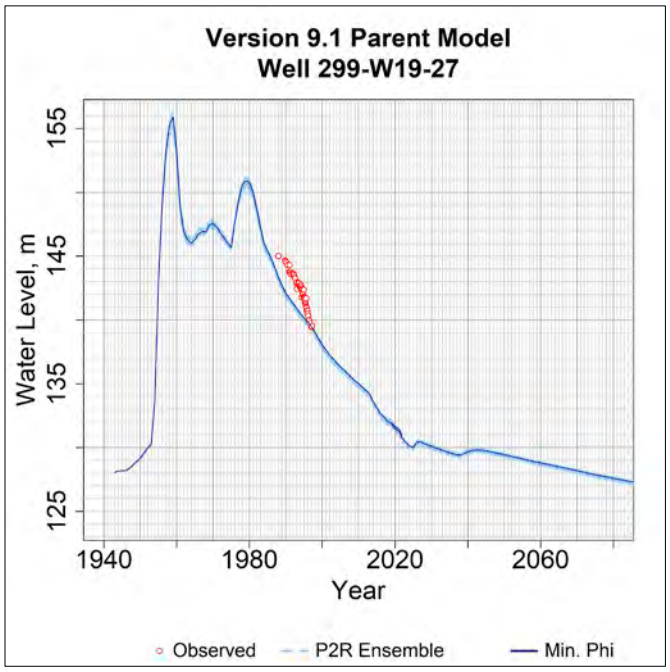

Figure B-282. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-27.

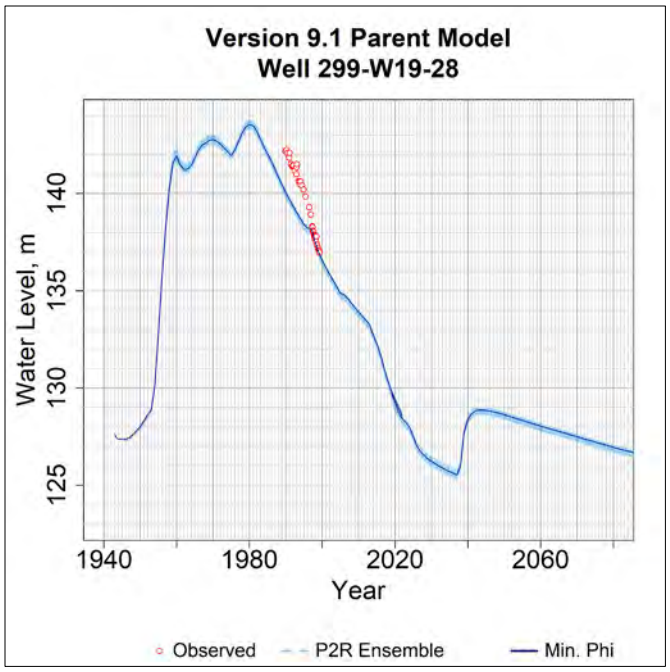

Figure B-283. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-28.

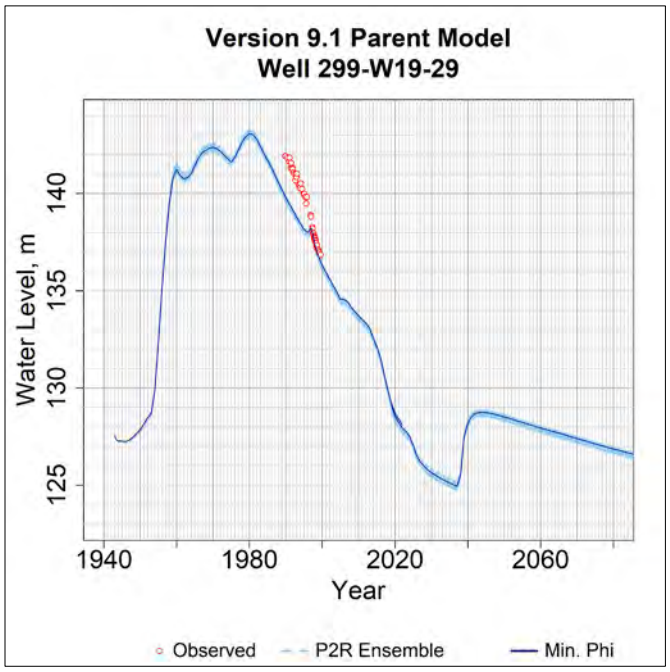

Figure B-284. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-29.

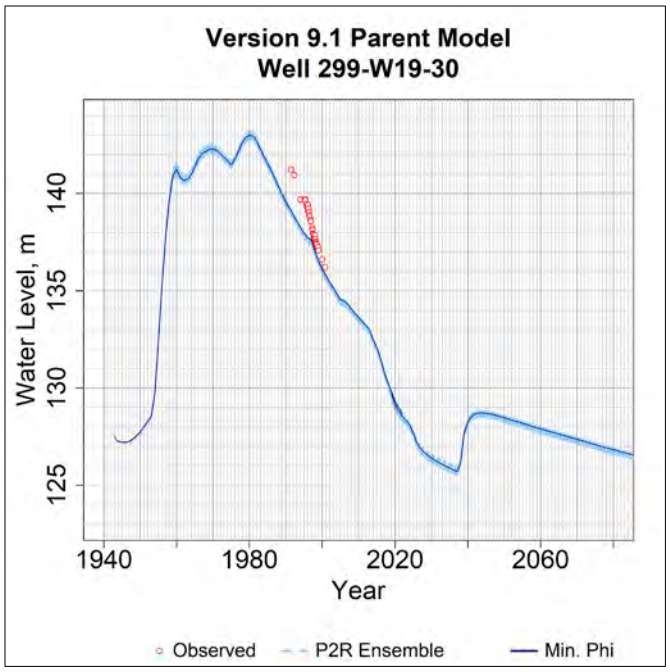

Figure B-285. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-30.

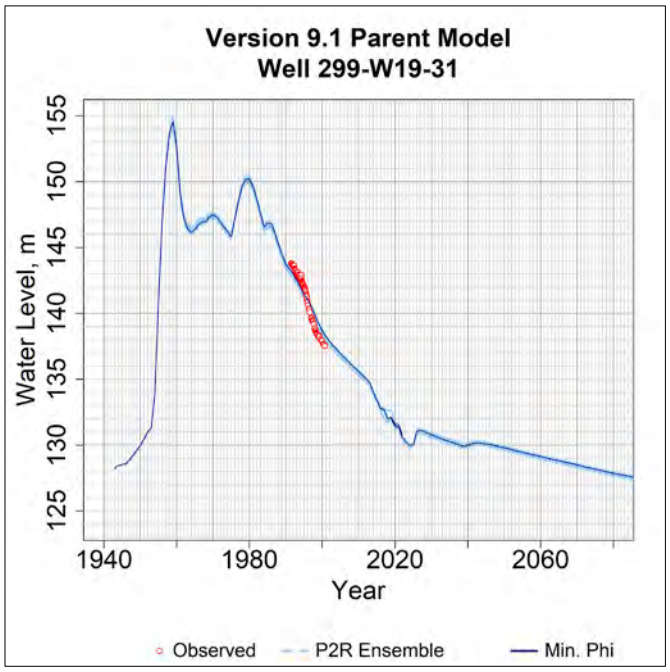

Figure B-286. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-31.

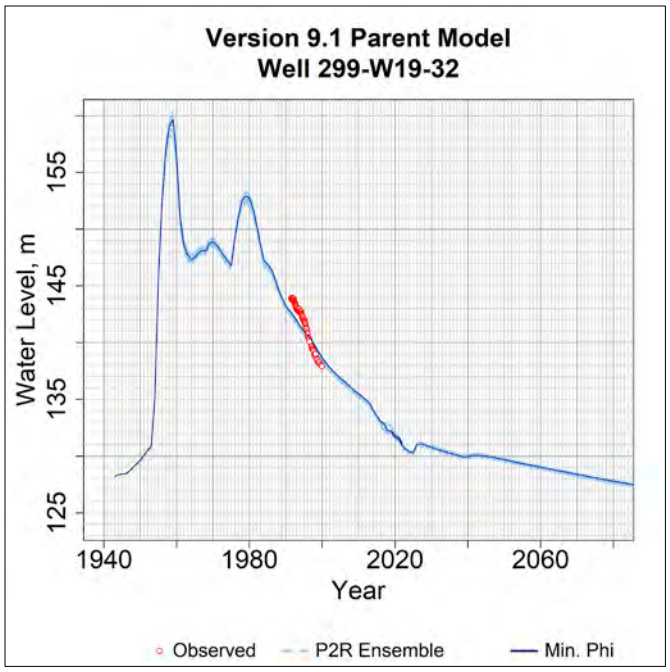

Figure B-287. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-32.

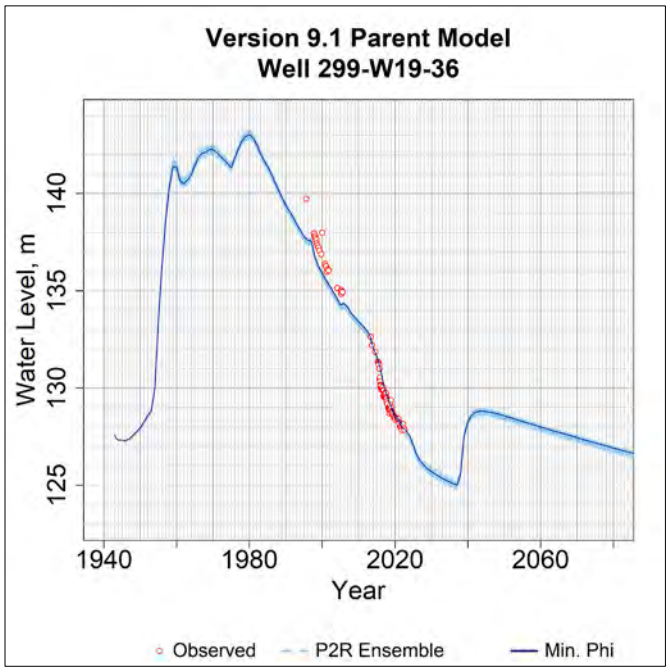

Figure B-288. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-36.

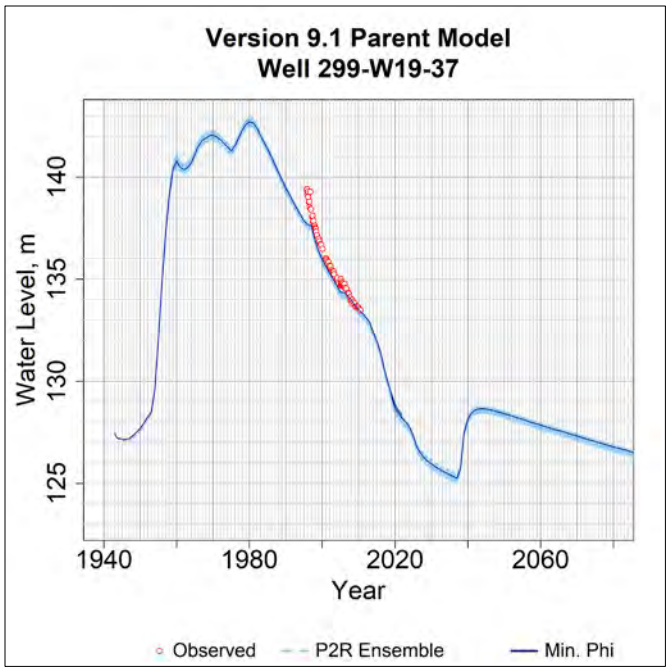

Figure B-289. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-37.

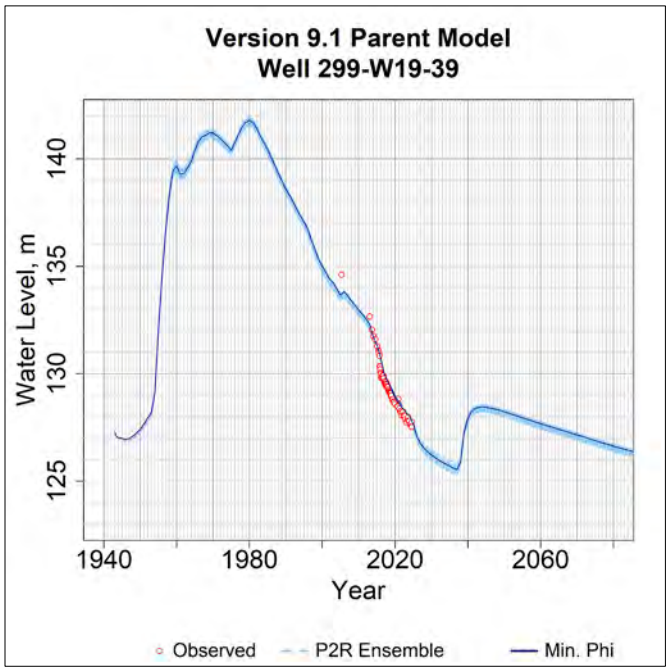

Figure B-290. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-39.

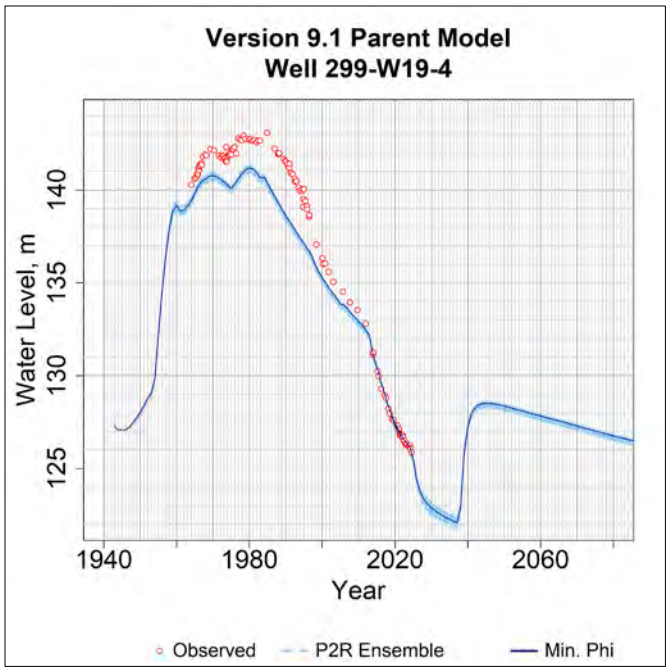

Figure B-291. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-4.

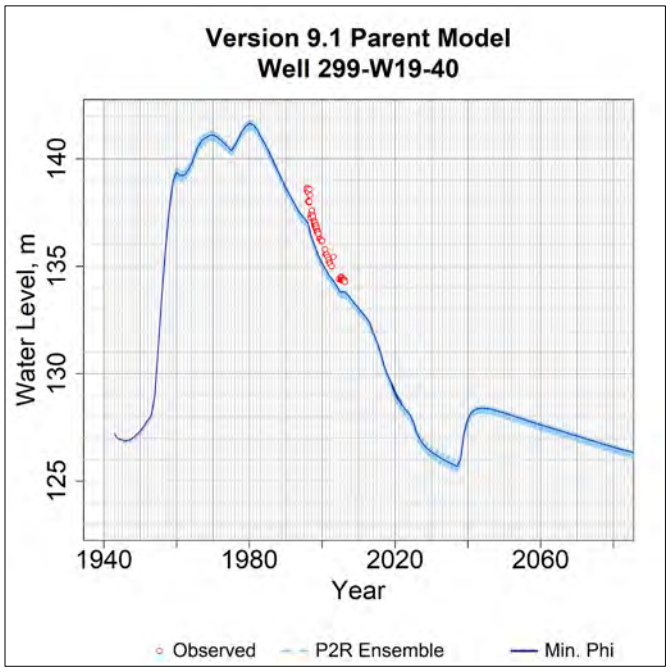

Figure B-292. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-40.

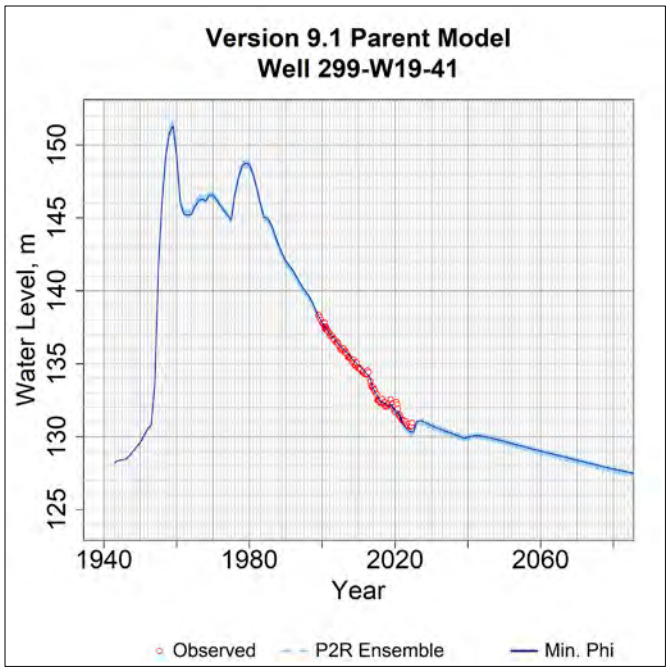

Figure B-293. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-41.

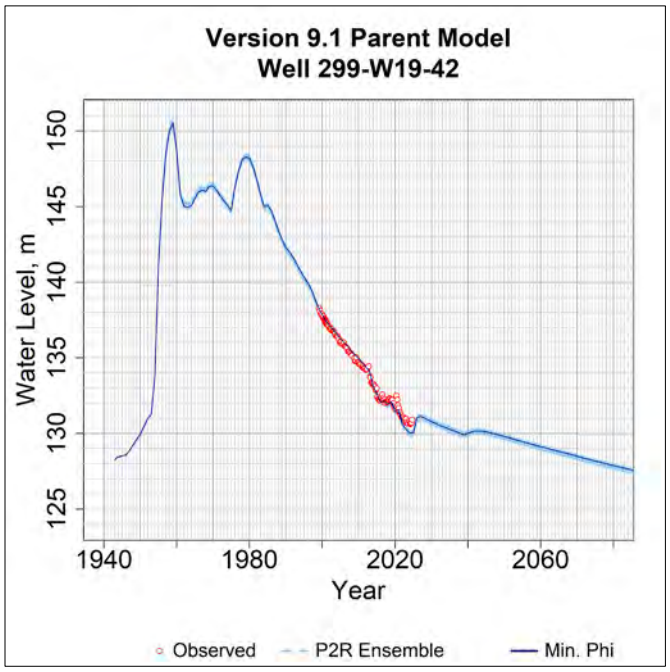

Figure B-294. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-42.

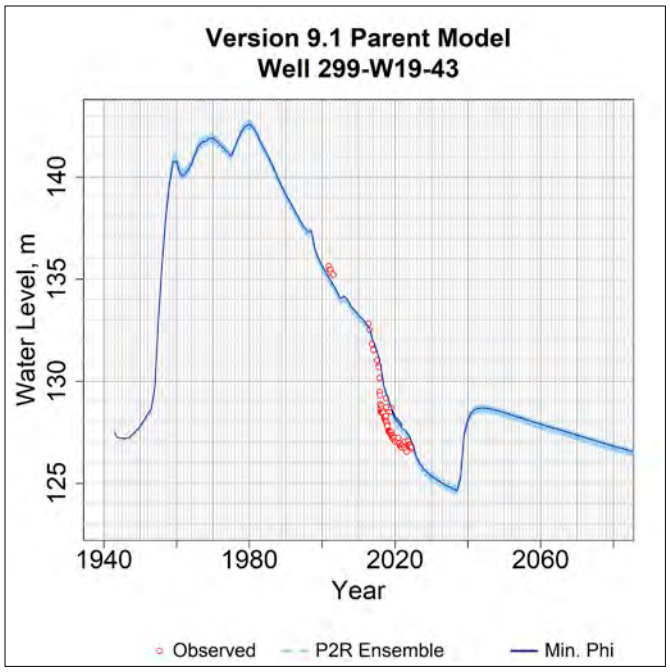

Figure B-295. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-43.

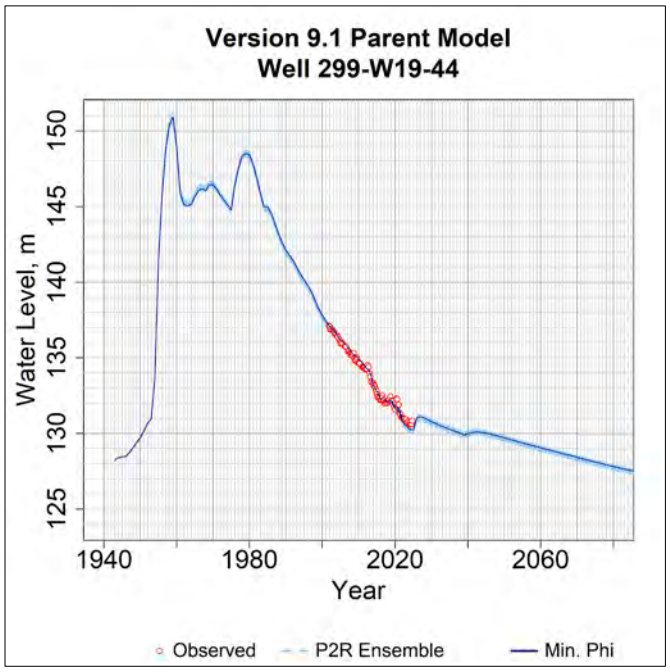

Figure B-296. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-44.

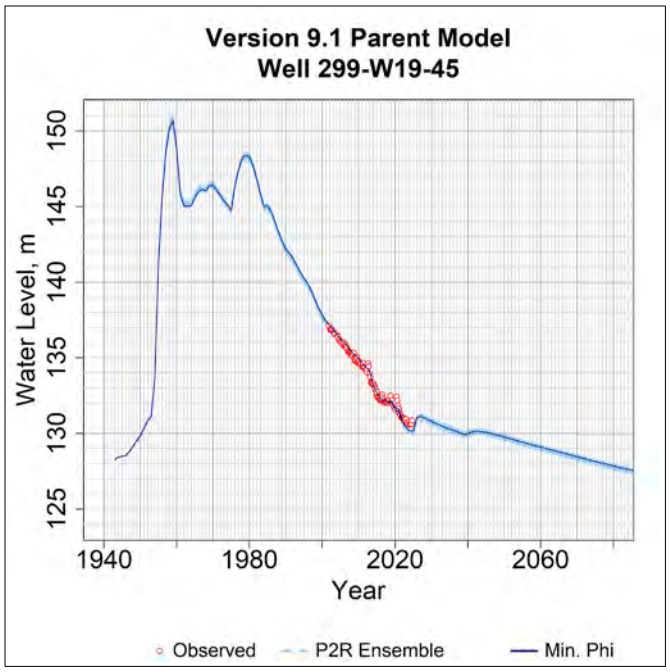

Figure B-297. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-45.

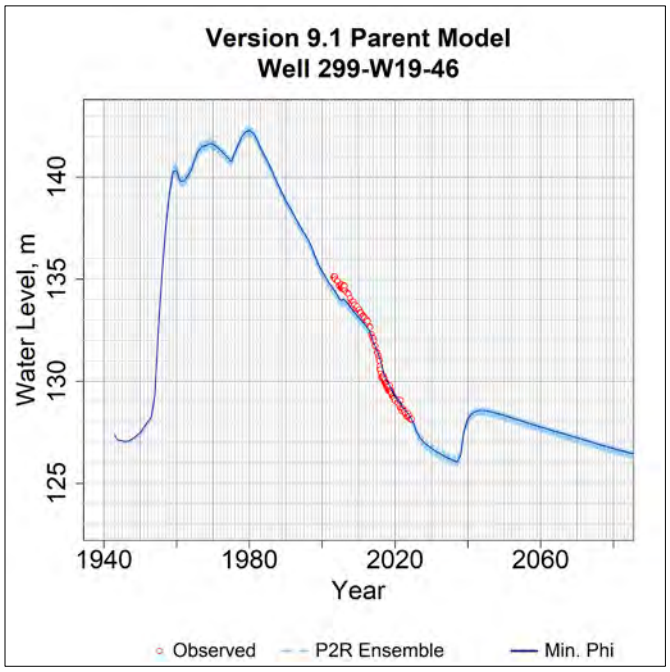

Figure B-298. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-46.

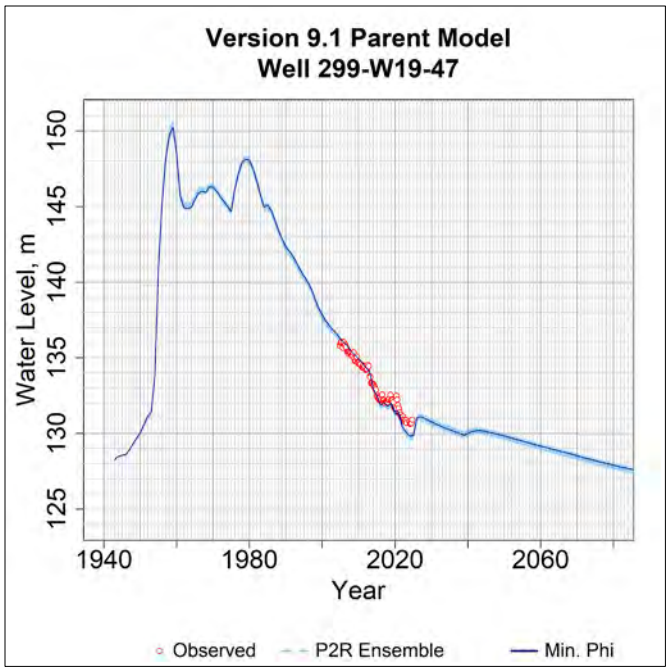

Figure B-299. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-47.

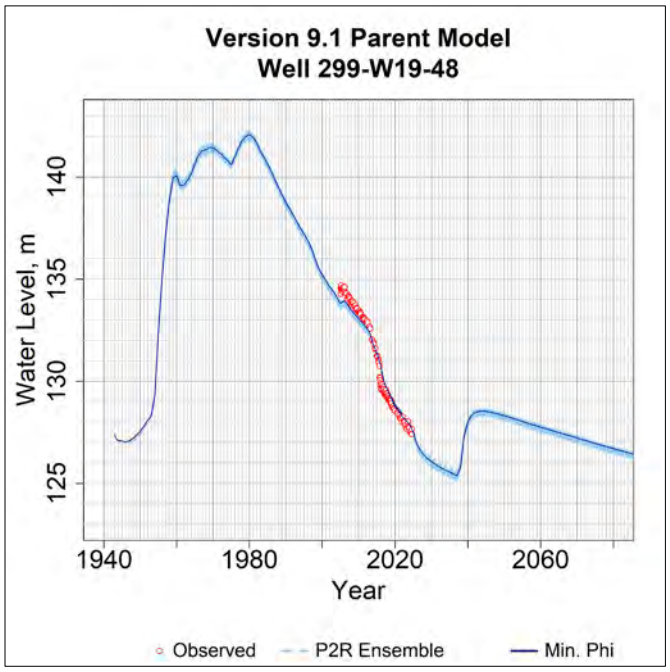

Figure B-300. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-48.

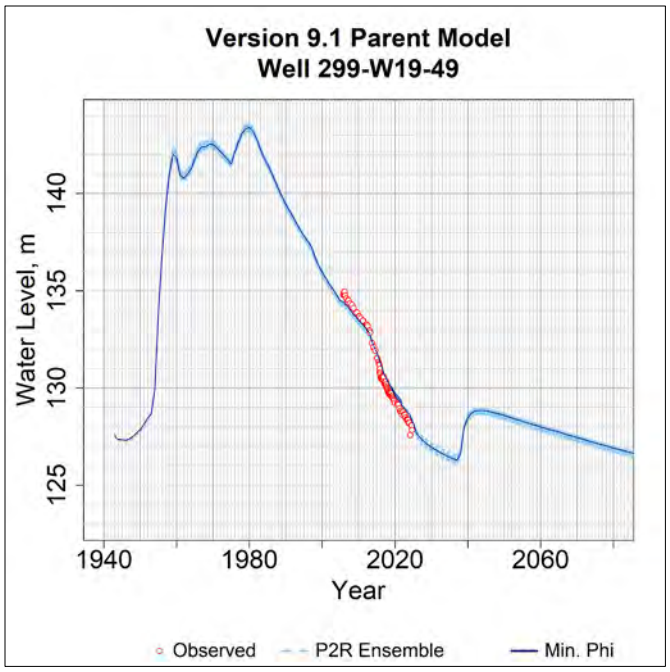

Figure B-301. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-49.

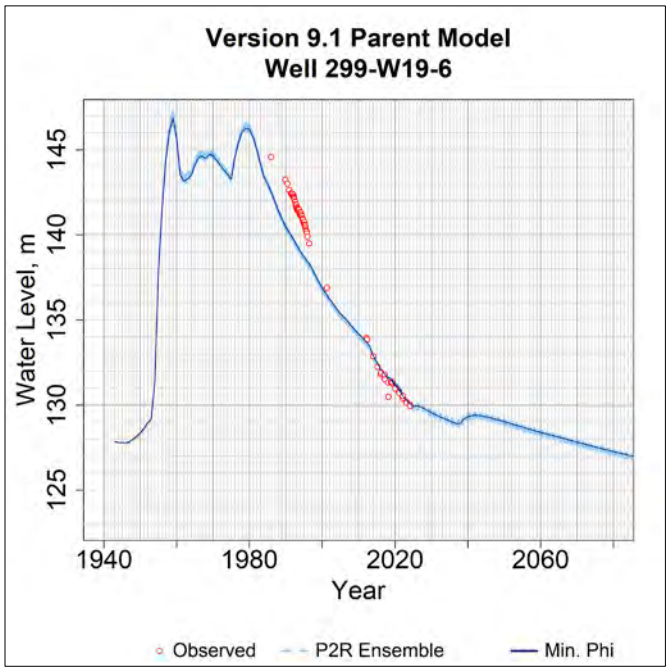

Figure B-302. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W19-6.

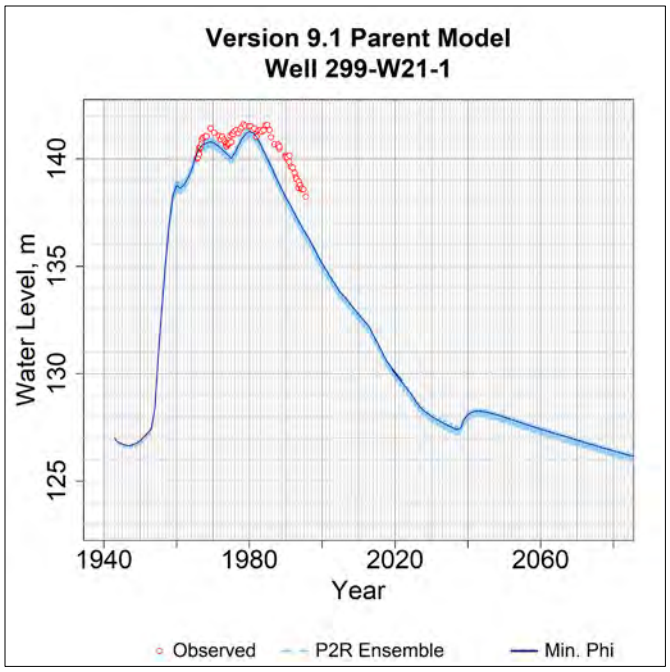

Figure B-303. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W21-1.

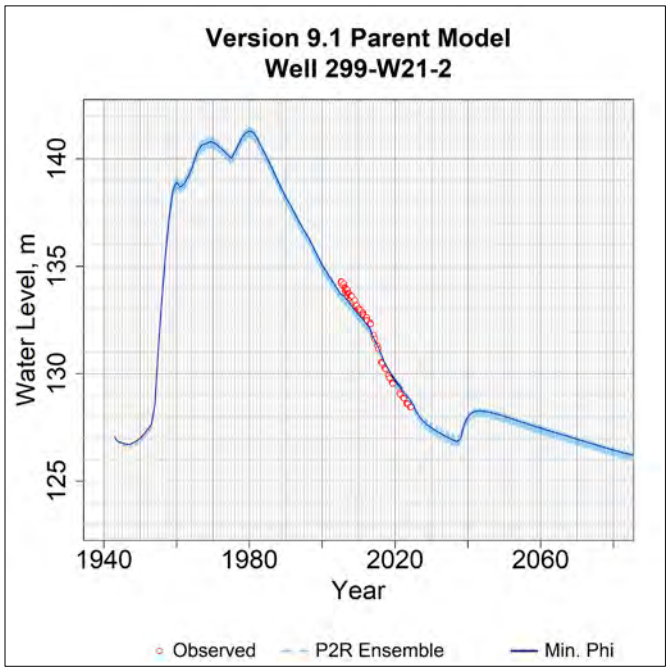

Figure B-304. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W21-2.

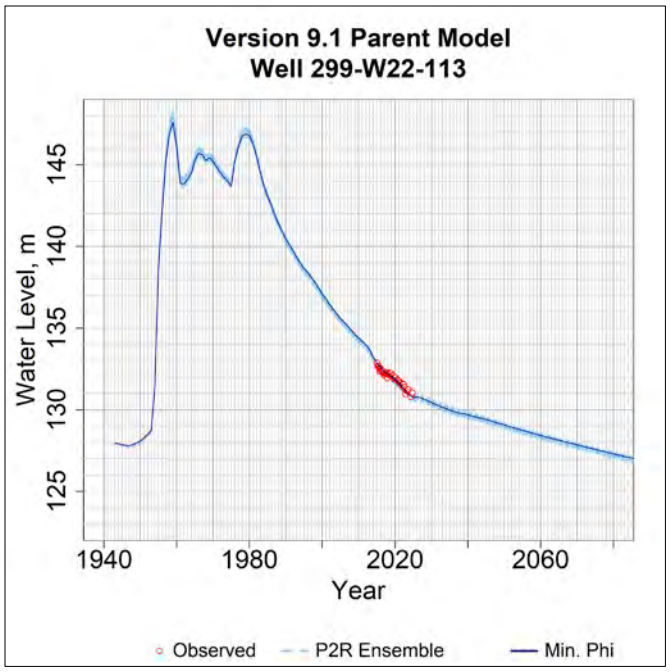

Figure B-305. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-113.

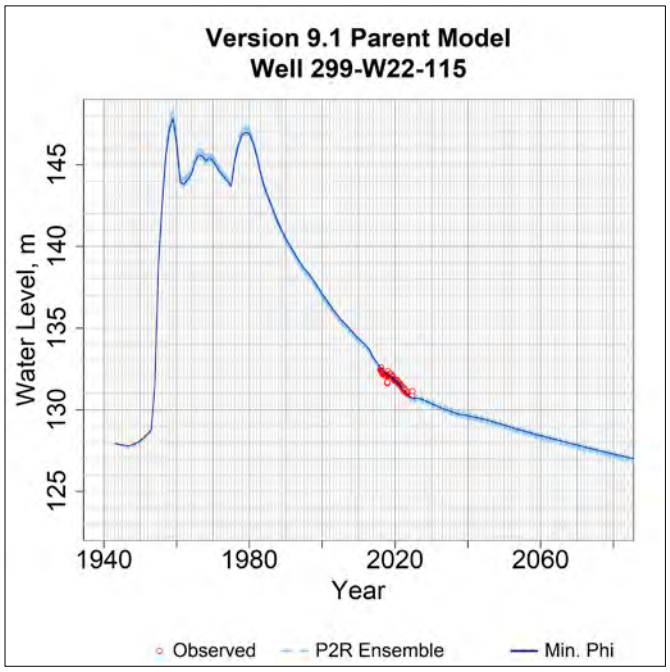

Figure B-306. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-115.

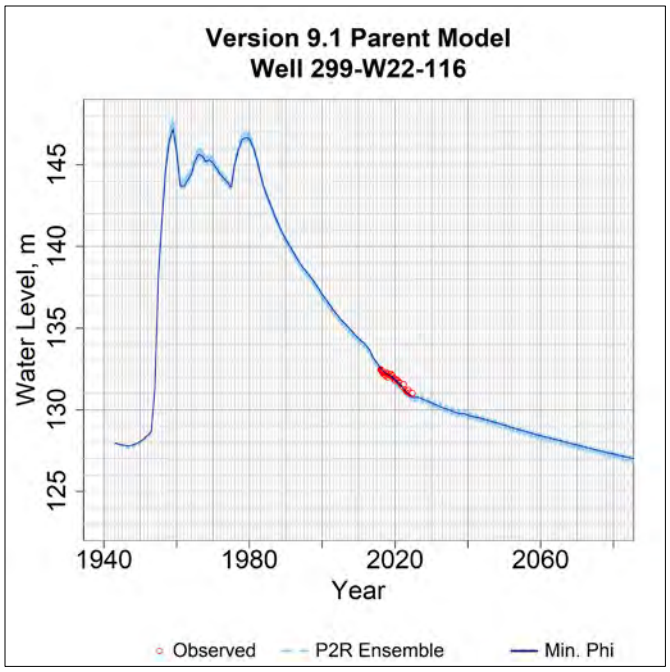

Figure B-307. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-116.

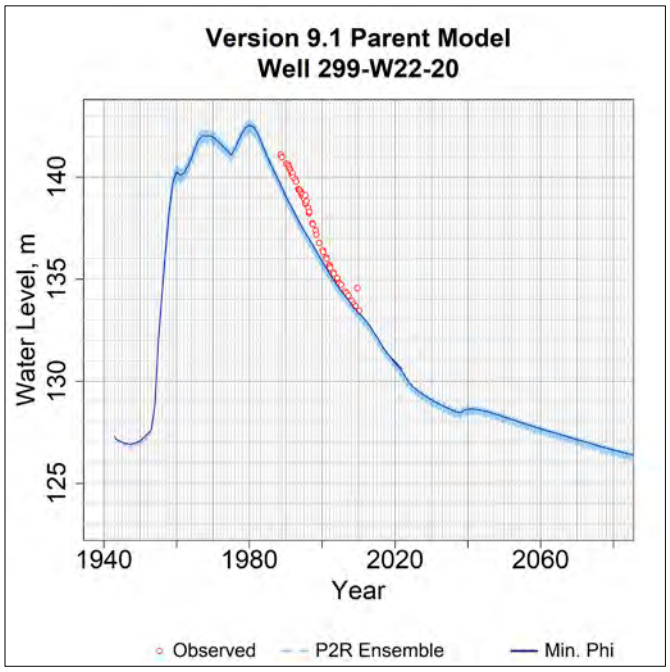

Figure B-308. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-20.

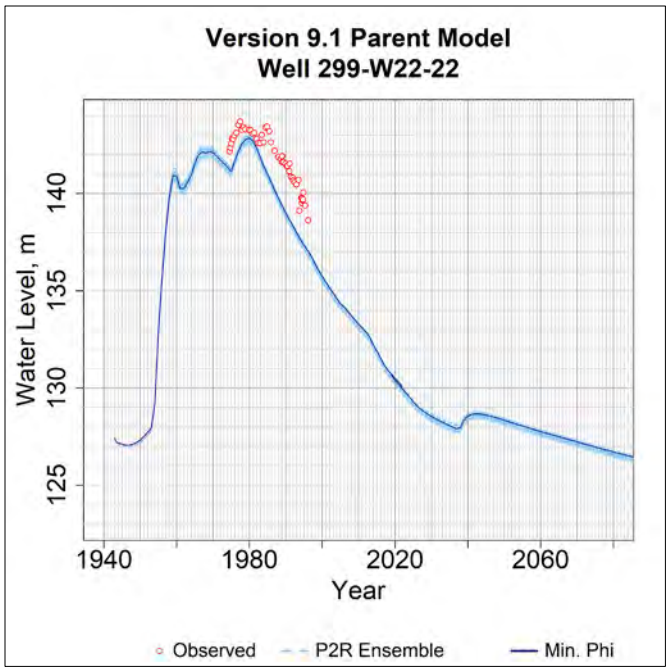

Figure B-309. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-22.

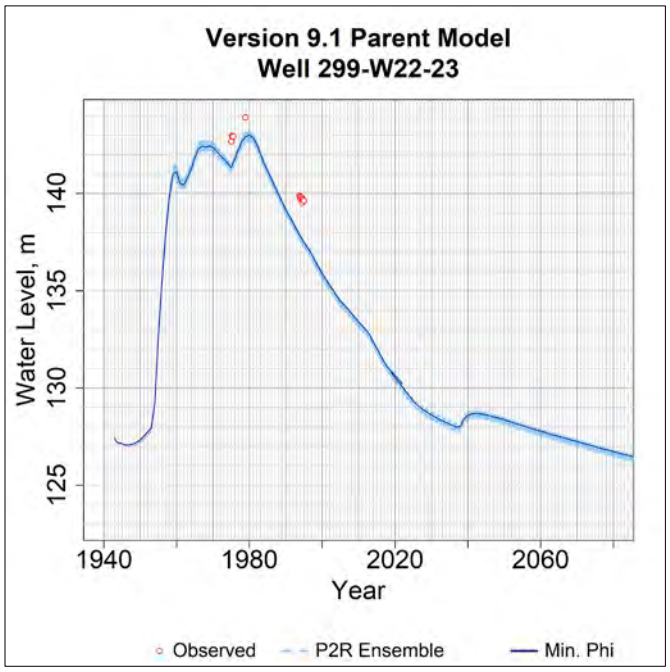

Figure B-310. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-23.

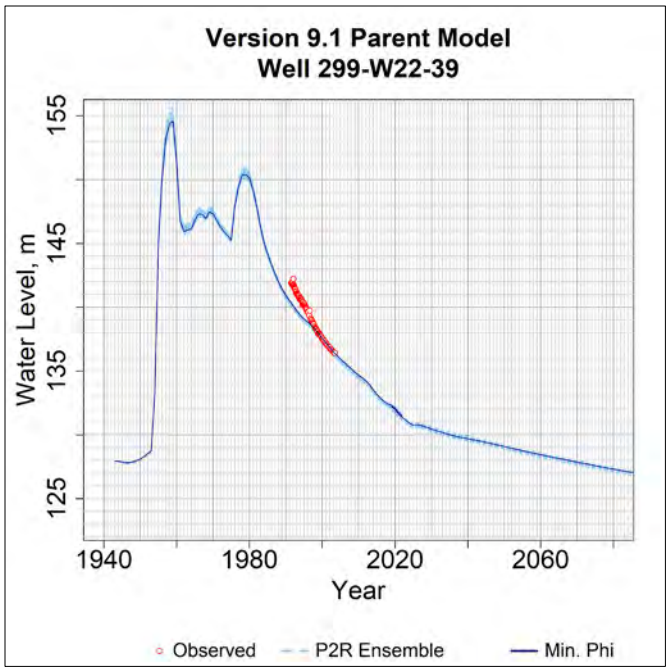

Figure B-311. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-39.

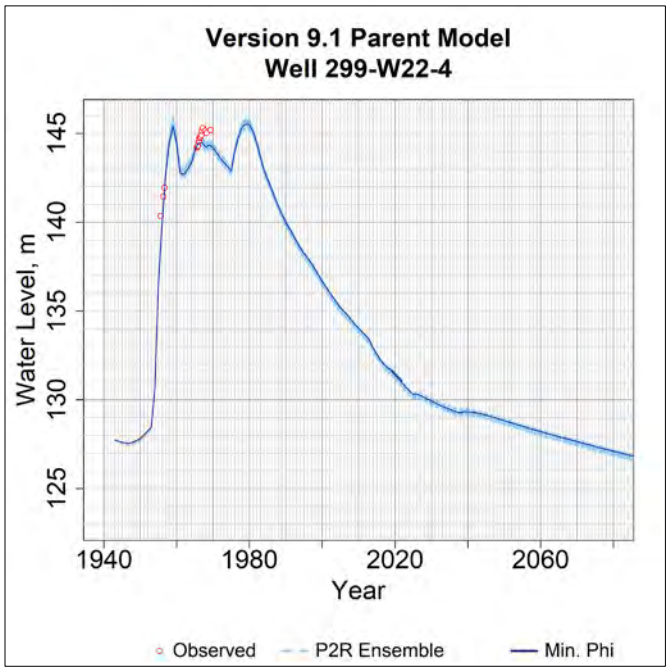

Figure B-312. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-4.

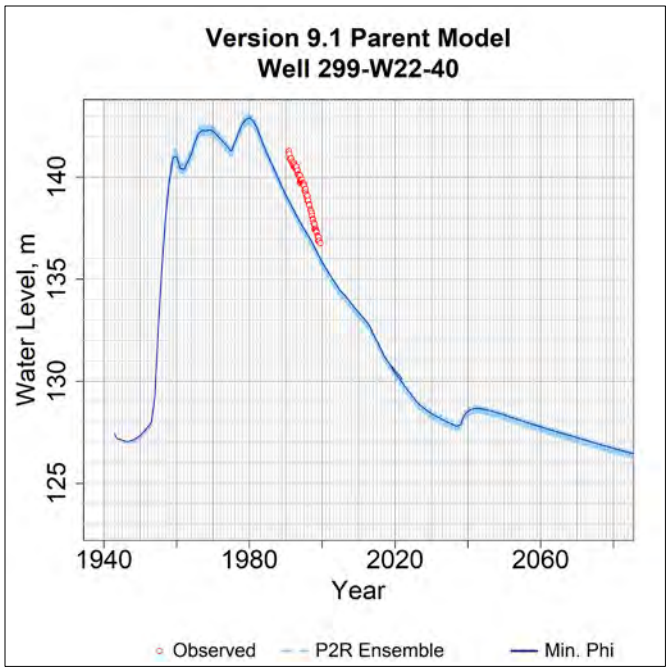

Figure B-313. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-40.

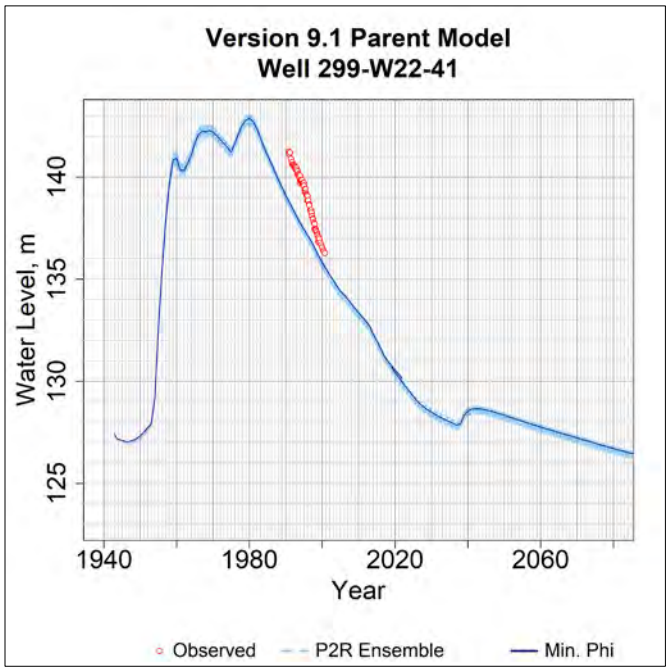

Figure B-314. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-41.

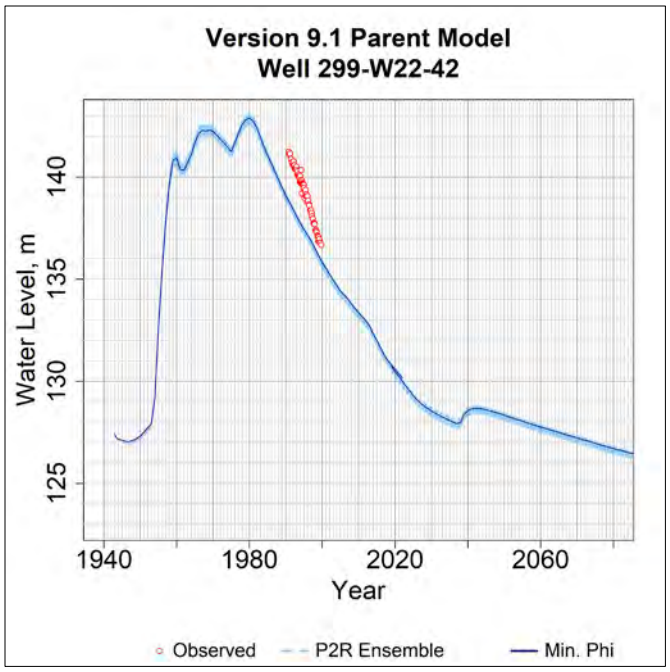

Figure B-315. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-42.

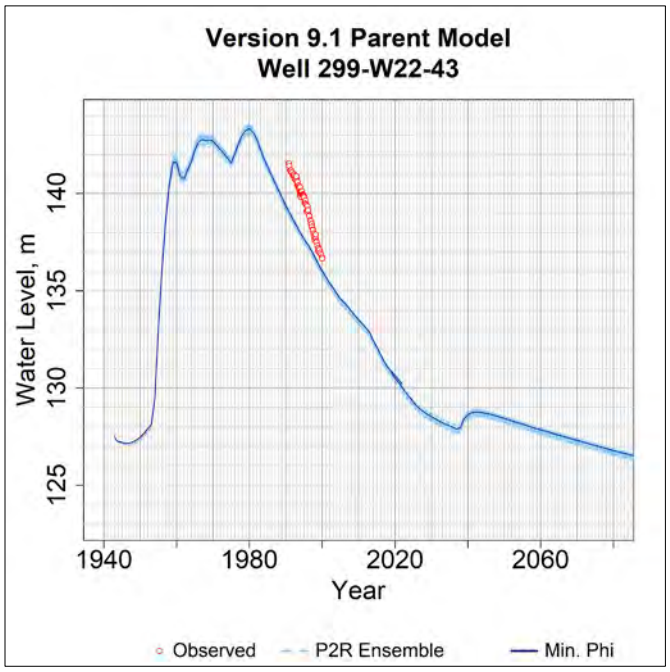

Figure B-316. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-43.

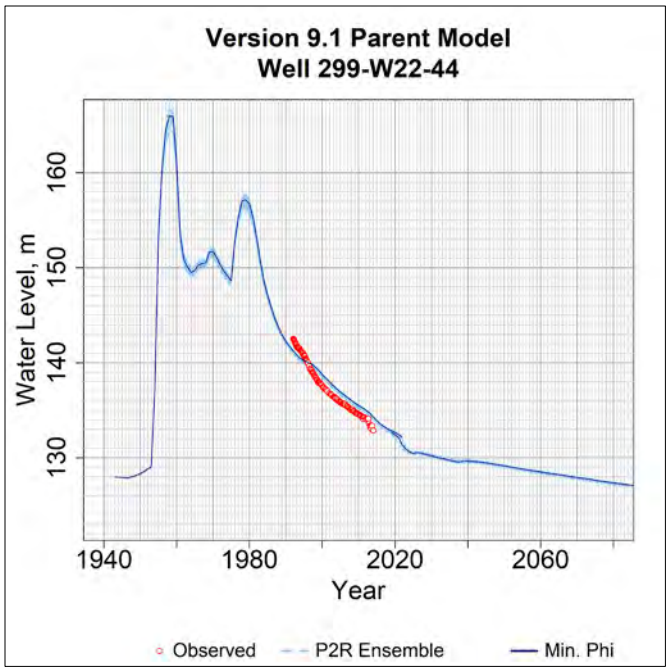

Figure B-317. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-44.

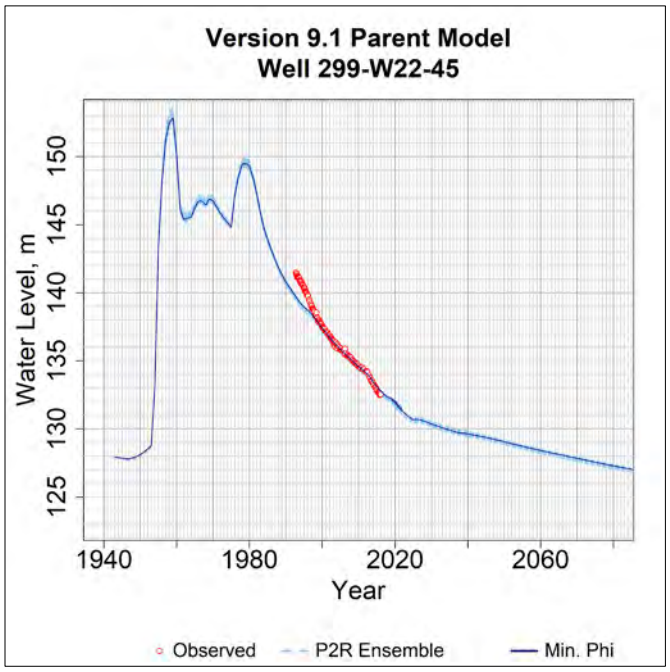

Figure B-318. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-45.

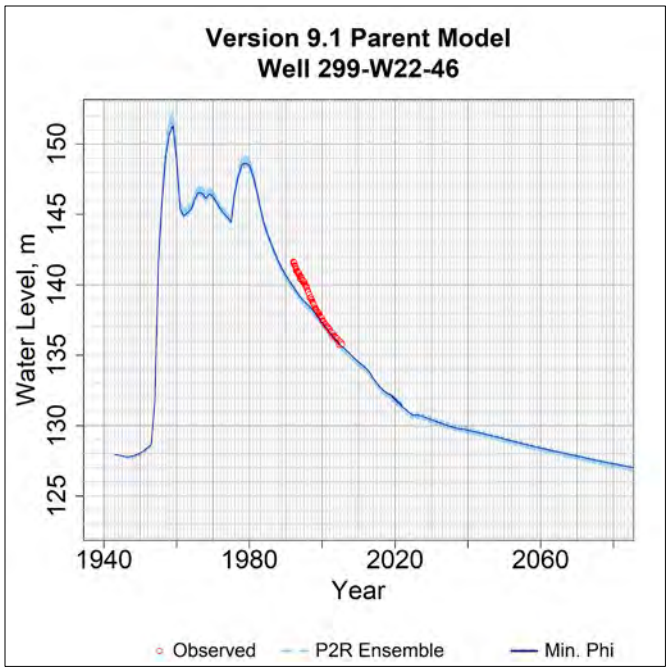

Figure B-319. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-46.

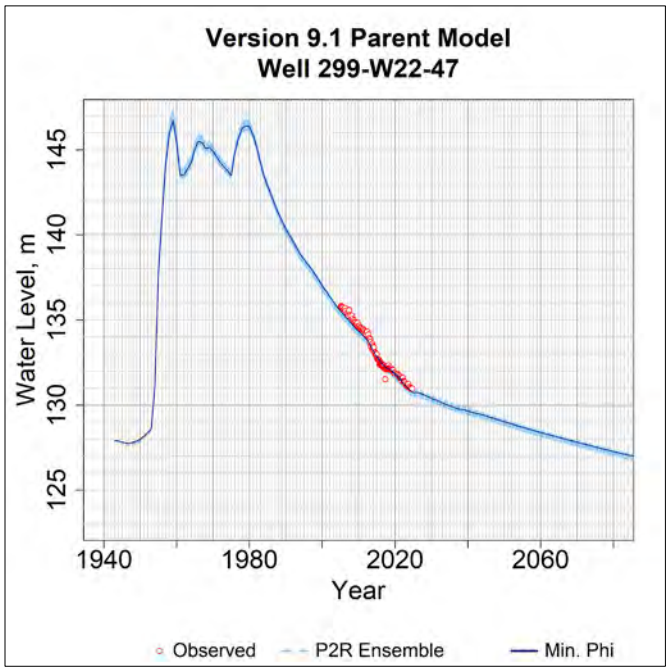

Figure B-320. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-47.

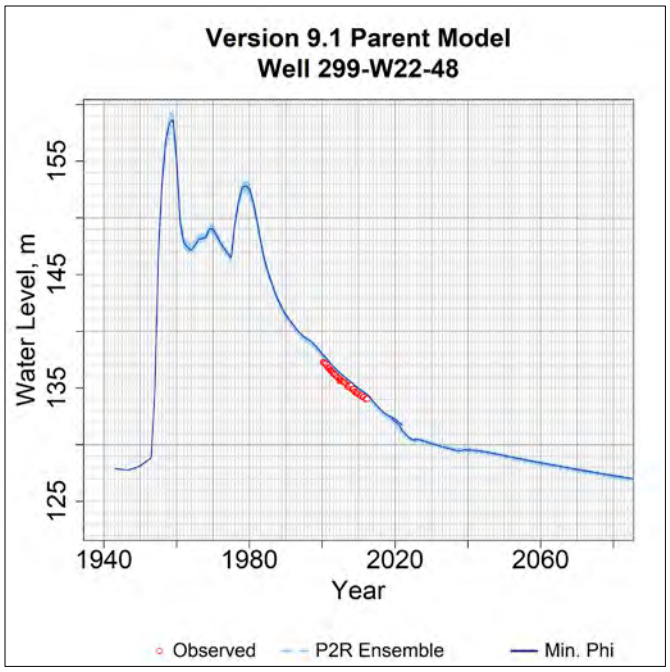

Figure B-321. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-48.

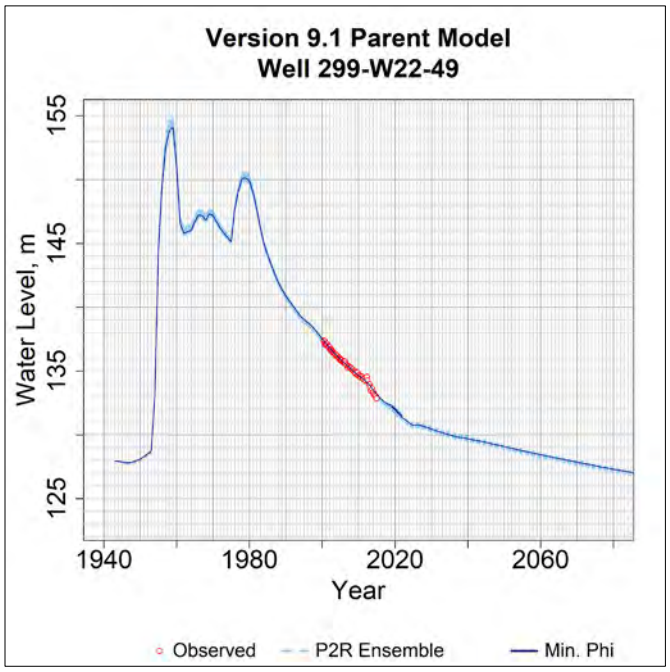

Figure B-322. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-49.

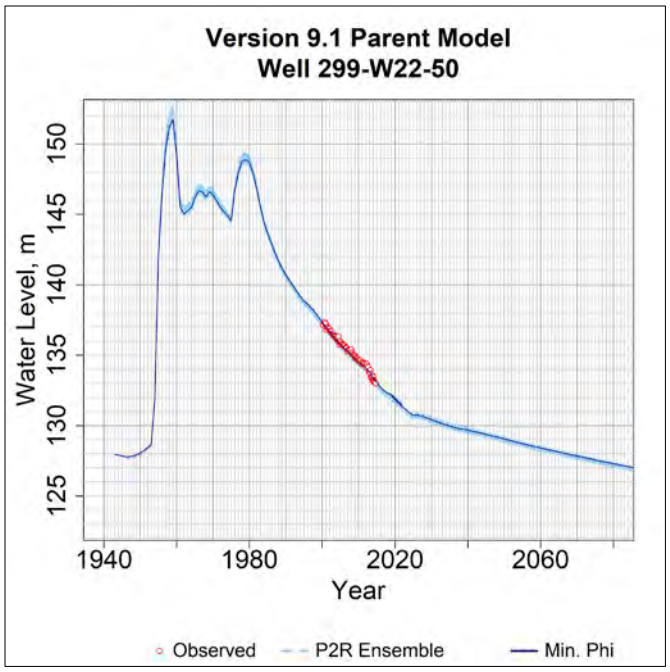

Figure B-323. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-50.

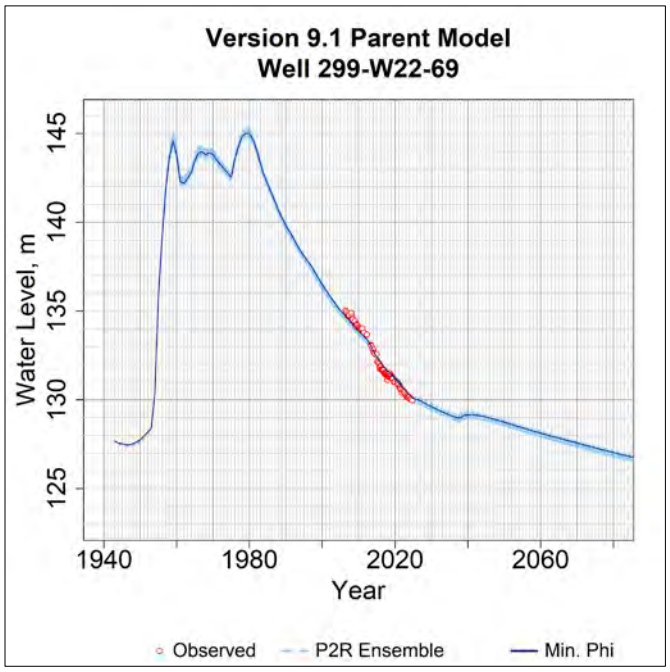

Figure B-324. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-69.

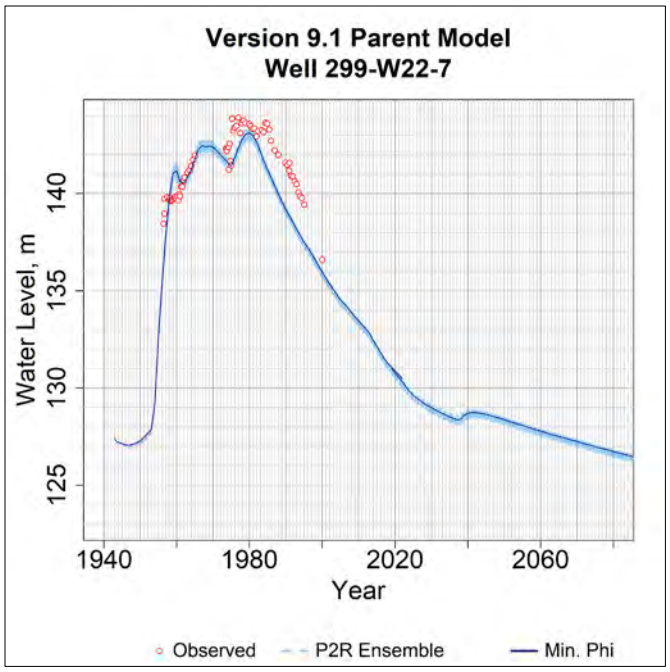

Figure B-325. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-7.

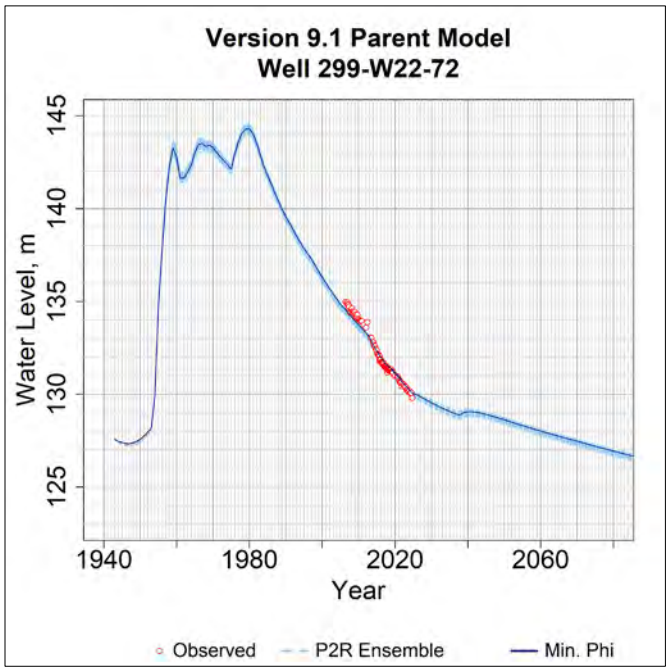

Figure B-326. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-72.

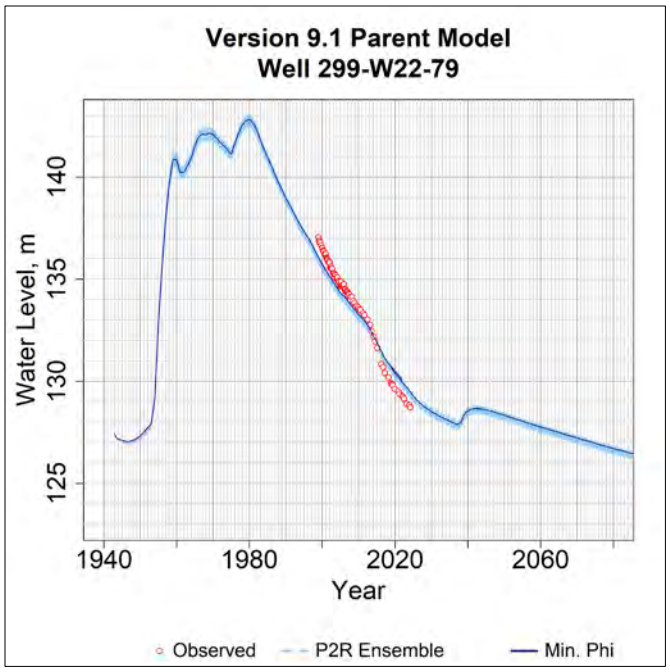

Figure B-327. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-79.

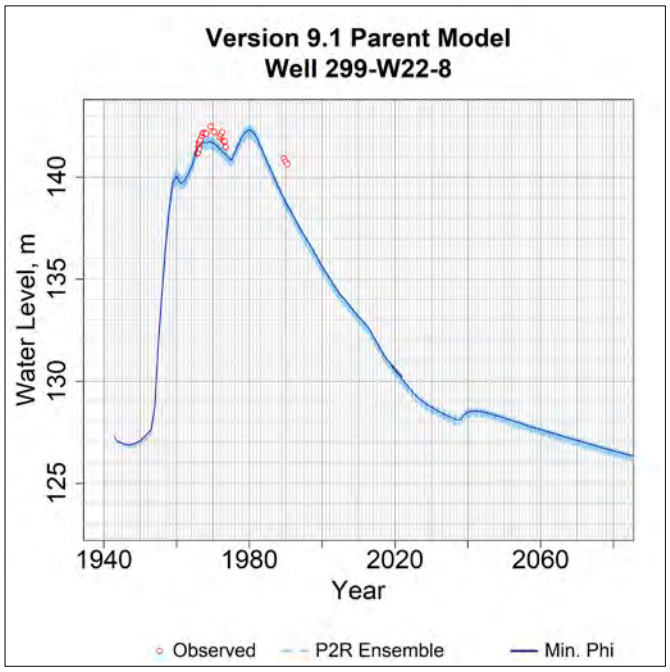

Figure B-328. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-8.

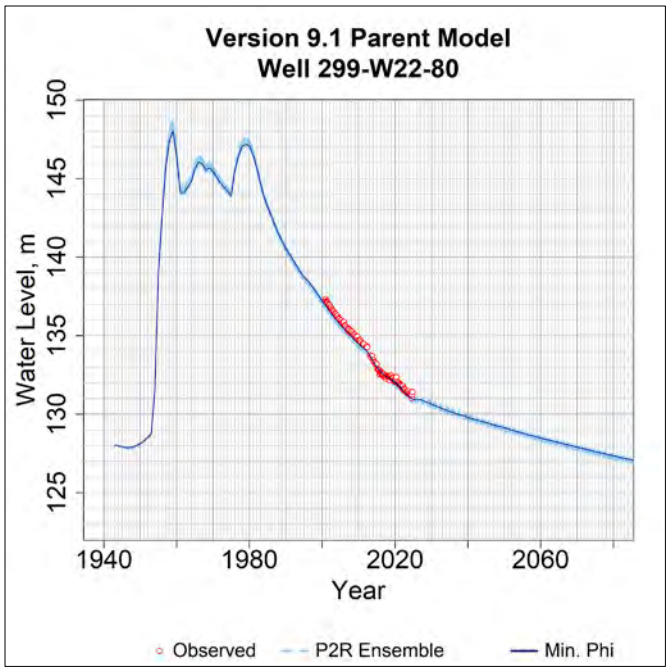

Figure B-329. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-80.

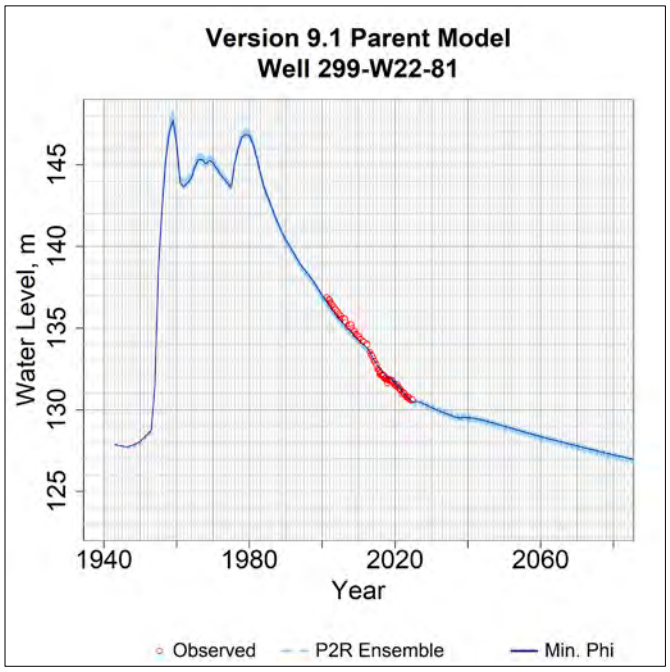

Figure B-330. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-81.

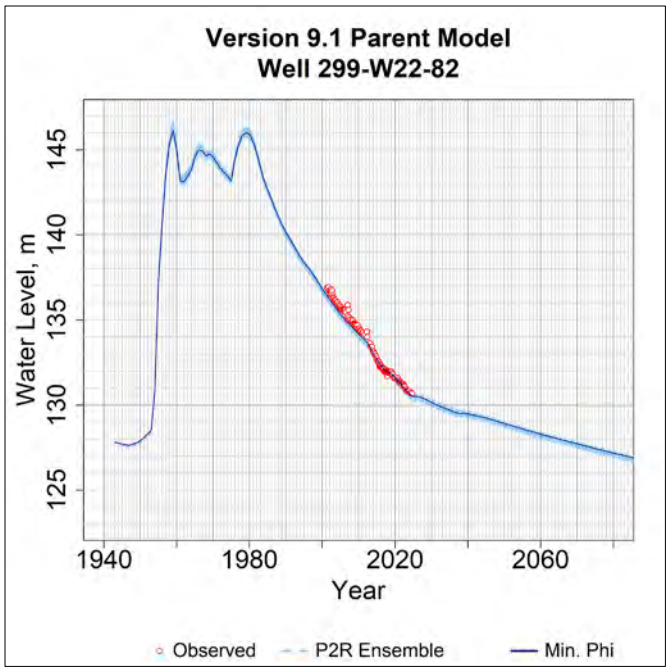

Figure B-331. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-82.

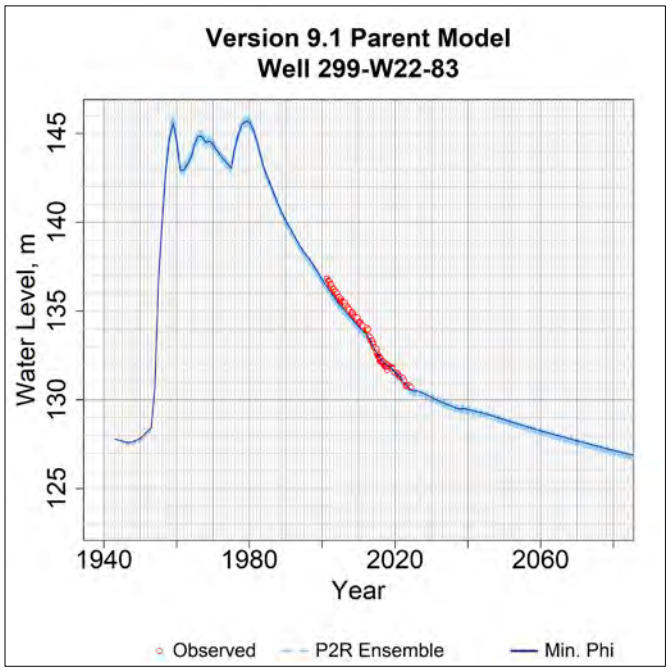

Figure B-332. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-83.

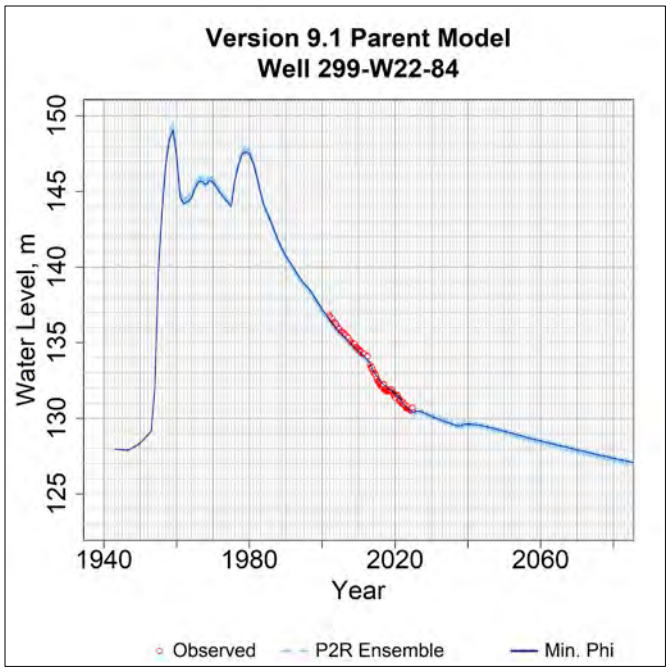

Figure B-333. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-84.

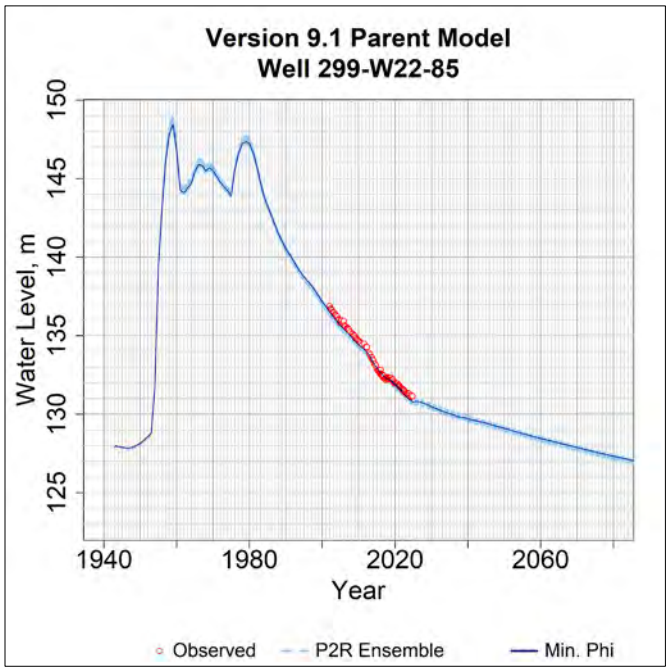

Figure B-334. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-85.

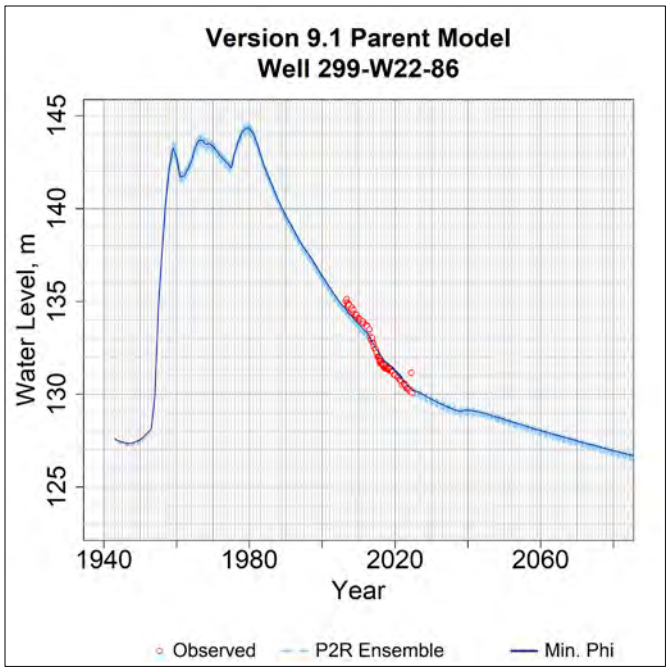

Figure B-335. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-86.

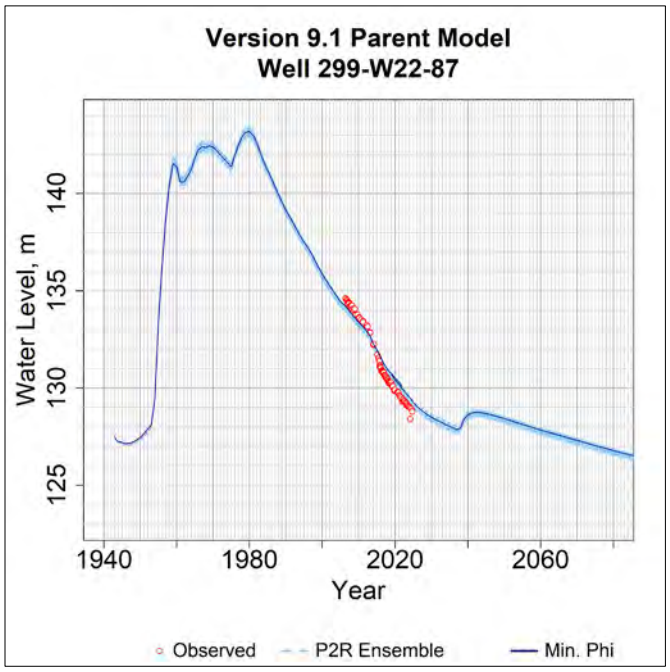

Figure B-336. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-87.

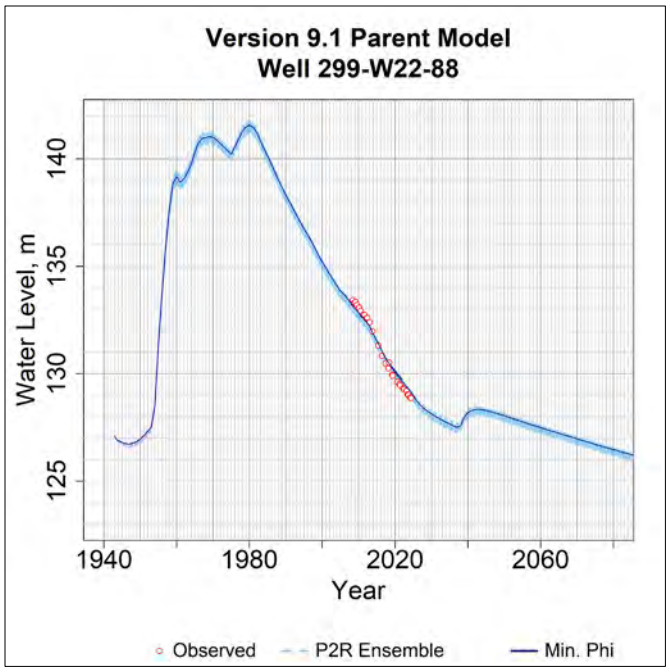

Figure B-337. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-88.

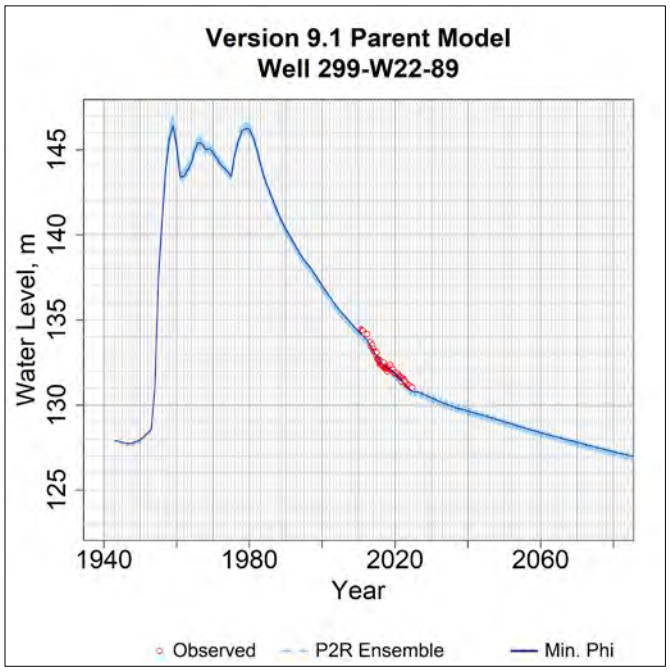

Figure B-338. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-89.

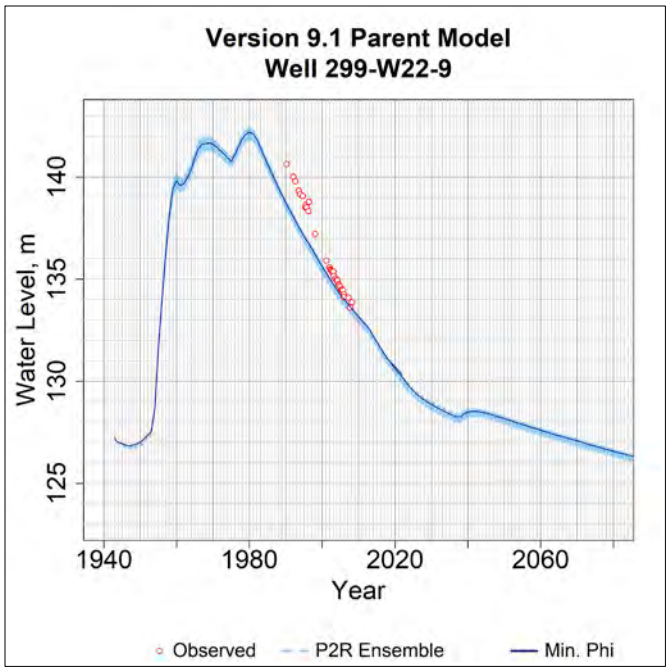

Figure B-339. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-9.

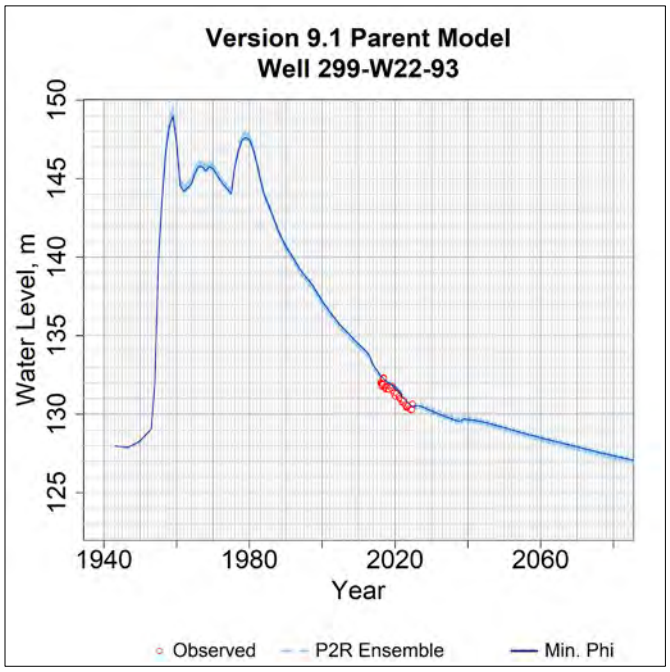

Figure B-340. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-93.

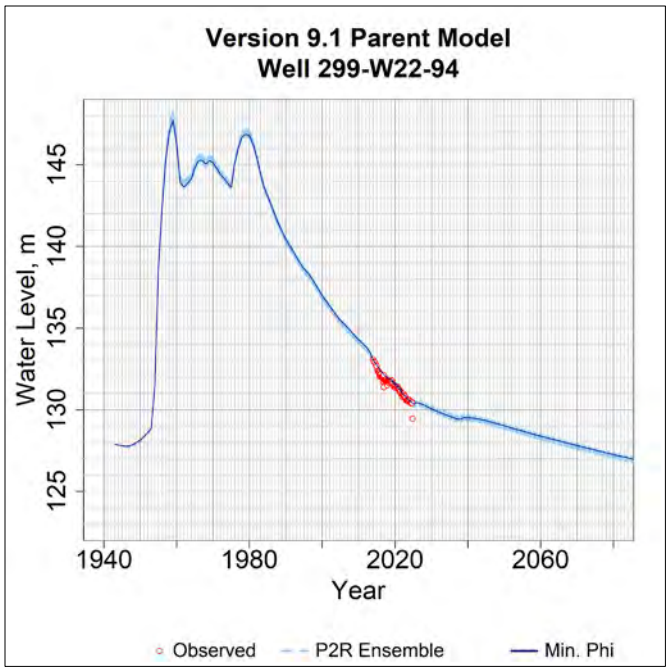

Figure B-341. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-94.

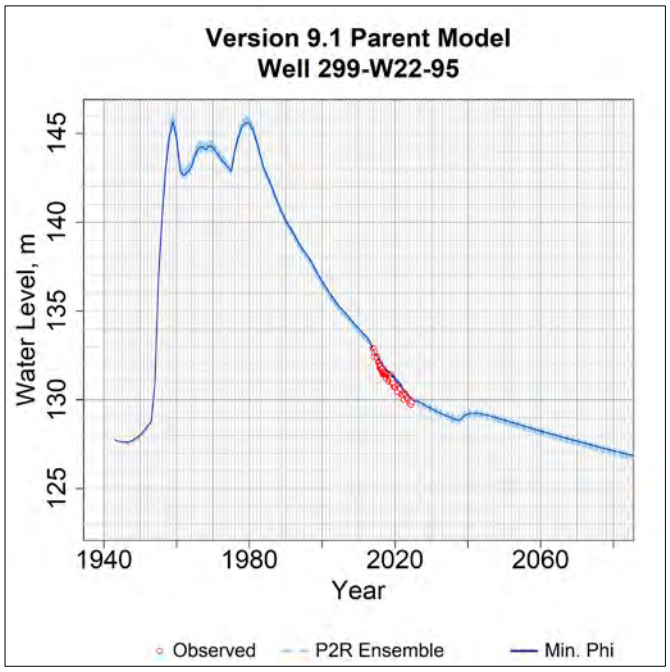

Figure B-342. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-95.

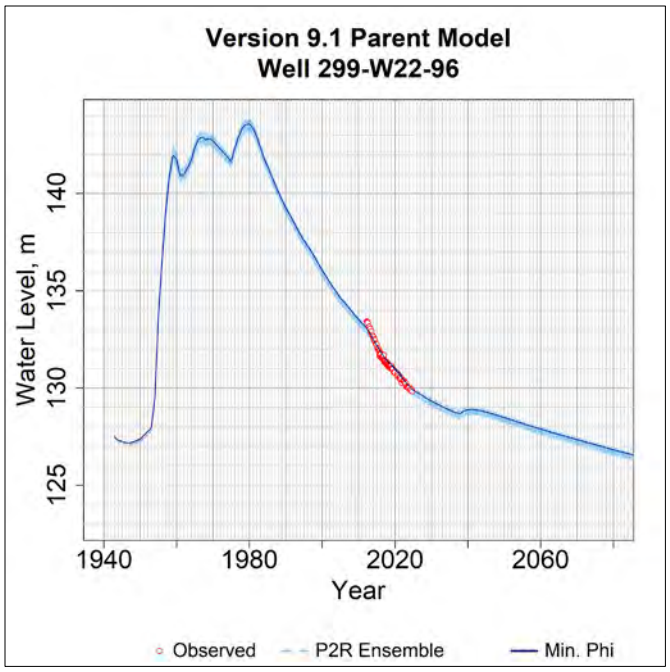

Figure B-343. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W22-96.

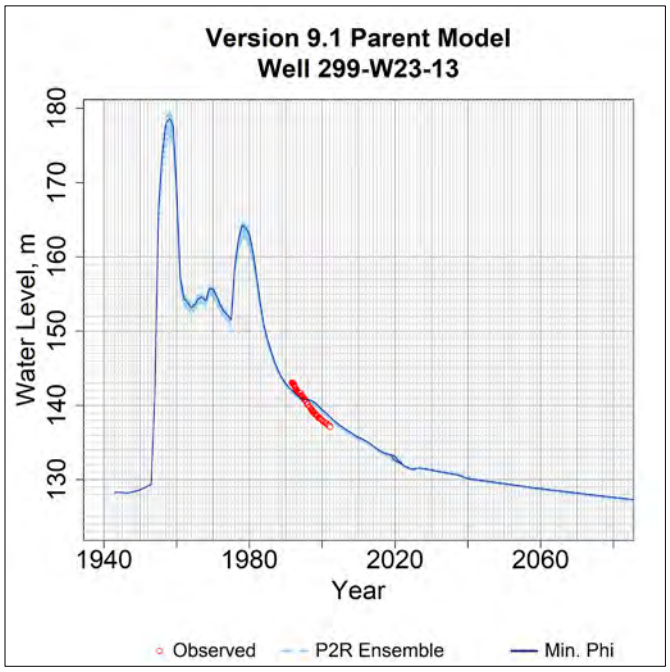

Figure B-344. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W23-13.

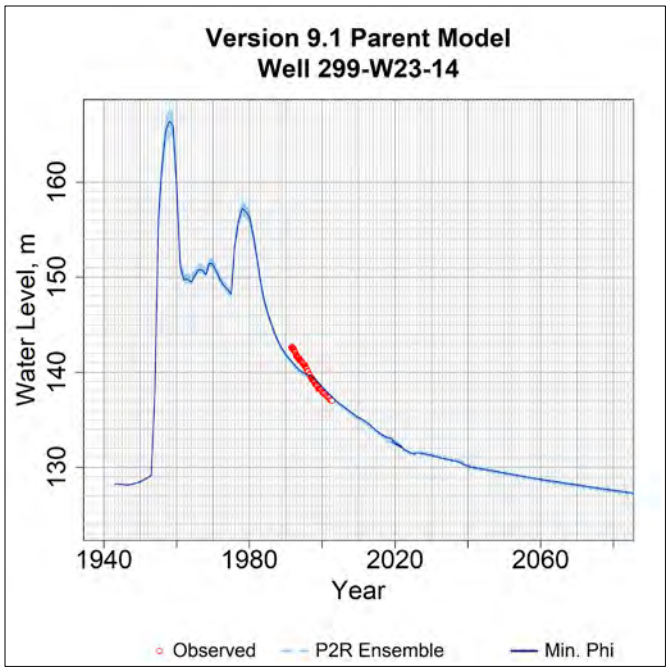

Figure B-345. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W23-14.

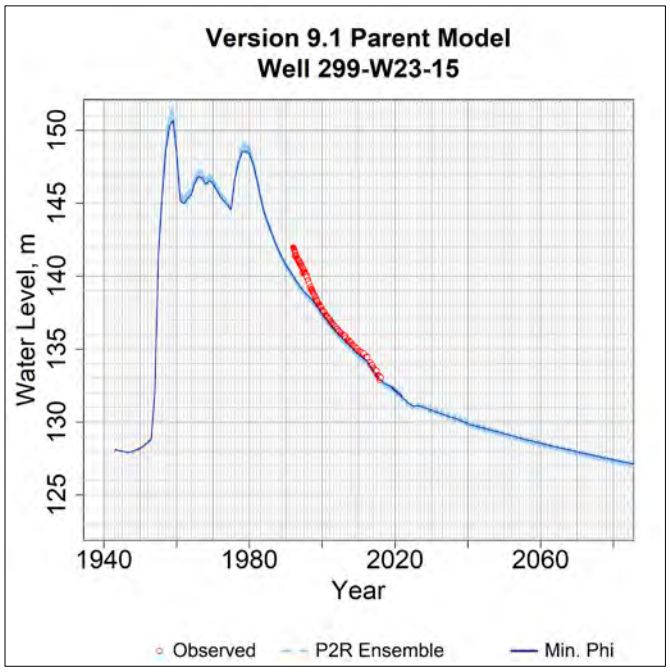

Figure B-346. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W23-15.

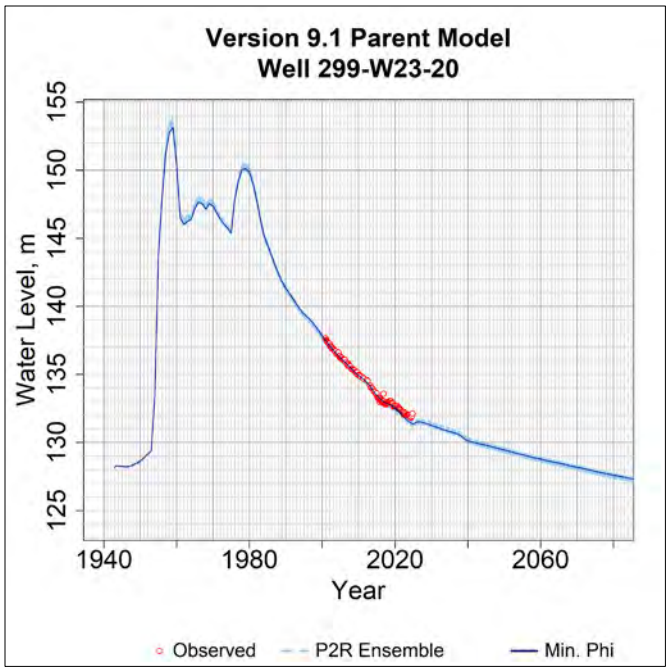

Figure B-347. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W23-20.

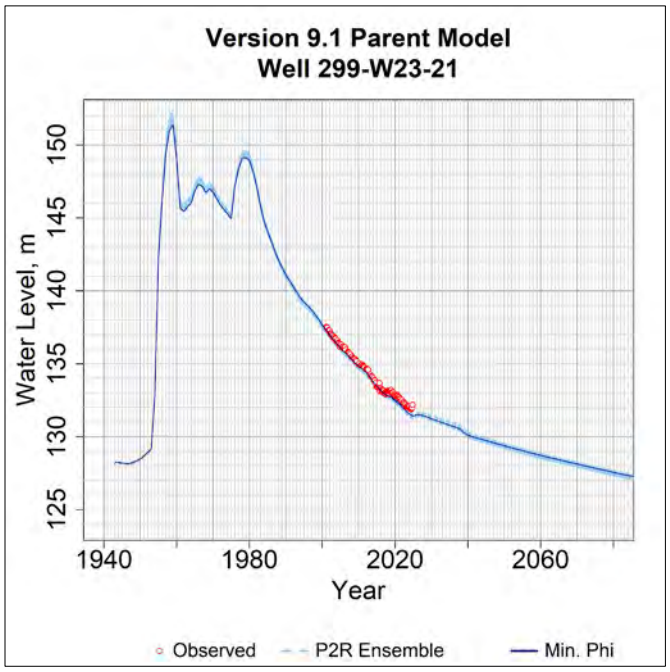

Figure B-348. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W23-21.

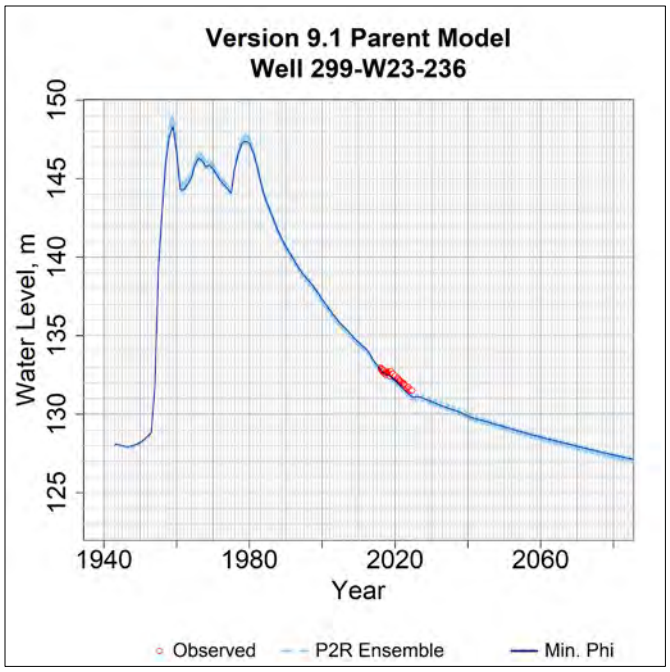

Figure B-349. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W23-236.

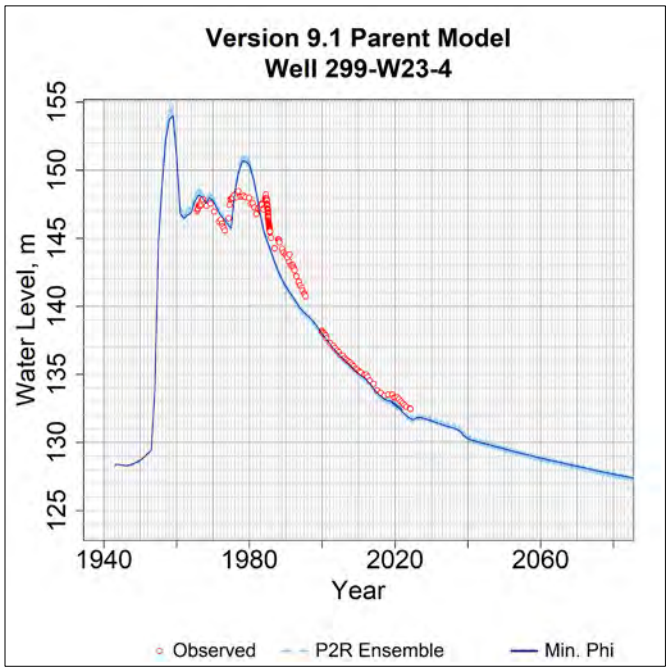

Figure B-350. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W23-4.

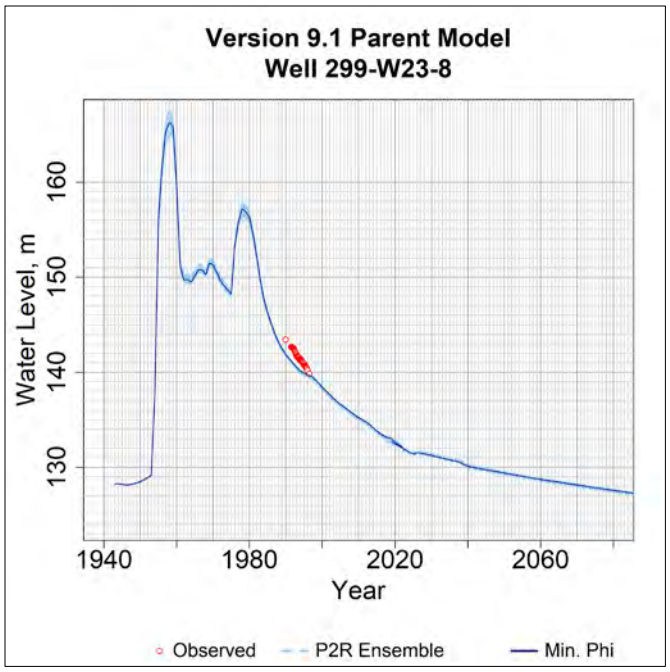

Figure B-351. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W23-8.

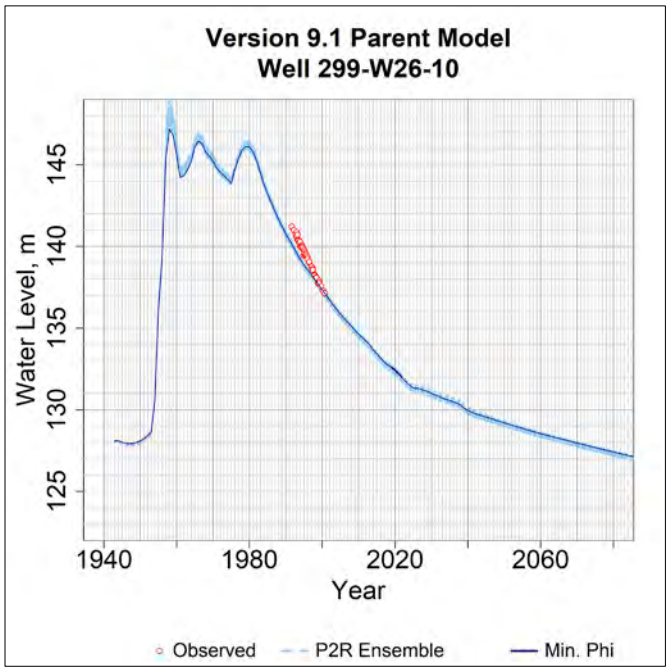

Figure B-352. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W26-10.

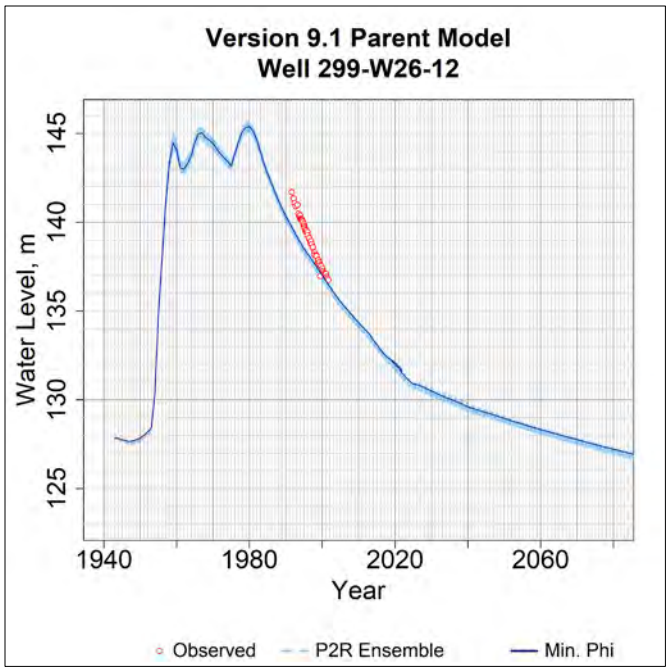

Figure B-353. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W26-12.

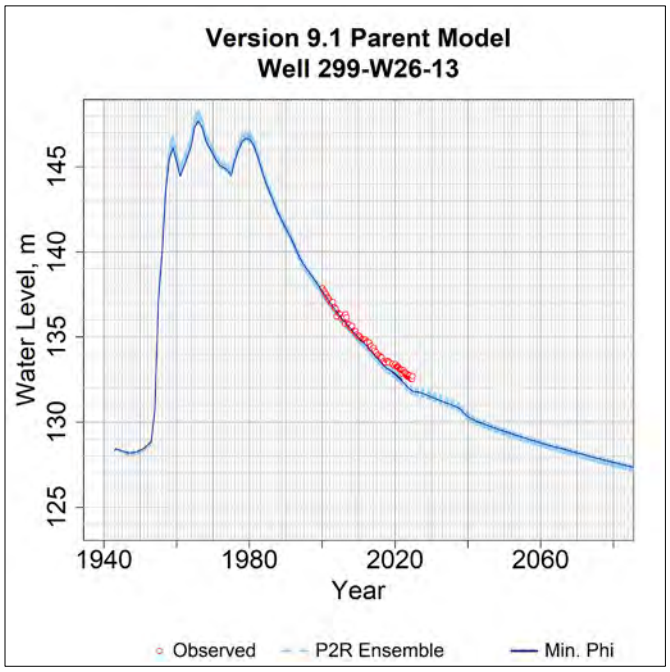

Figure B-354. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W26-13.

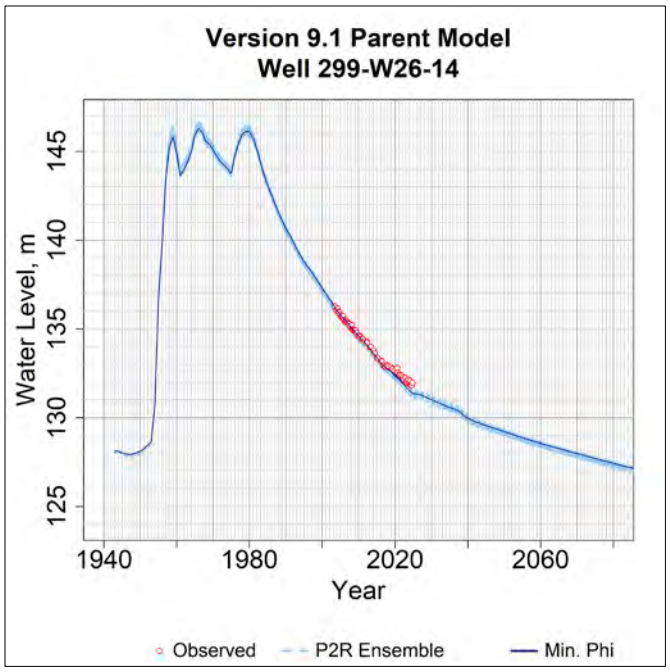

Figure B-355. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W26-14.

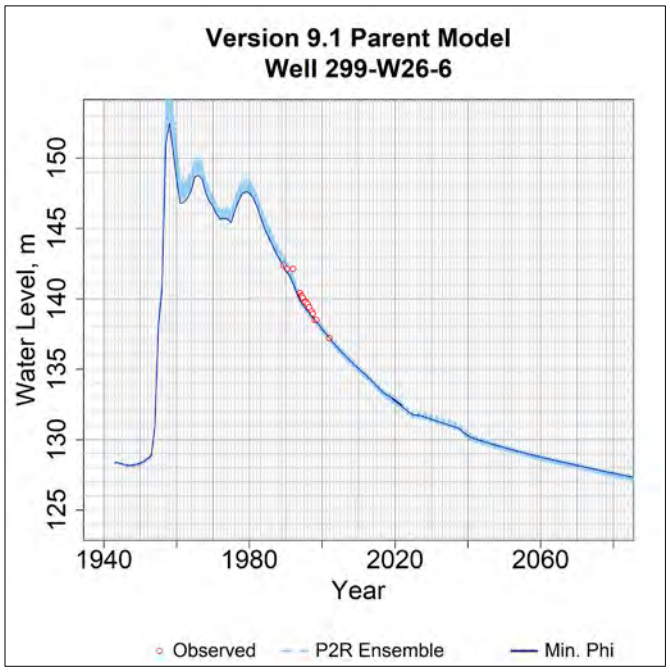

Figure B-356. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W26-6.

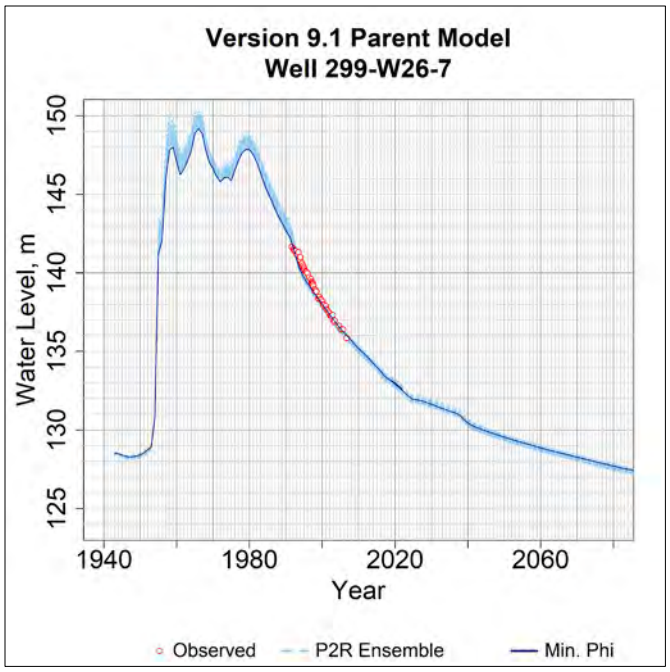

Figure B-357. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W26-7.

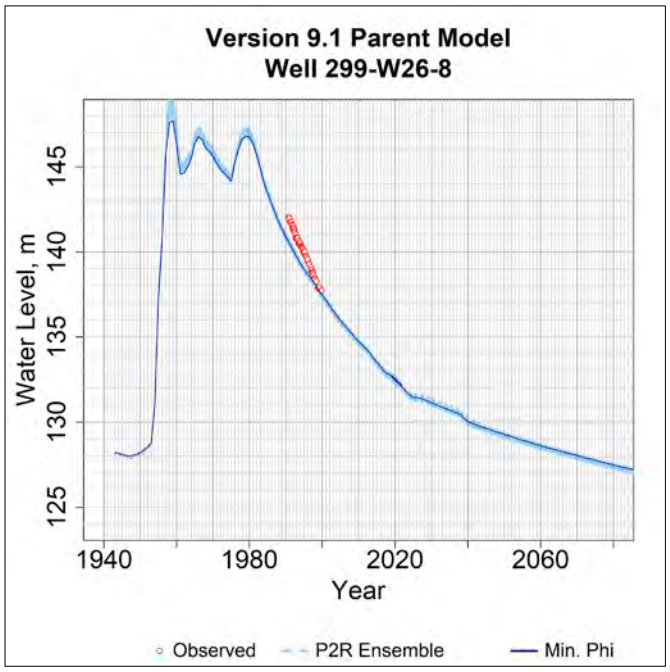

Figure B-358. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W26-8.

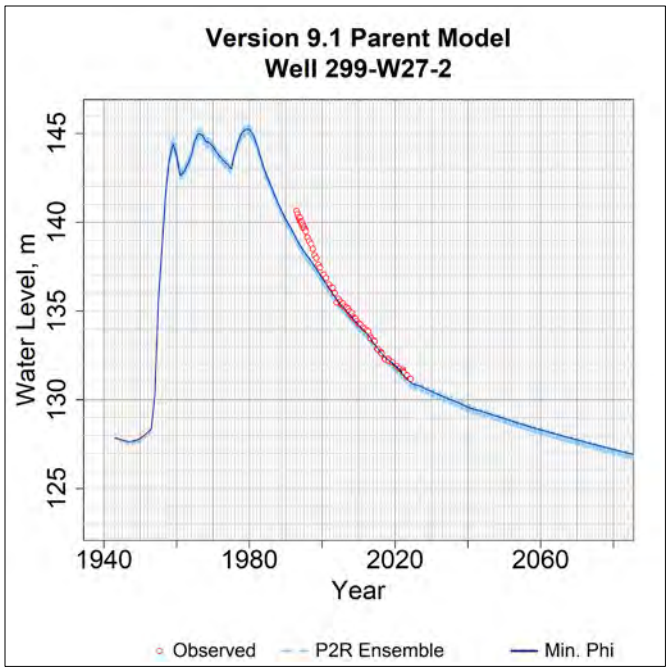

Figure B-359. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W27-2.

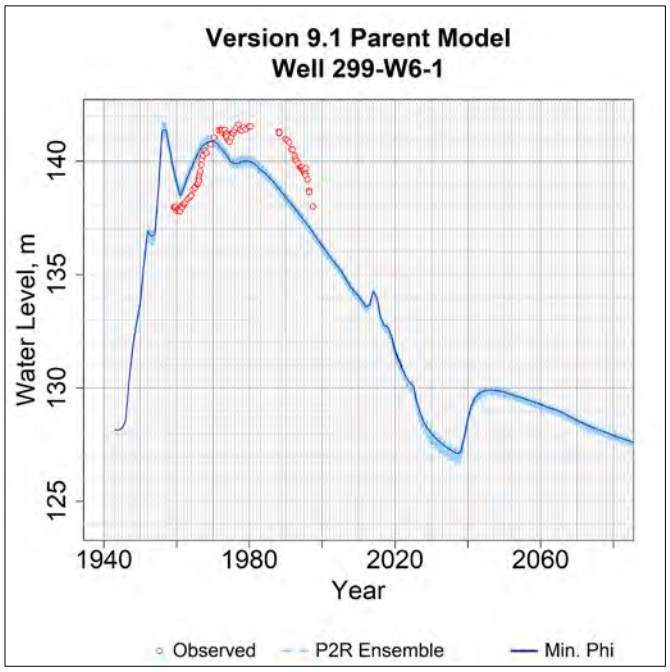

Figure B-360. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W6-1.

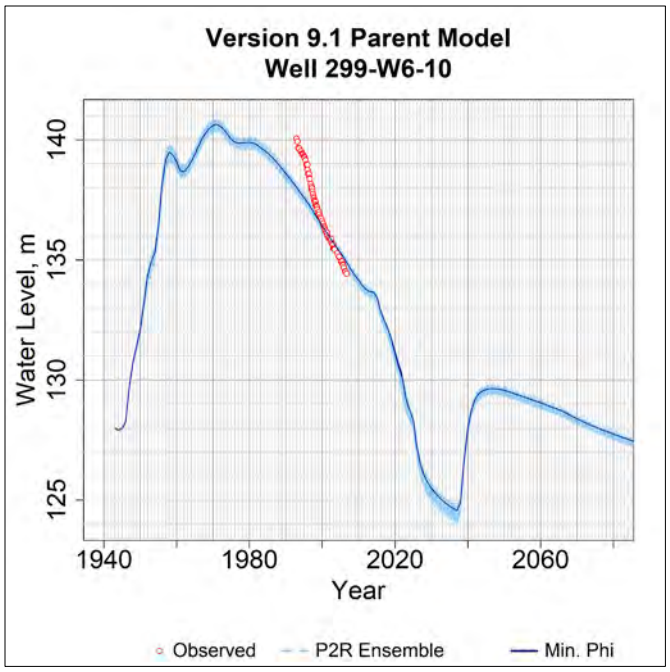

Figure B-361. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W6-10.

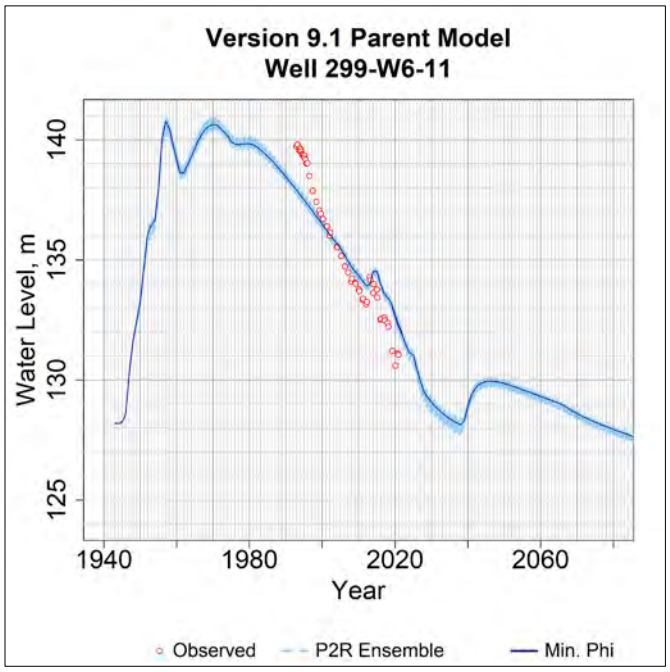

Figure B-362. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W6-11.

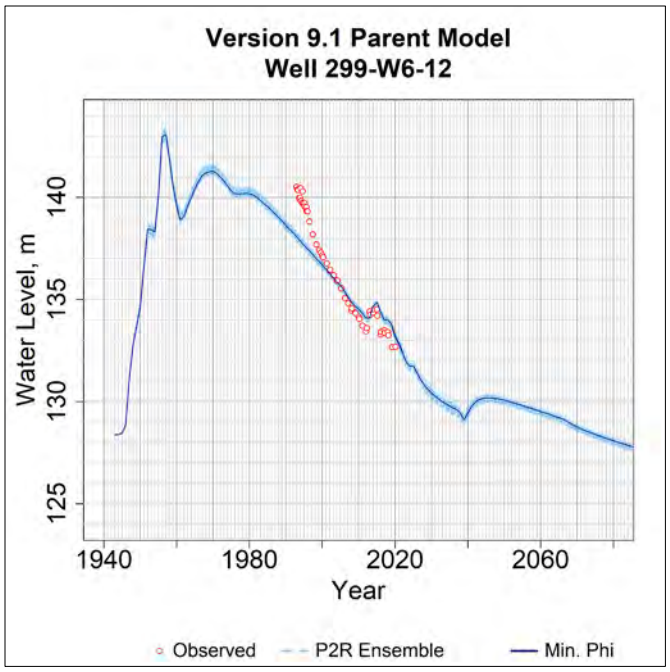

Figure B-363. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W6-12.

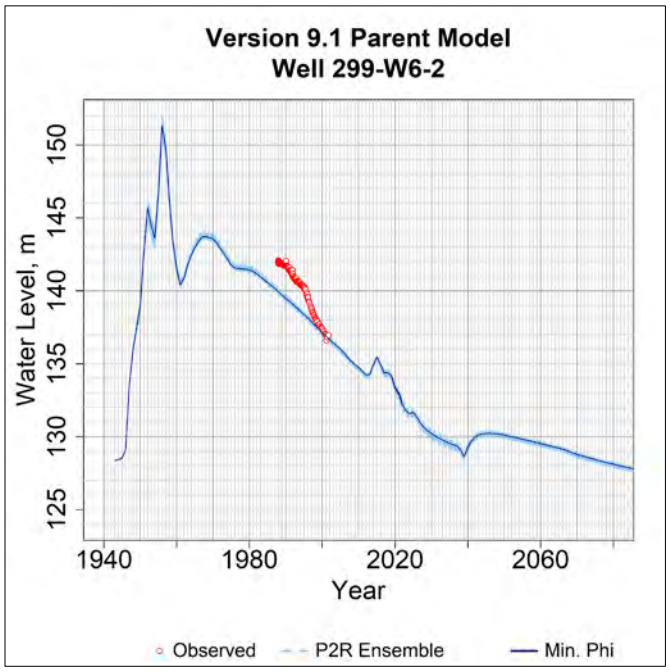

Figure B-364. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W6-2.

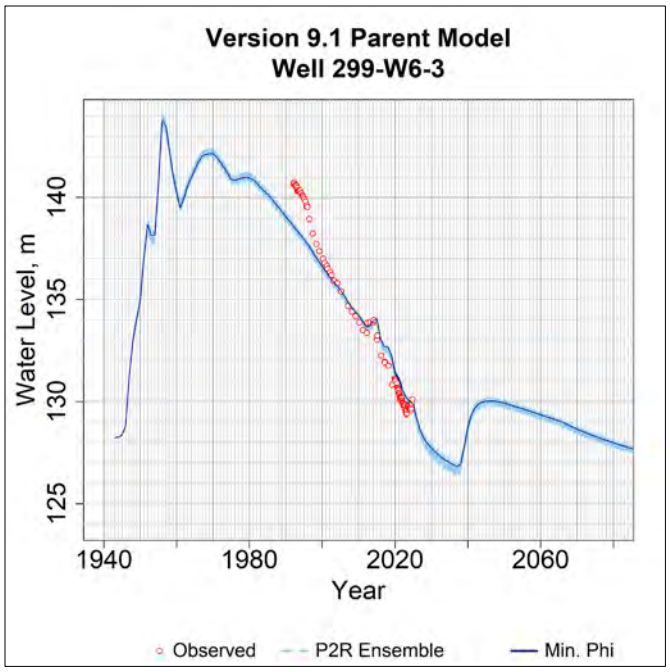

Figure B-365. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W6-3.

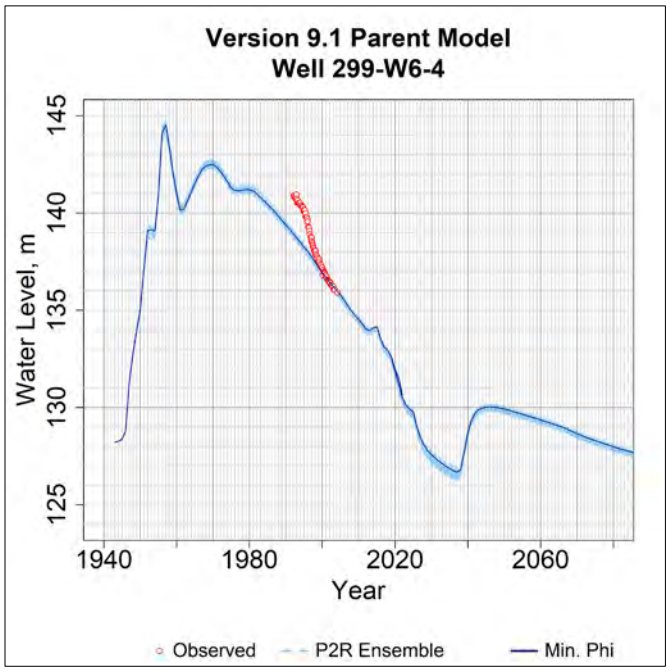

Figure B-366. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W6-4.

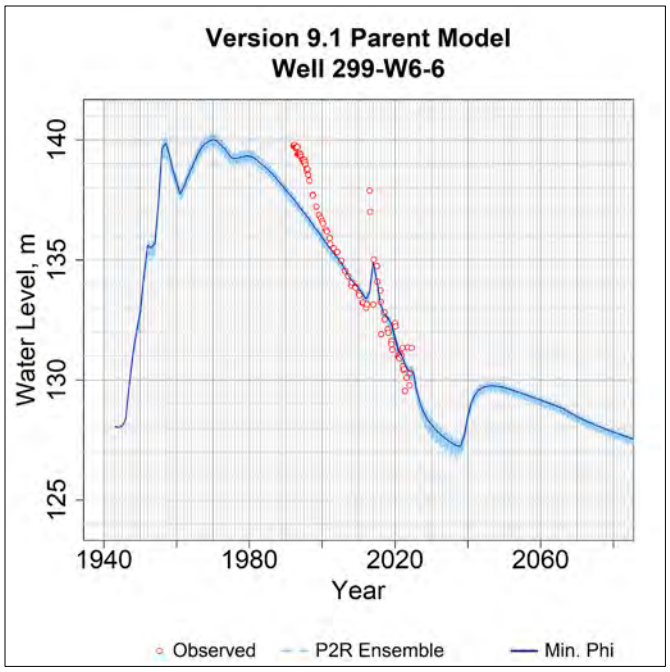

Figure B-367. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W6-6.

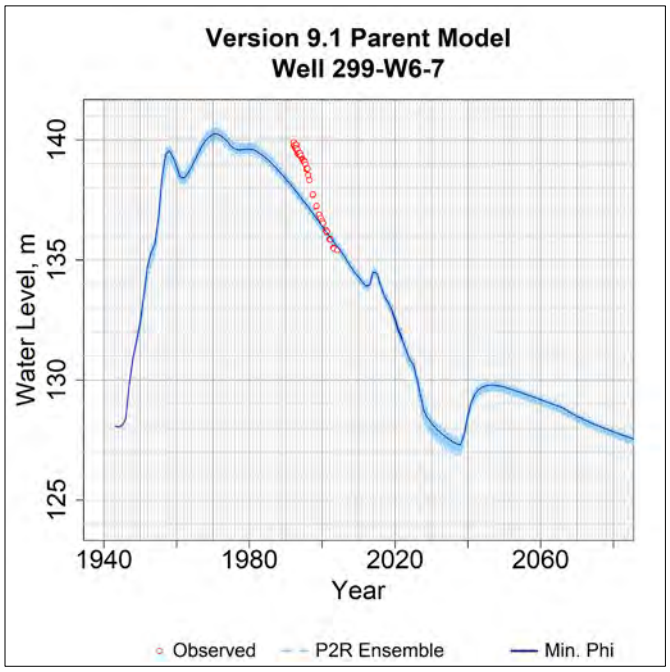

Figure B-368. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W6-7.

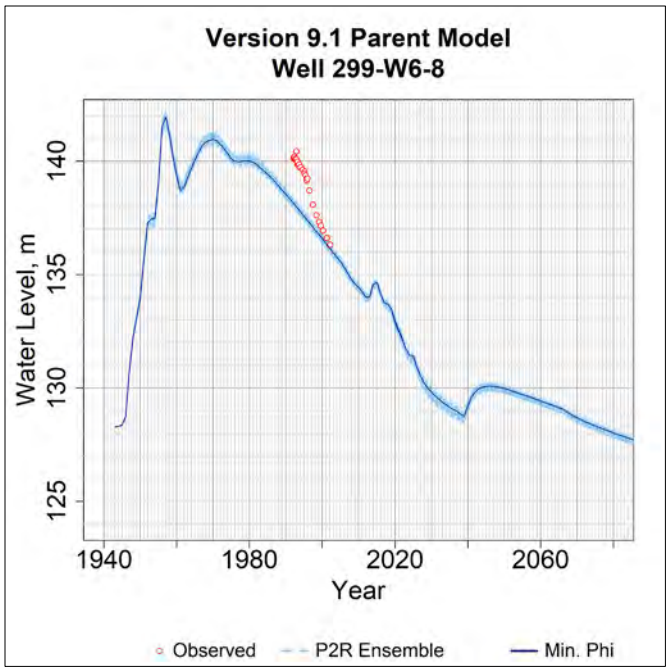

Figure B-369. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W6-8.

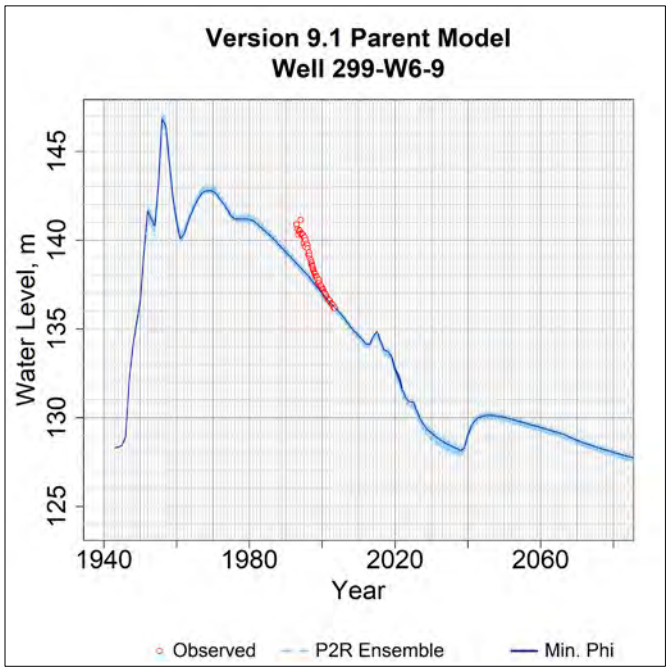

Figure B-370. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W6-9.

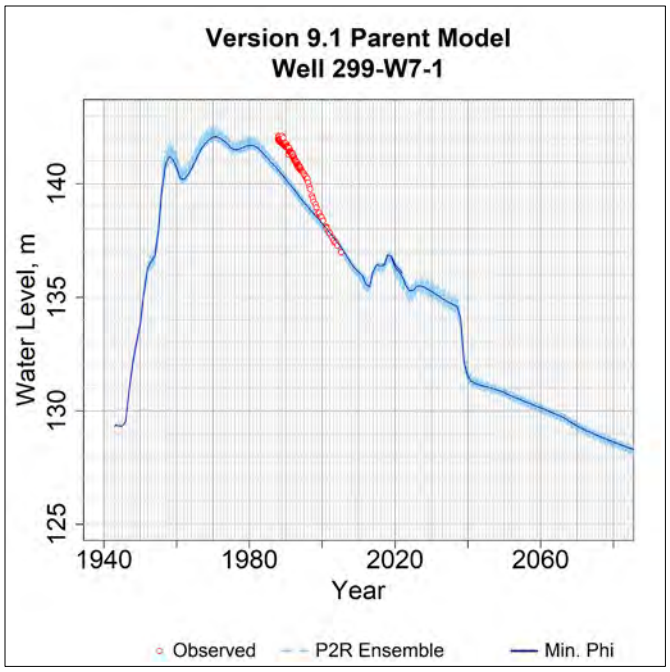

Figure B-371. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W7-1.

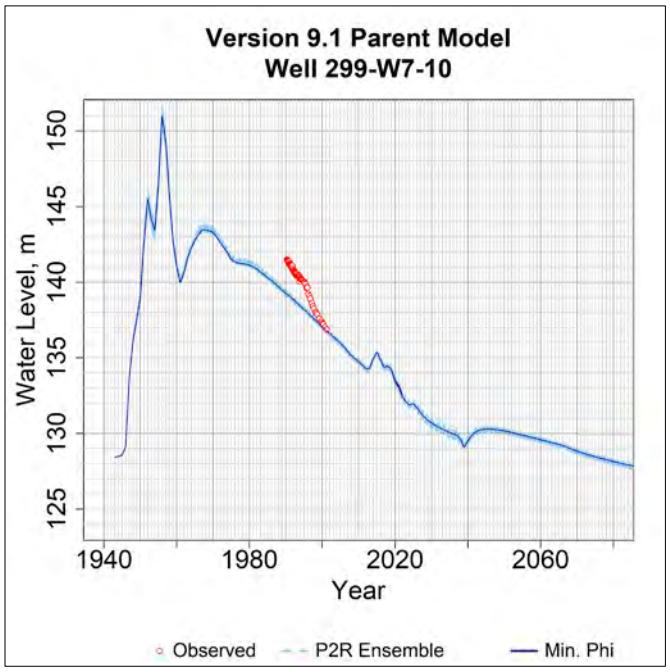

Figure B-372. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W7-10.

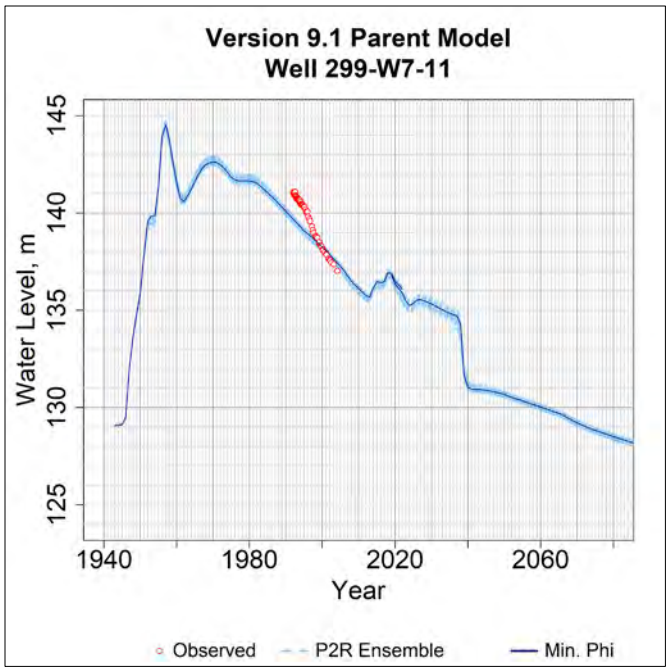

Figure B-373. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W7-11.

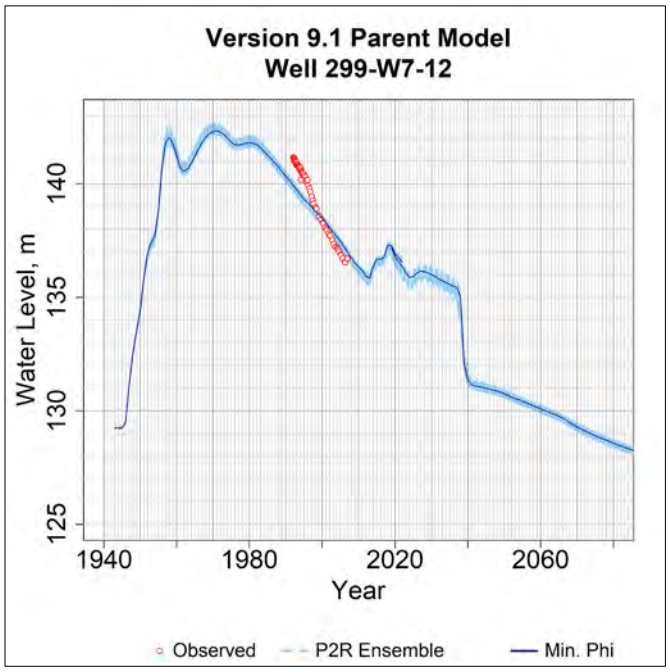

Figure B-374. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W7-12.

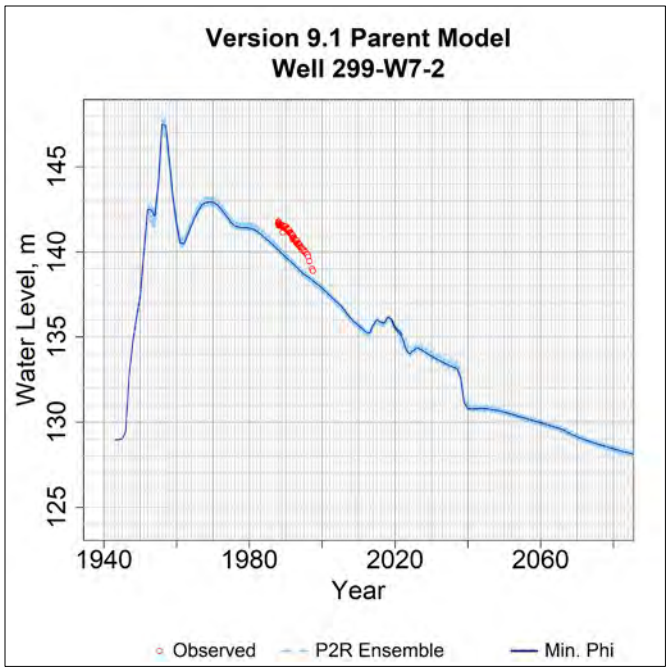

Figure B-375. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W7-2.

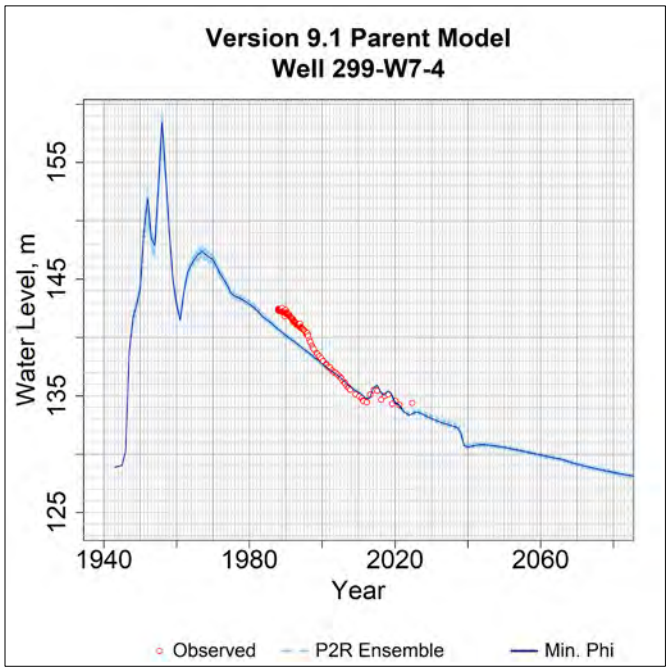

Figure B-376. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W7-4.

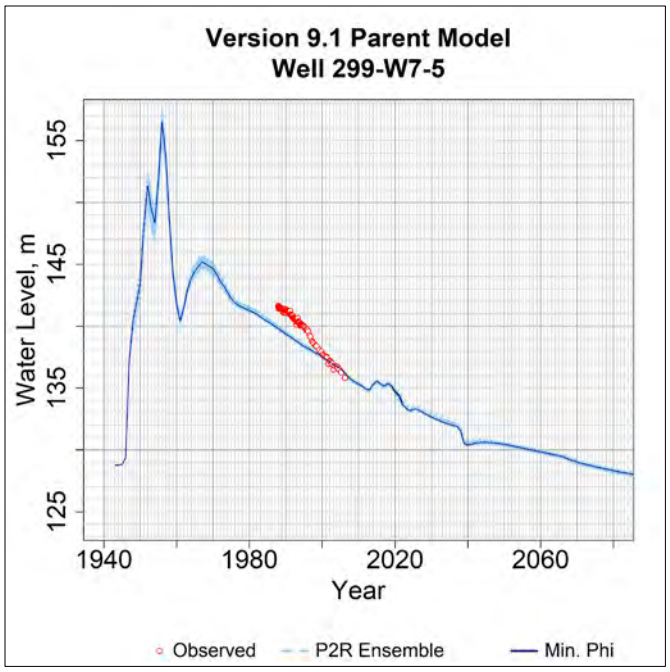

Figure B-377. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W7-5.

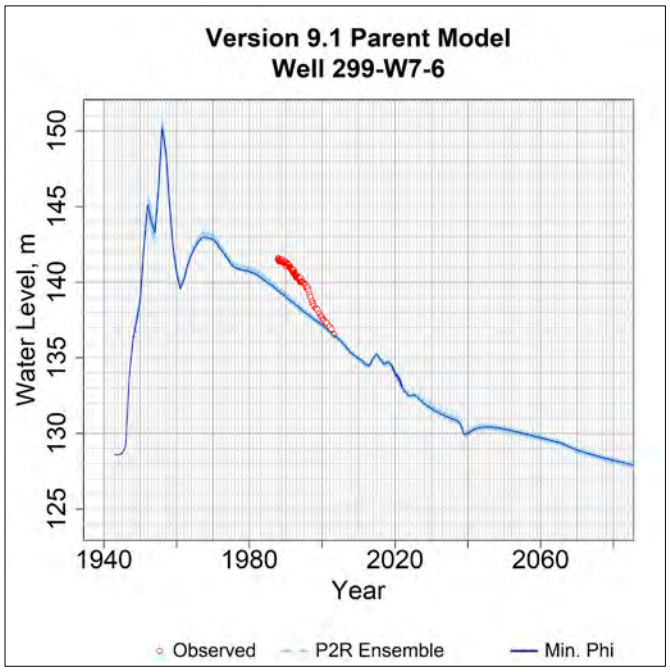

Figure B-378. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W7-6.

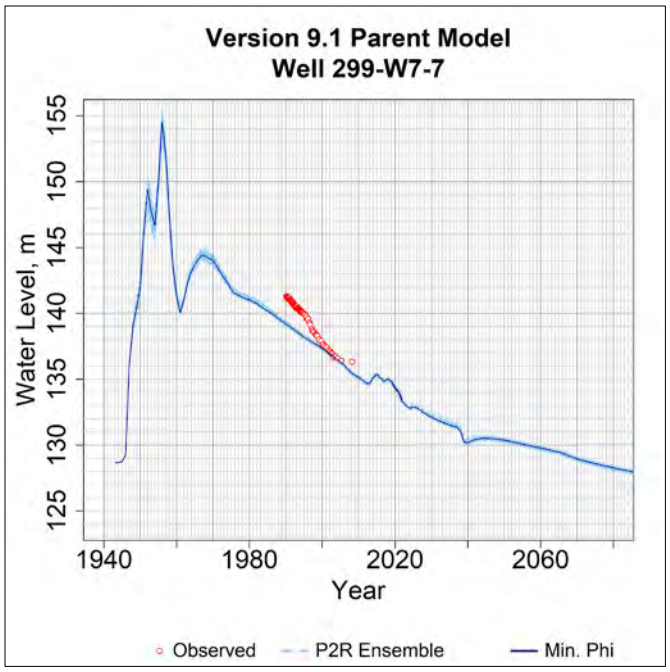

Figure B-379. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W7-7.

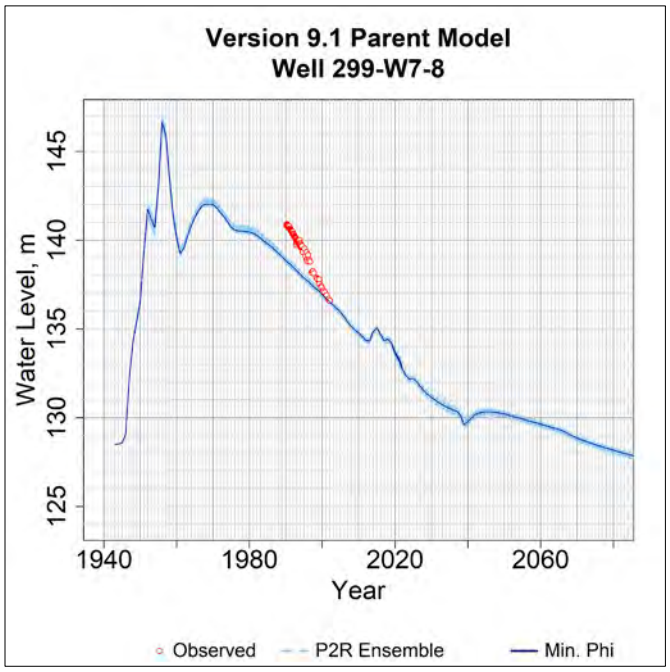

Figure B-380. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W7-8.

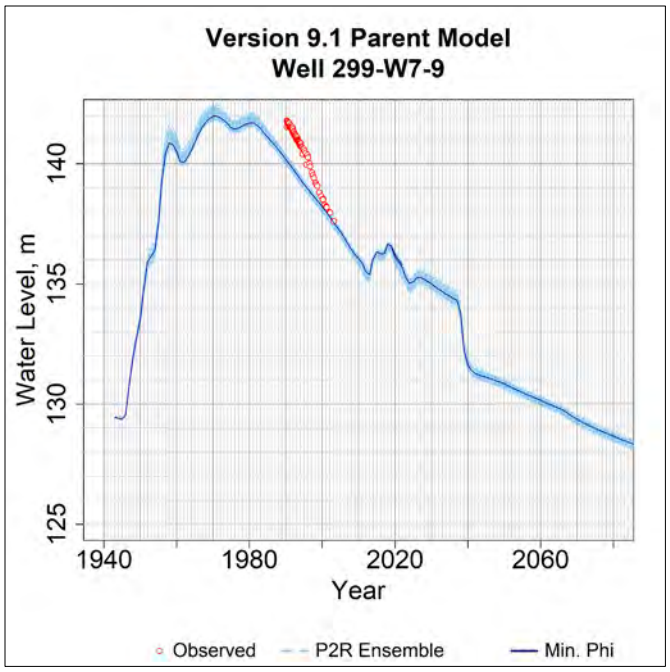

Figure B-381. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W7-9.

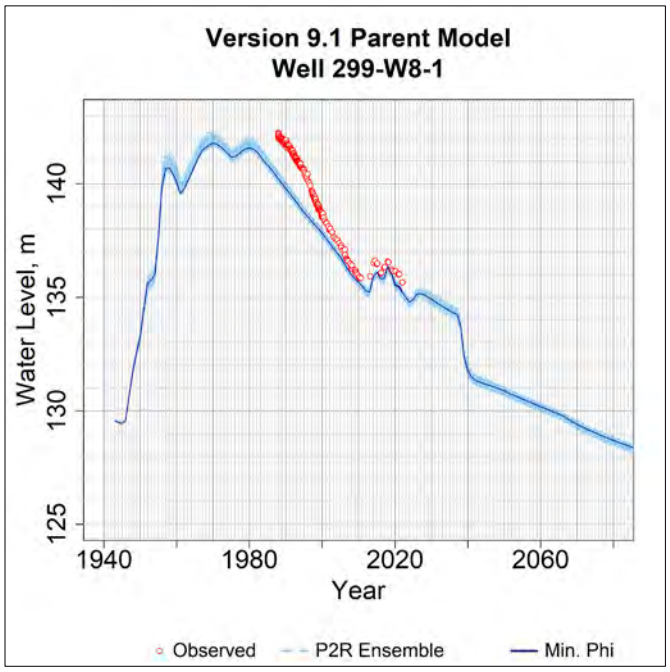

Figure B-382. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W8-1.

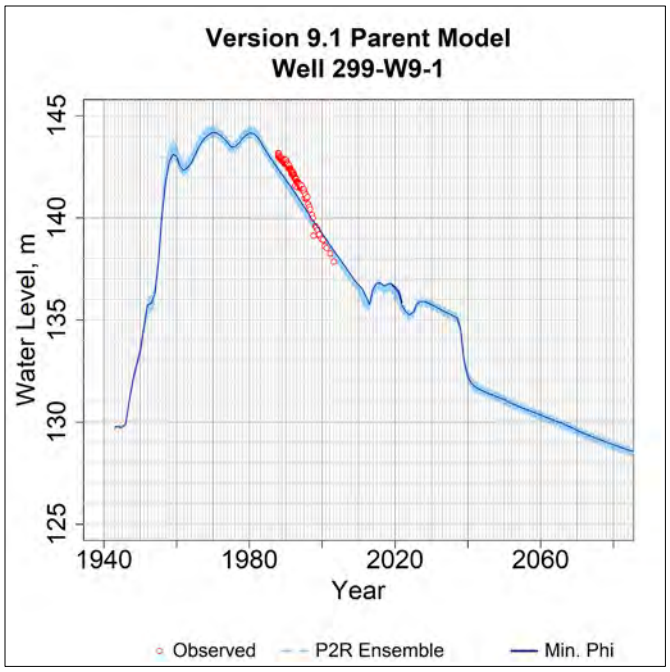

Figure B-383. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W9-1.

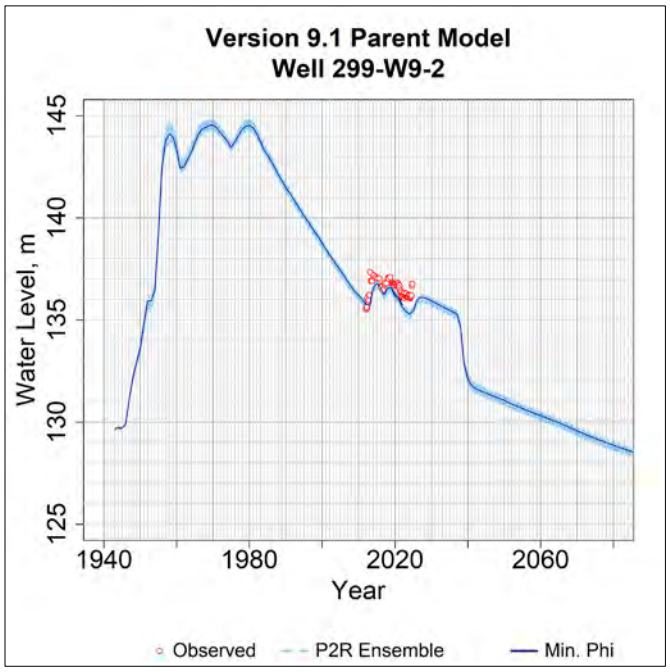

Figure B-384. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 299-W9-2.

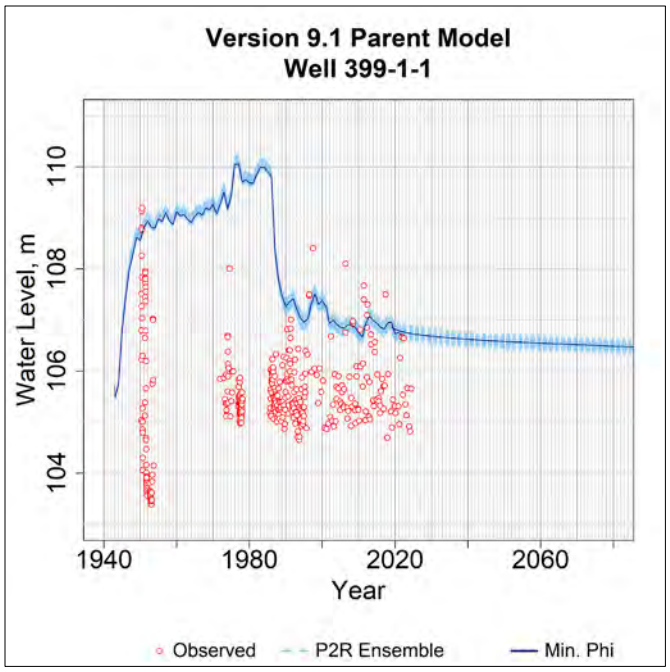

Figure B-385. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 399-1-1.

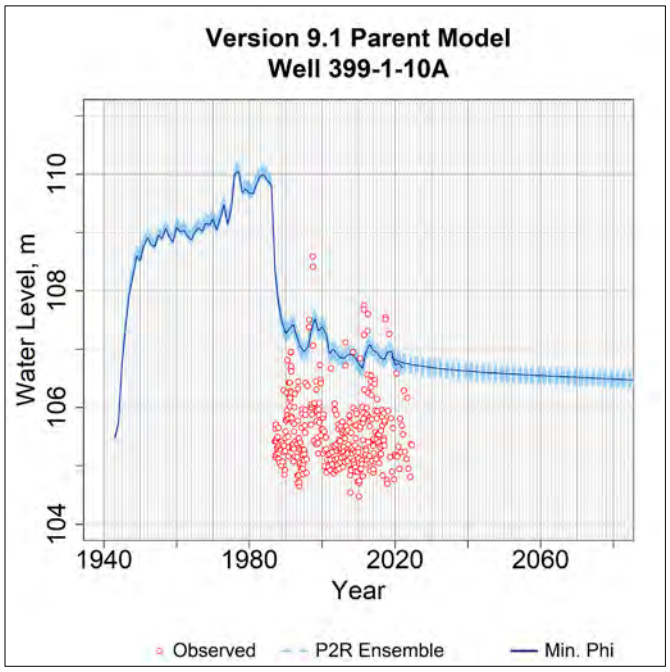

Figure B-386. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 399-1-10A.

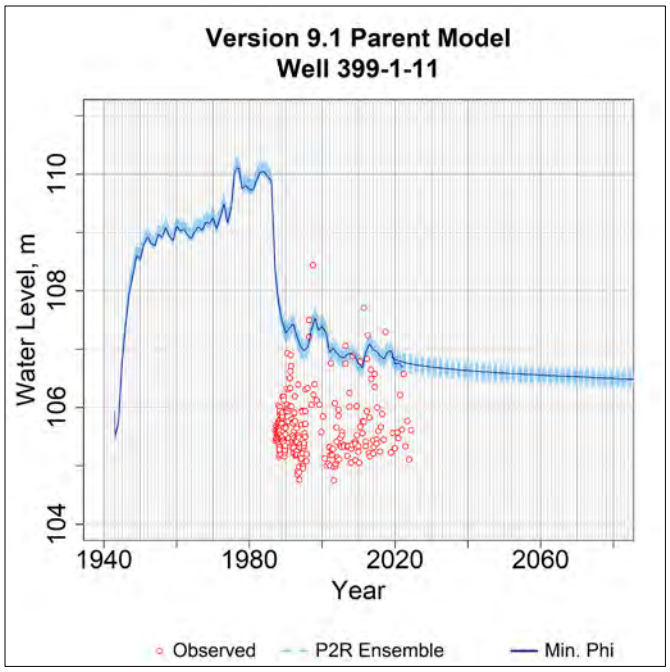

Figure B-387. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 399-1-11.

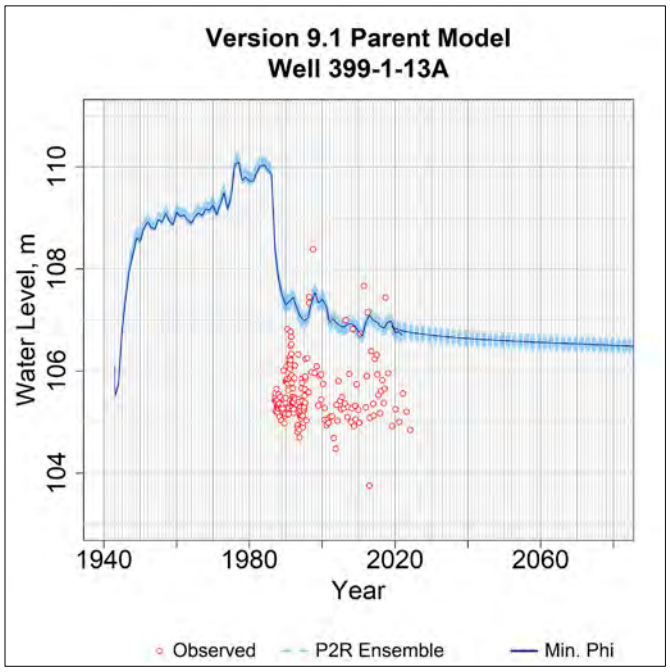

Figure B-388. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 399-1-13A.

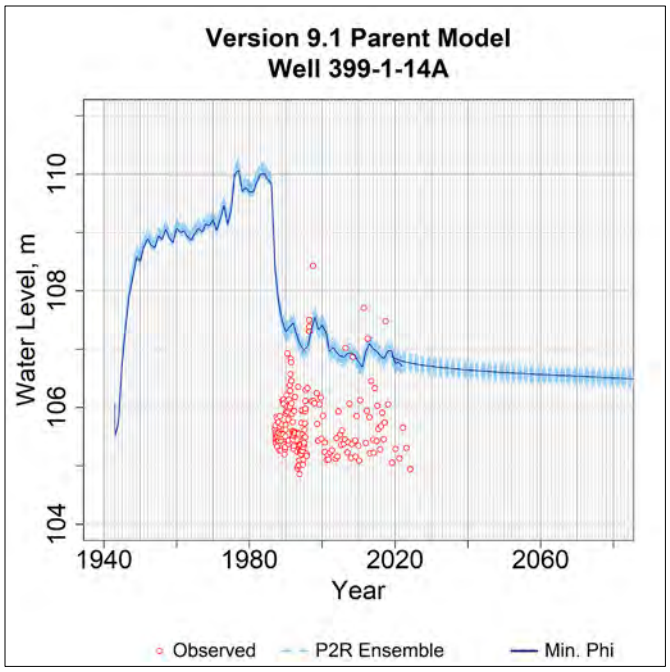

Figure B-389. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 399-1-14A.

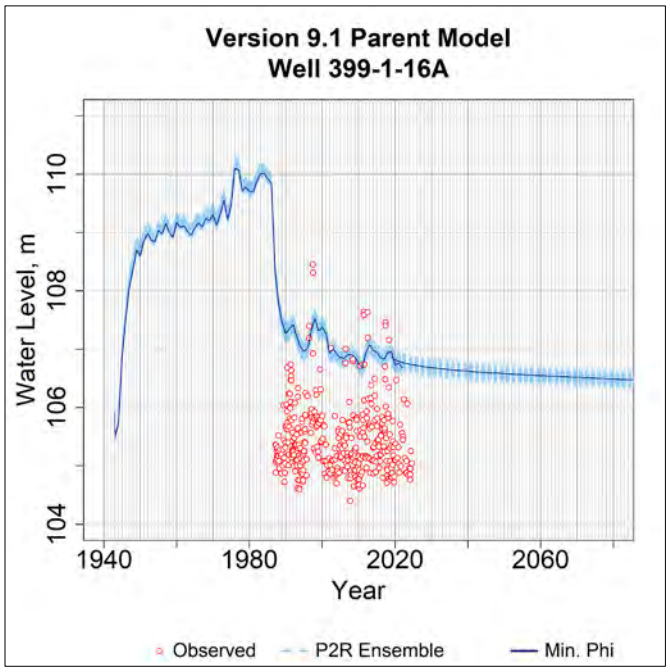

Figure B-390. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 399-1-16A.

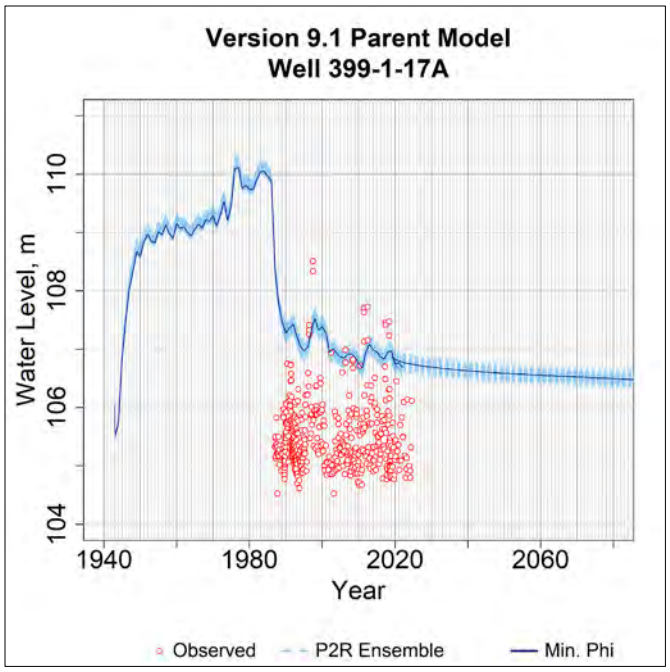

Figure B-391. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 399-1-17A.

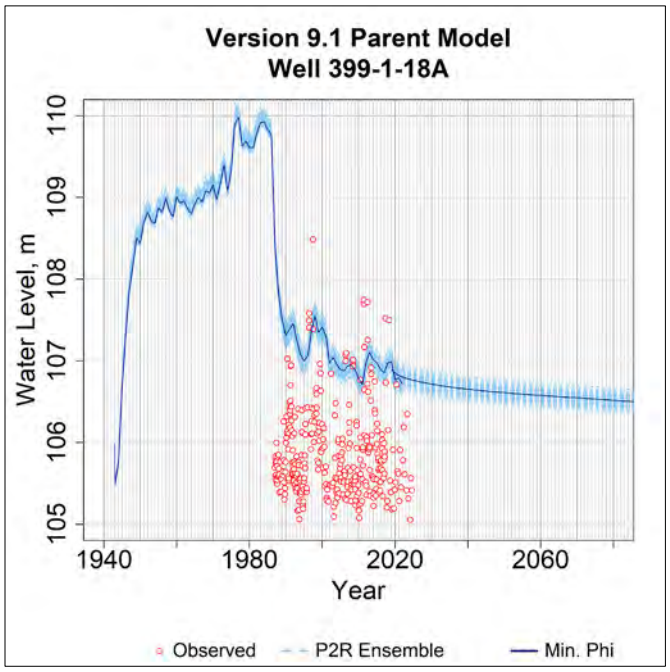

Figure B-392. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 399-1-18A.

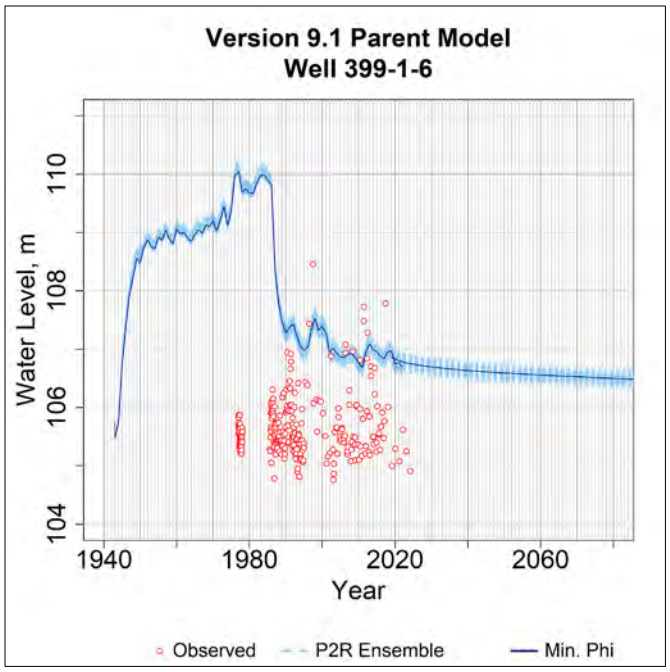

Figure B-393. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 399-1-6.

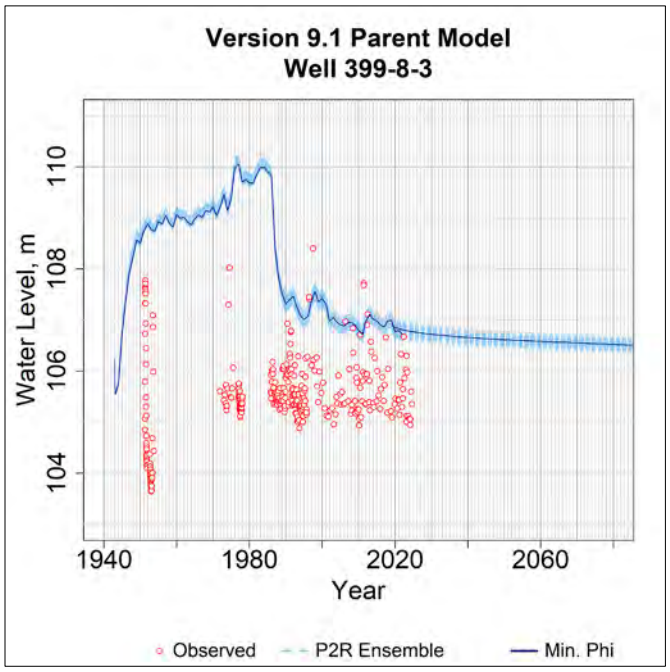

Figure B-394. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 399-8-3.

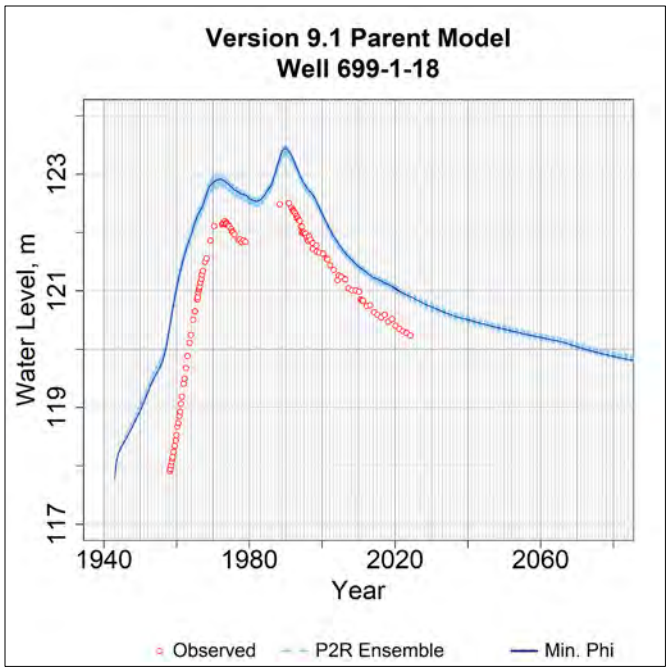

Figure B-395. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-1-18.

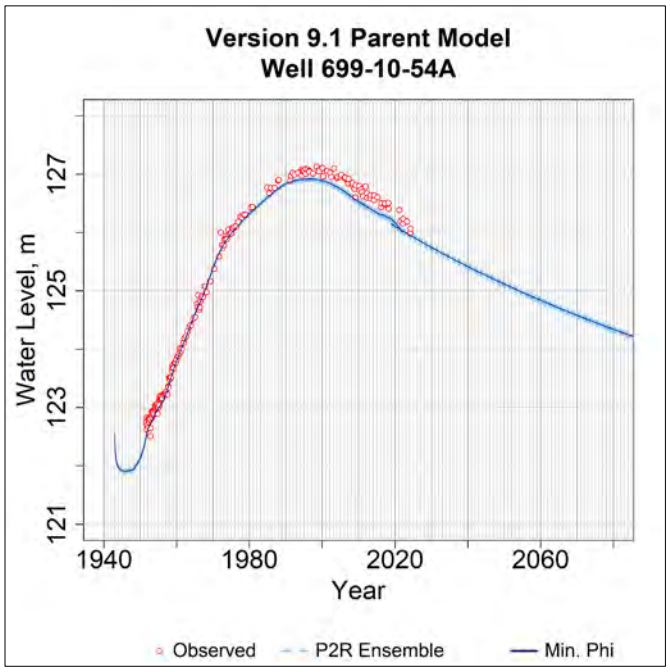

Figure B-396. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-10-54A.

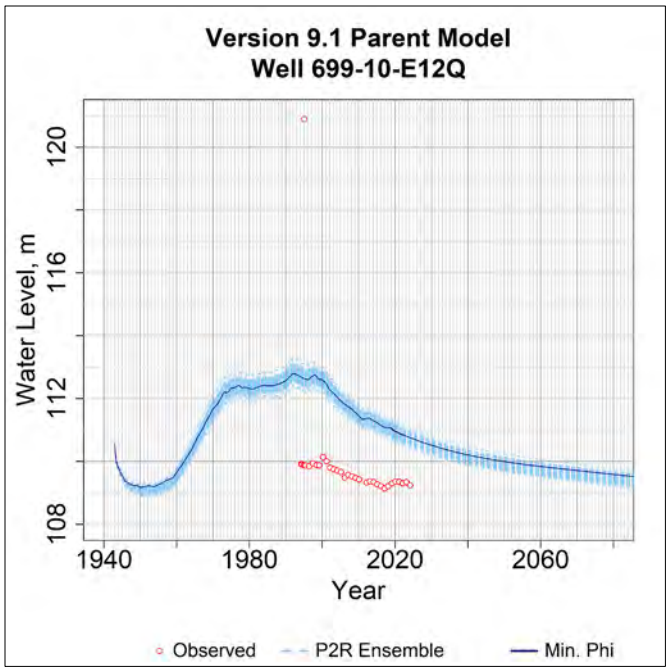

Figure B-397. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-10-E12Q.

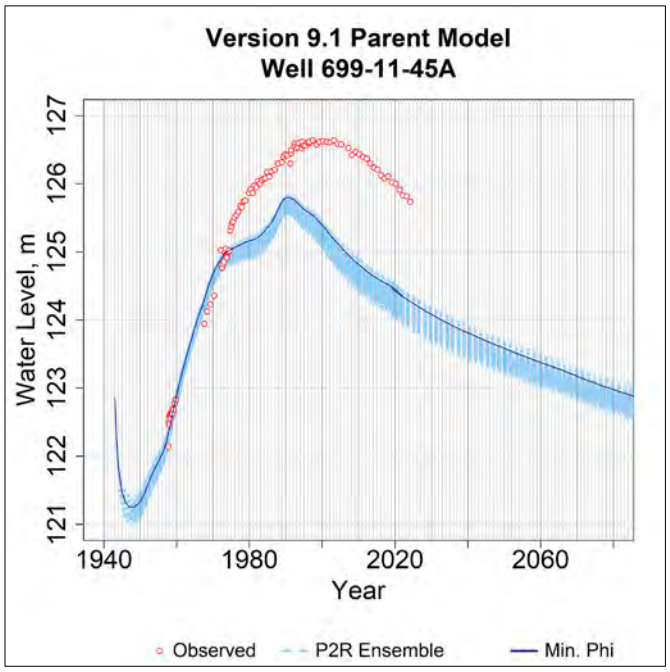

Figure B-398. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-11-45A.

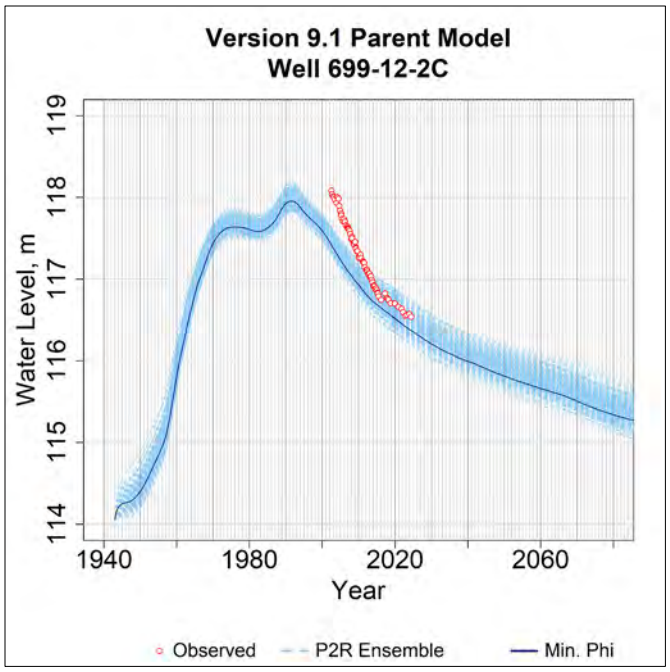

Figure B-399. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-12-2C.

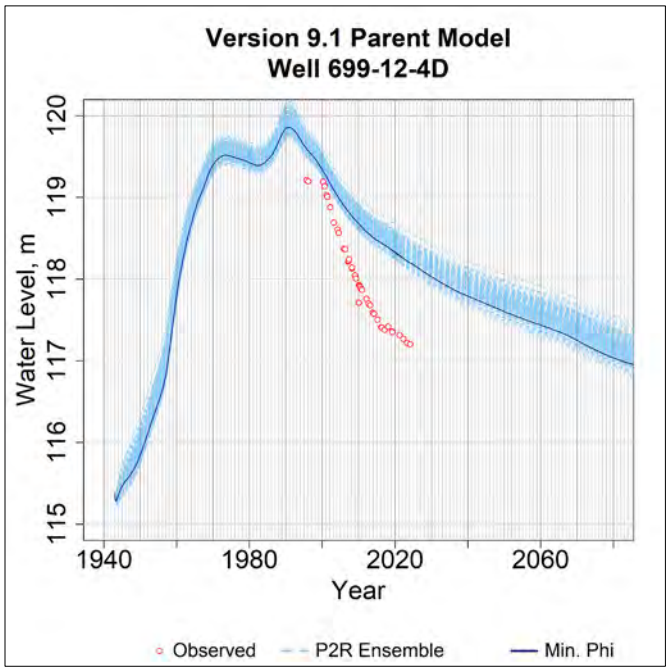

Figure B-400. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-12-4D.

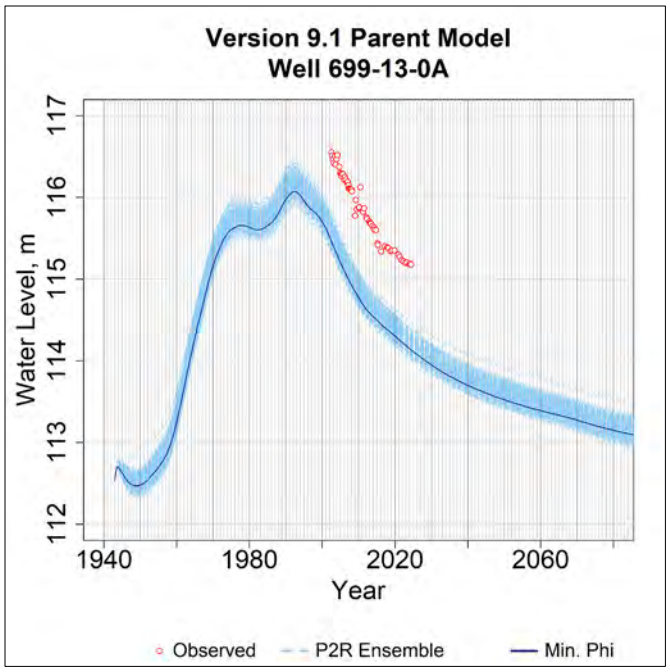

Figure B-401. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-13-0A.

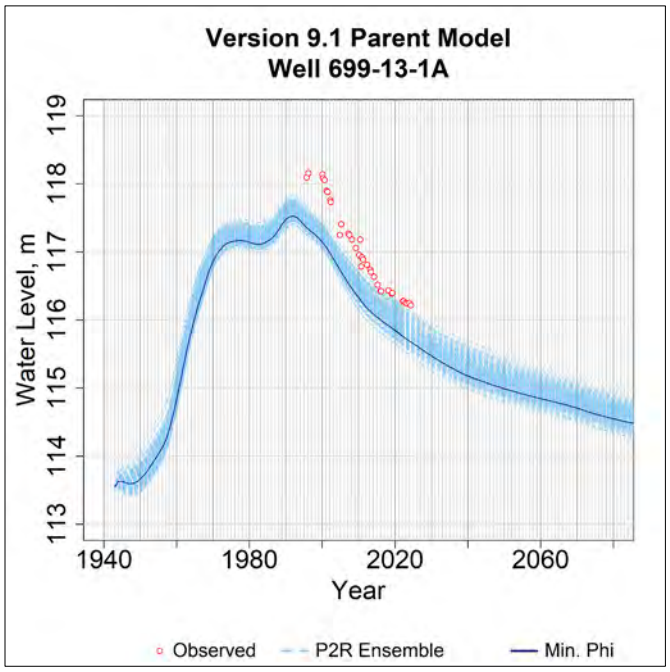

Figure B-402. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-13-1A.

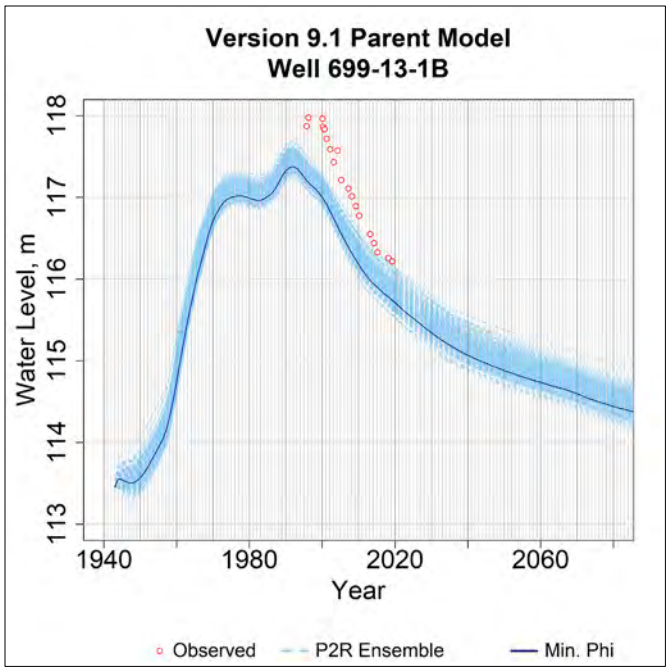

Figure B-403. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-13-1B.

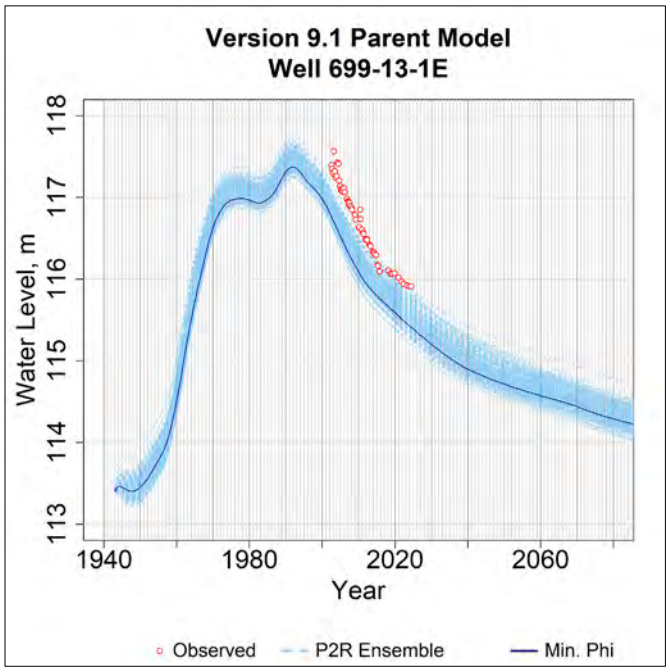

Figure B-404. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-13-1E.

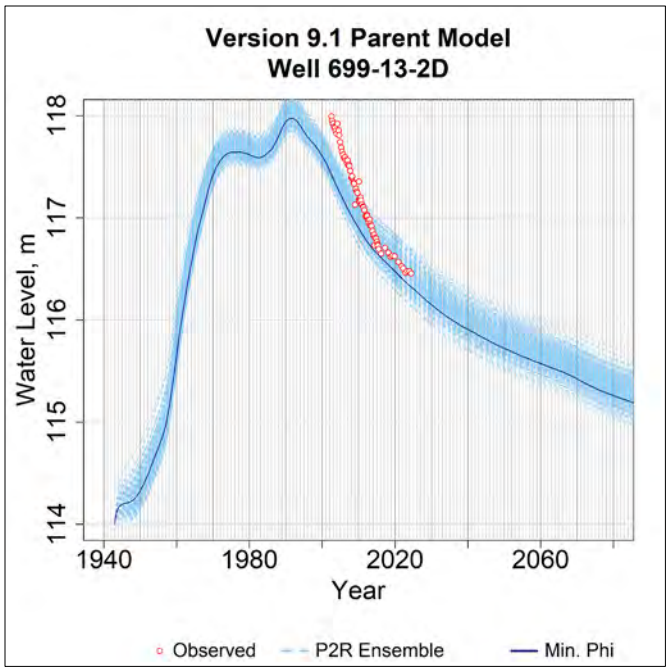

Figure B-405. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-13-2D.

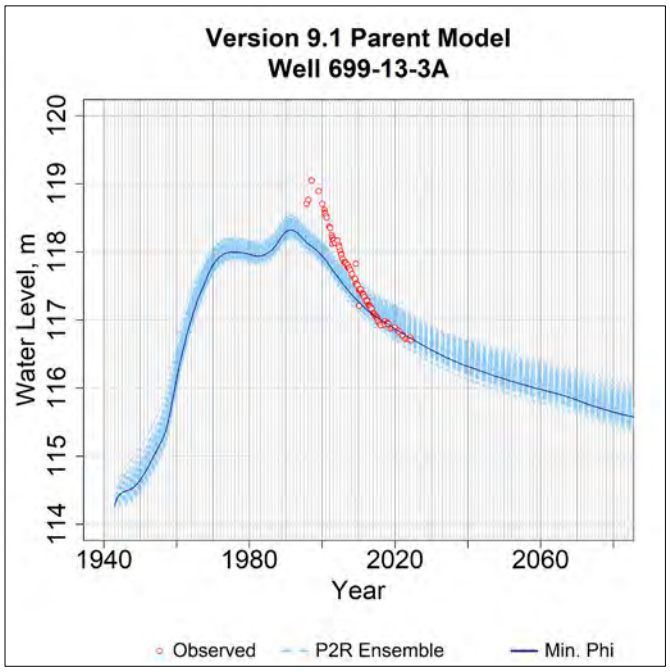

Figure B-406. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-13-3A.

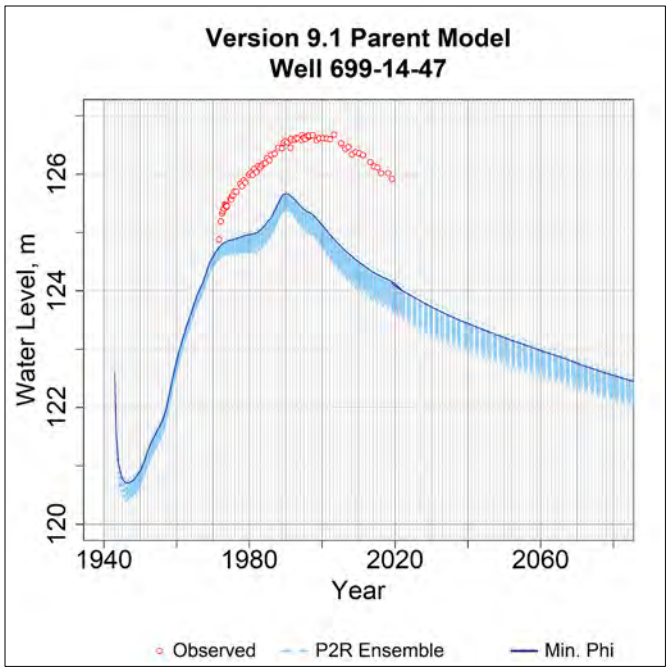

Figure B-407. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-14-47.

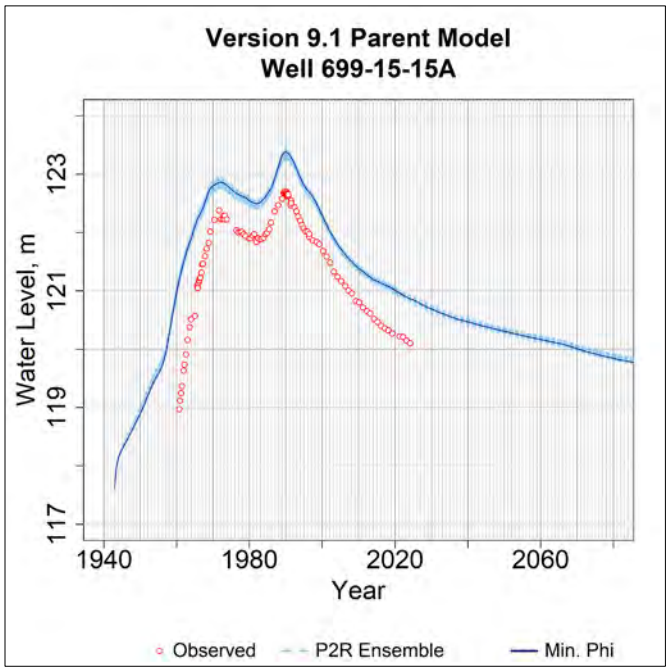

Figure B-408. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-15-15A.

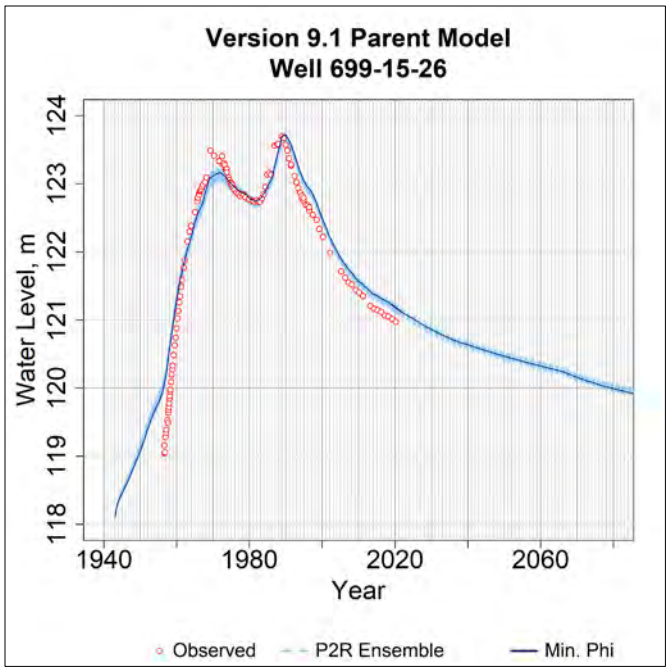

Figure B-409. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-15-26.

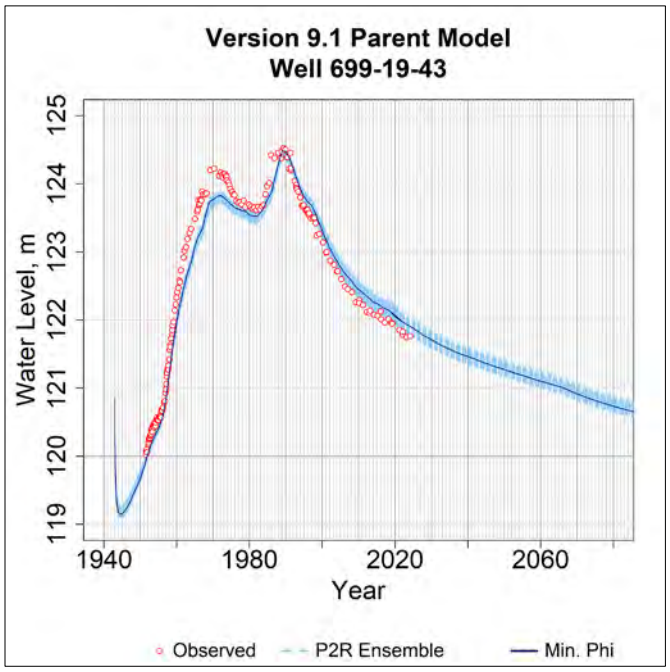

Figure B-410. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-19-43.

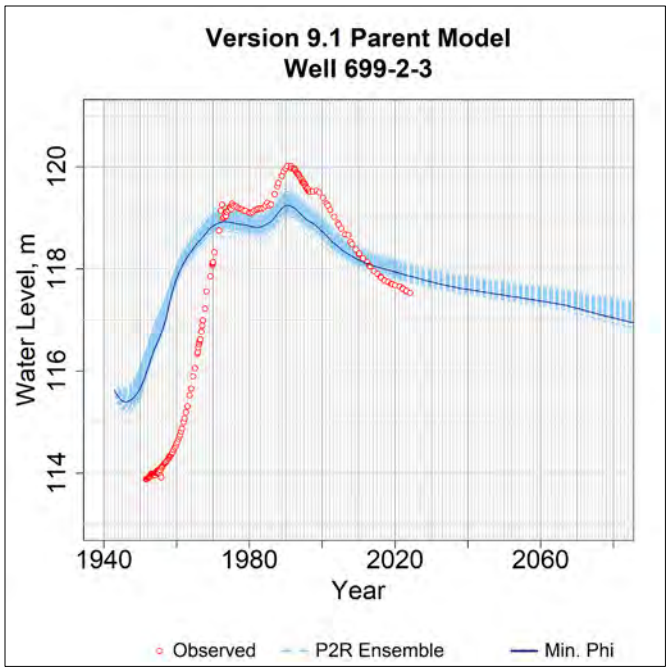

Figure B-411. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-2-3.

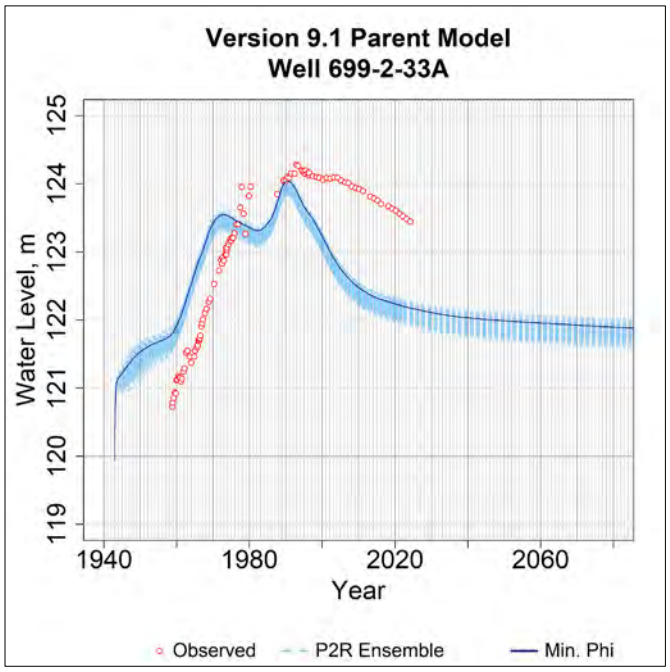

Figure B-412. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-2-33A.

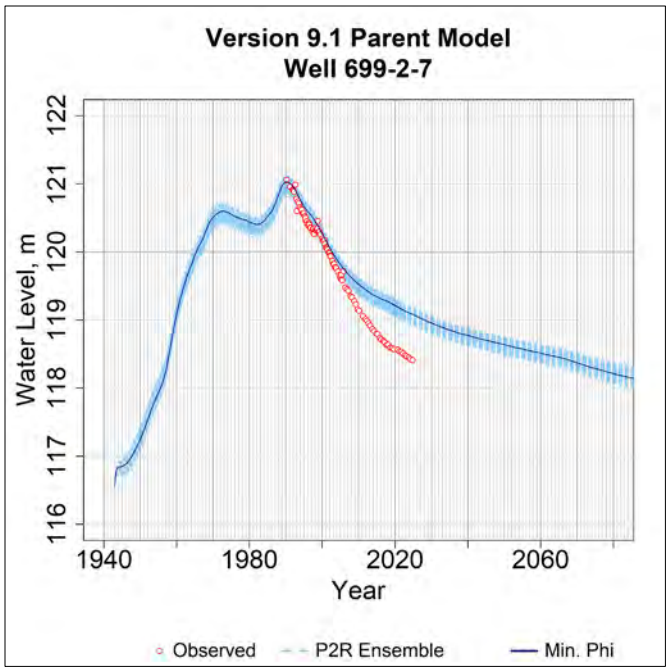

Figure B-413. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-2-7.

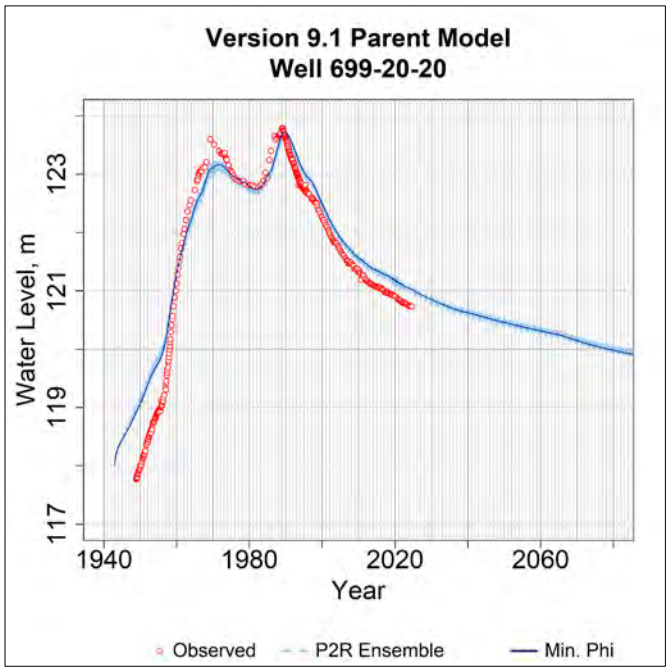

Figure B-414. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-20-20.

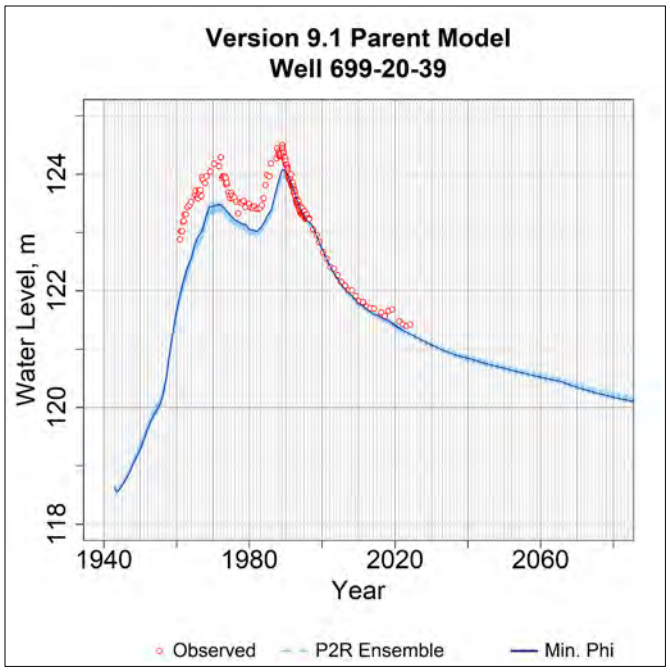

Figure B-415. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-20-39.

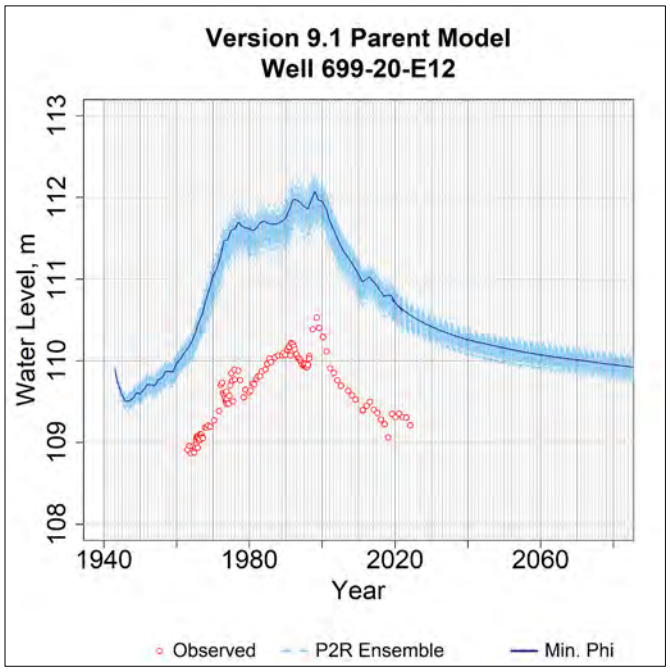

Figure B-416. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-20-E12.

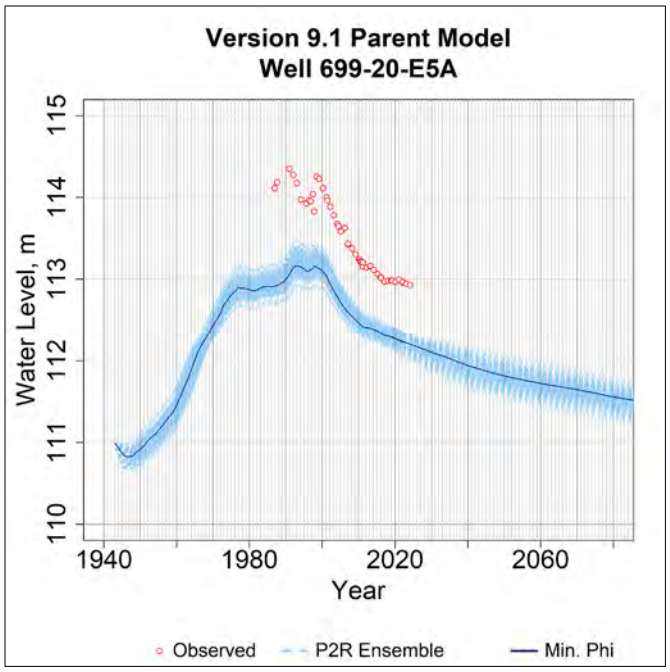

Figure B-417. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-20-E5A.

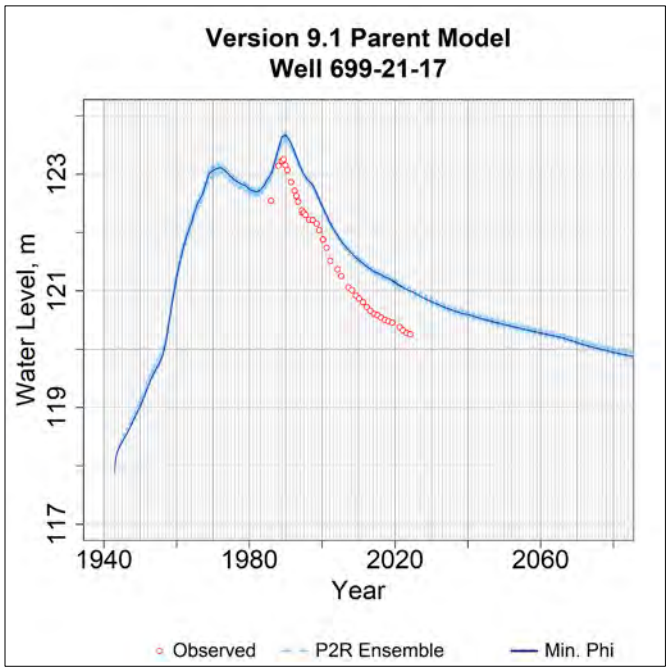

Figure B-418. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-21-17.

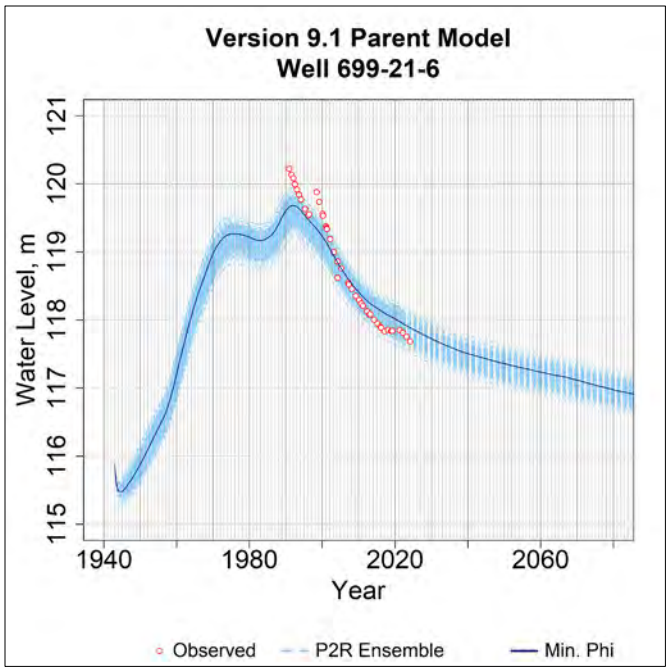

Figure B-419. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-21-6.

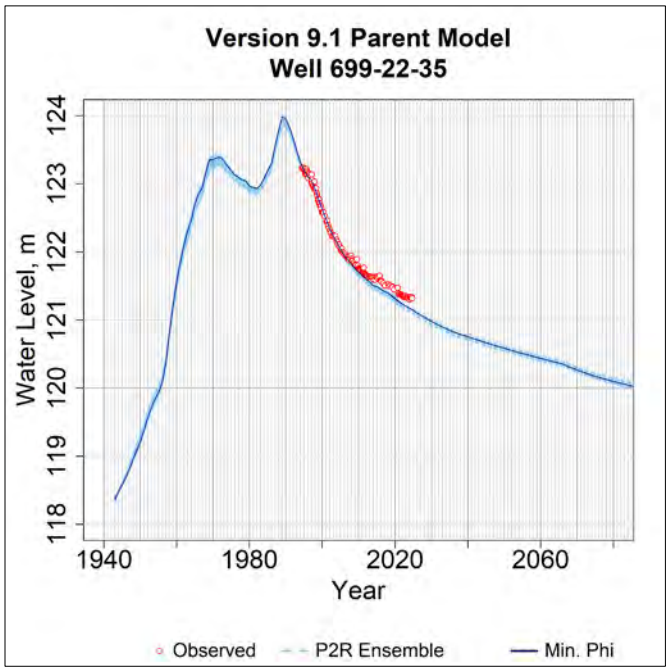

Figure B-420. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-22-35.

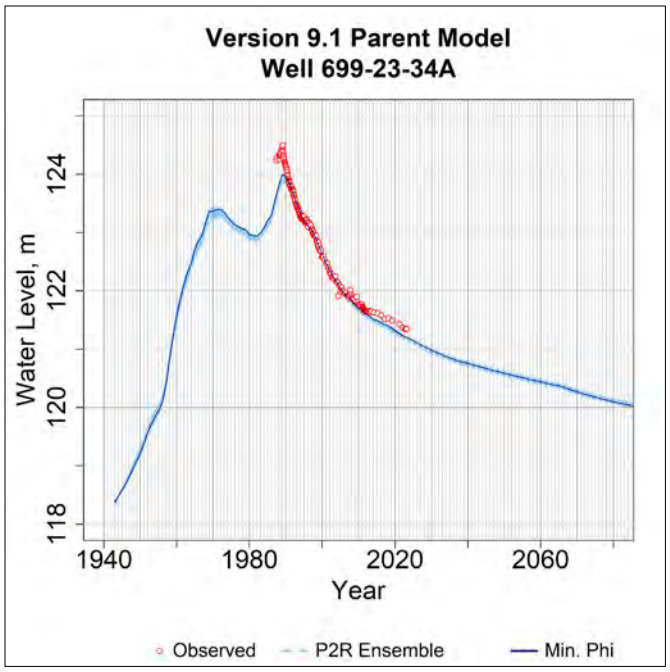

Figure B-421. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-23-34A.

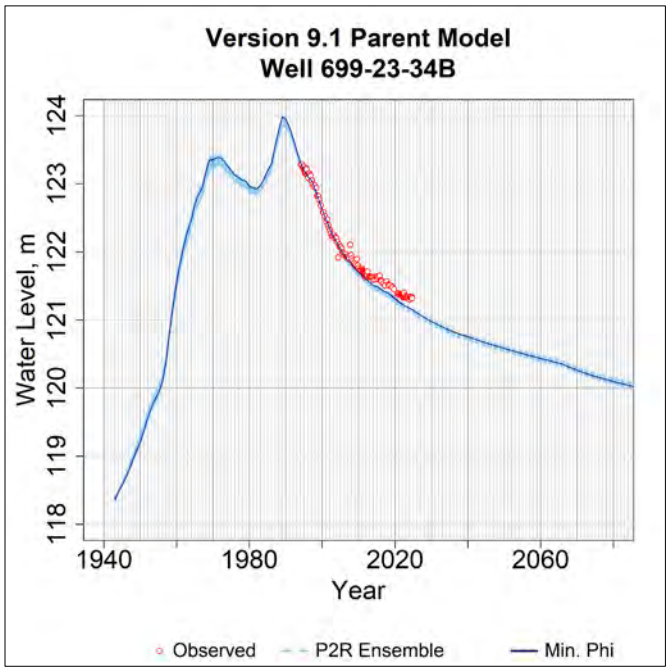

Figure B-422. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-23-34B.

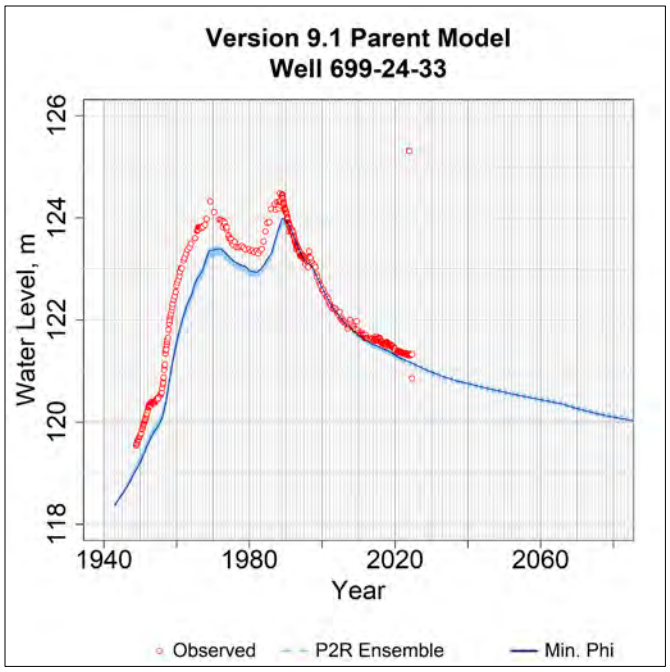

Figure B-423. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-24-33.

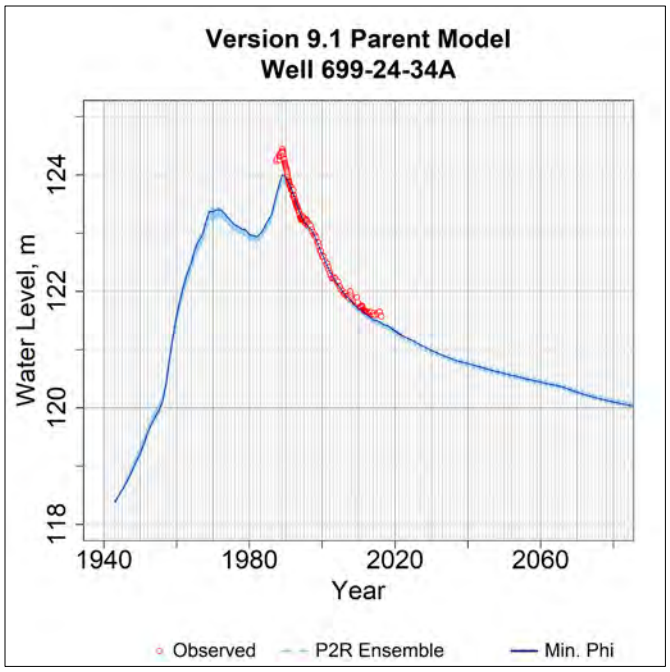

Figure B-424. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-24-34A.

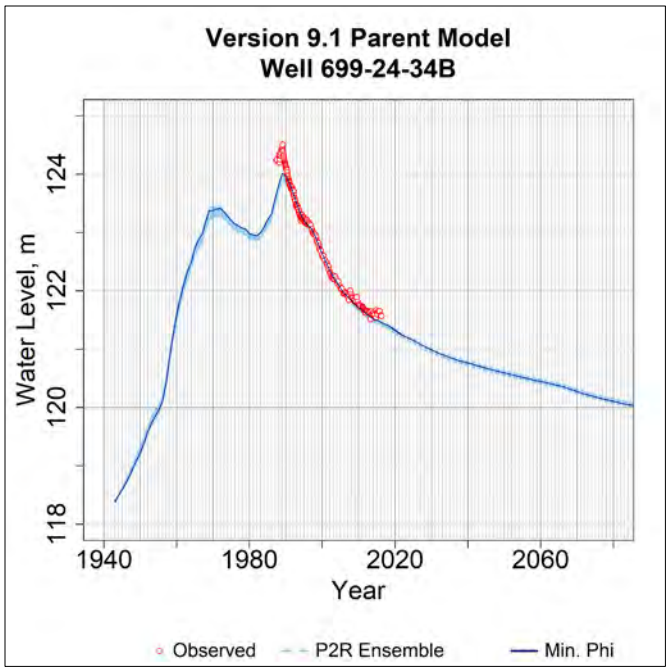

Figure B-425. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-24-34B.

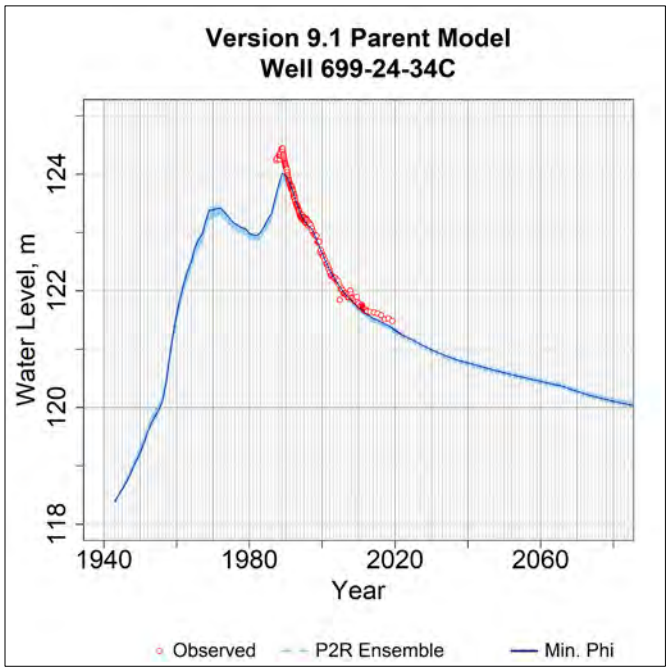

Figure B-426. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-24-34C.

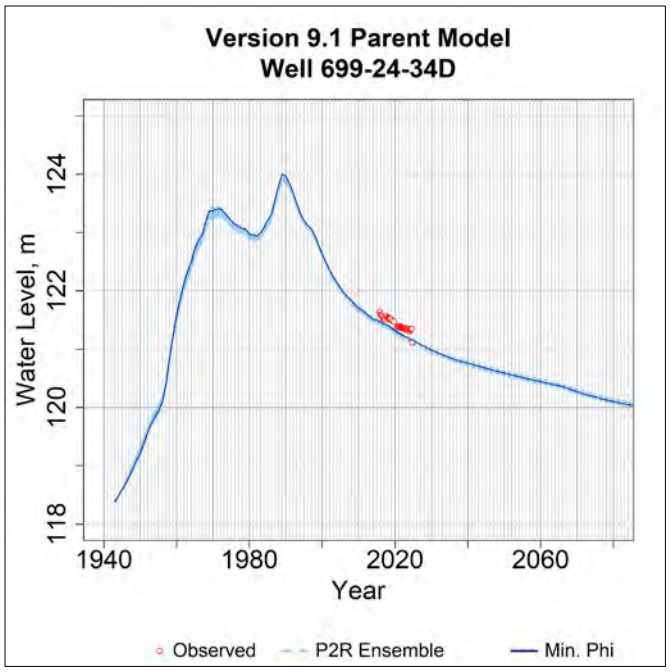

Figure B-427. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-24-34D.

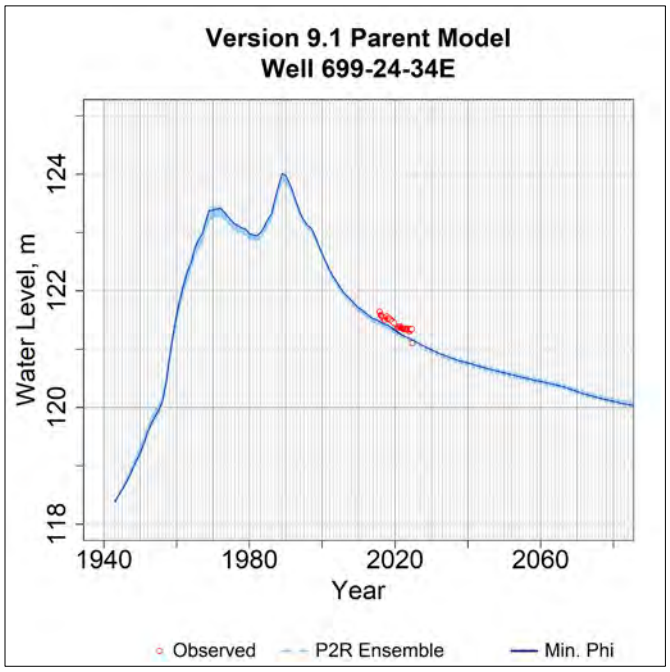

Figure B-428. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-24-34E.

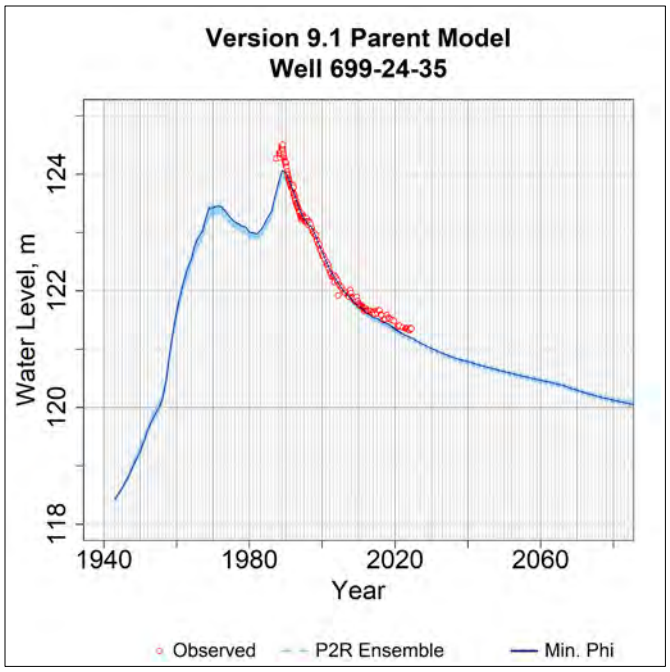

Figure B-429. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-24-35.

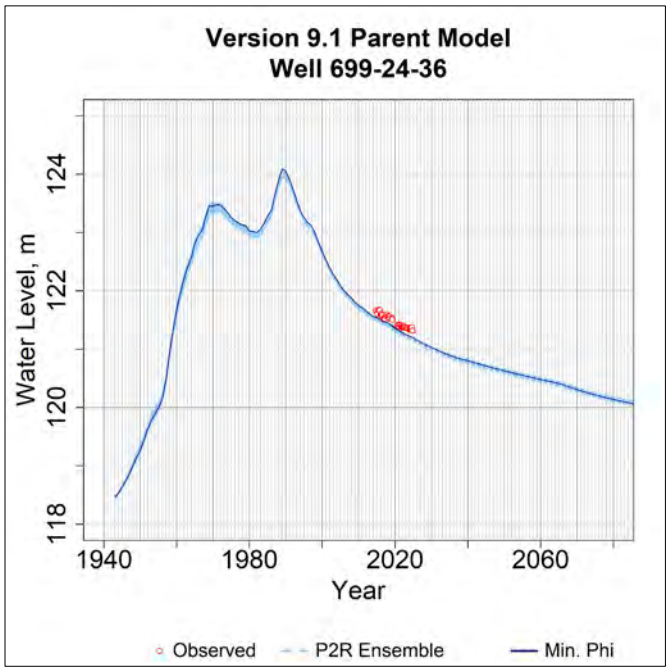

Figure B-430. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-24-36.

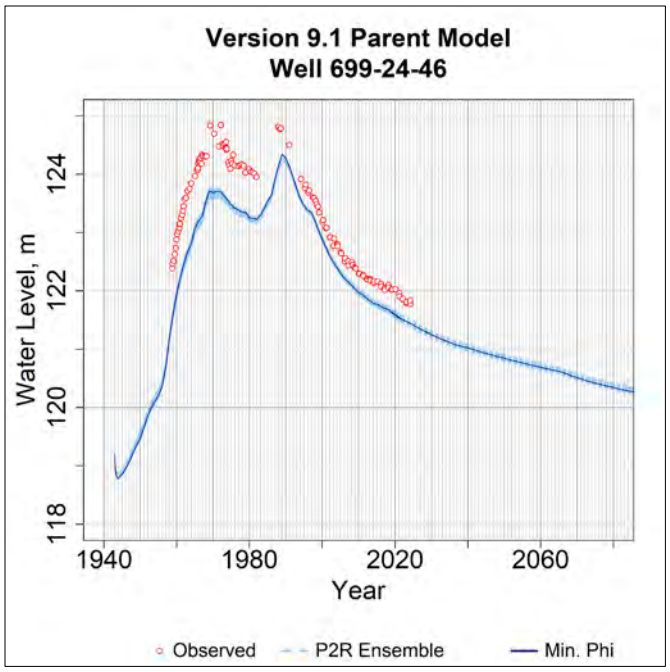

Figure B-431. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-24-46.

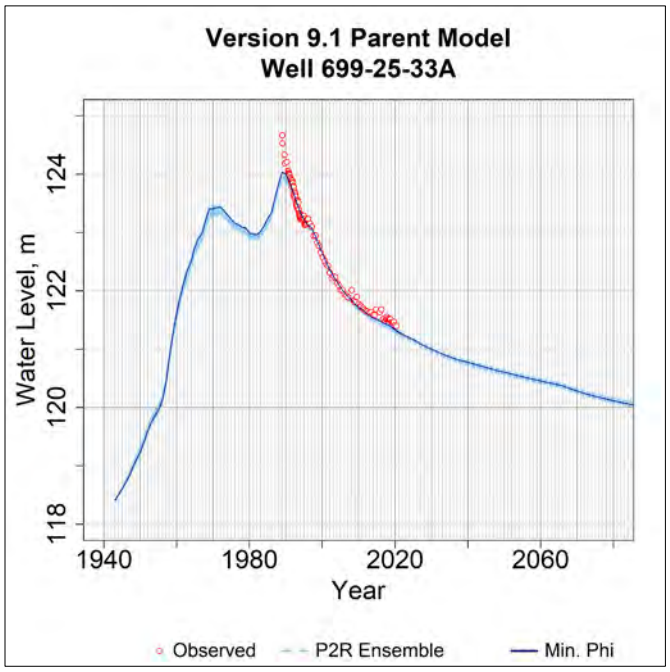

Figure B-432. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-25-33A.

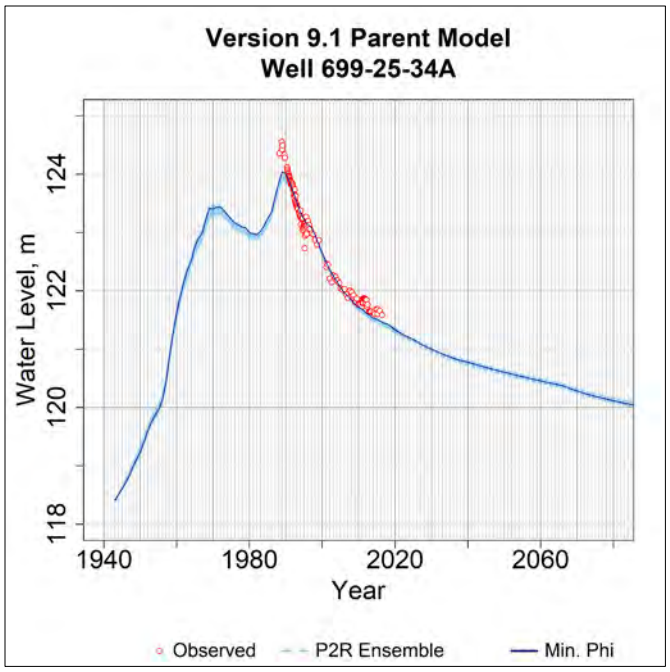

Figure B-433. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-25-34A.

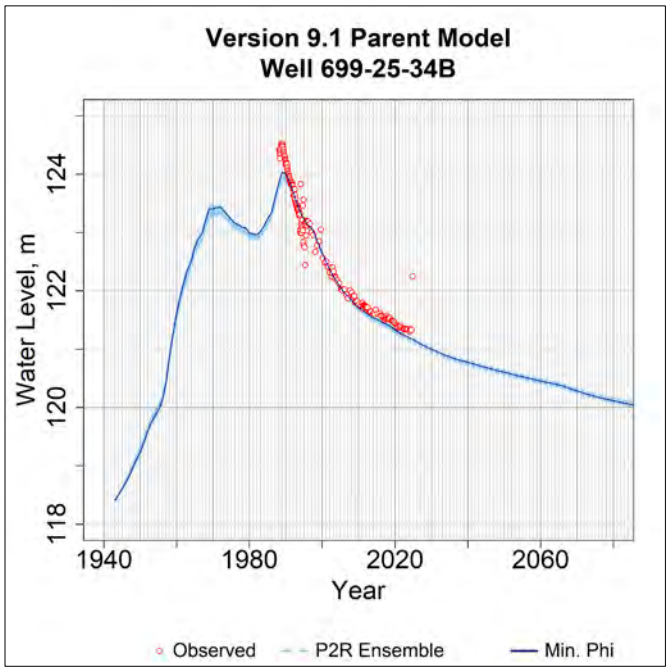

Figure B-434. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-25-34B.

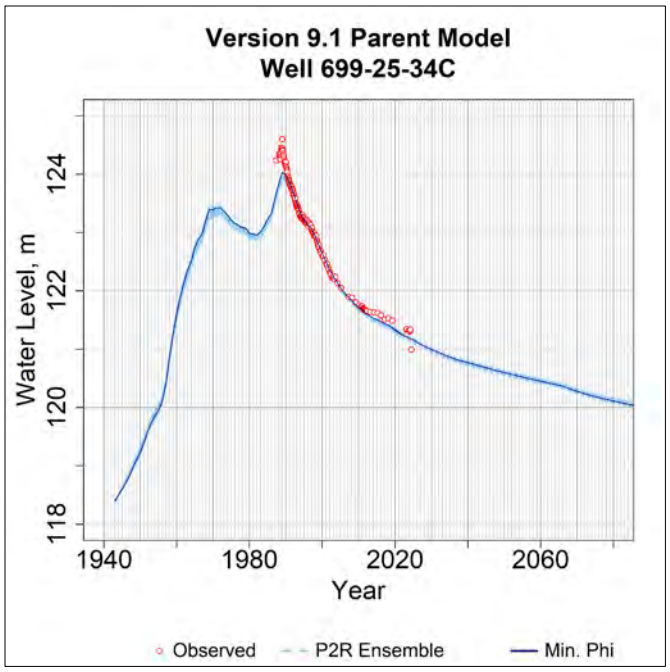

Figure B-435. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-25-34C.

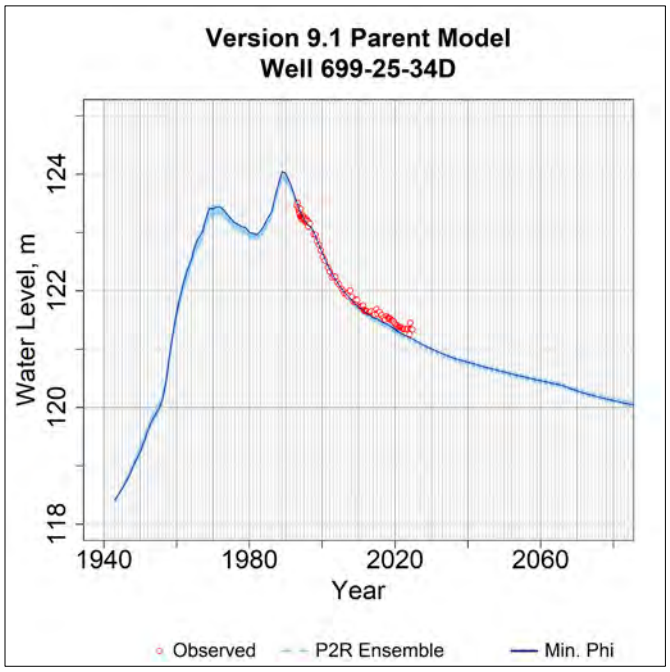

Figure B-436. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-25-34D.

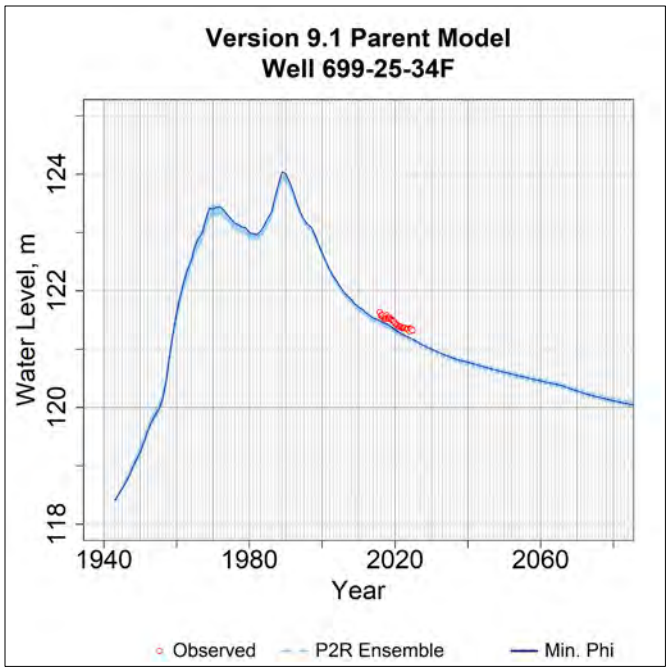

Figure B-437. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-25-34F.

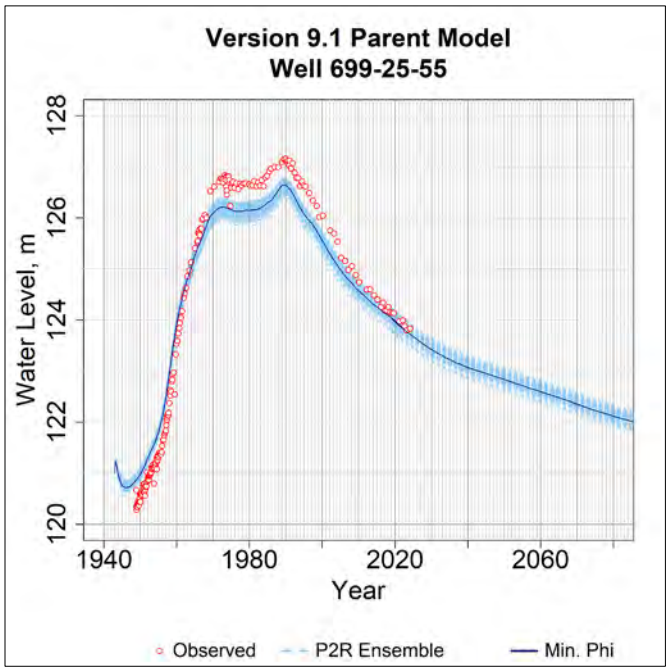

Figure B-438. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-25-55.

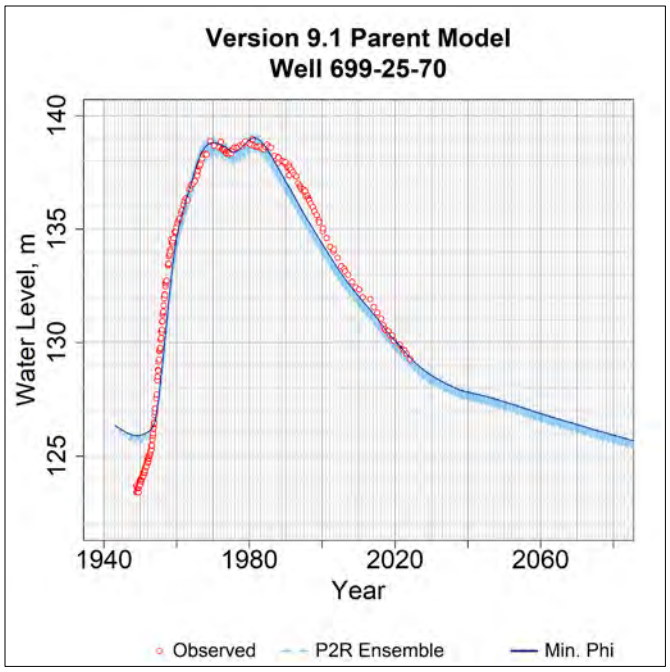

Figure B-439. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-25-70.

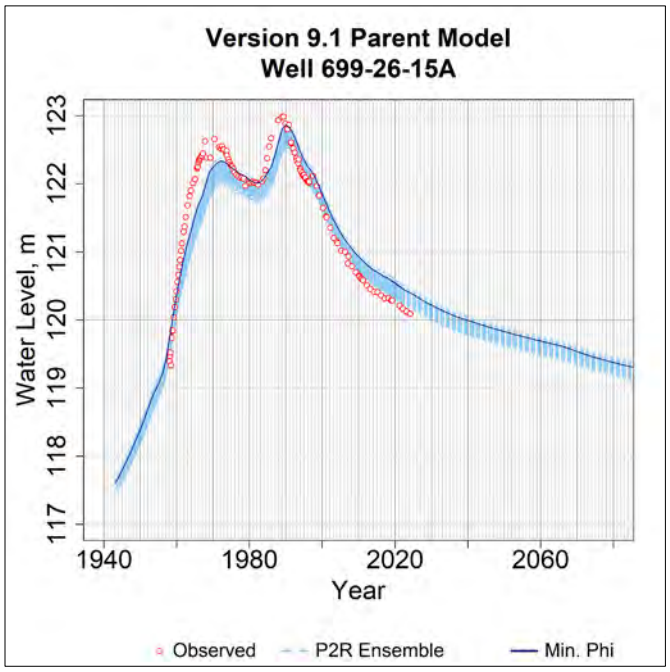

Figure B-440. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-26-15A.

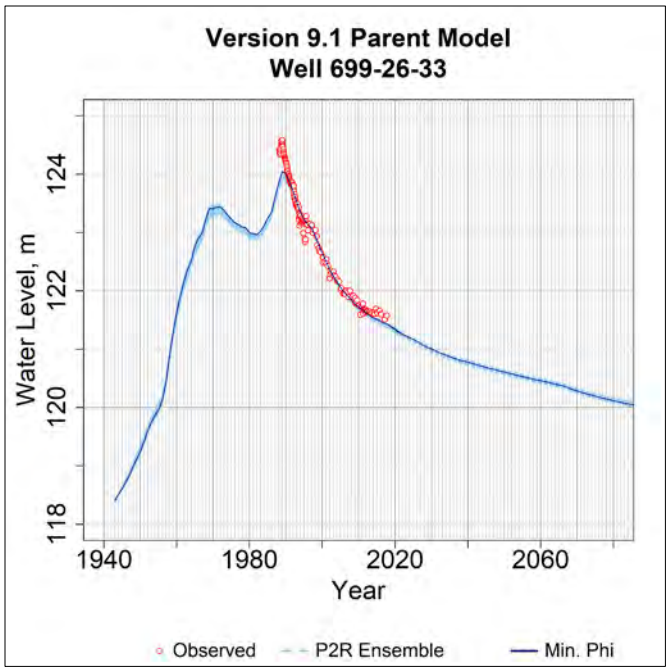

Figure B-441. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-26-33.

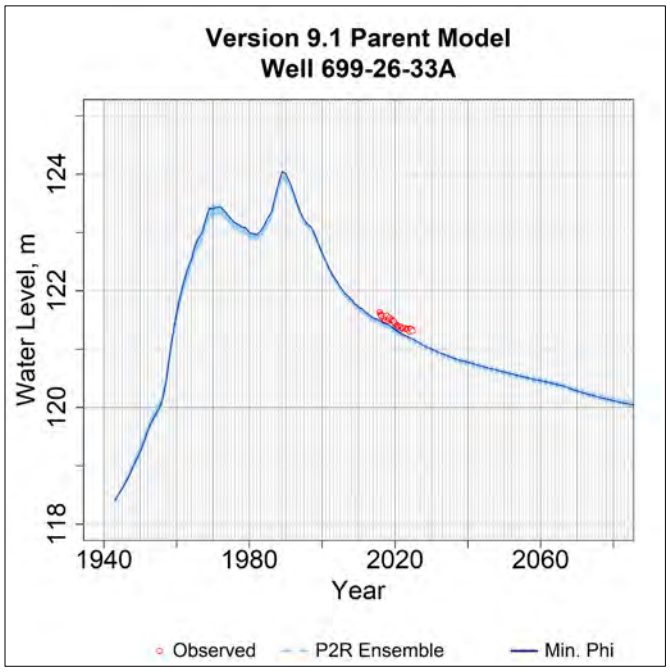

Figure B-442. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-26-33A.

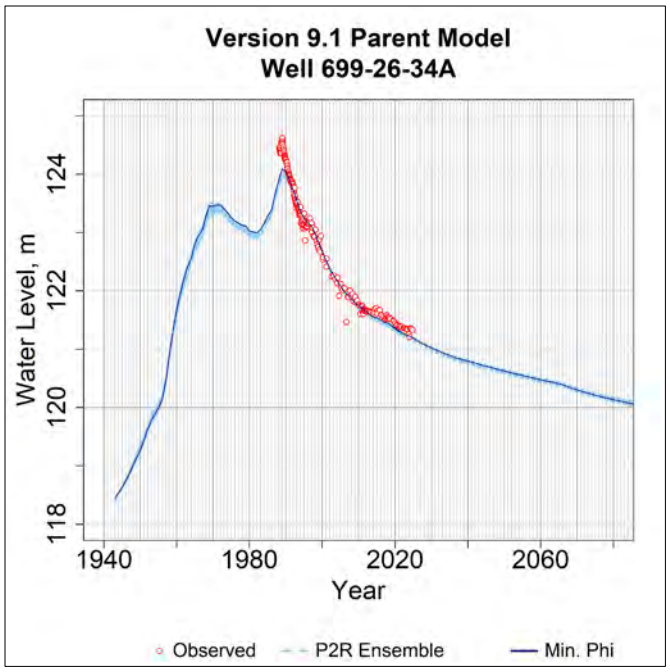

Figure B-443. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-26-34A.

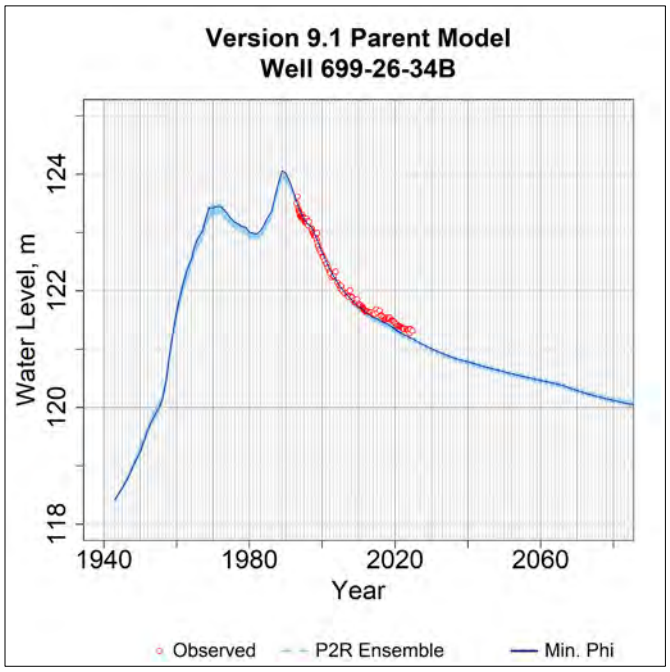

Figure B-444. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-26-34B.

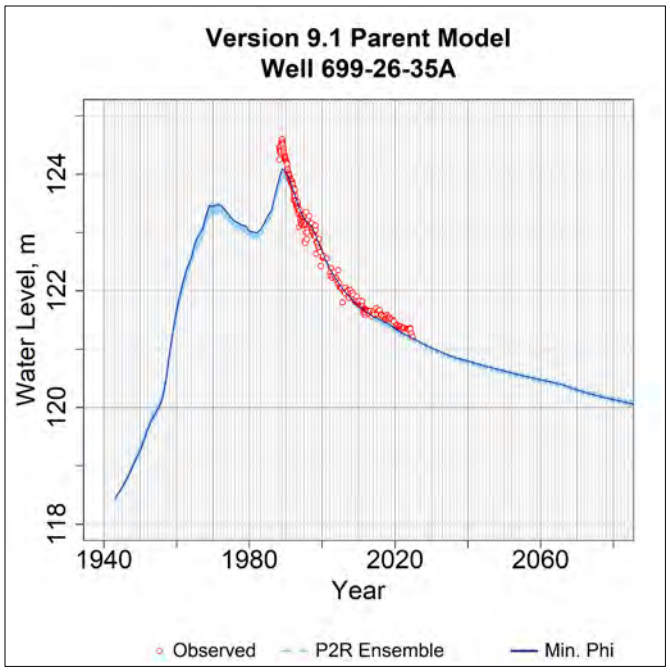

Figure B-445. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-26-35A.

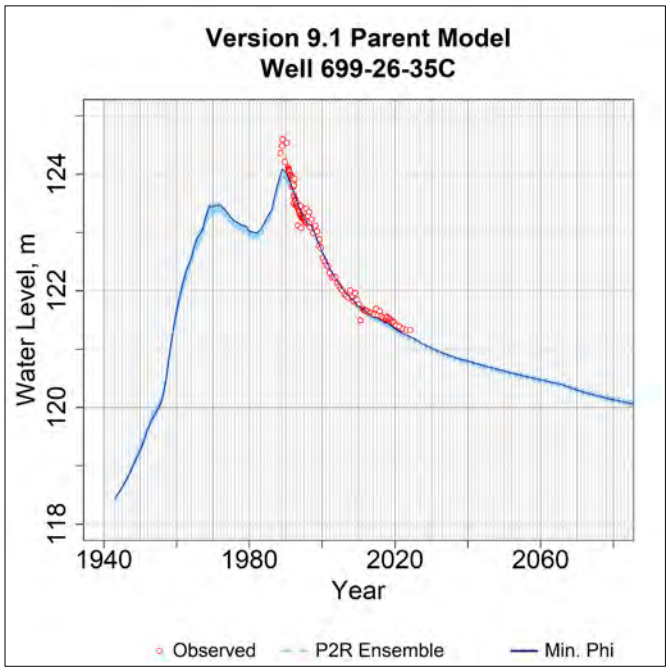

Figure B-446. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-26-35C.

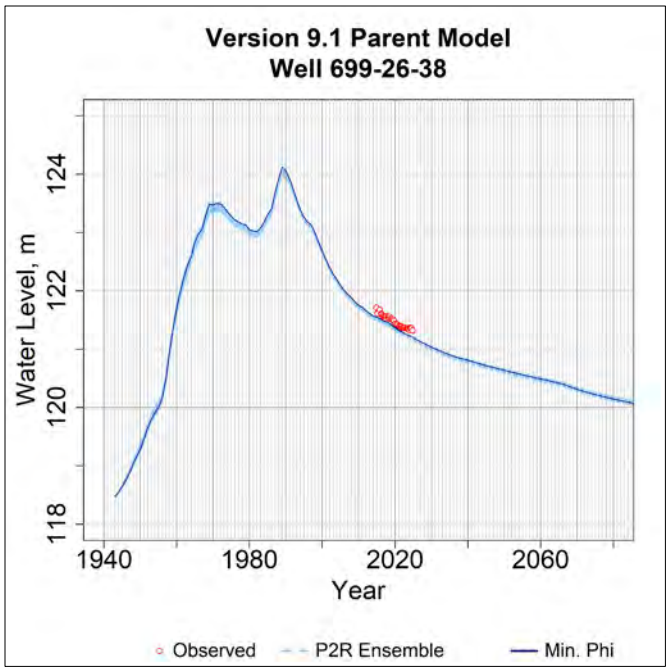

Figure B-447. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-26-38.

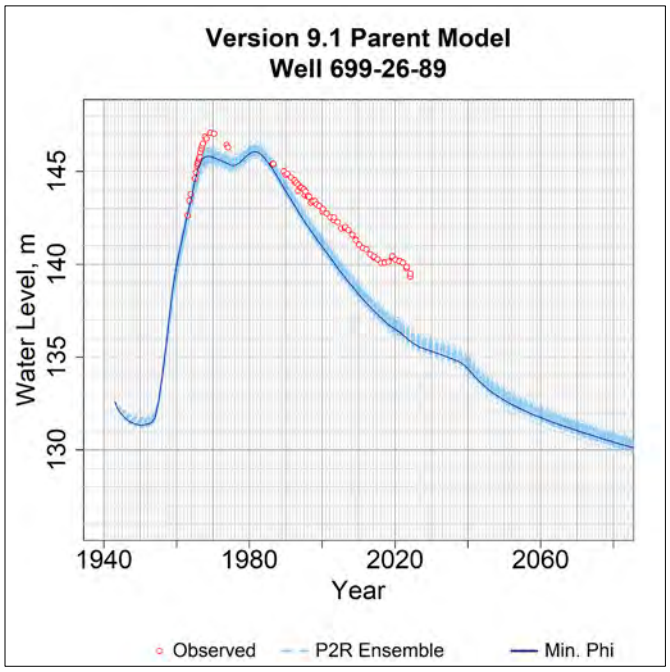

Figure B-448. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-26-89.

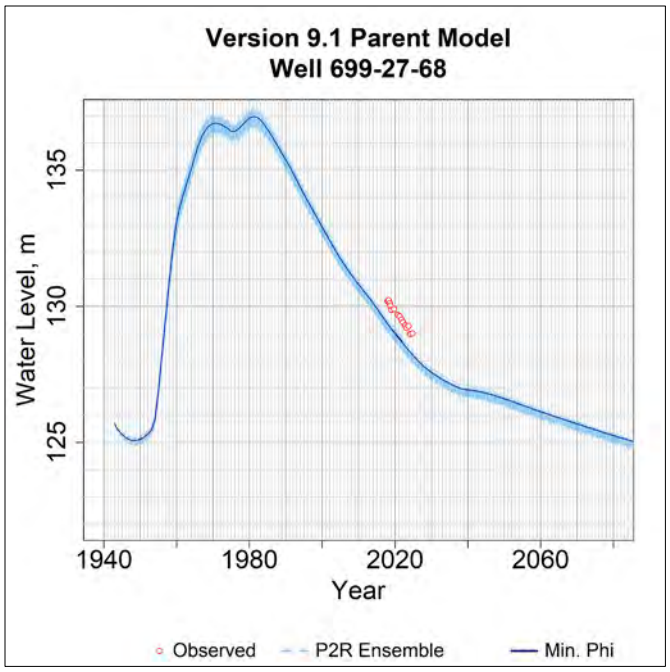

Figure B-449. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-27-68.

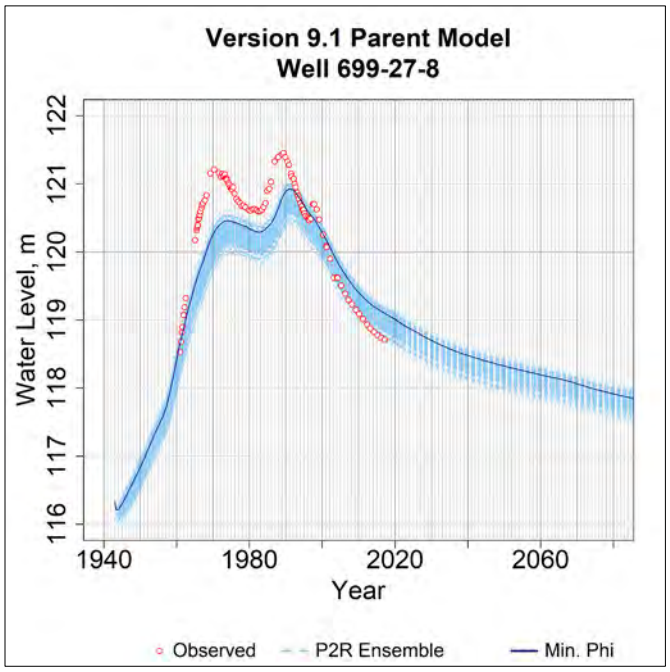

Figure B-450. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-27-8.

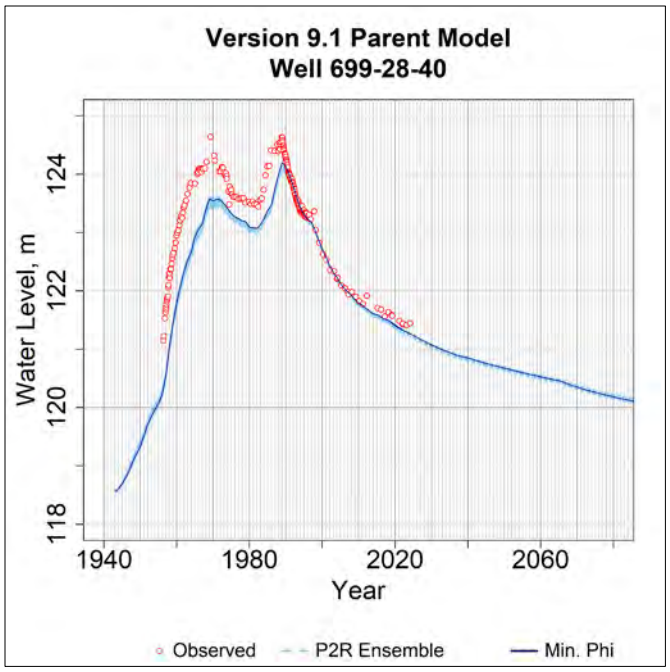

Figure B-451. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-28-40.

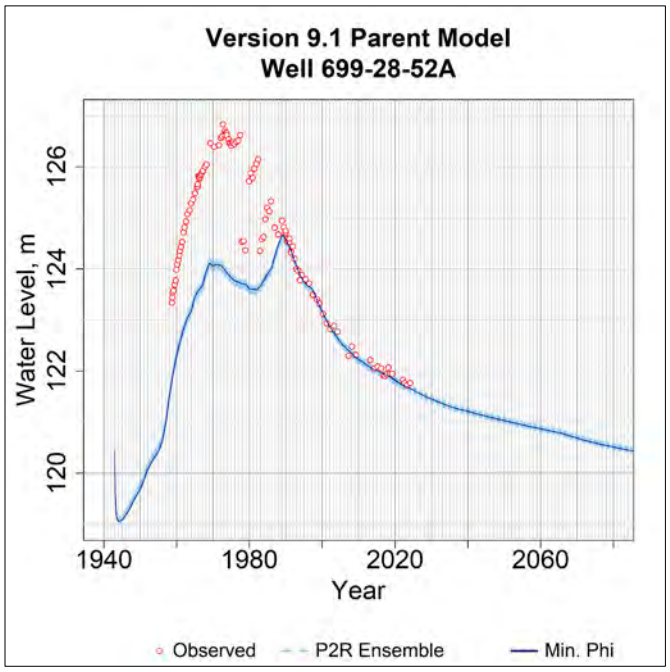

Figure B-452. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-28-52A.

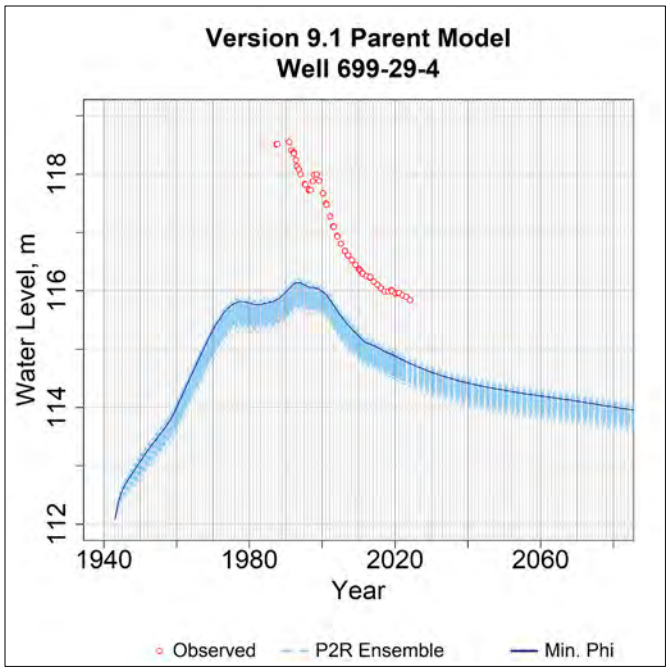

Figure B-453. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-29-4.

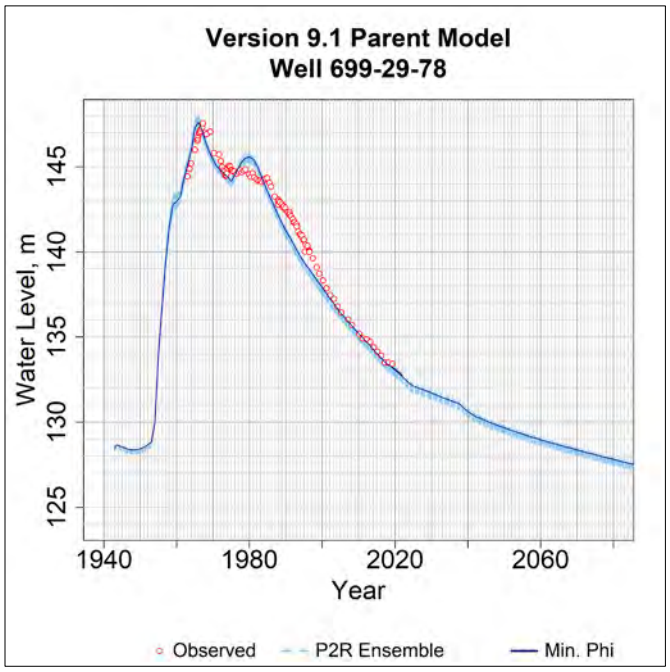

Figure B-454. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-29-78.

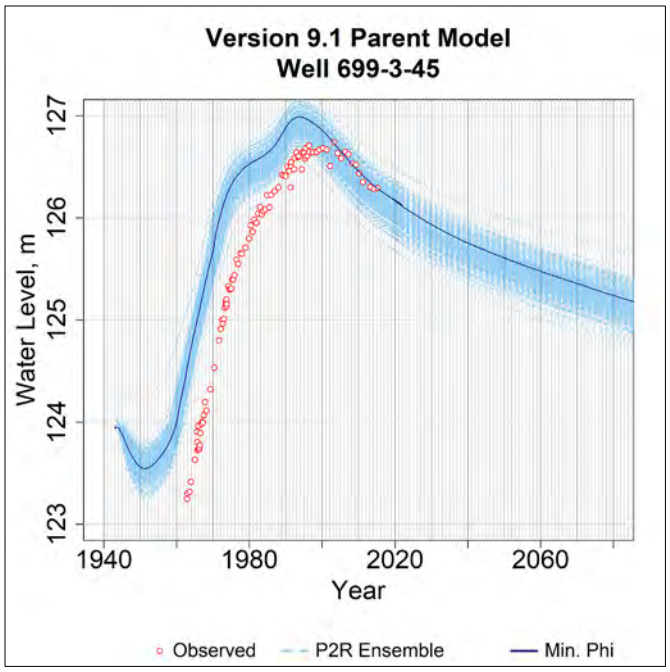

Figure B-455. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-3-45.

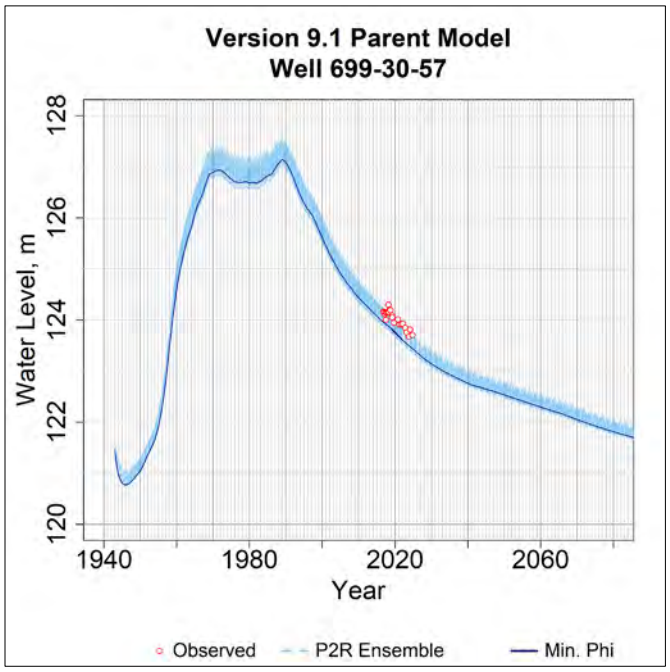

Figure B-456. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-30-57.

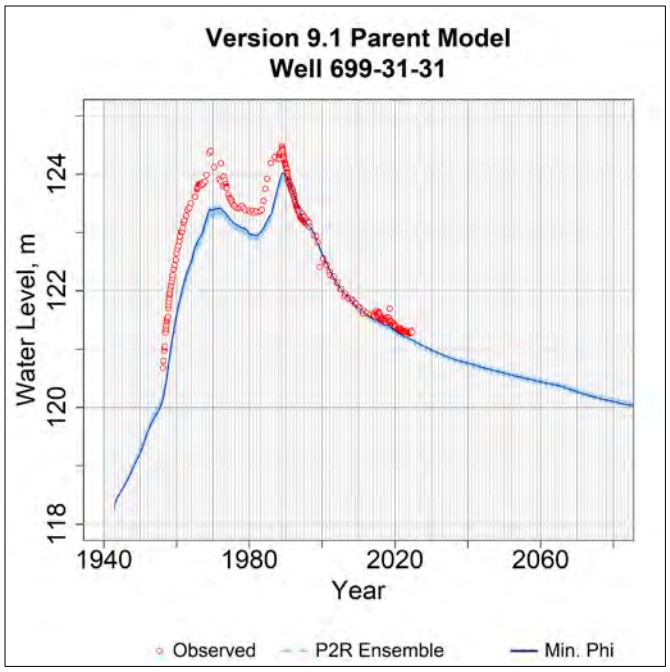

Figure B-457. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-31-31.

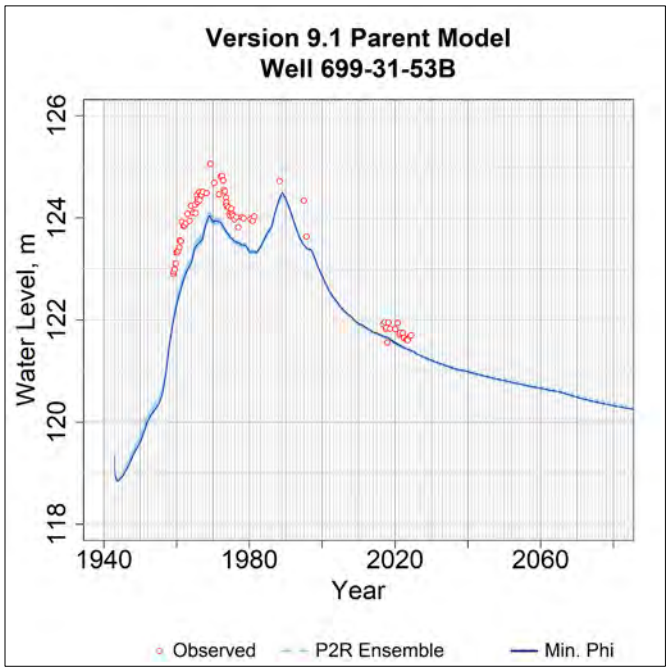

Figure B-458. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-31-53B.

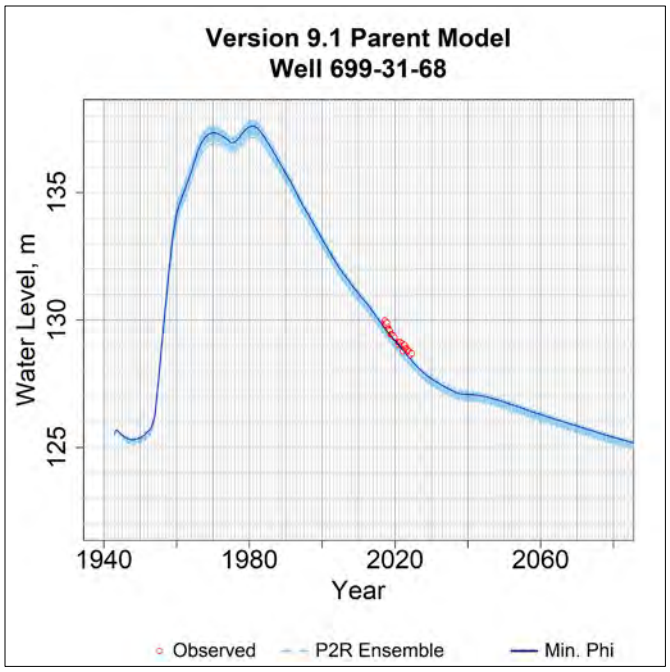

Figure B-459. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-31-68.

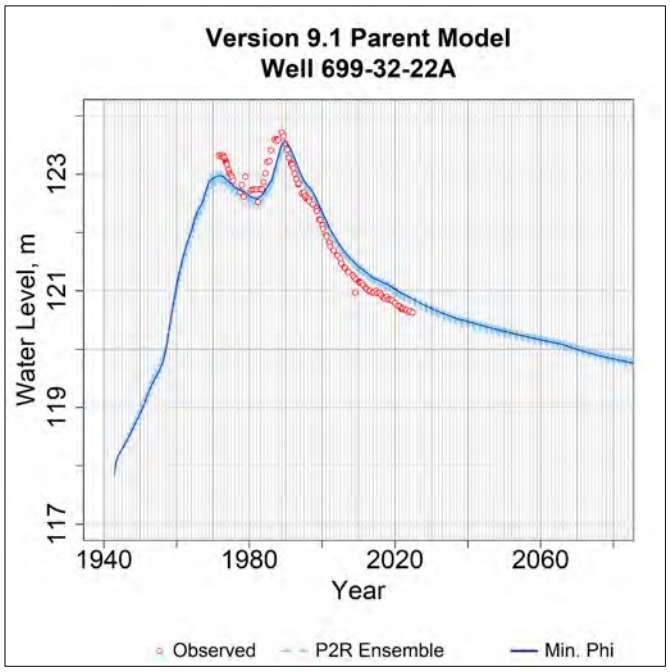

Figure B-460. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-32-22A.

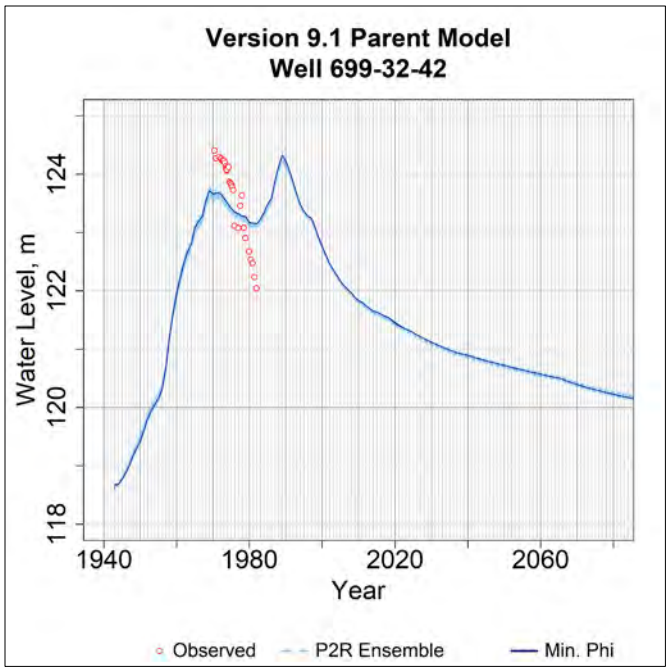

Figure B-461. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-32-42.

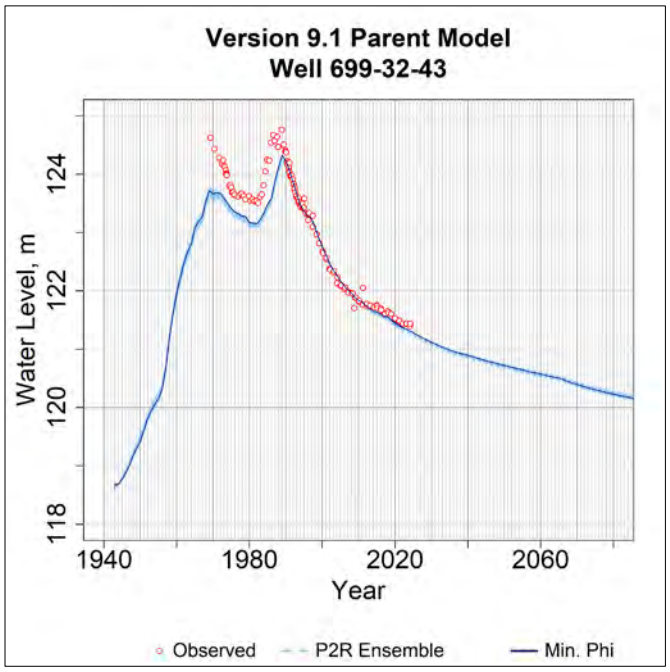

Figure B-462. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-32-43.

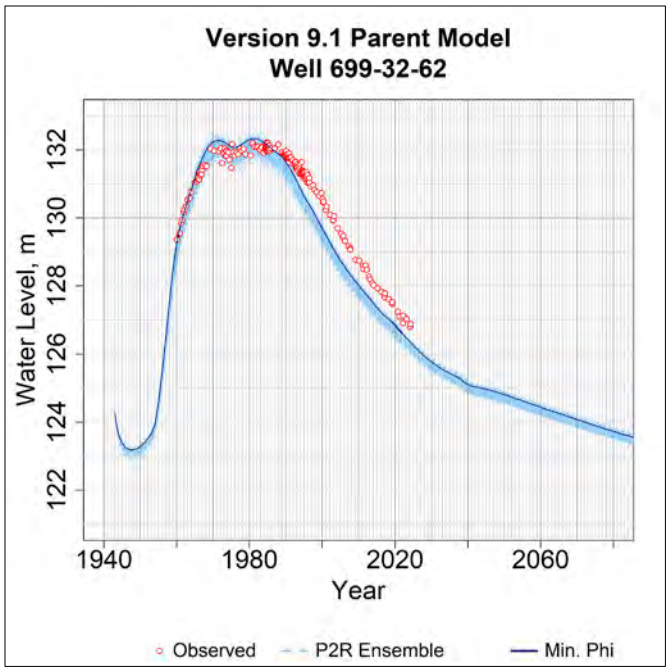

Figure B-463. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-32-62.

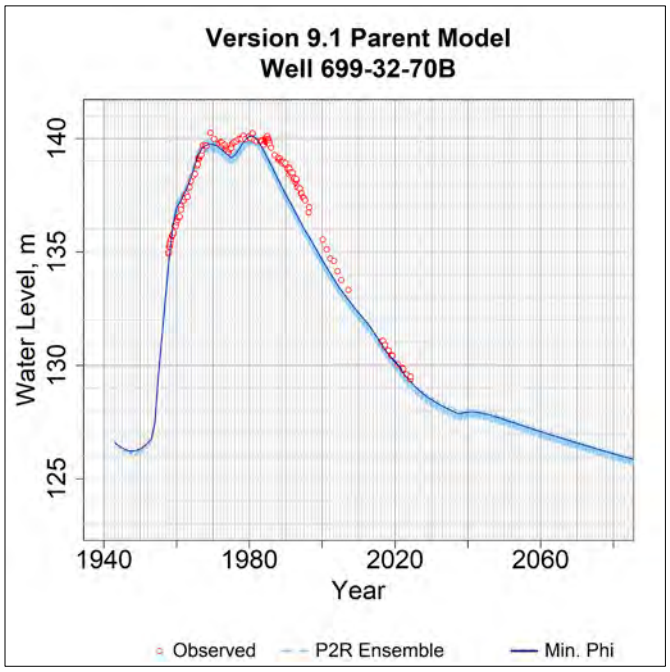

Figure B-464. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-32-70B.

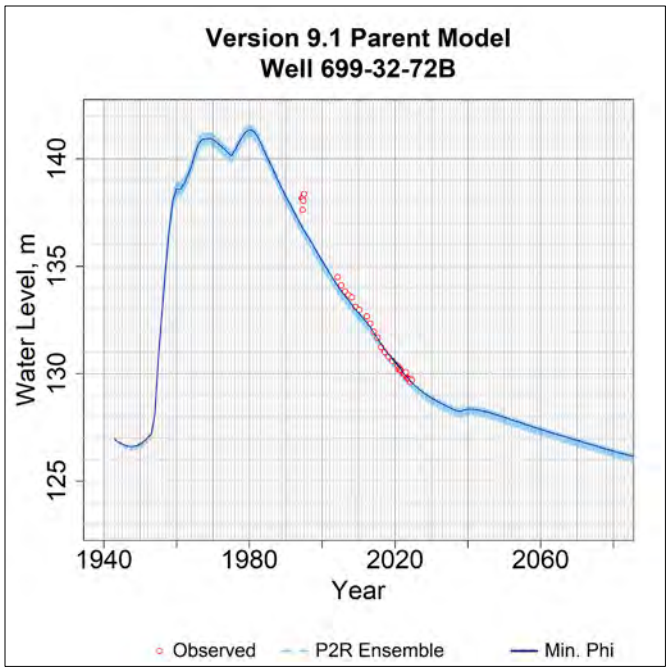

Figure B-465. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-32-72B.

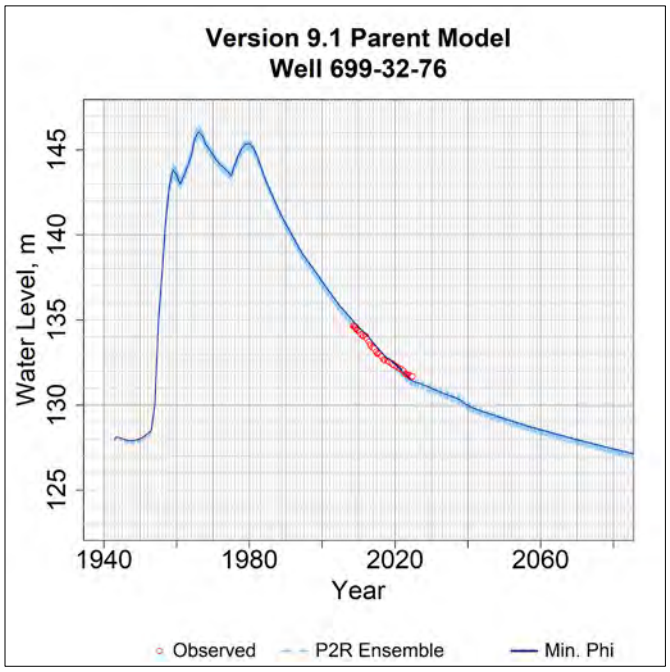

Figure B-466. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-32-76.

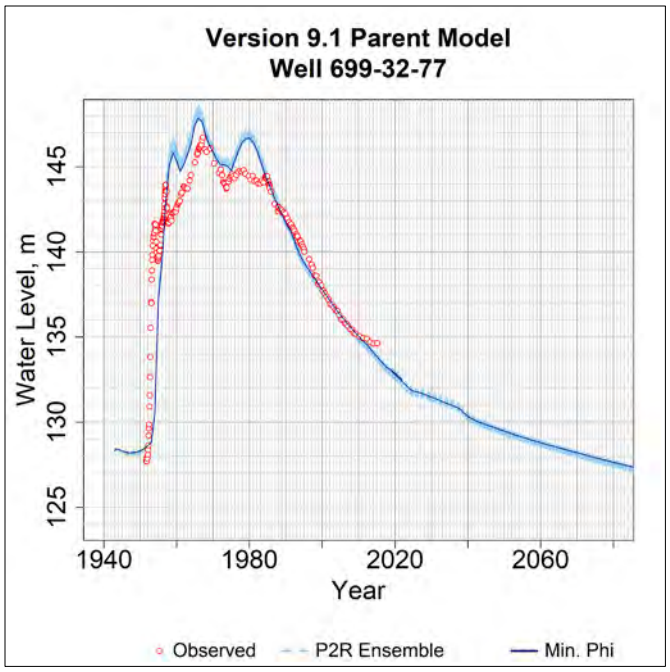

Figure B-467. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-32-77.

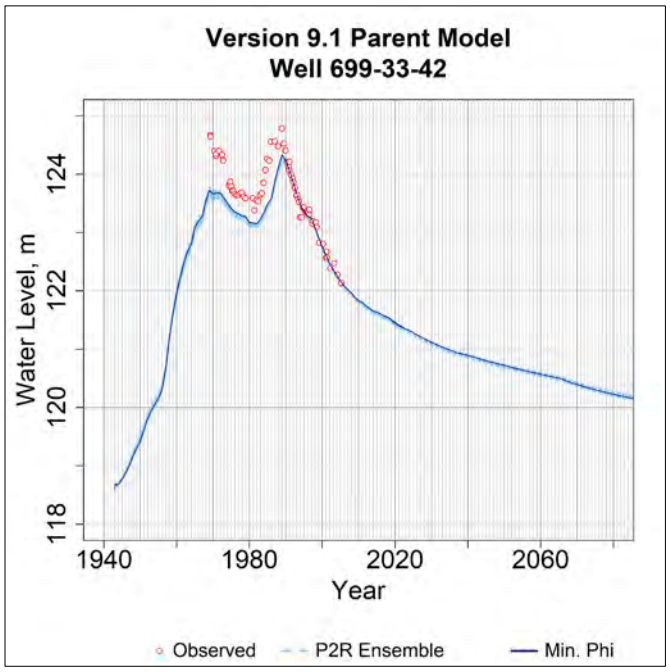

Figure B-468. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-33-42.

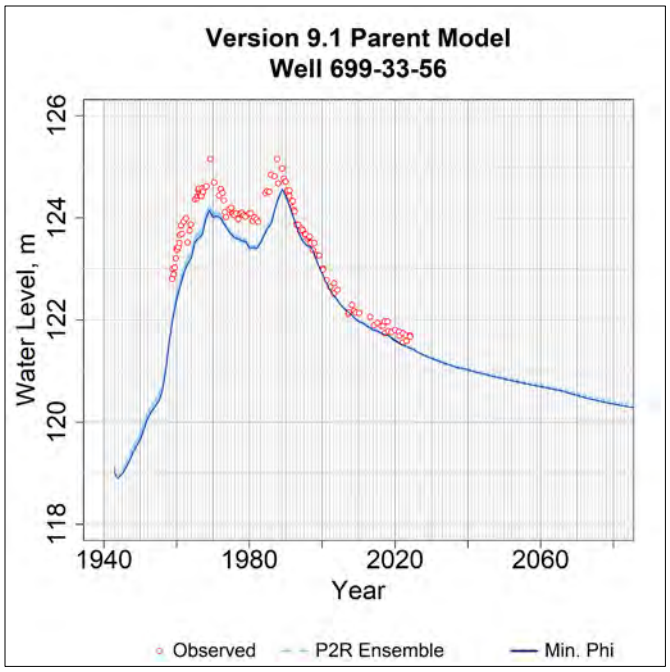

Figure B-469. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-33-56.

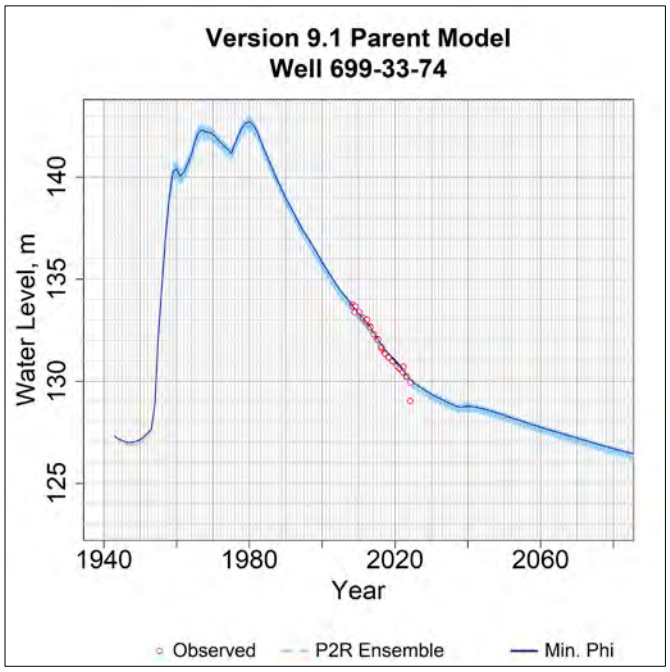

Figure B-470. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-33-74.

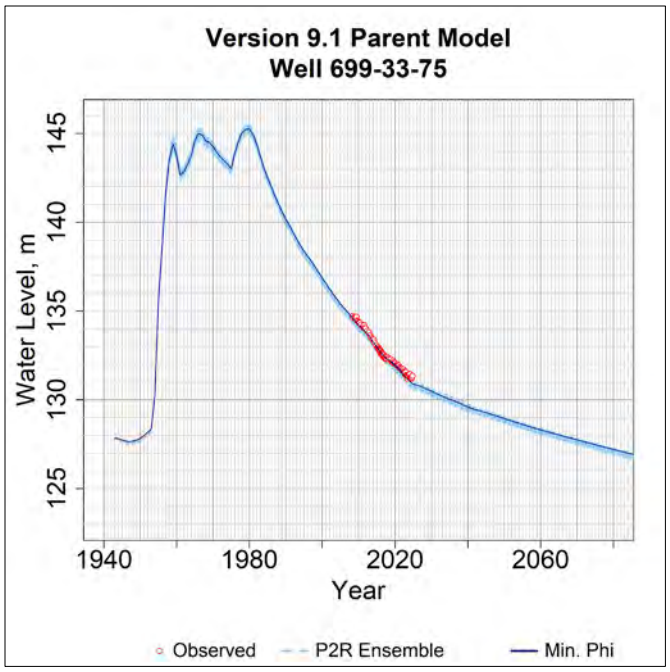

Figure B-471. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-33-75.

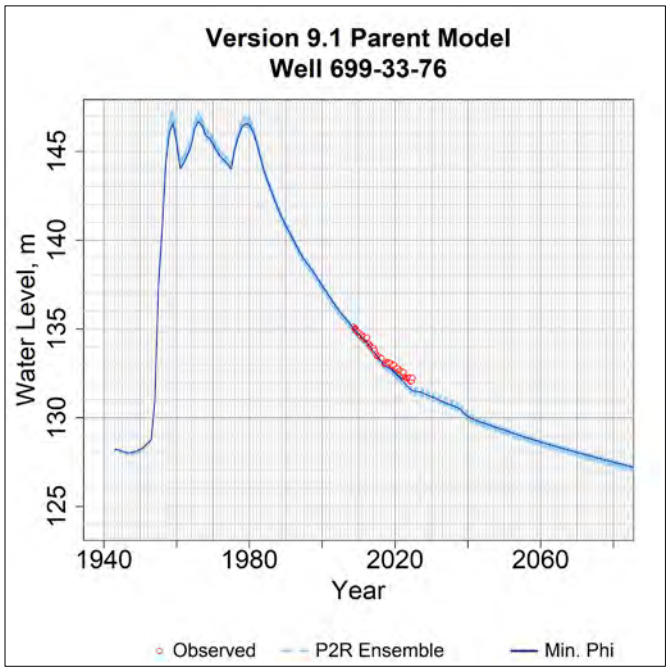

Figure B-472. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-33-76.

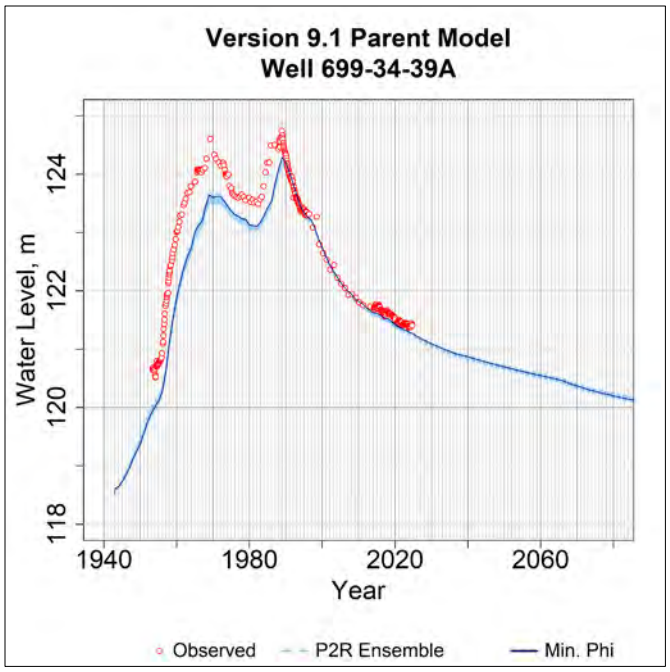

Figure B-473. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-34-39A.

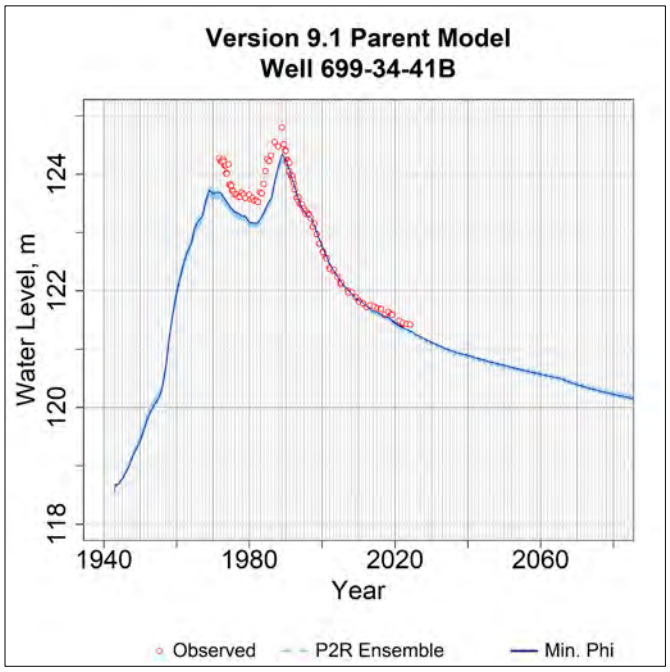

Figure B-474. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-34-41B.

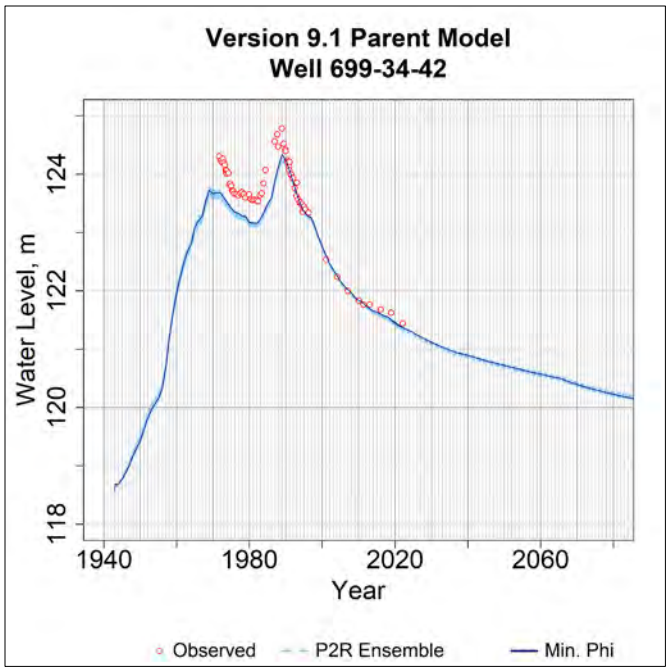

Figure B-475. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-34-42.

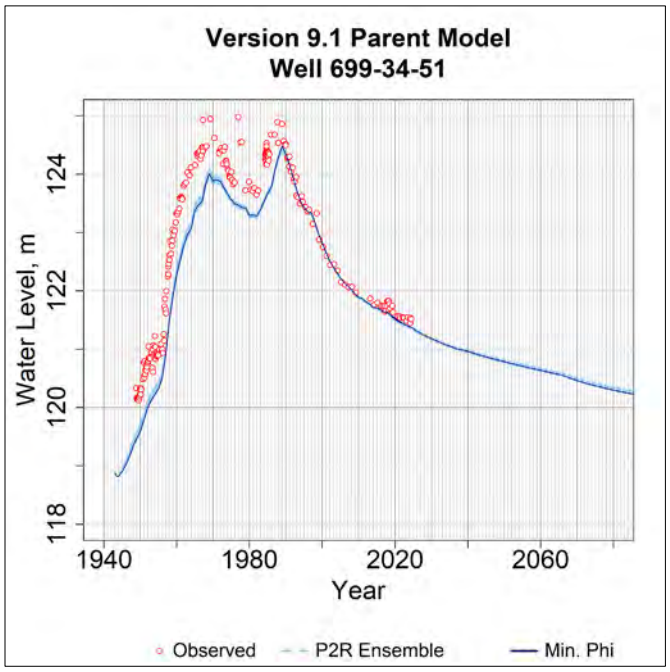

Figure B-476. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-34-51.

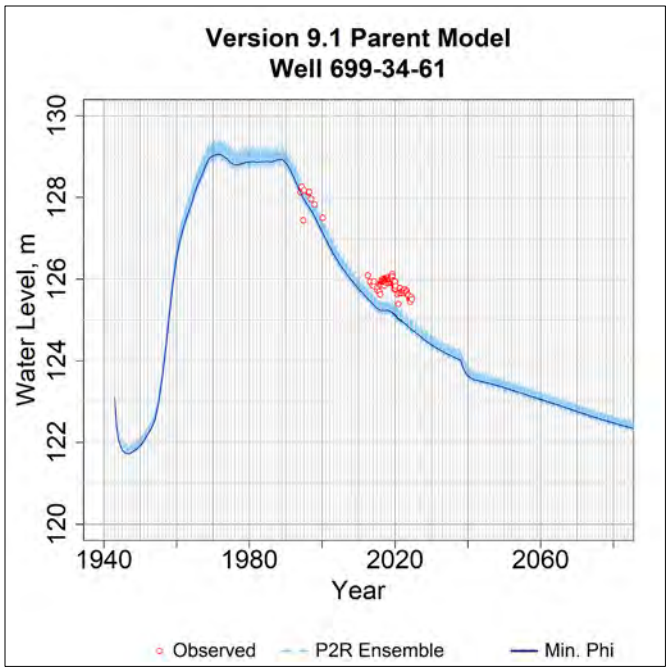

Figure B-477. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-34-61.

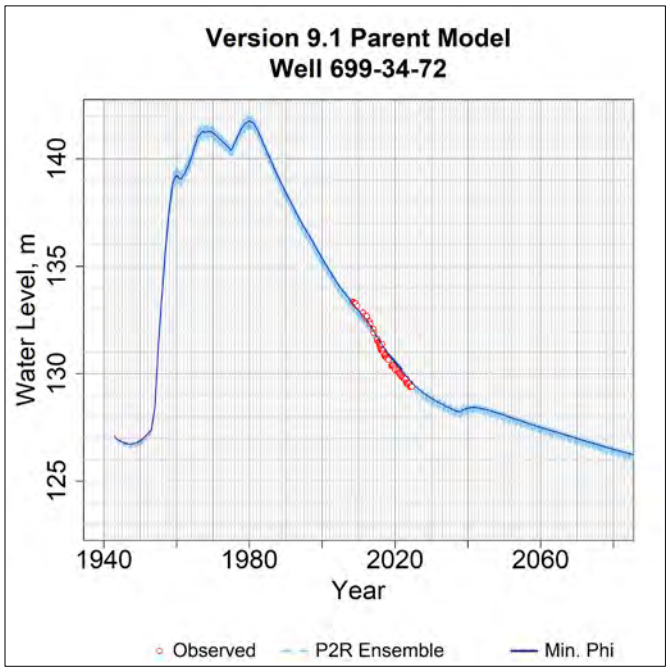

Figure B-478. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-34-72.

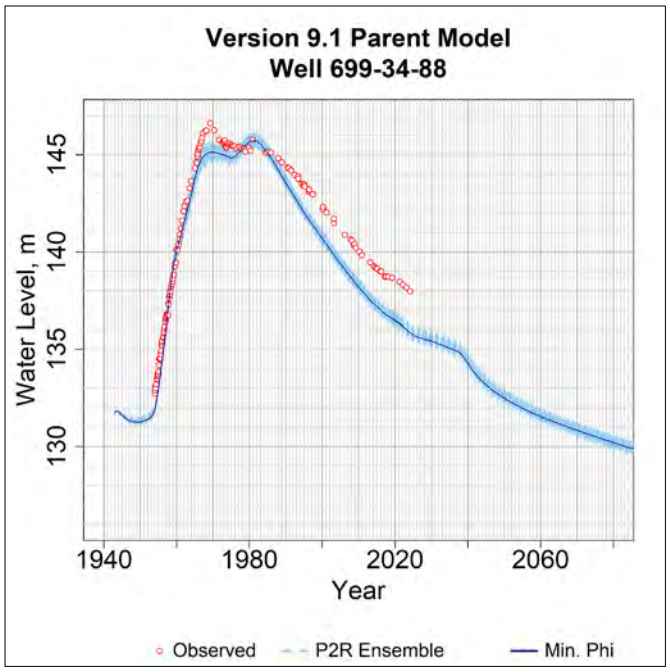

Figure B-479. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-34-88.

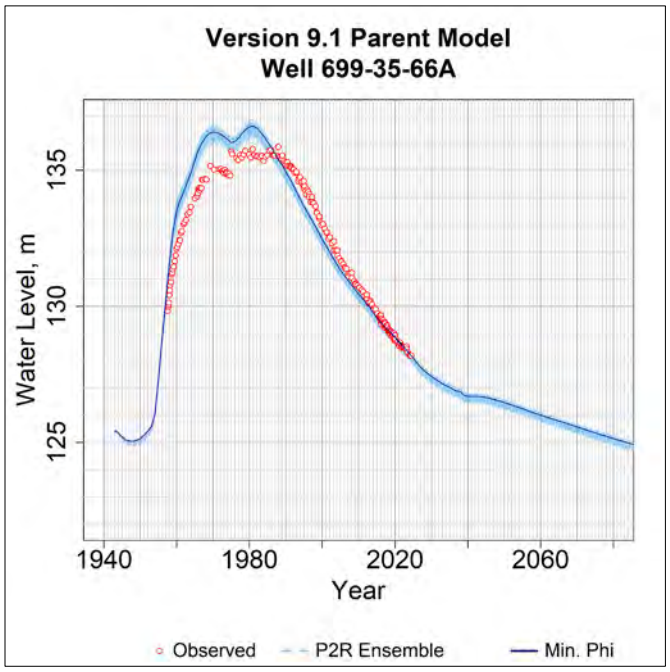

Figure B-480. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-35-66A.

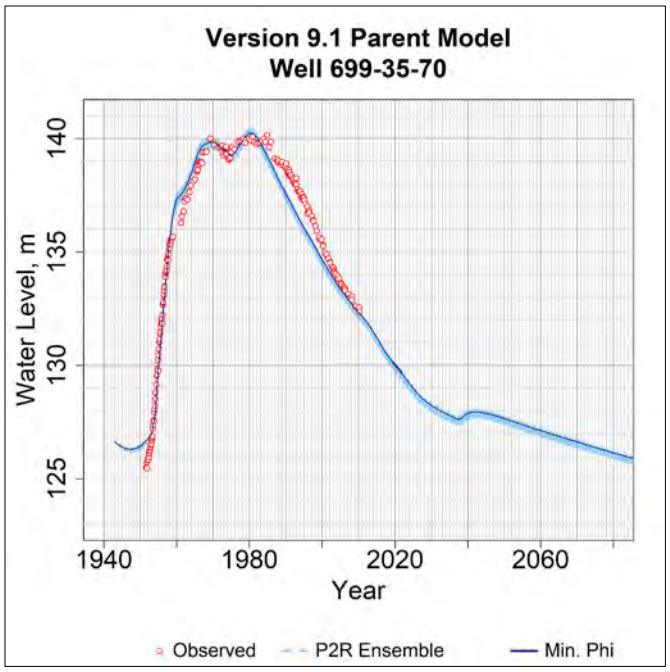

Figure B-481. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-35-70.

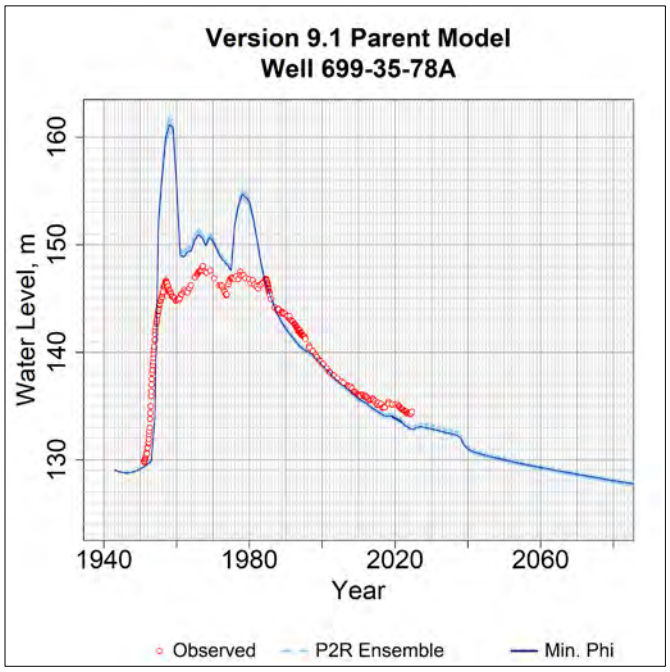

Figure B-482. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-35-78A.

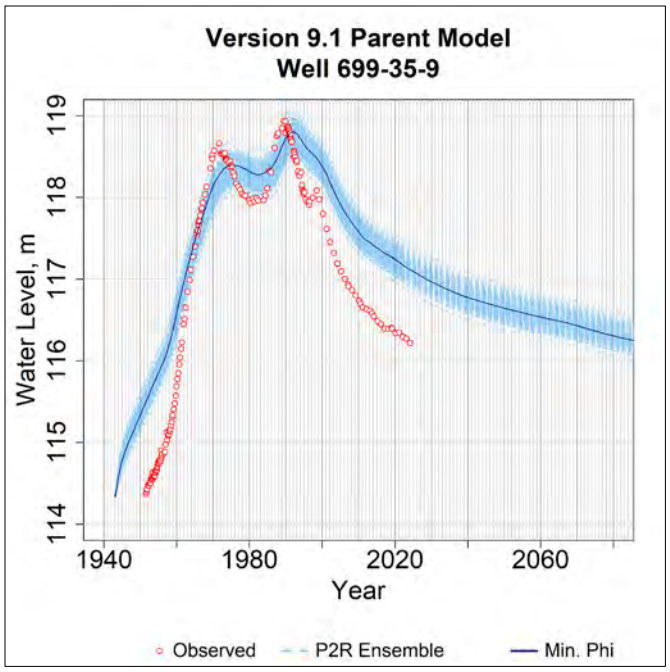

Figure B-483. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-35-9.

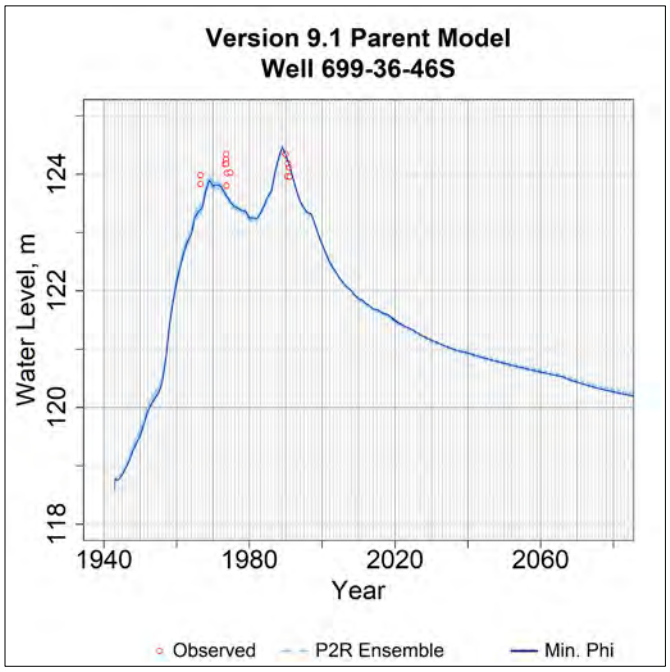

Figure B-484. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-36-46S.

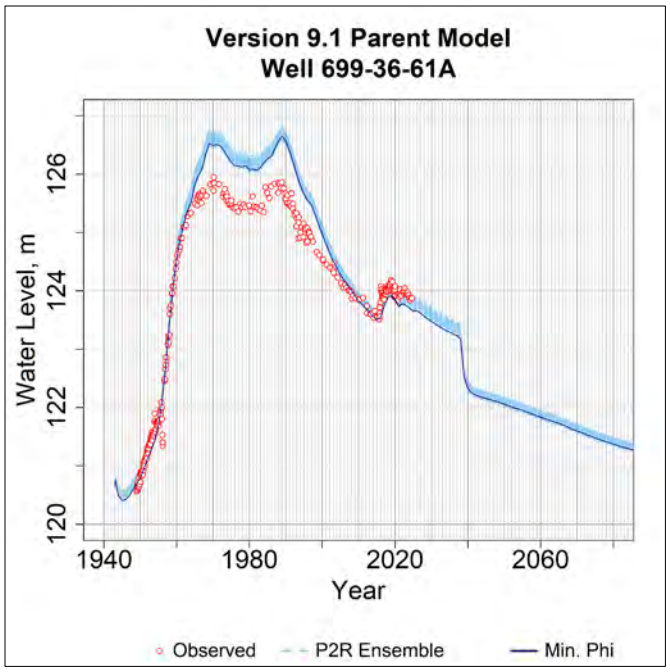

Figure B-485. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-36-61A.

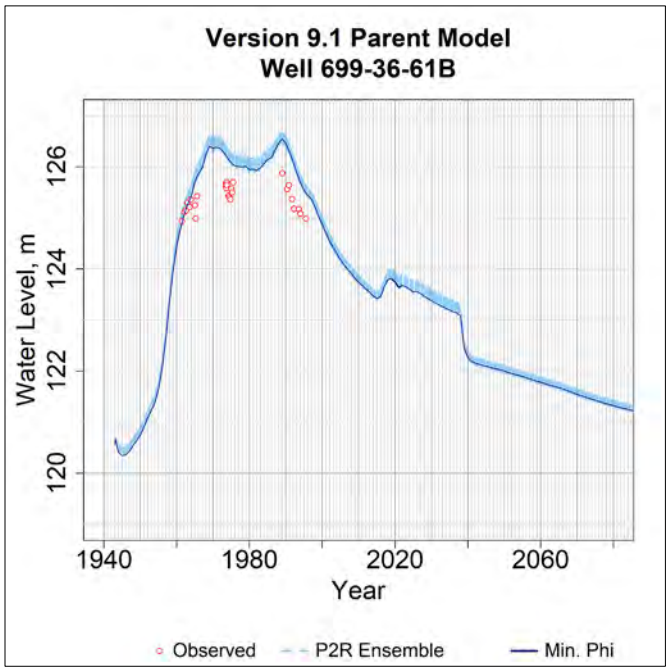

Figure B-486. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-36-61B.

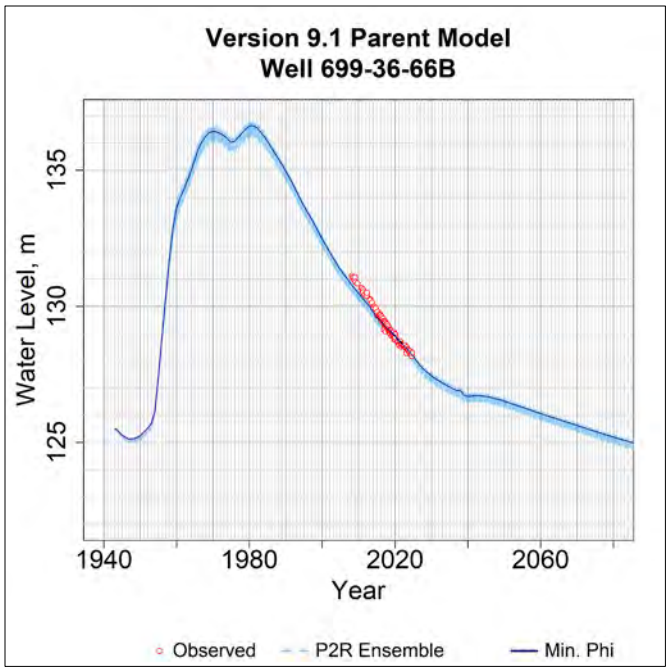

Figure B-487. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-36-66B.

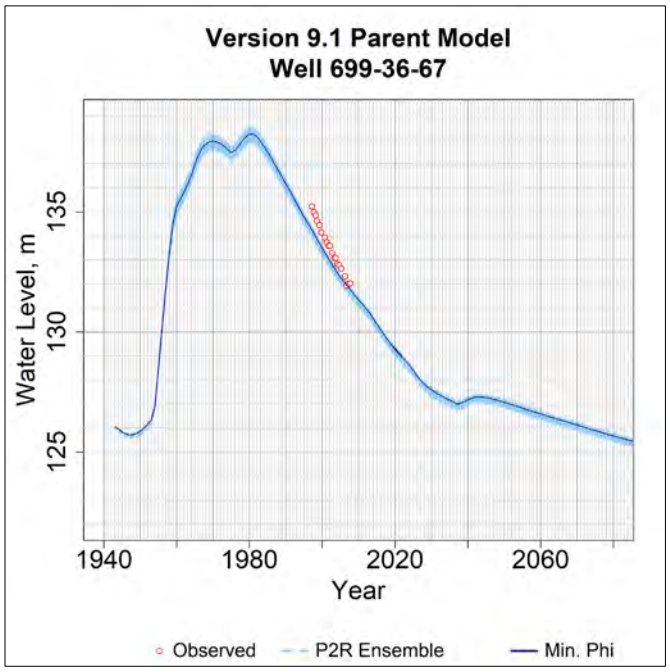

Figure B-488. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-36-67.

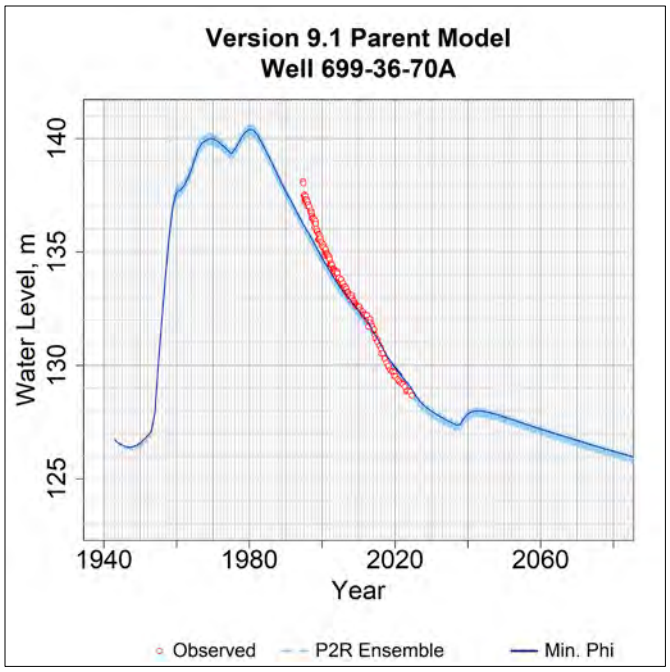

Figure B-489. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-36-70A.

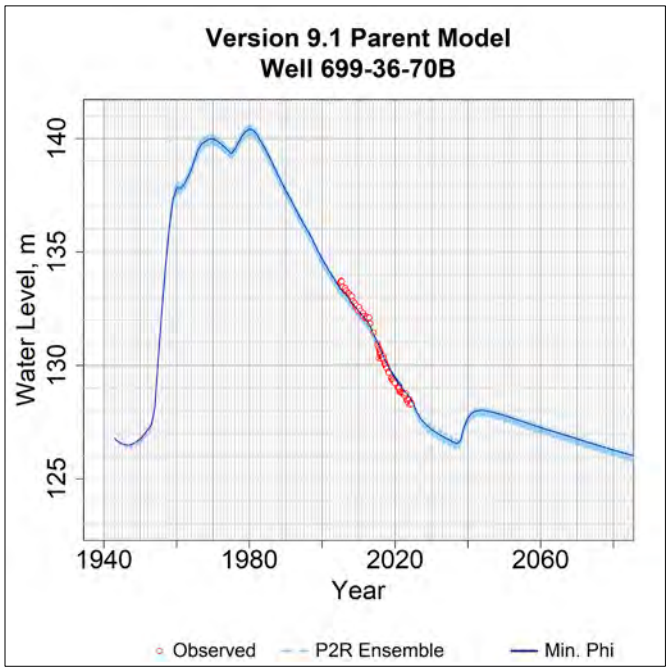

Figure B-490. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-36-70B.

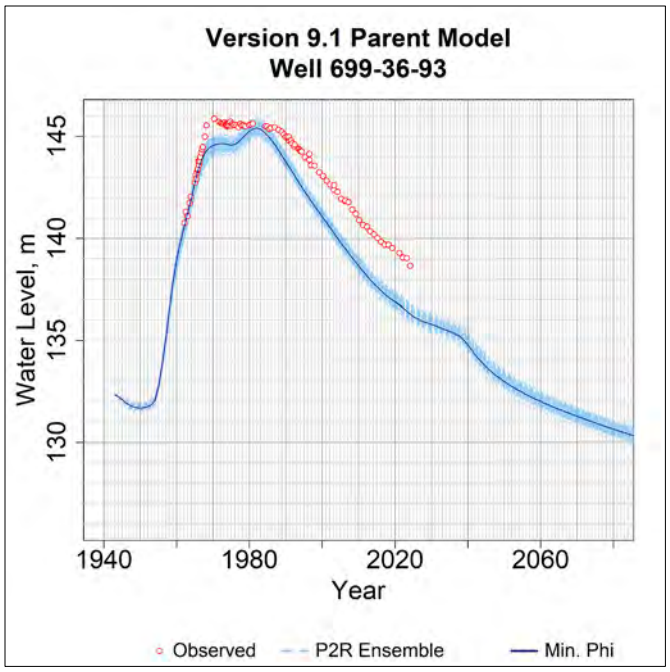

Figure B-491. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-36-93.

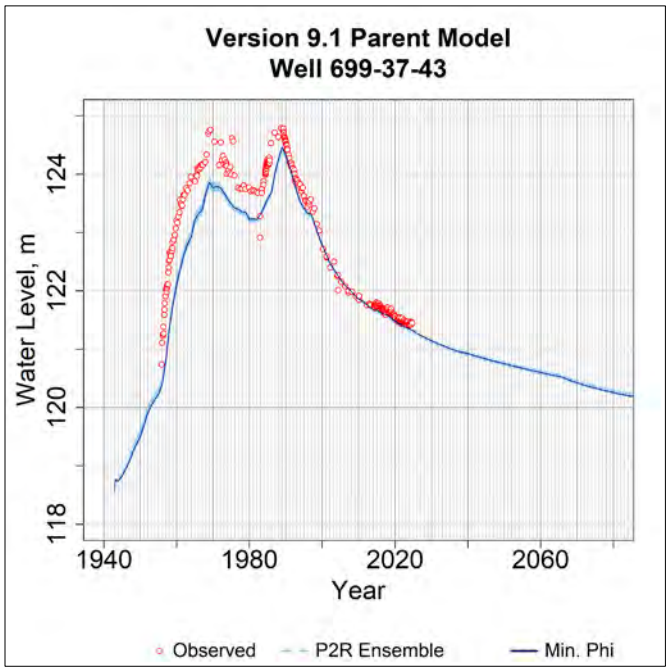

Figure B-492. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-37-43.

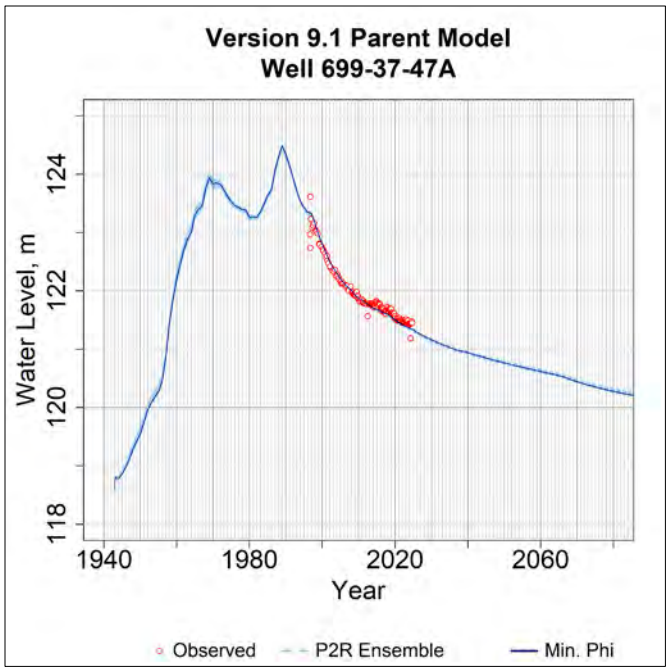

Figure B-493. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-37-47A.

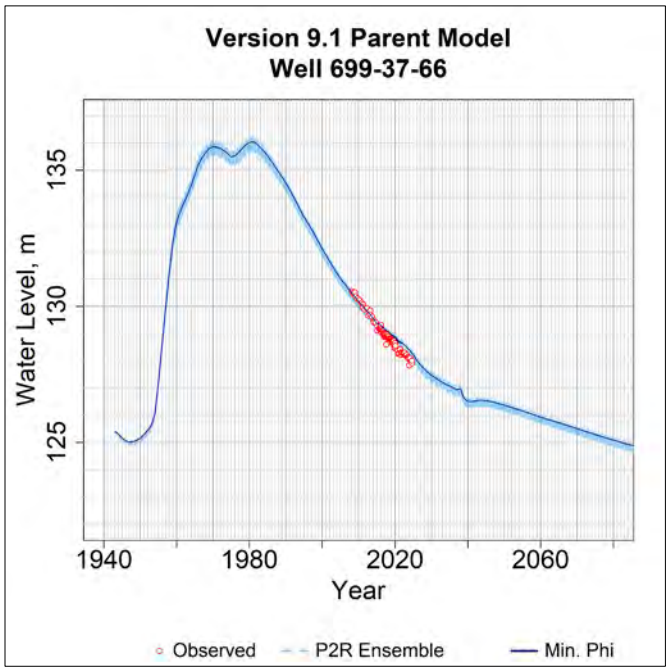

Figure B-494. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-37-66.

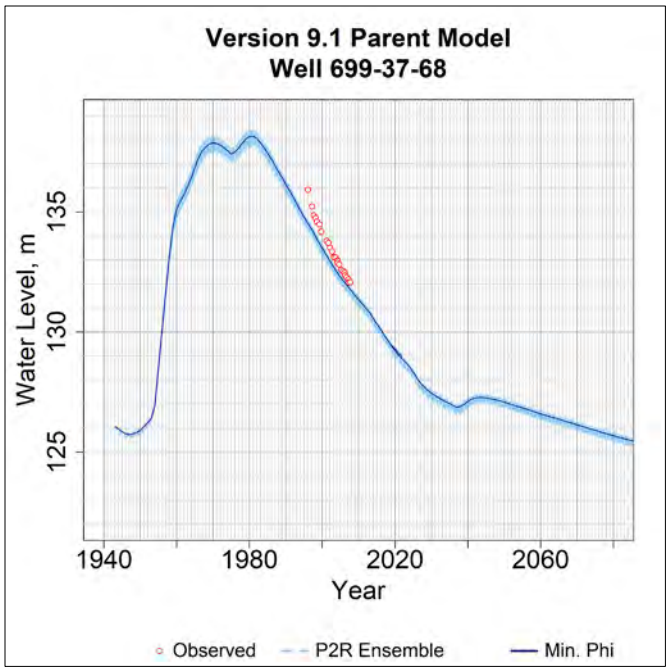

Figure B-495. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-37-68.

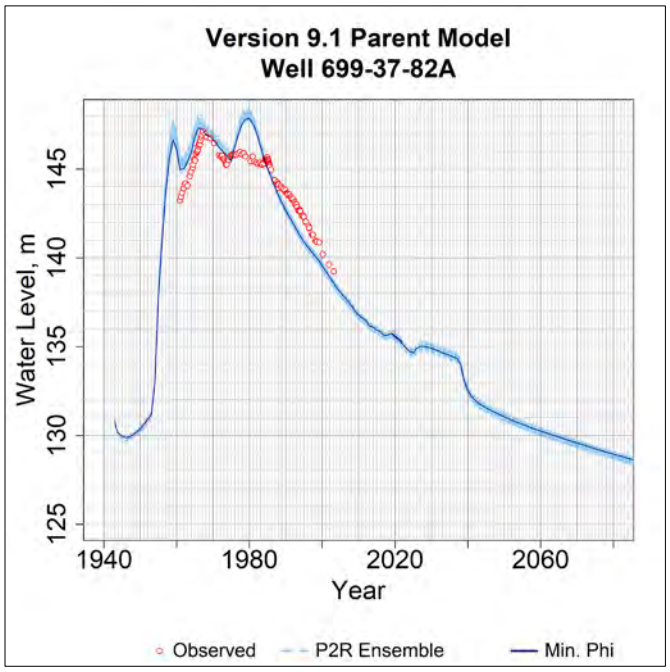

Figure B-496. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-37-82A.

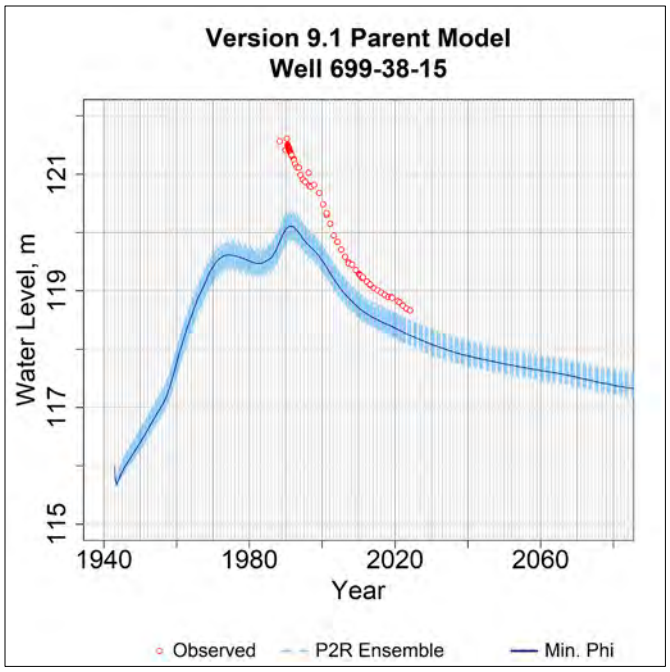

Figure B-497. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-38-15.

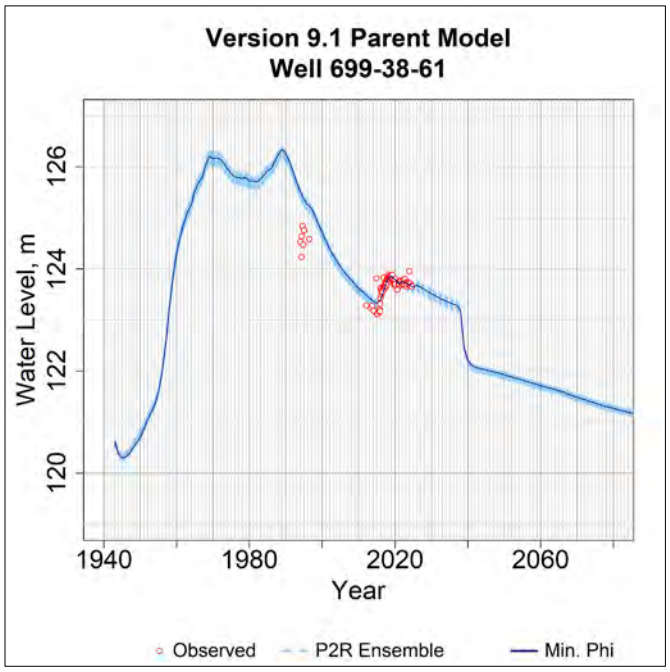

Figure B-498. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-38-61.

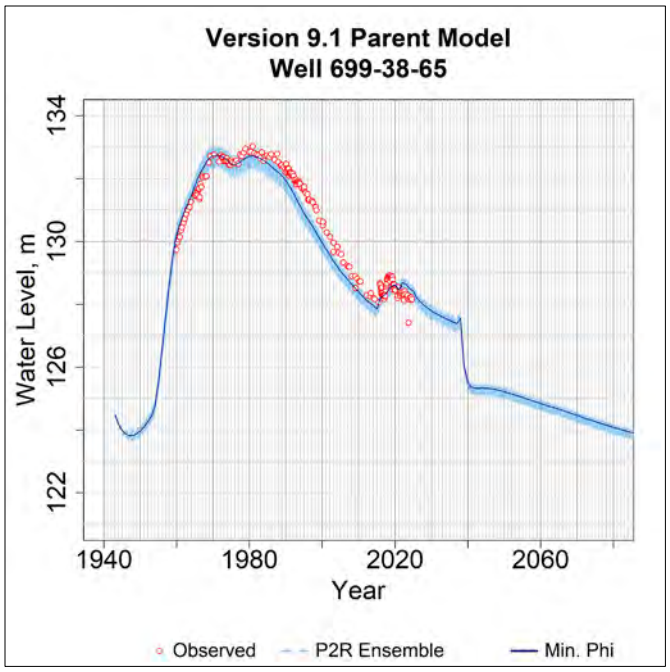

Figure B-499. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-38-65.

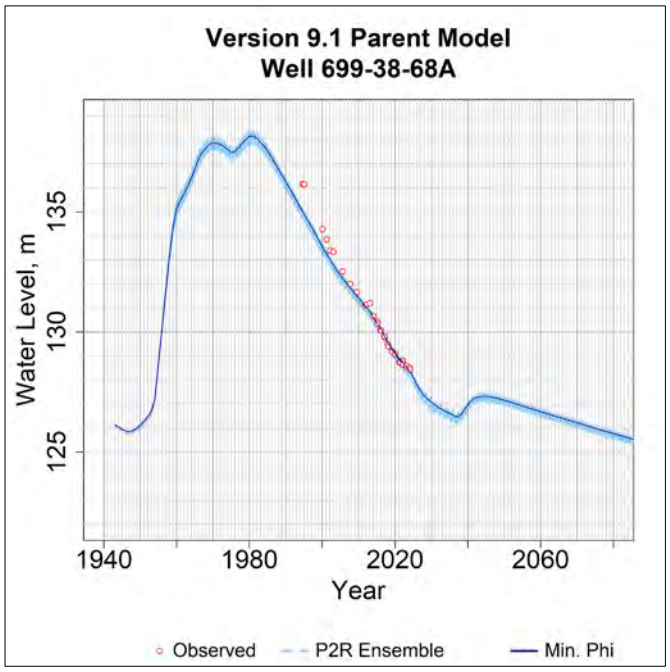

Figure B-500. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-38-68A.

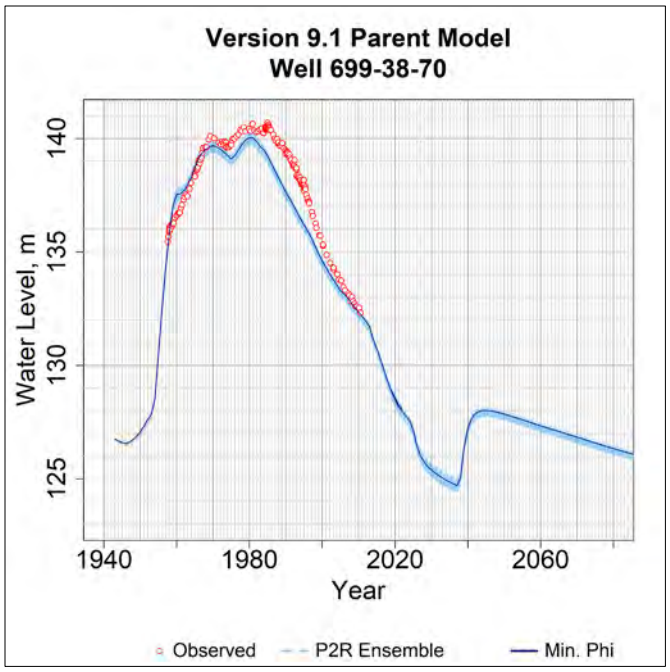

Figure B-501. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-38-70.

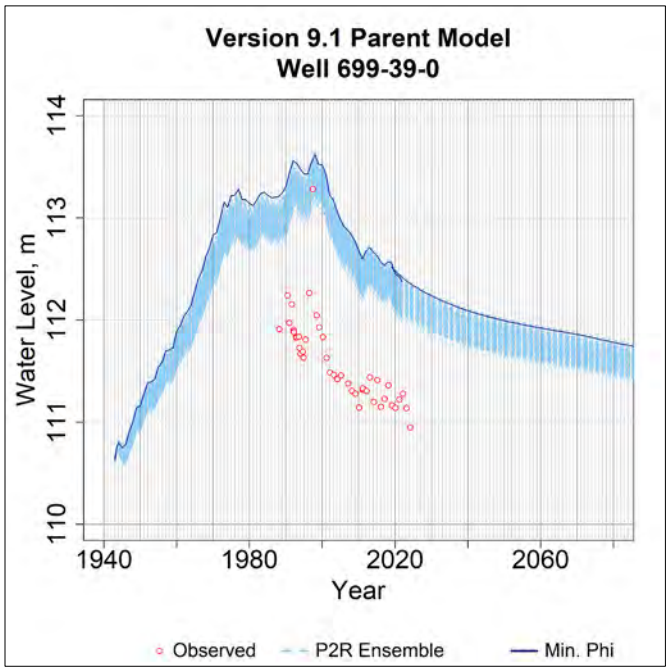

Figure B-502. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-39-0.

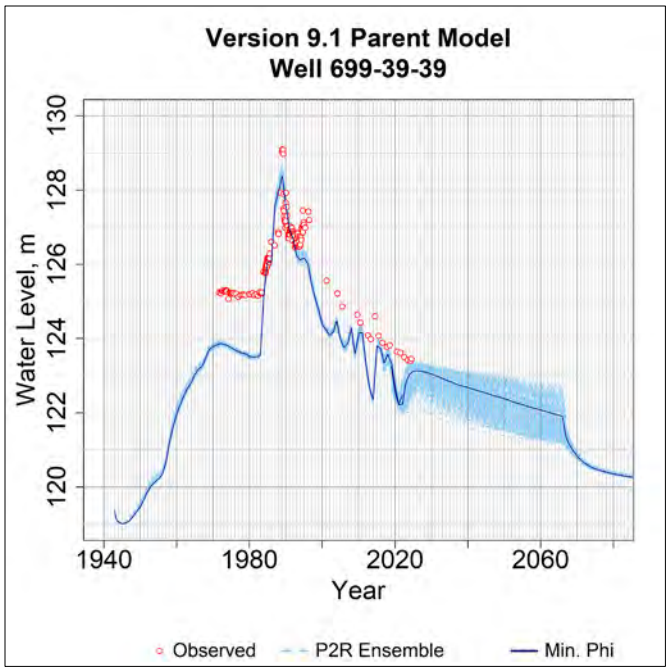

Figure B-503. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-39-39.

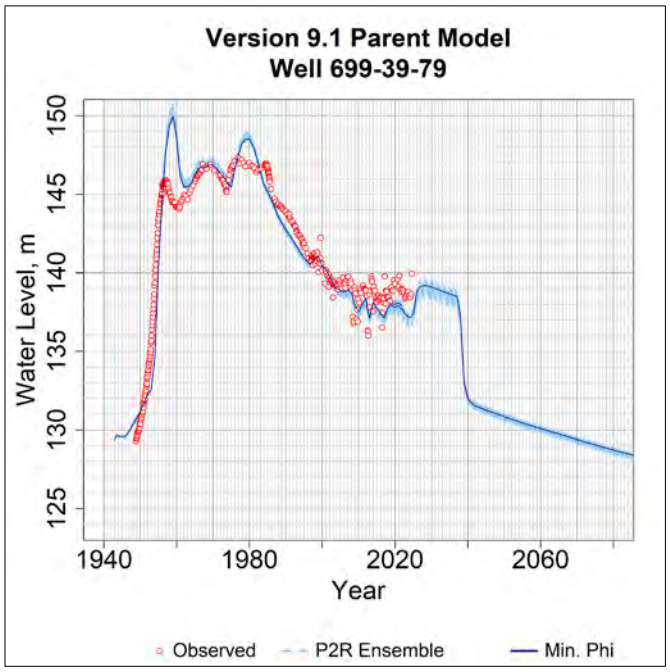

Figure B-504. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-39-79.

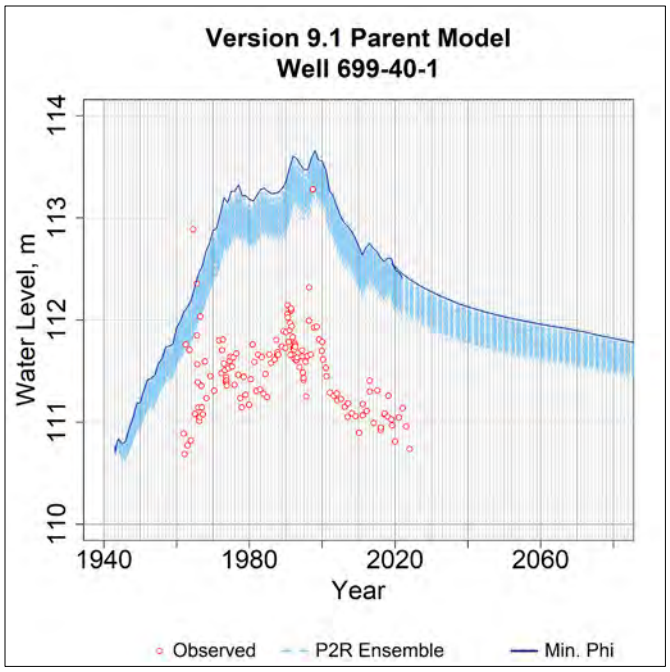

Figure B-505. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-40-1.

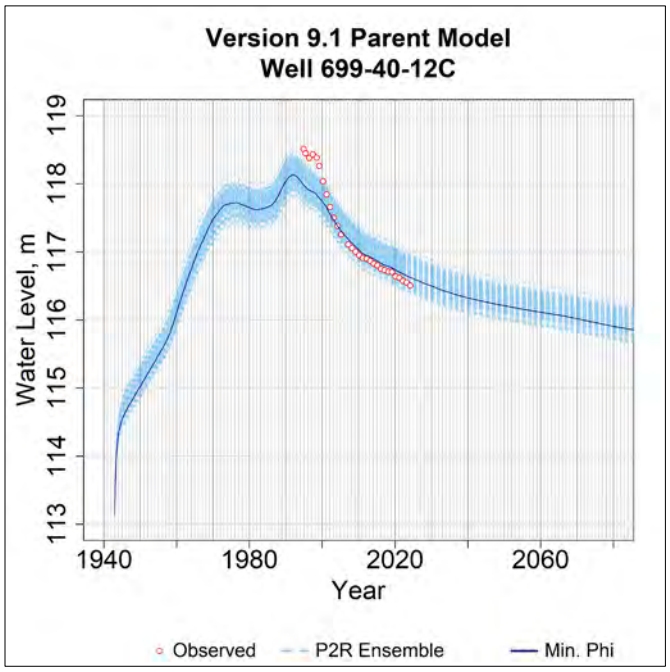

Figure B-506. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-40-12C.

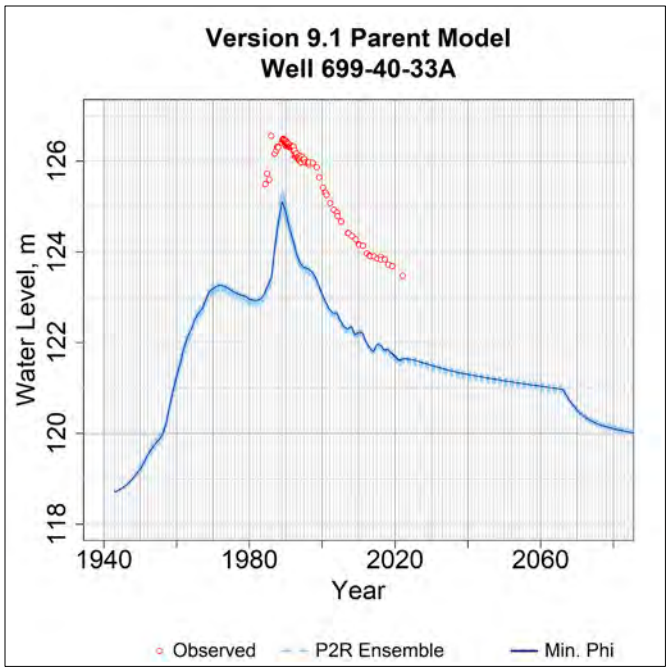

Figure B-507. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-40-33A.

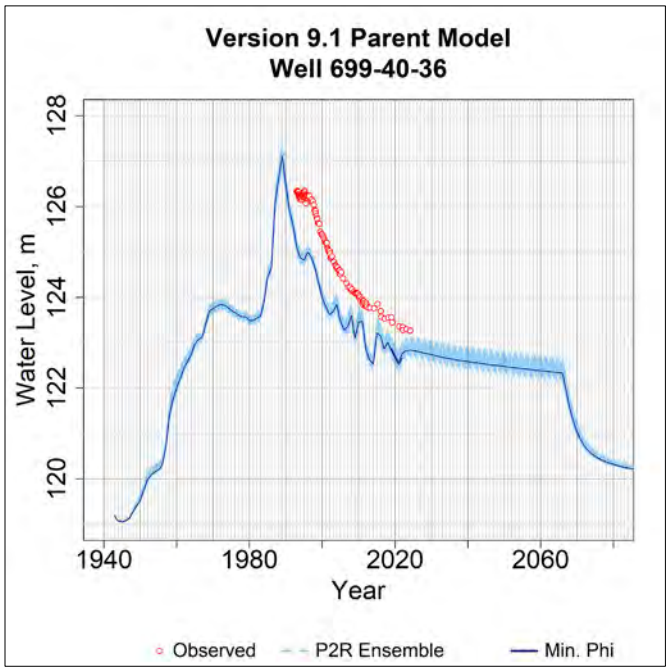

Figure B-508. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-40-36.

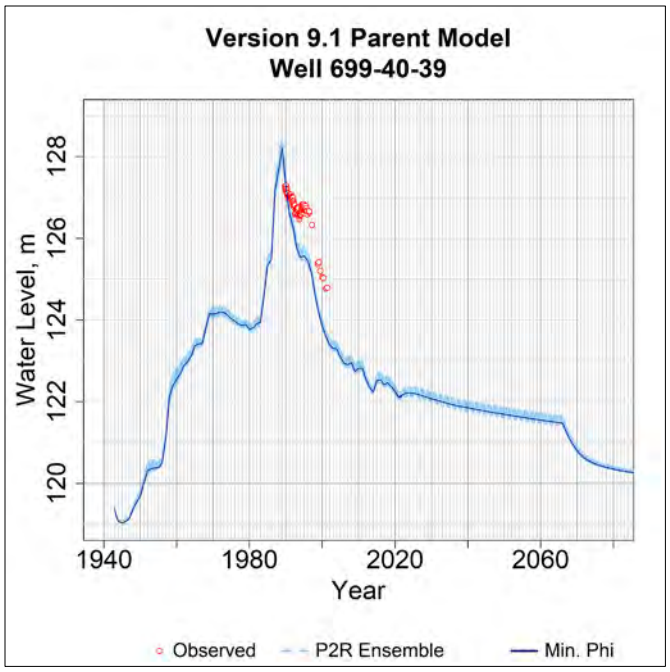

Figure B-509. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-40-39.

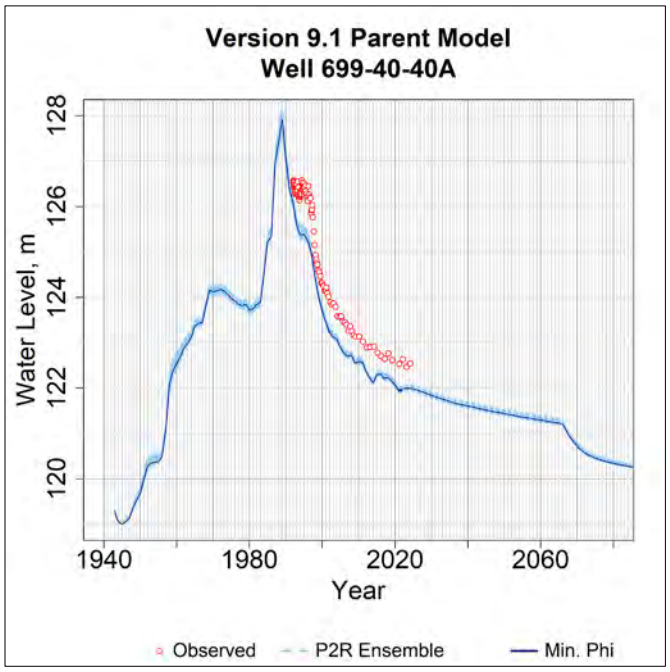

Figure B-510. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-40-40A.

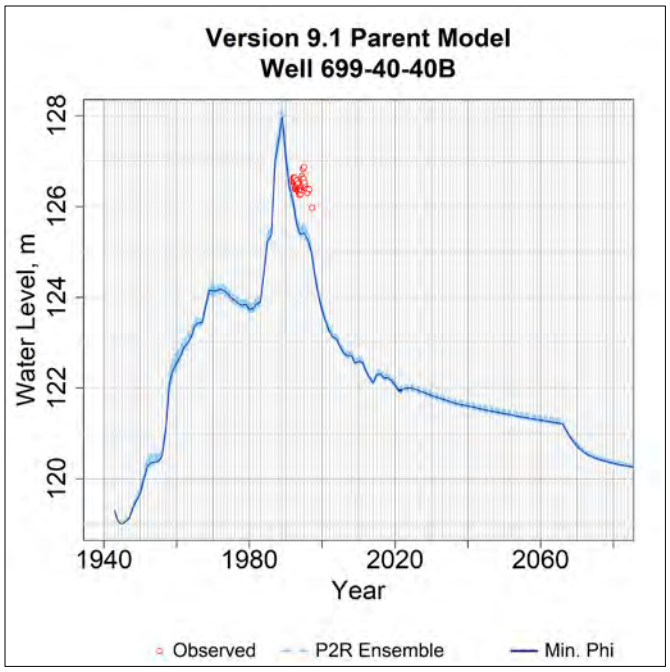

Figure B-511. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-40-40B.

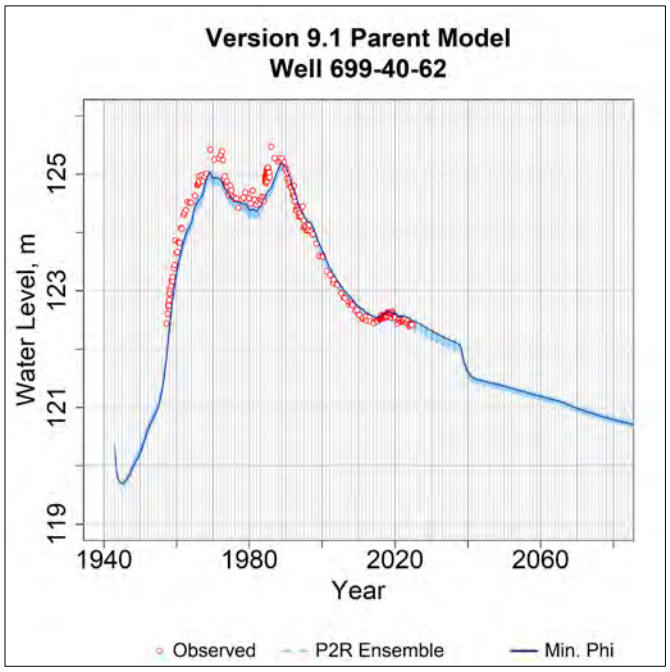

Figure B-512. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-40-62.

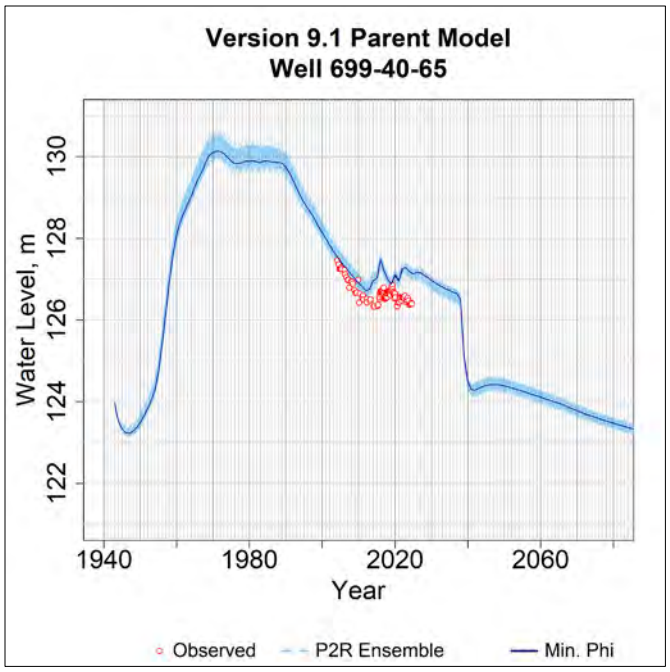

Figure B-513. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-40-65.

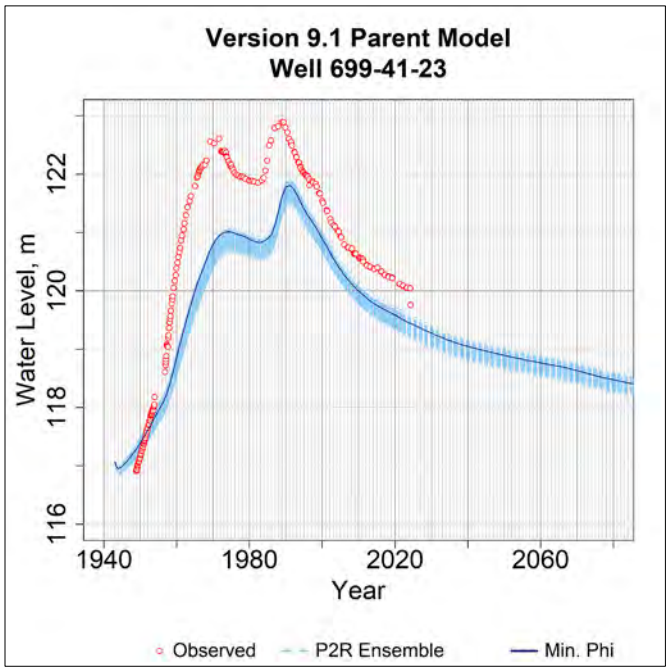

Figure B-514. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-41-23.

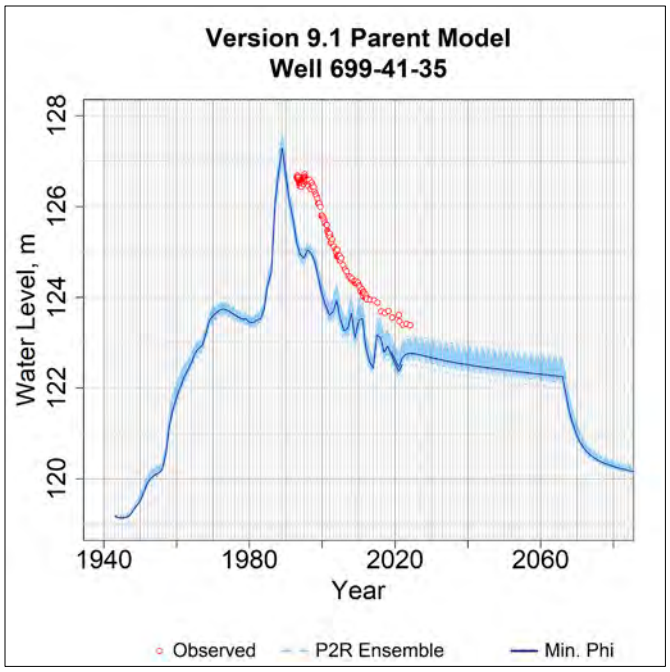

Figure B-515. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-41-35.

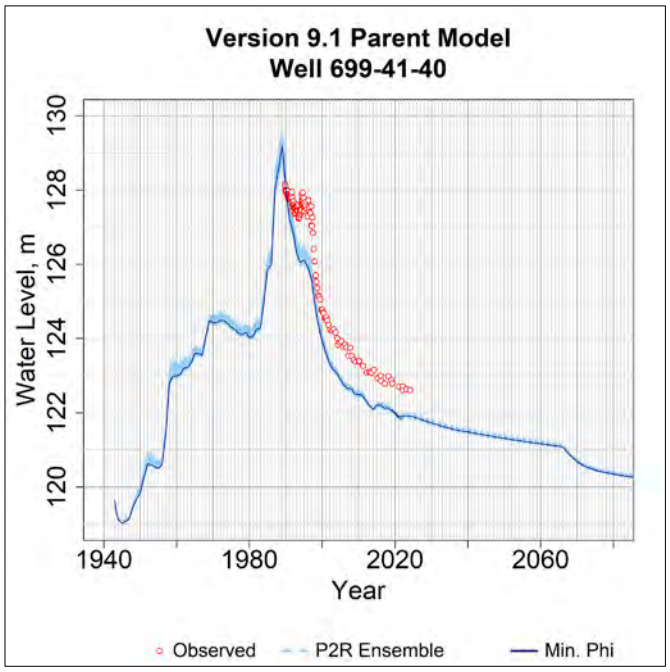

Figure B-516. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-41-40.

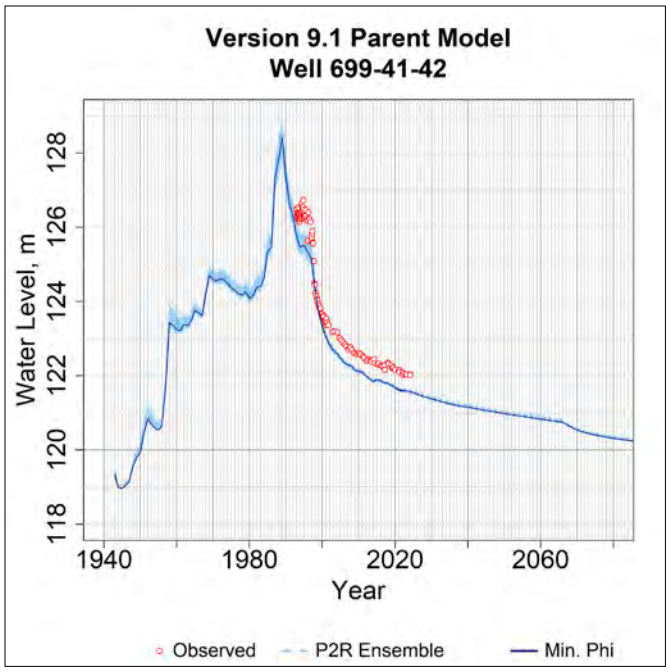

Figure B-517. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-41-42.

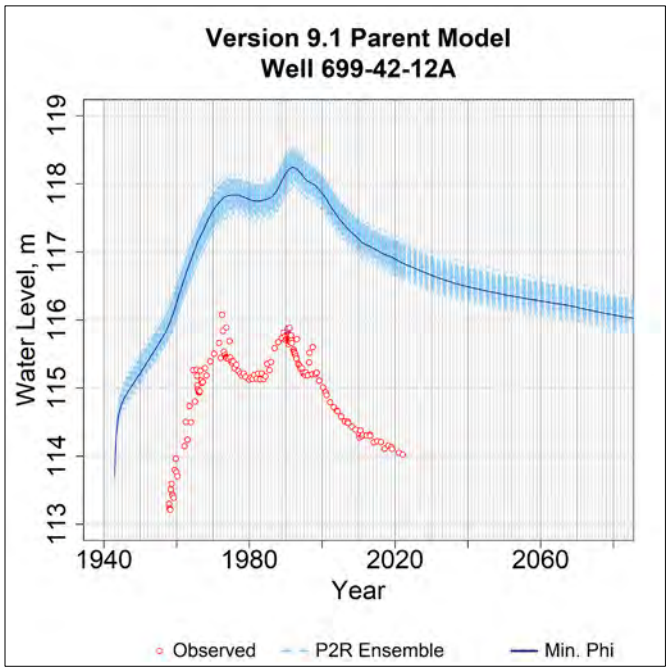

Figure B-518. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-42-12A.

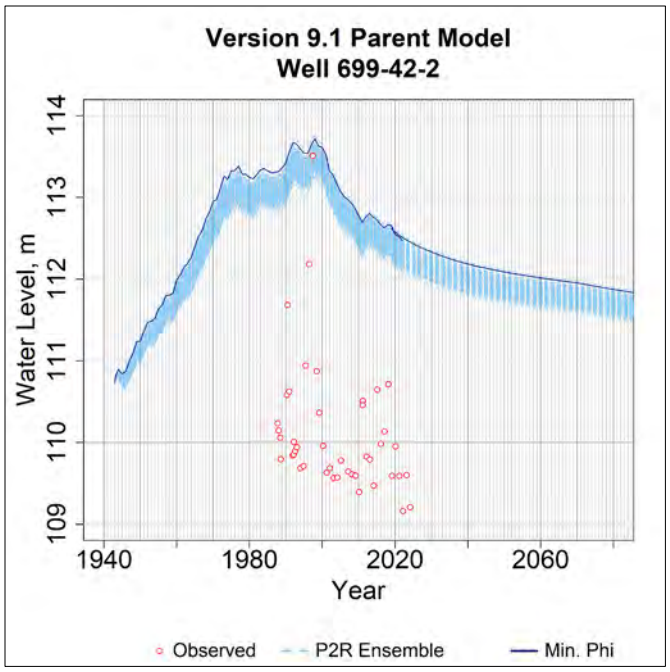

Figure B-519. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-42-2.

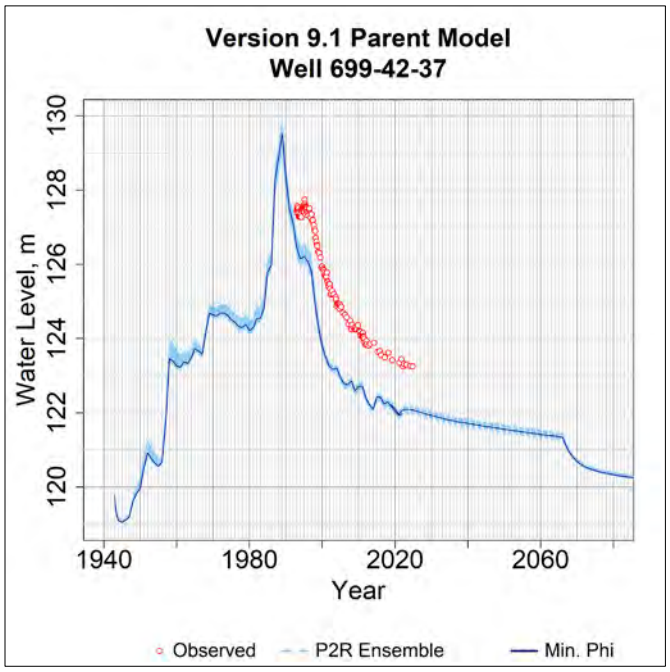

Figure B-520. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-42-37.

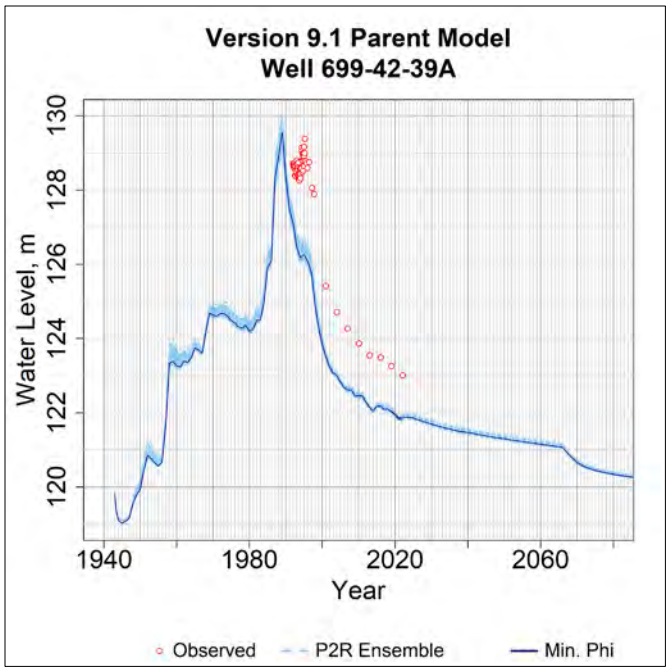

Figure B-521. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-42-39A.

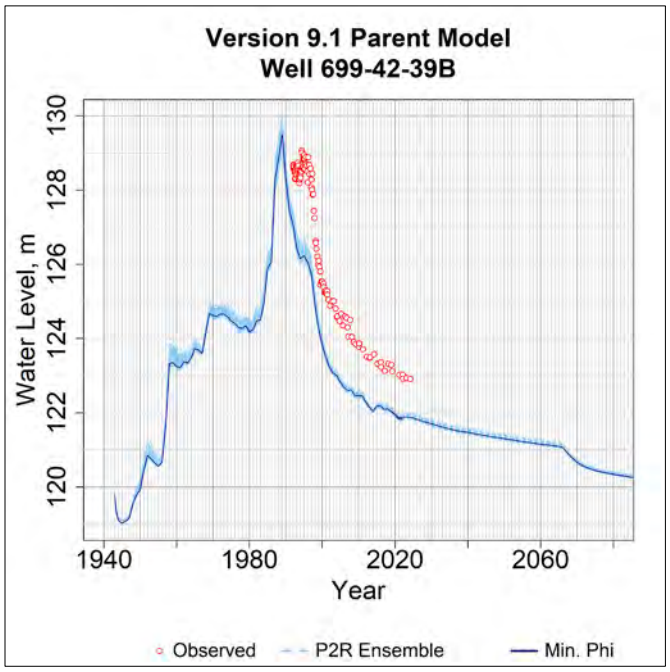

Figure B-522. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-42-39B.

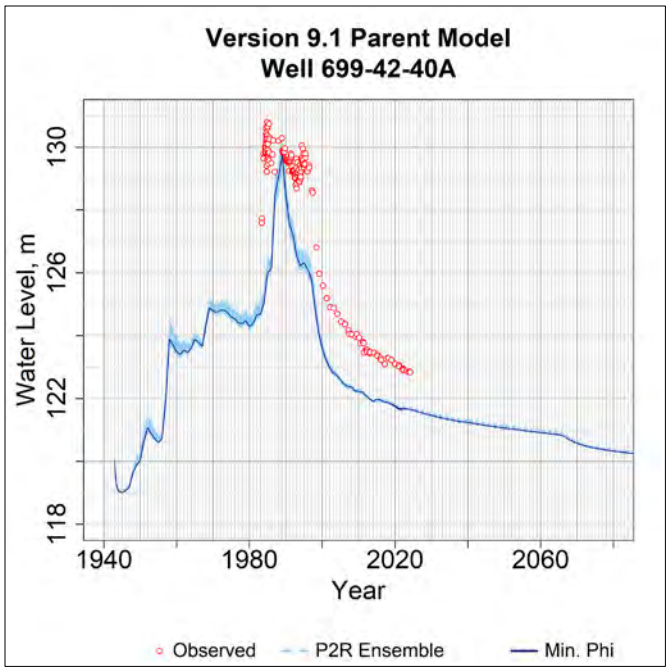

Figure B-523. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-42-40A.

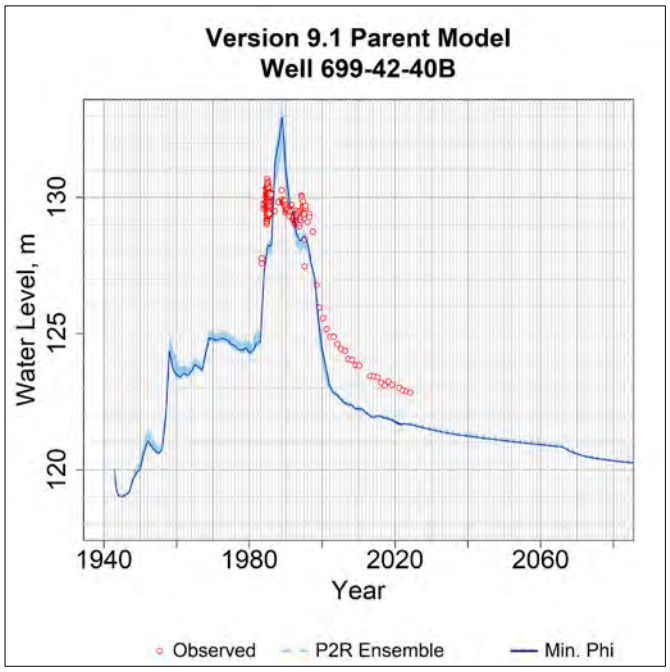

Figure B-524. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-42-40B.

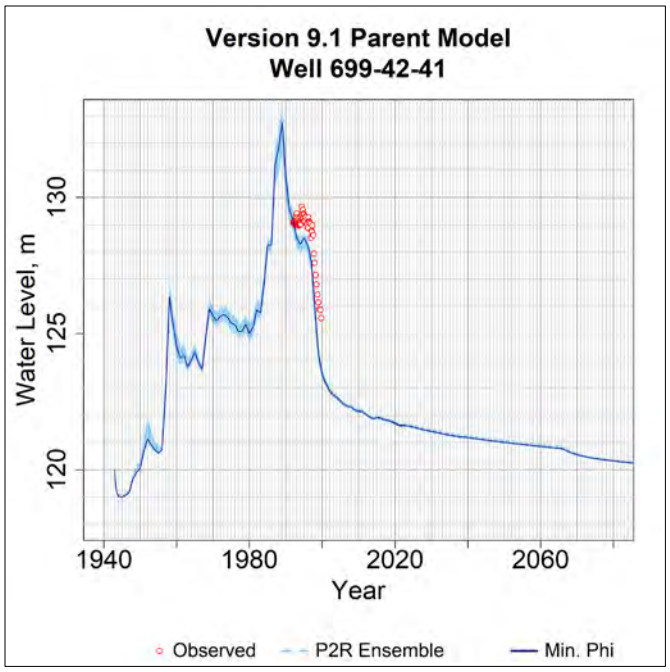

Figure B-525. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-42-41.

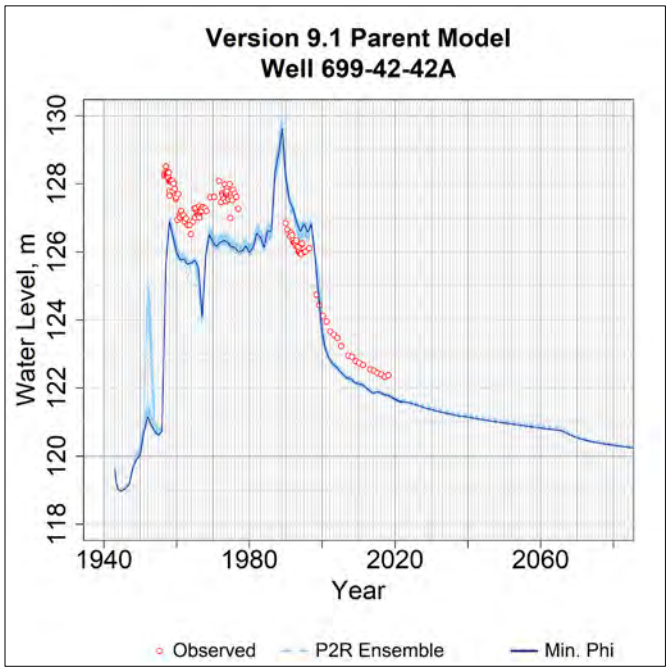

Figure B-526. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-42-42A.

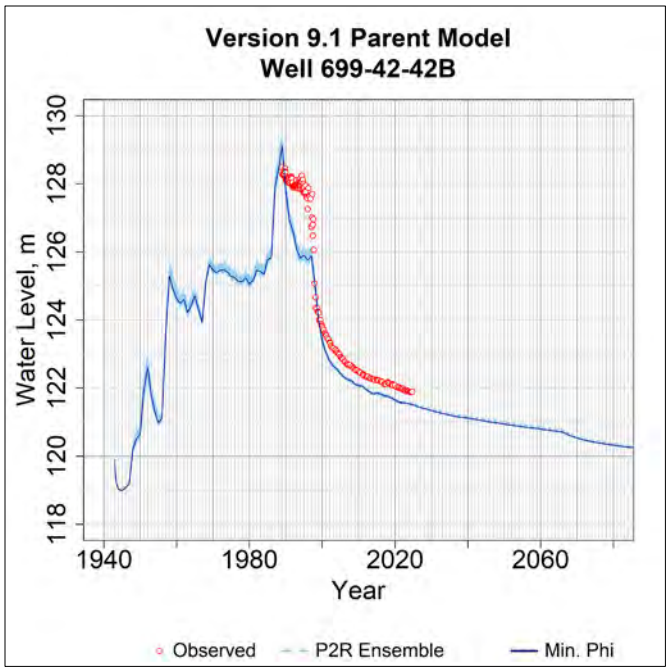

Figure B-527. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-42-42B.

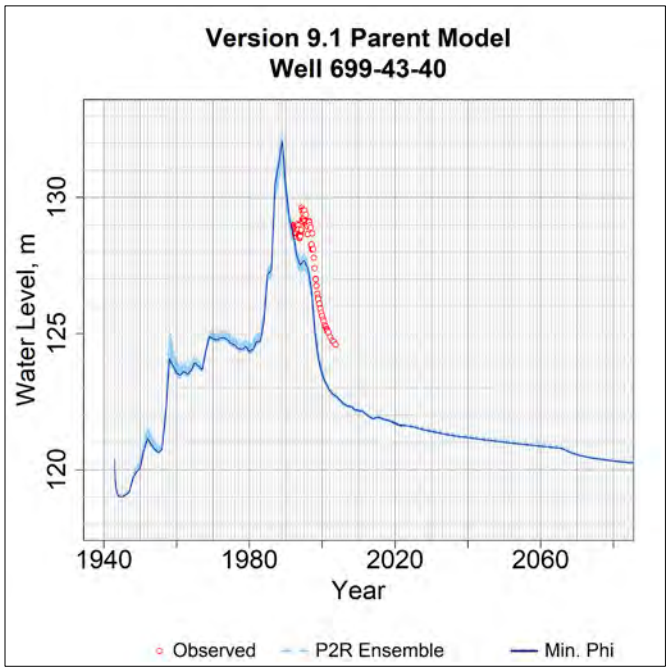

Figure B-528. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-43-40.

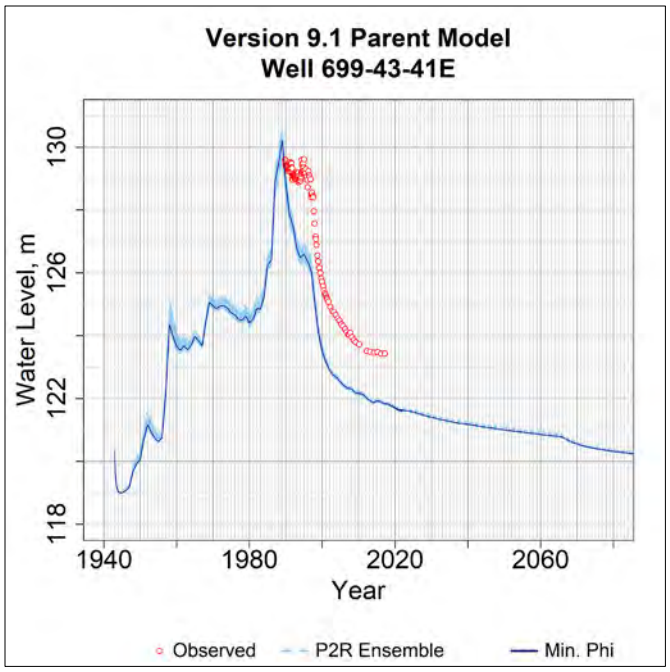

Figure B-529. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-43-41E.

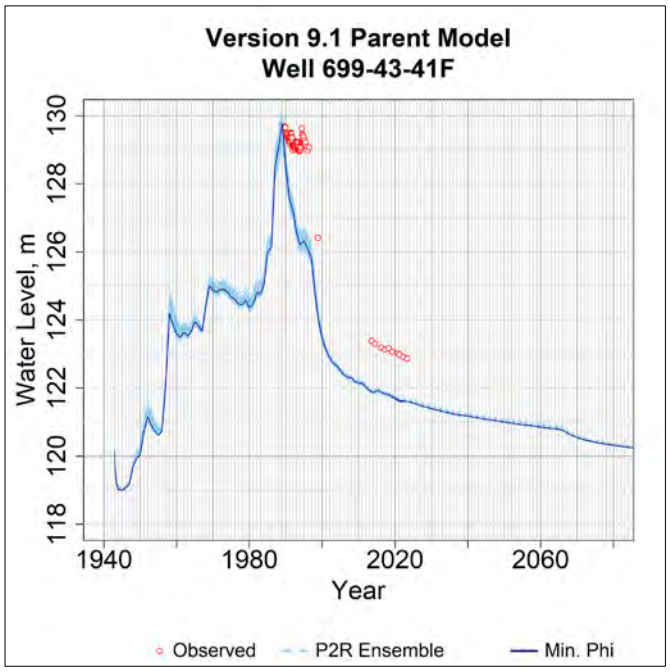

Figure B-530. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-43-41F.

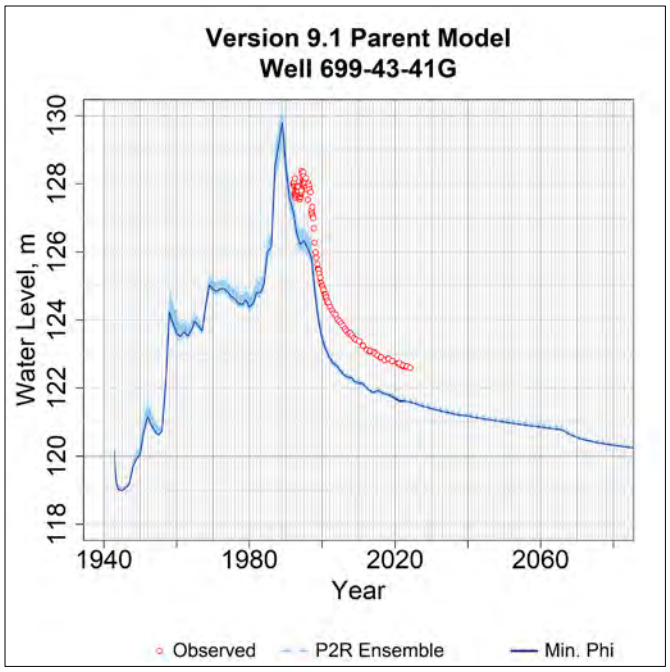

Figure B-531. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-43-41G.

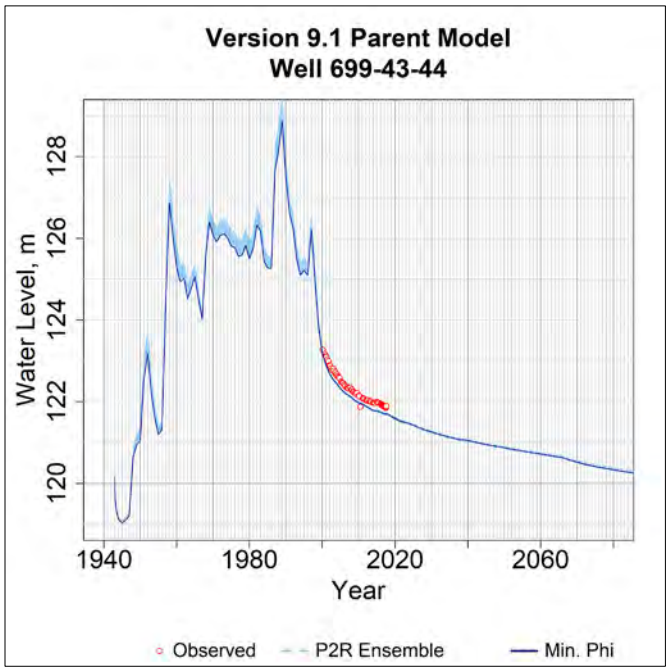

Figure B-532. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-43-44.

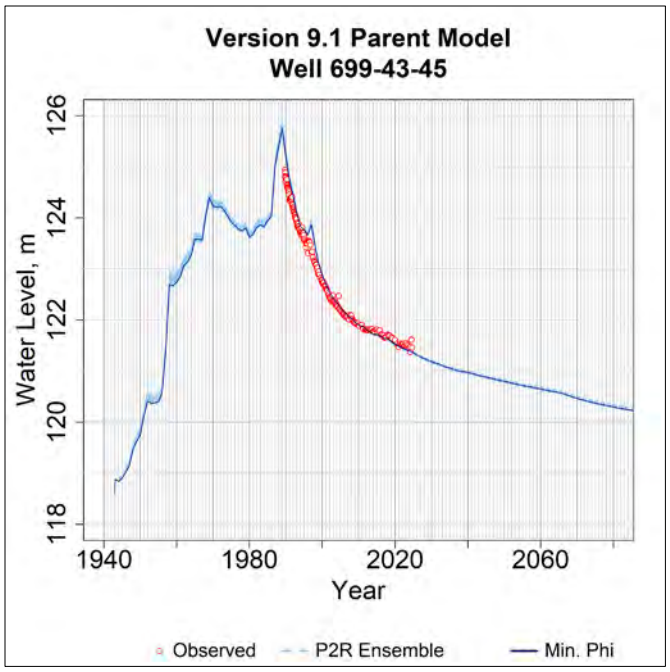

Figure B-533. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-43-45.

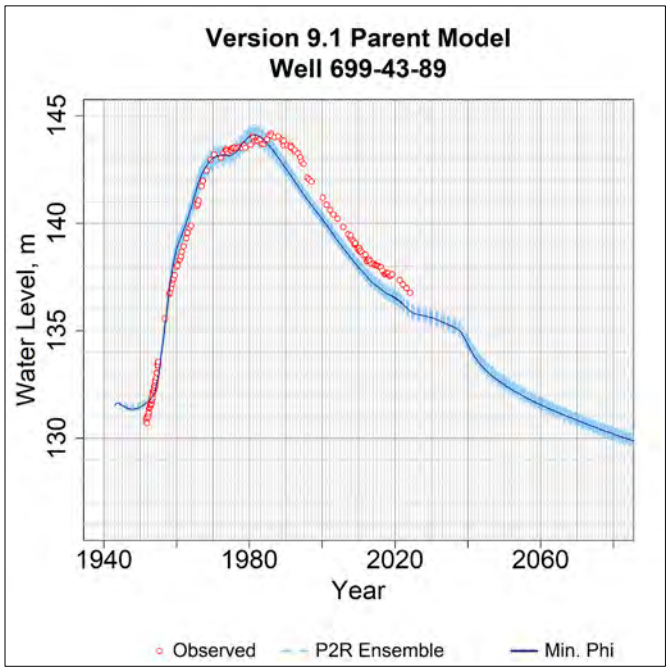

Figure B-534. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-43-89.

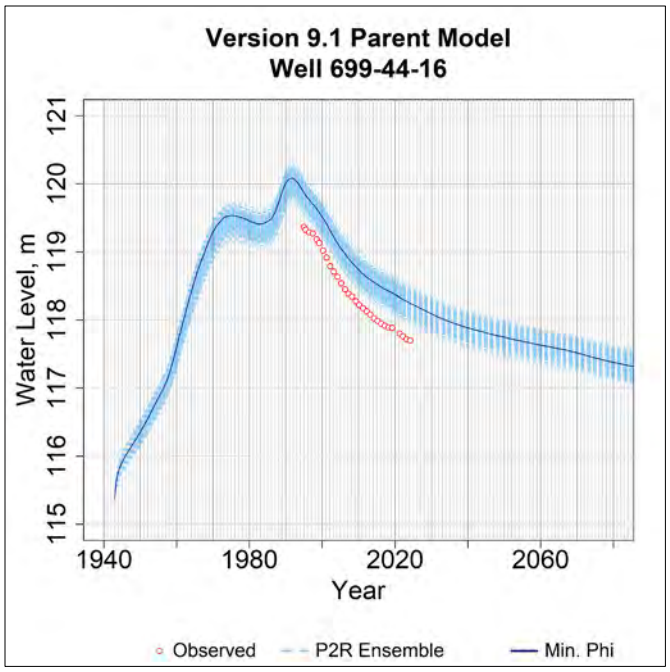

Figure B-535. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-44-16.

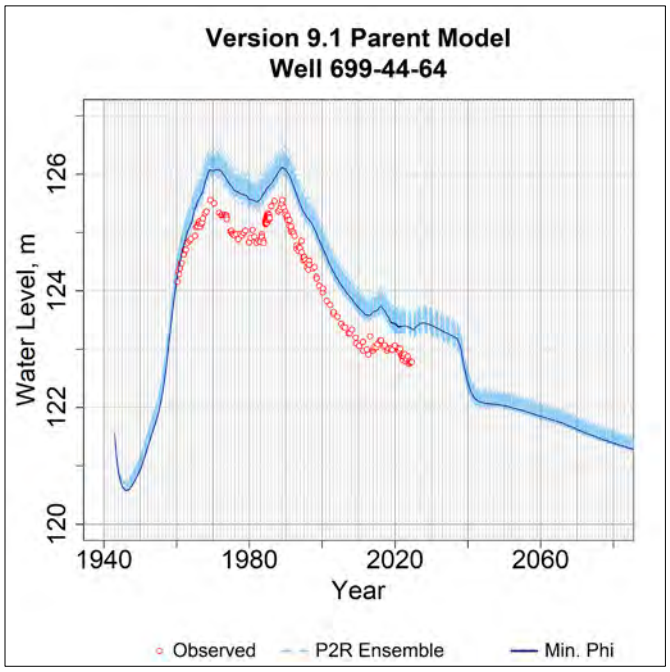

Figure B-536. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-44-64.

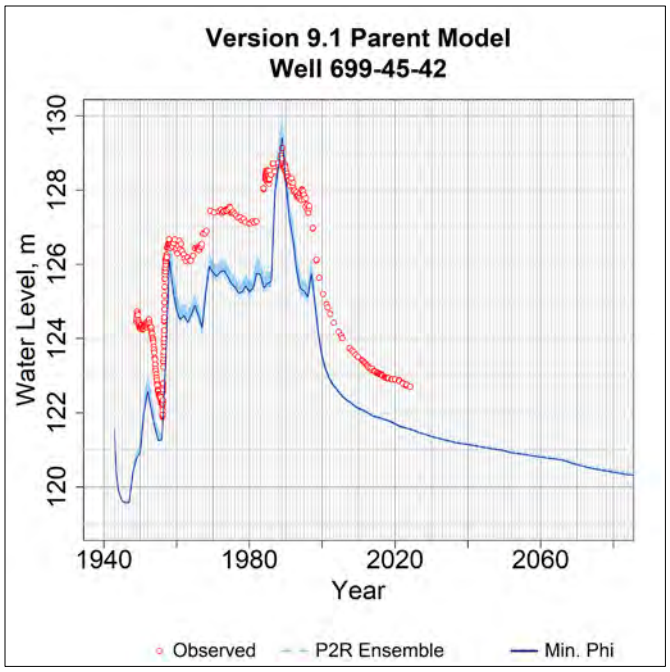

Figure B-537. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-45-42.

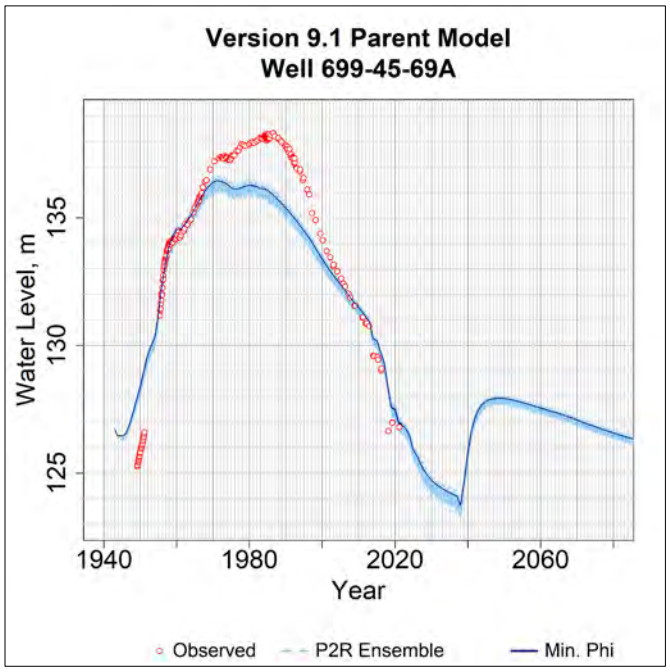

Figure B-538. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-45-69A.

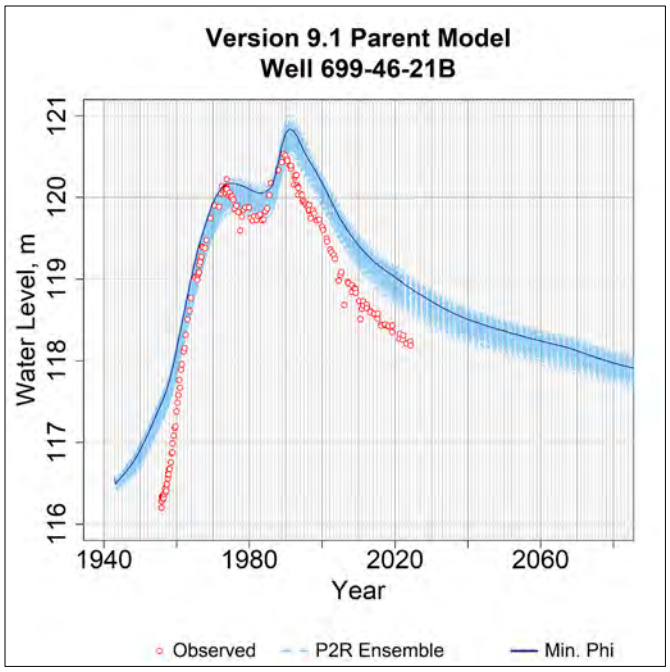

Figure B-539. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-46-21B.

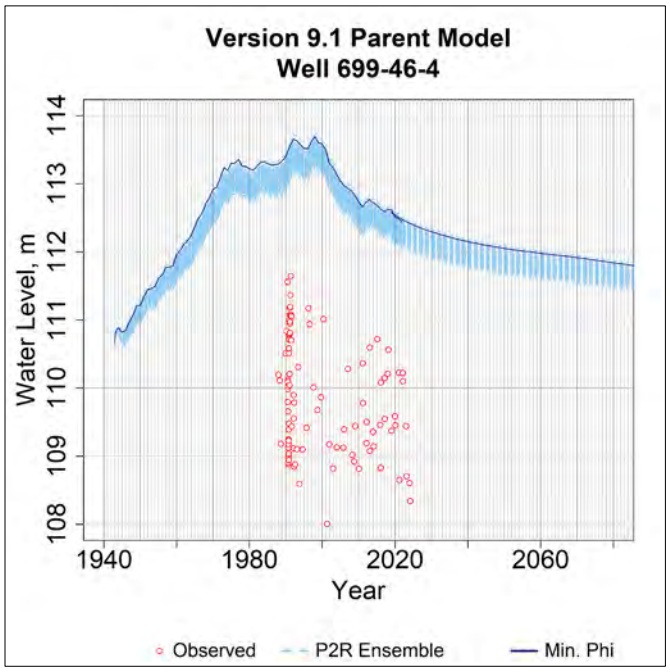

Figure B-540. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-46-4.

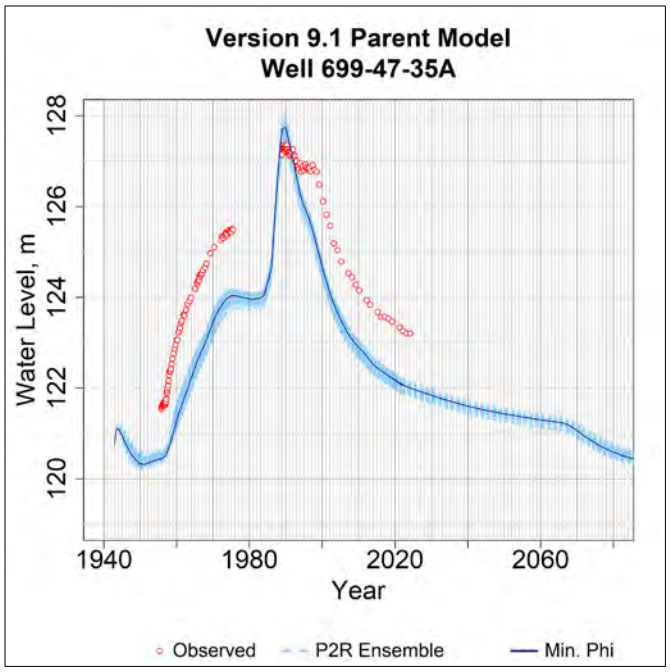

Figure B-541. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-47-35A.

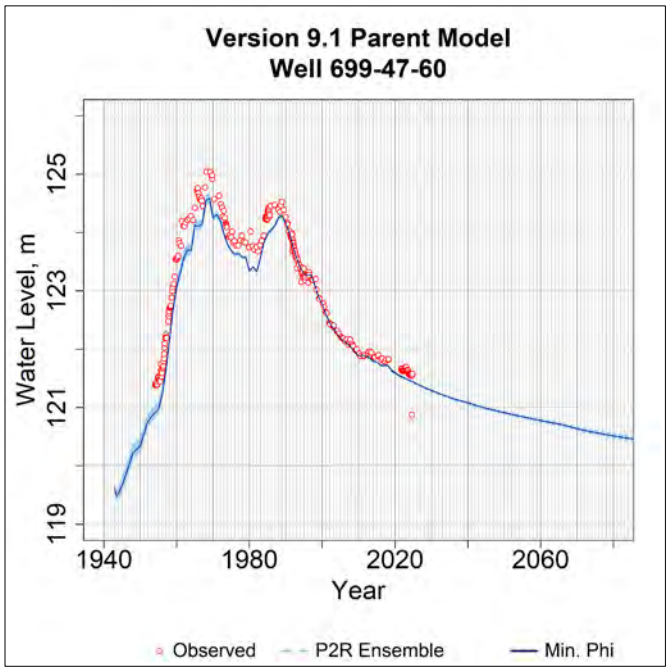

Figure B-542. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-47-60.

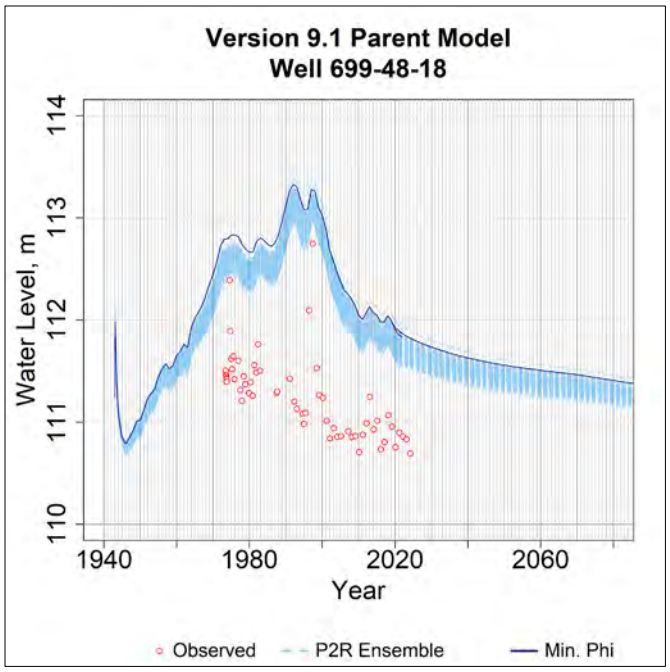

Figure B-543. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-48-18.

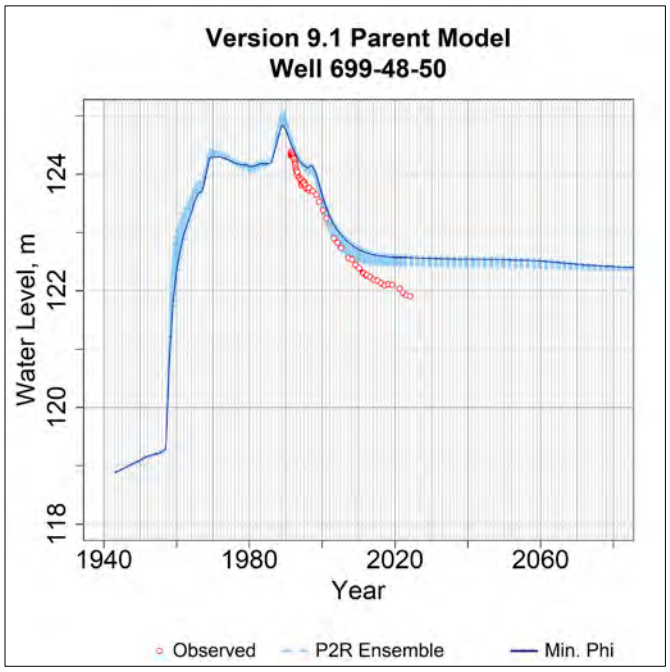

Figure B-544. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-48-50.

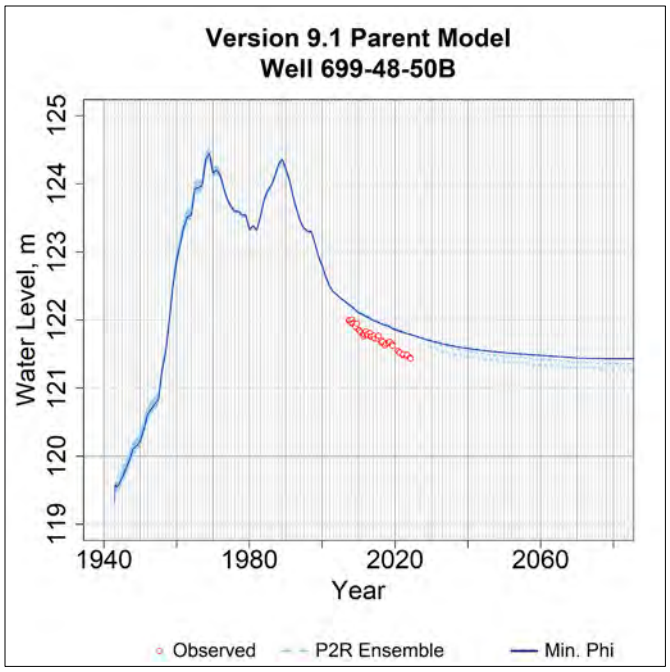

Figure B-545. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-48-50B.

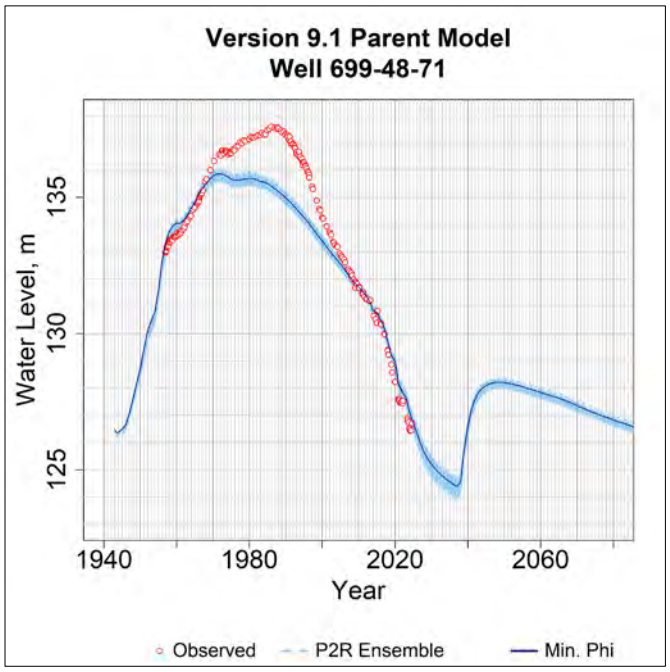

Figure B-546. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-48-71.

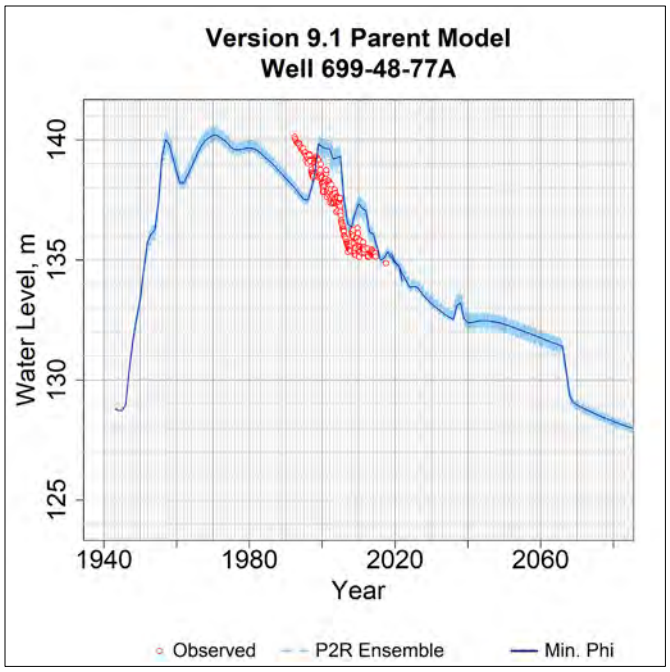

Figure B-547. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-48-77A.

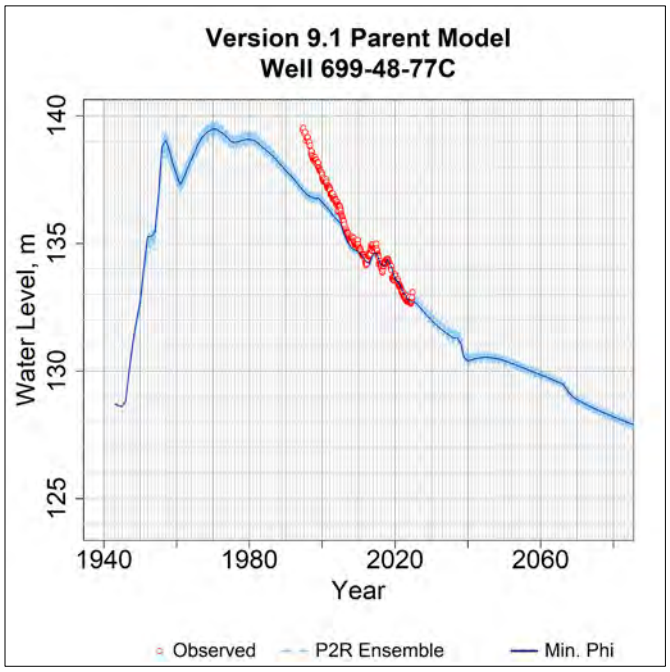

Figure B-548. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-48-77C.

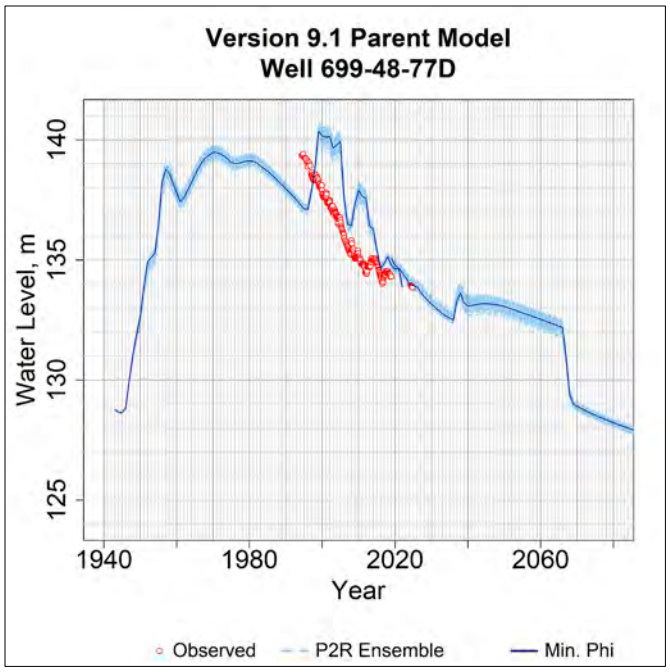

Figure B-549. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-48-77D.

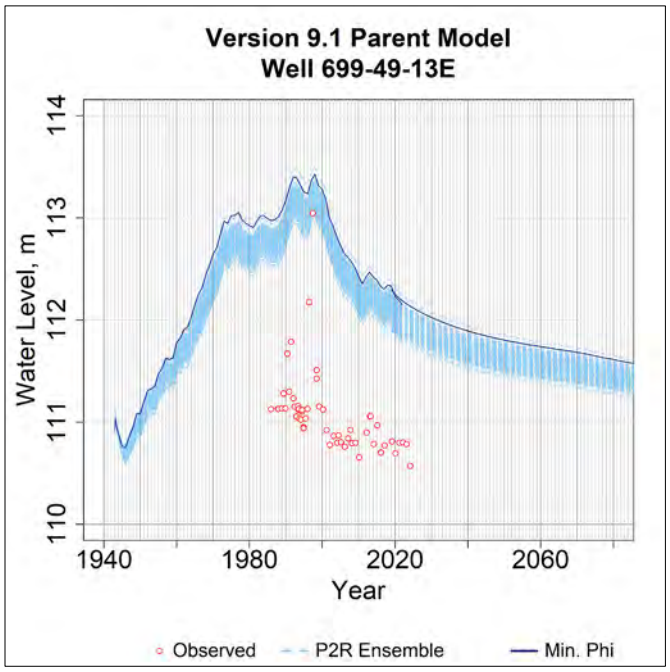

Figure B-550. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-49-13E.

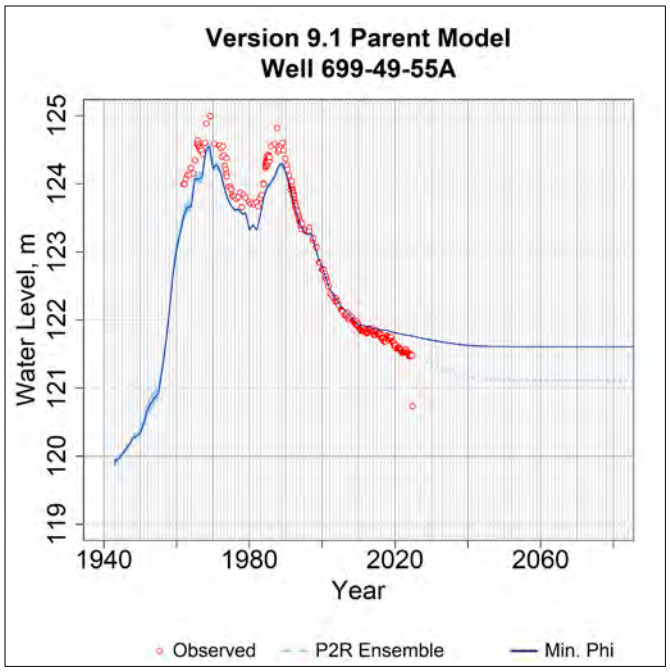

Figure B-551. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-49-55A.

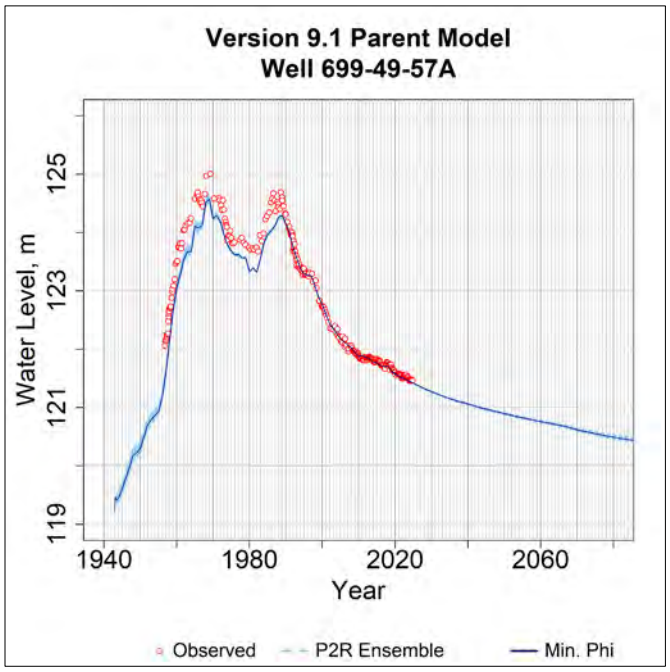

Figure B-552. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-49-57A.

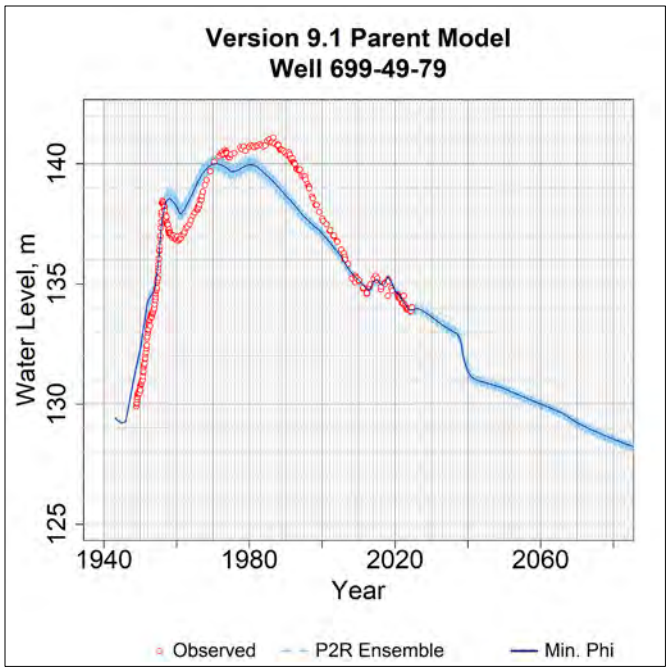

Figure B-553. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-49-79.

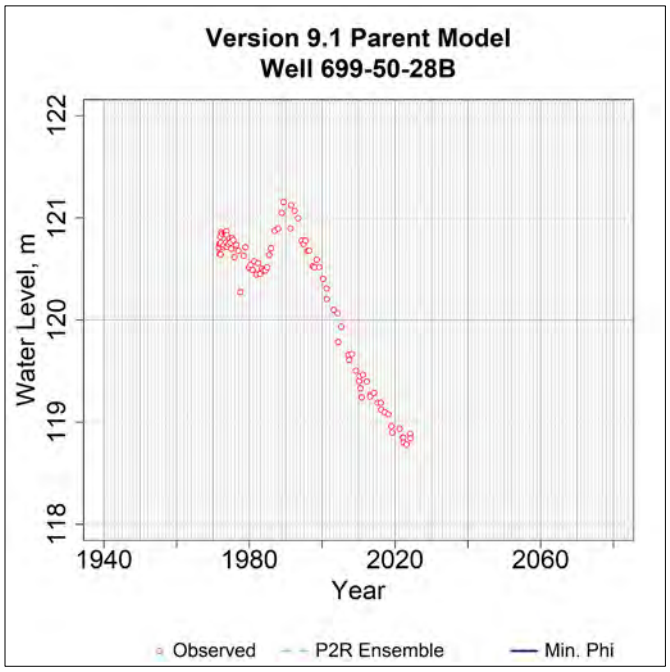

Figure B-554. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-50-28B.

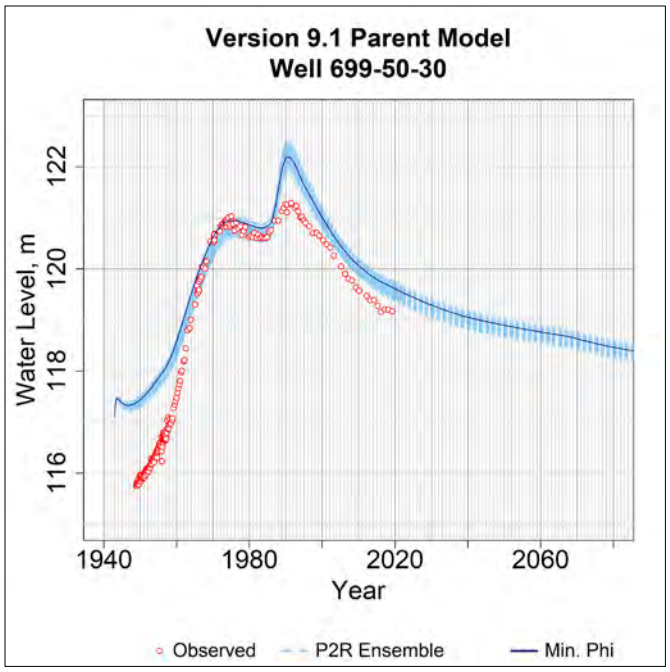

Figure B-555. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-50-30.

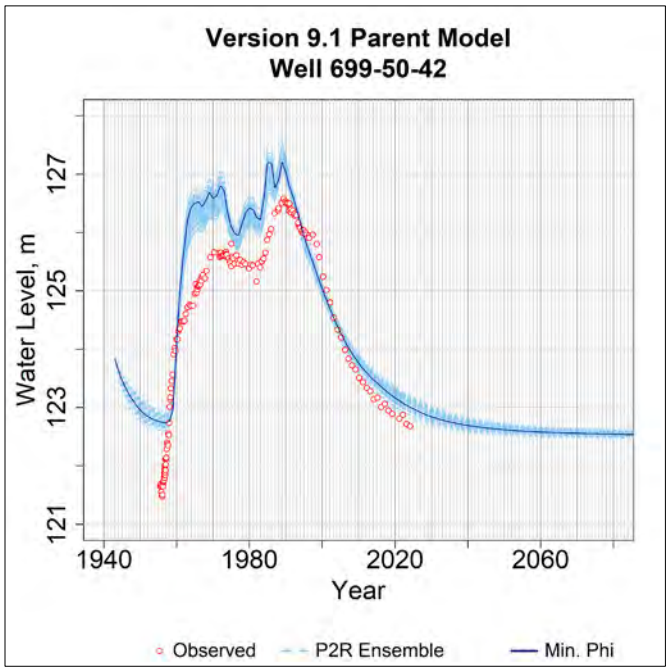

Figure B-556. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-50-42.

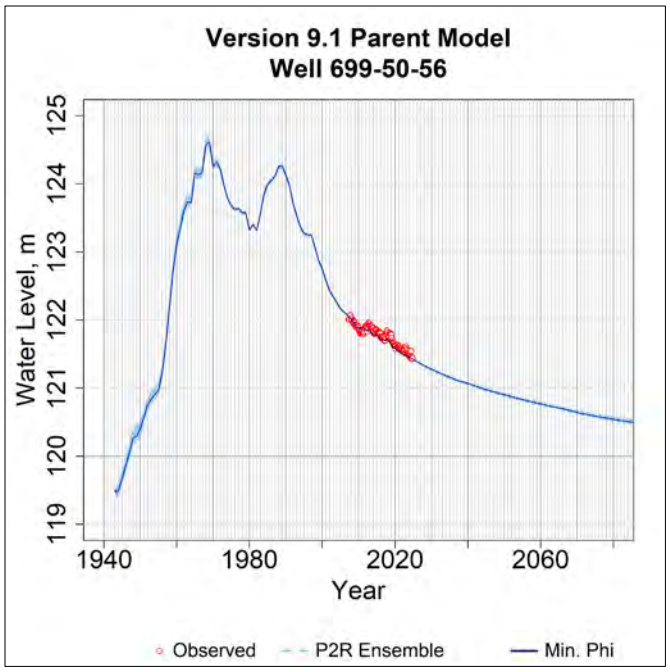

Figure B-557. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-50-56.

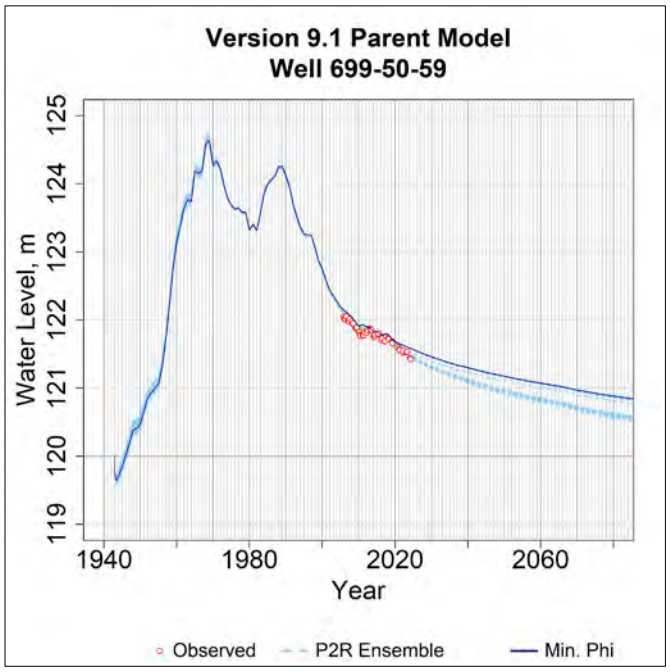

Figure B-558. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-50-59.

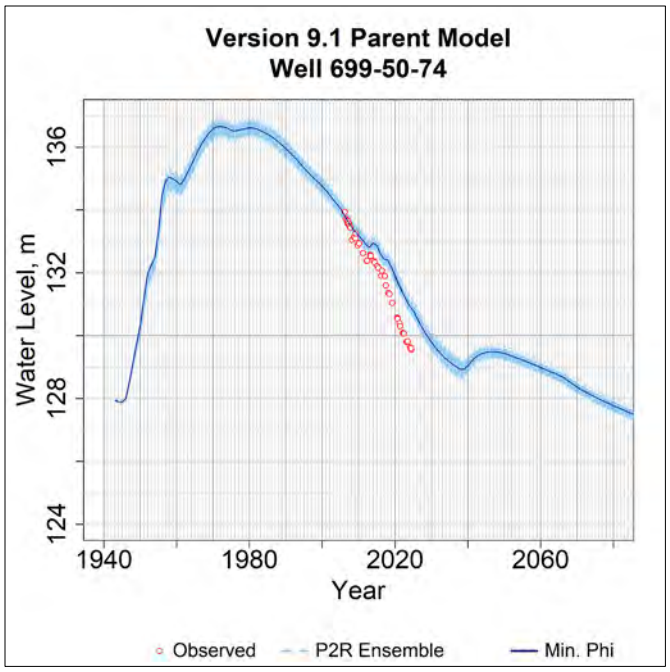

Figure B-559. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-50-74.

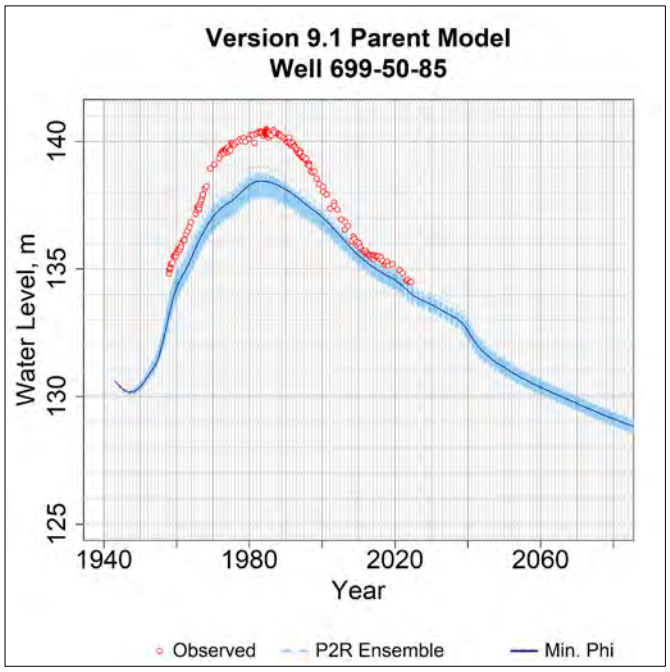

Figure B-560. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-50-85.

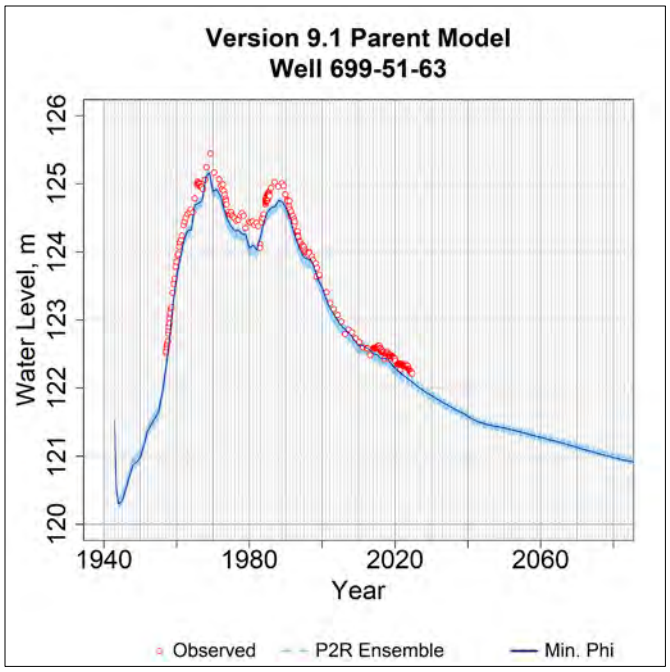

Figure B-561. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-51-63.

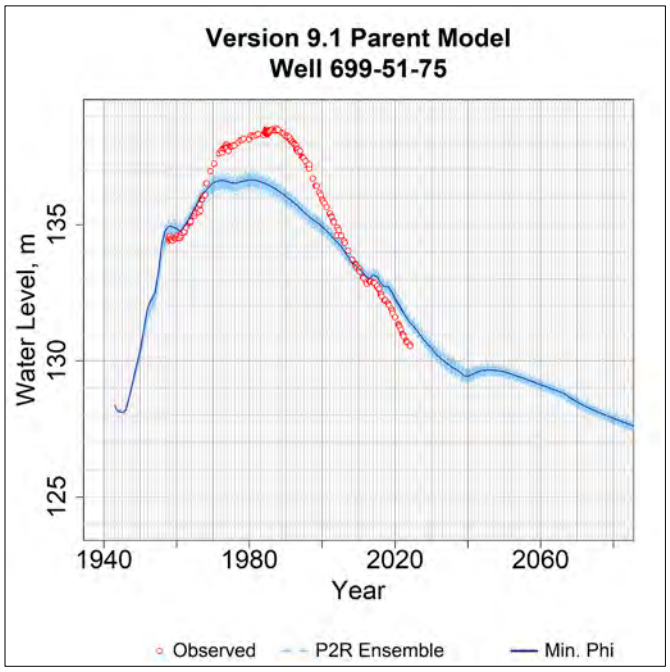

Figure B-562. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-51-75.

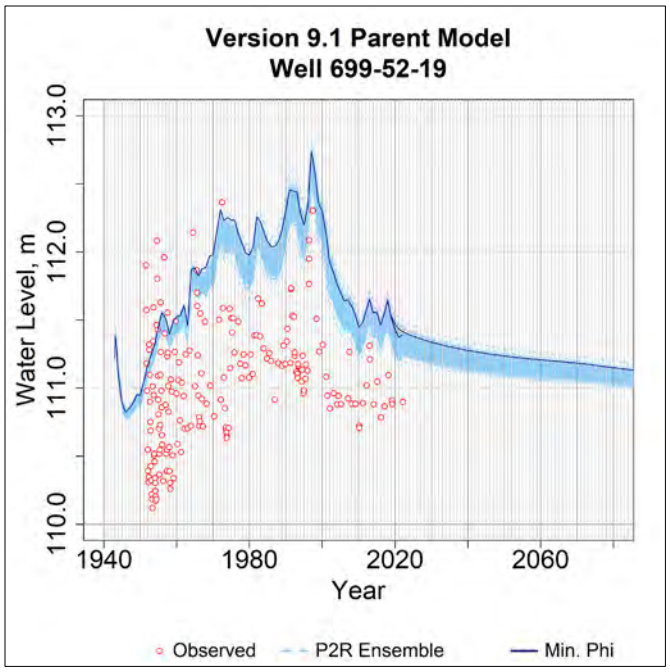

Figure B-563. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-52-19.

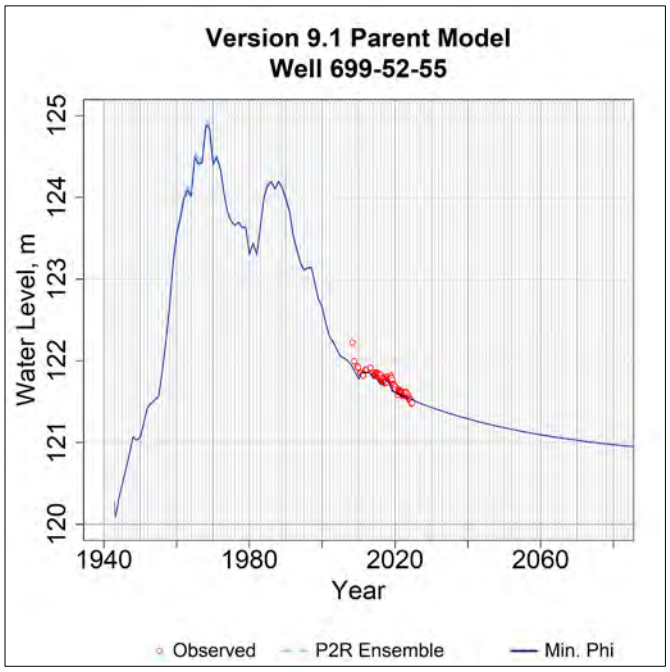

Figure B-564. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-52-55.

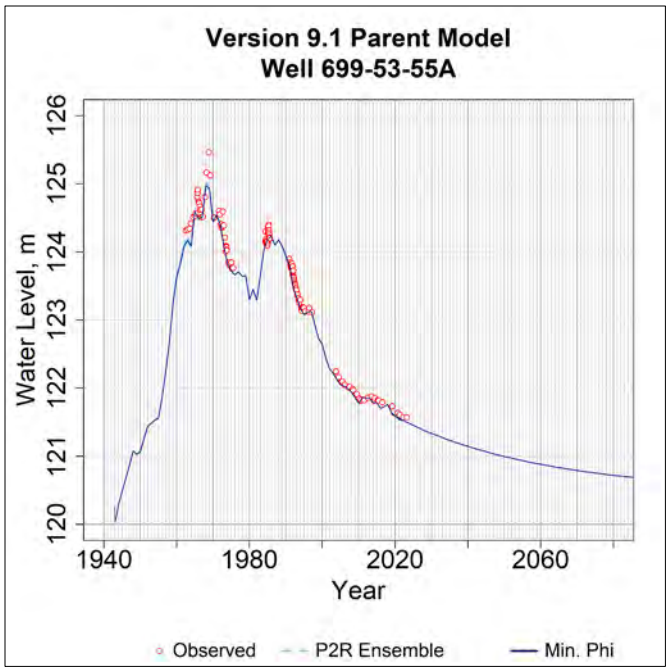

Figure B-565. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-53-55A.

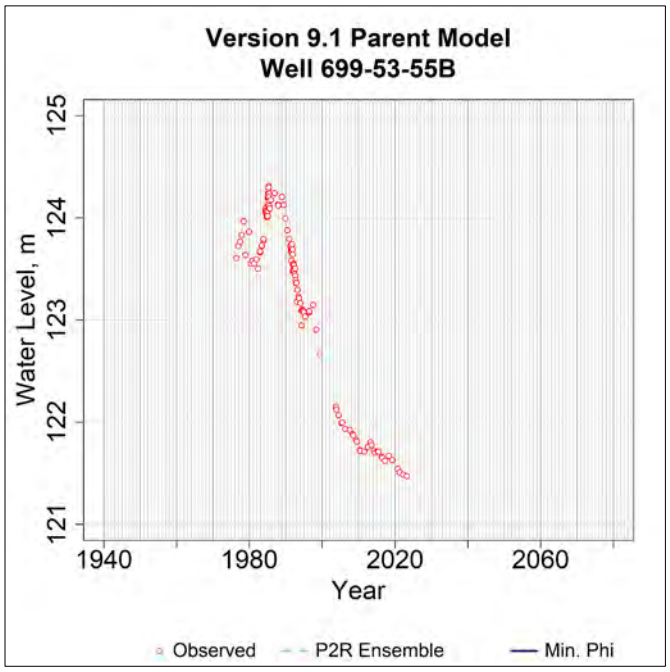

Figure B-566. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-53-55B.

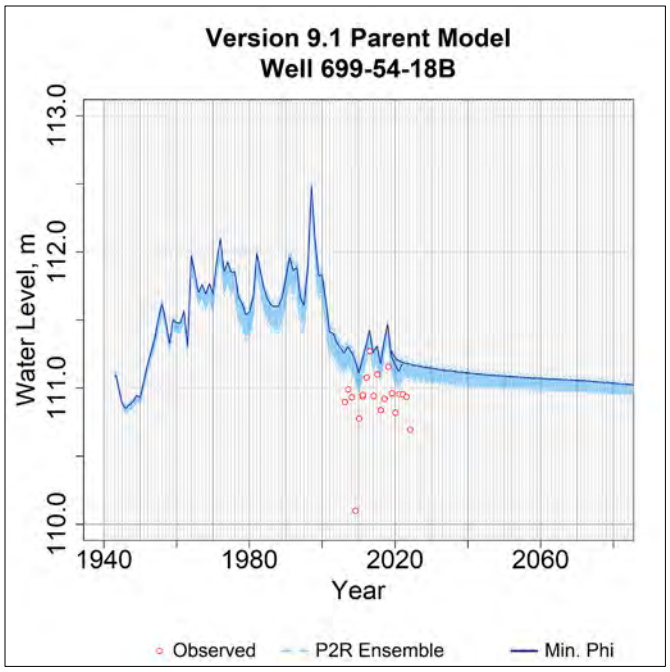

Figure B-567. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-54-18B.

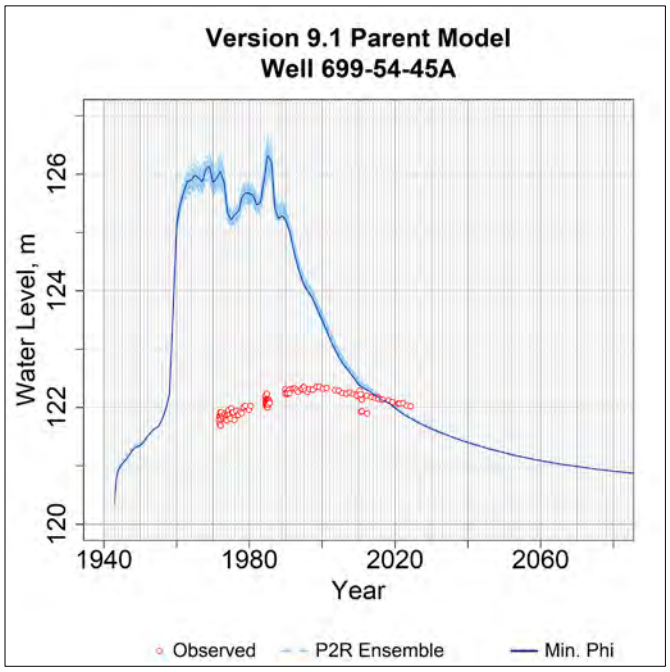

Figure B-568. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-54-45A.

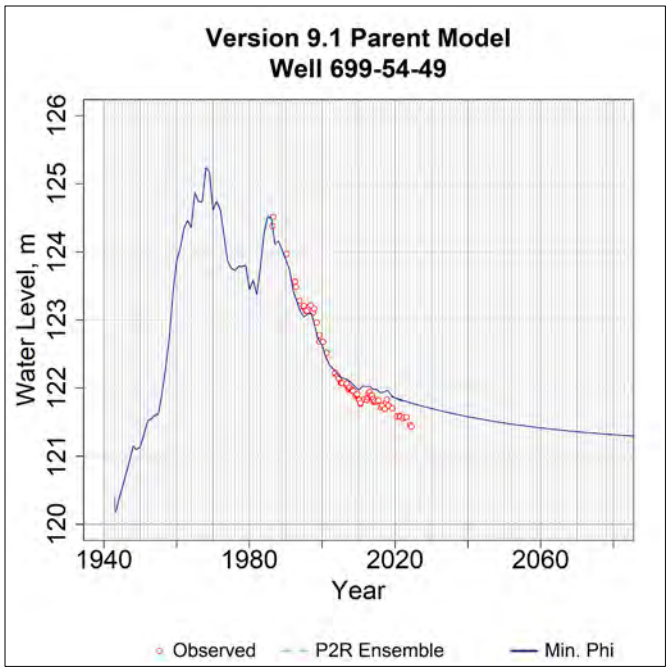

Figure B-569. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-54-49.

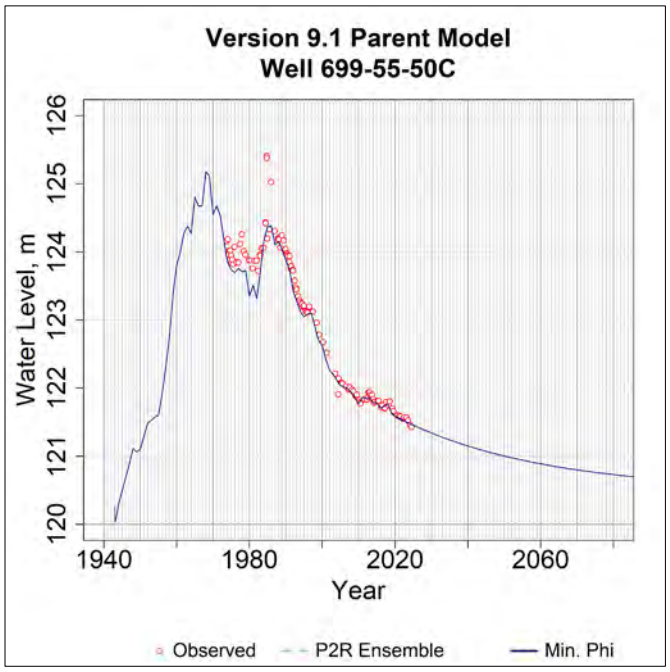

Figure B-570. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-55-50C.

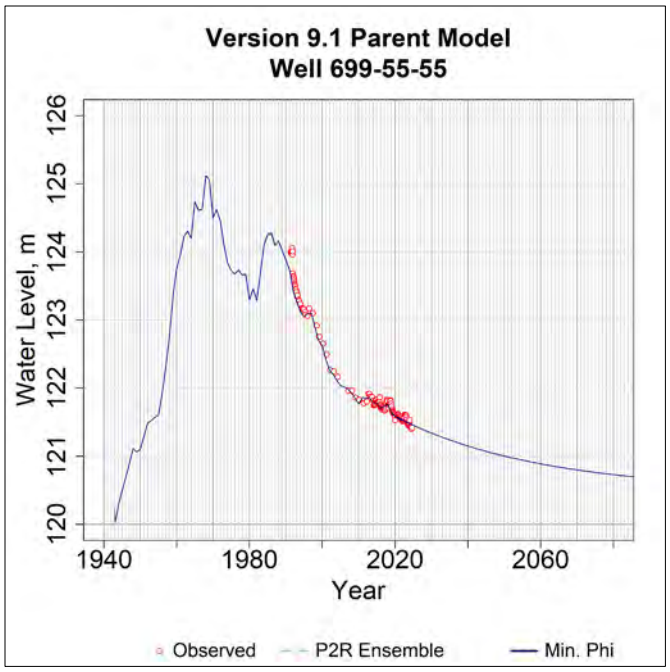

Figure B-571. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-55-55.

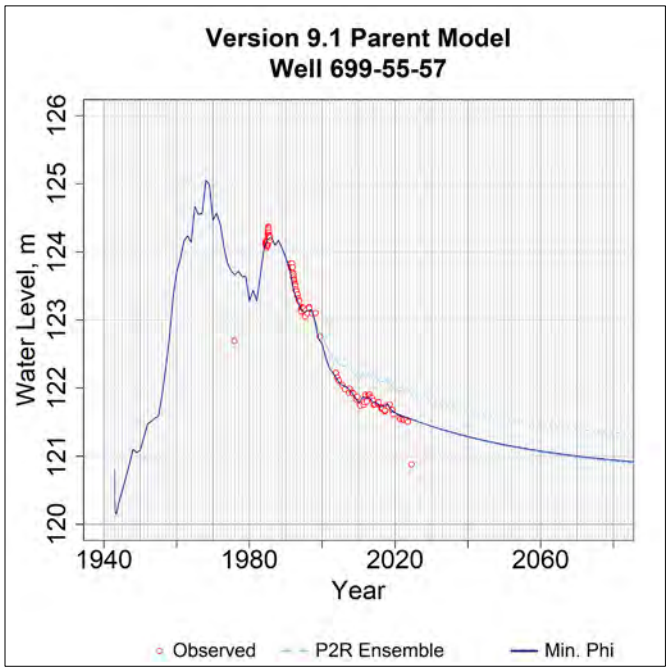

Figure B-572. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-55-57.

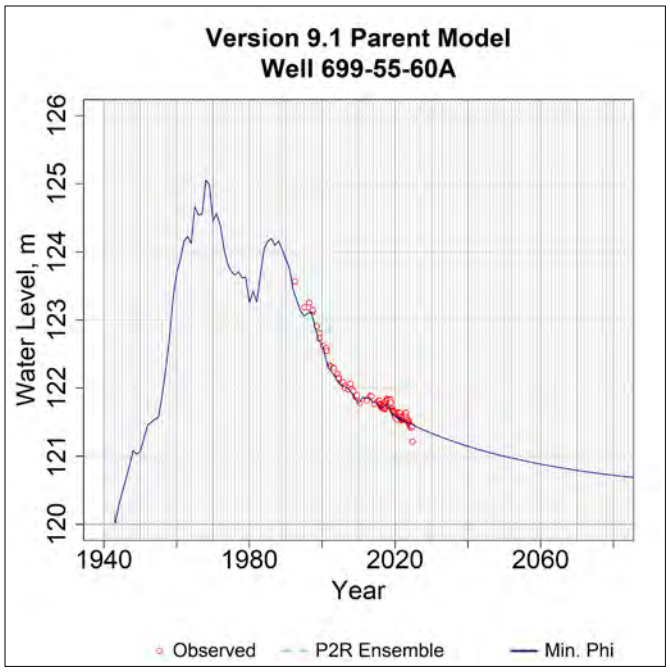

Figure B-573. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-55-60A.

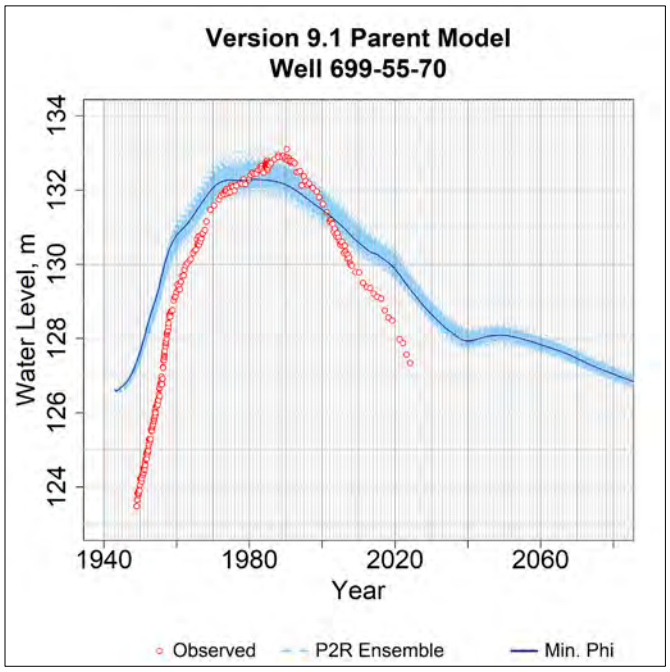

Figure B-574. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-55-70.

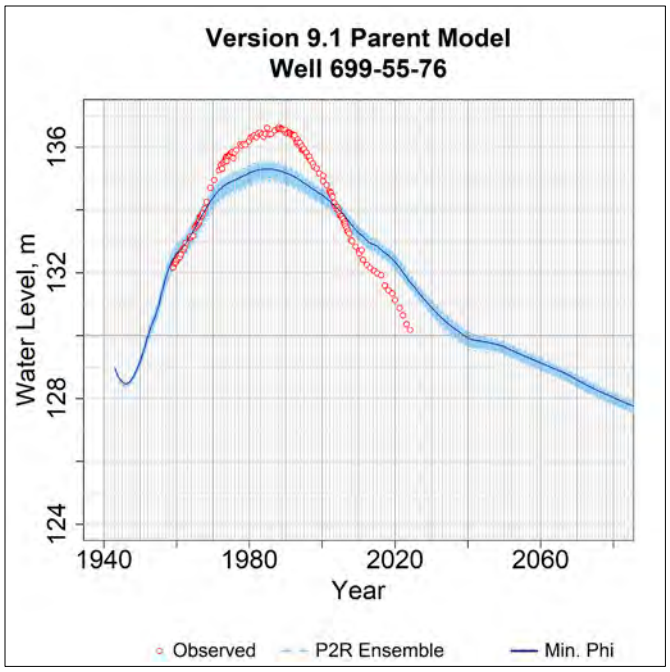

Figure B-575. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-55-76.

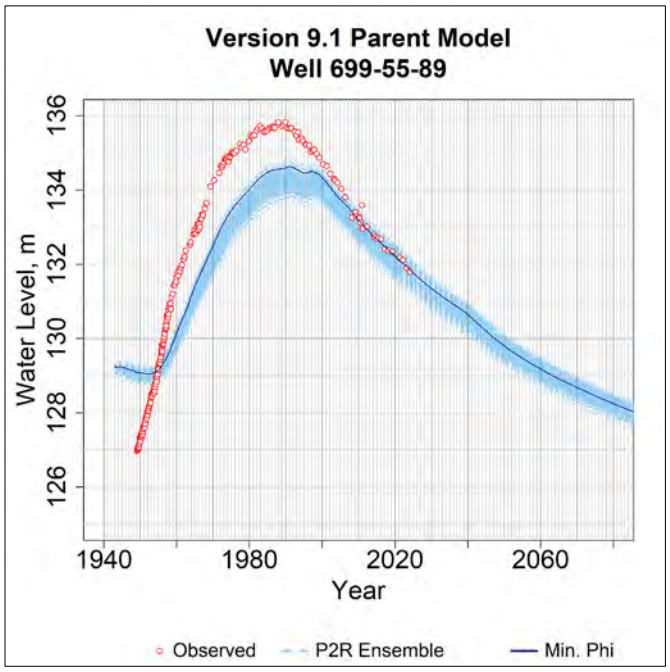

Figure B-576. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-55-89.

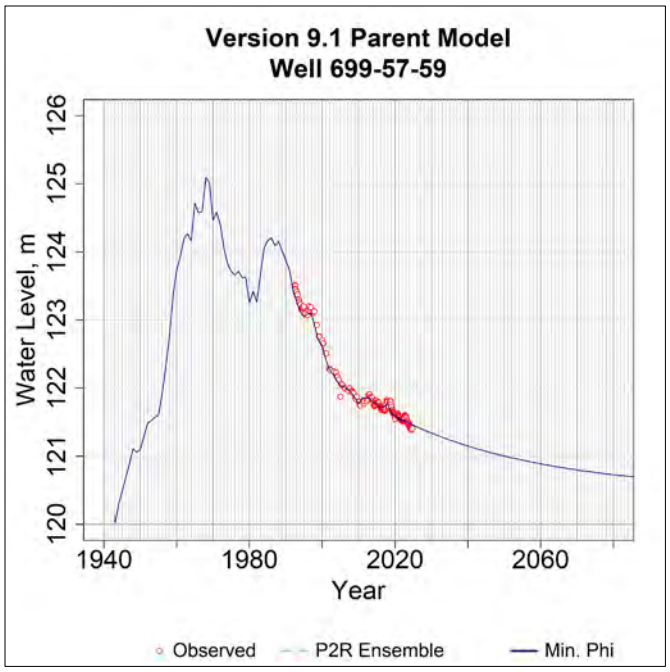

Figure B-577. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-57-59.

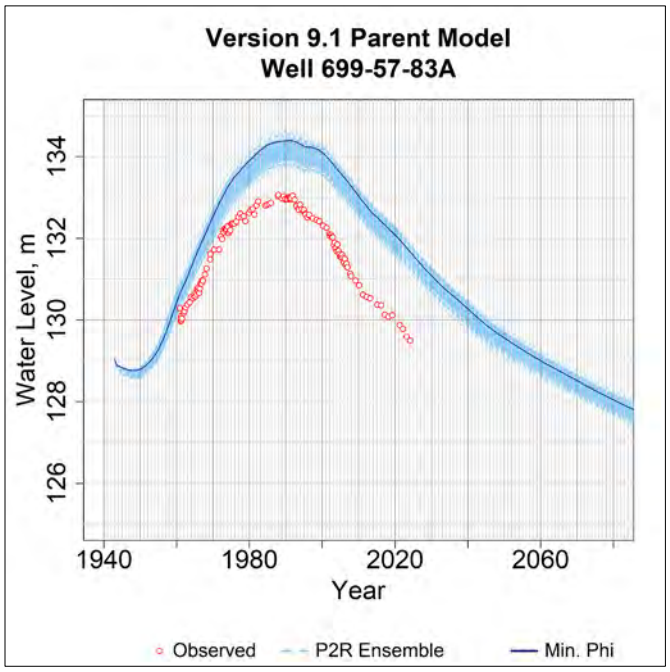

Figure B-578. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-57-83A.

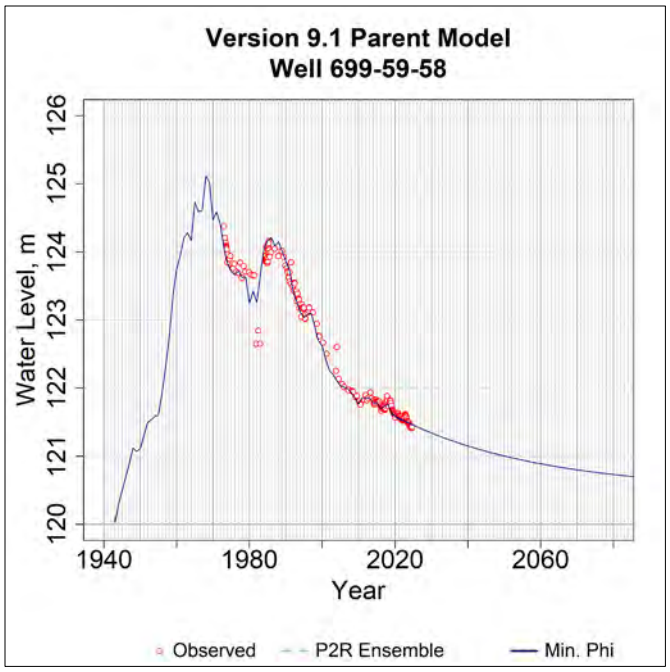

Figure B-579. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-59-58.

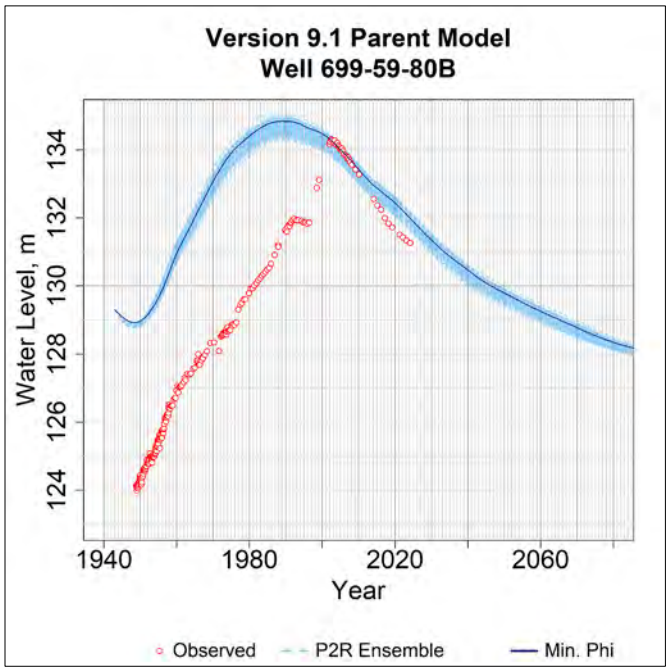

Figure B-580. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-59-80B.

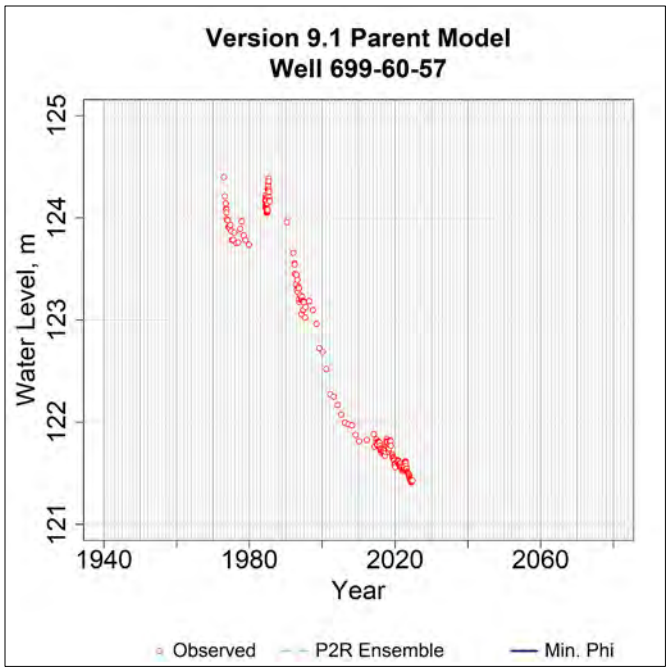

Figure B-581. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-60-57.

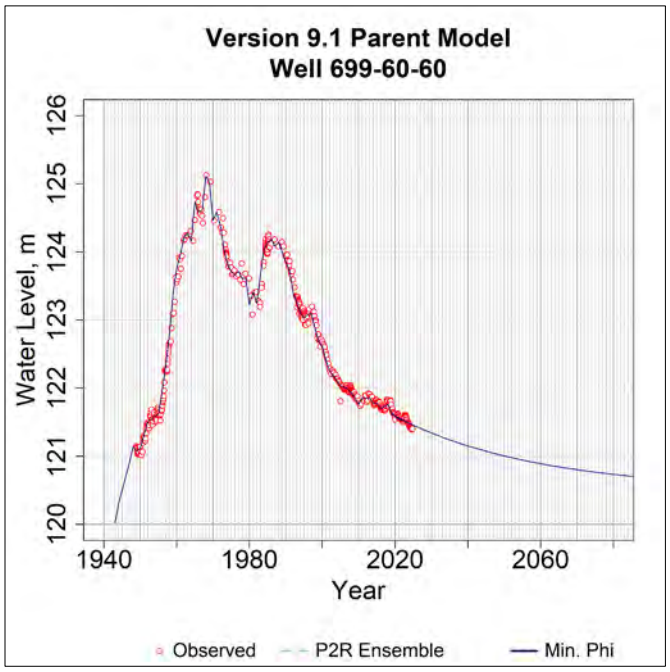

Figure B-582. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-60-60.

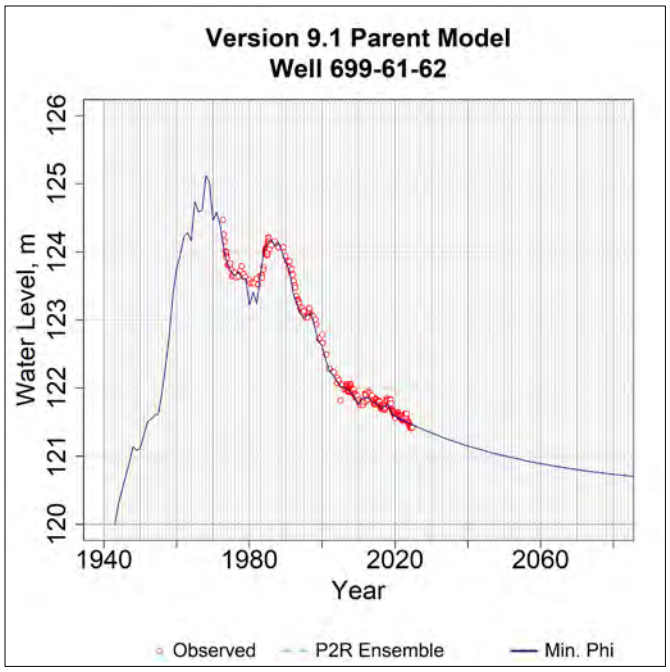

Figure B-583. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-61-62.

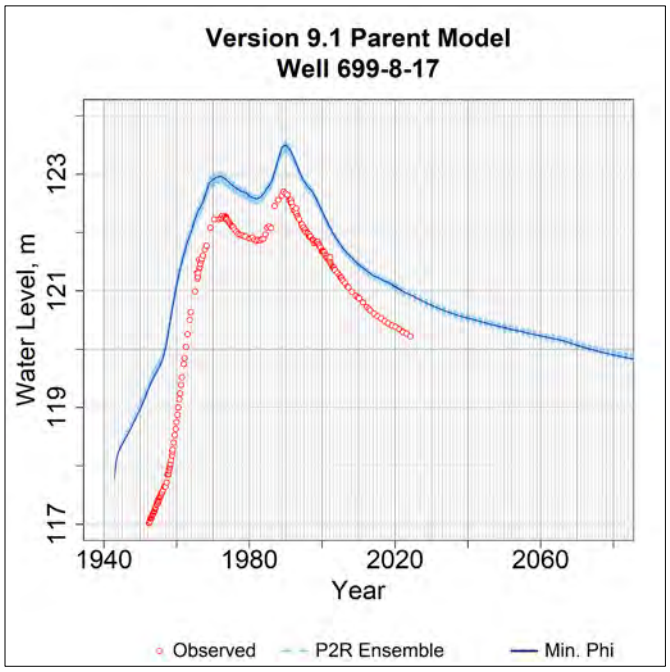

Figure B-584. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-8-17.

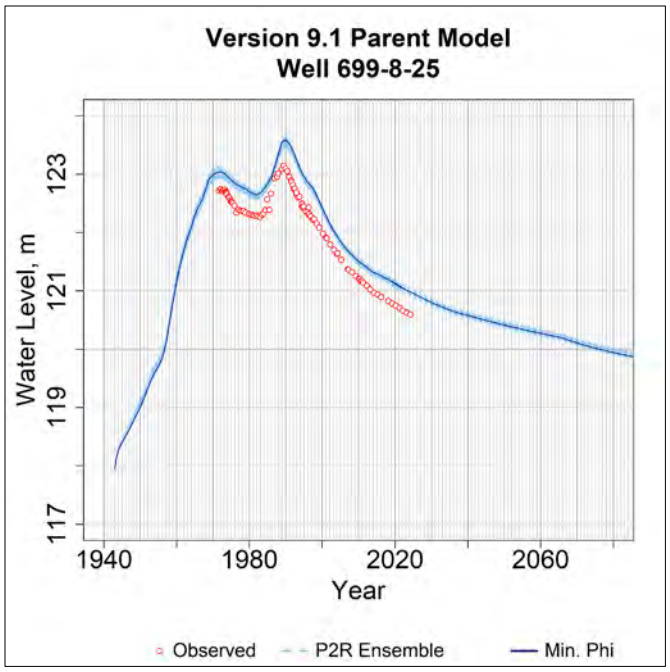

Figure B-585. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-8-25.

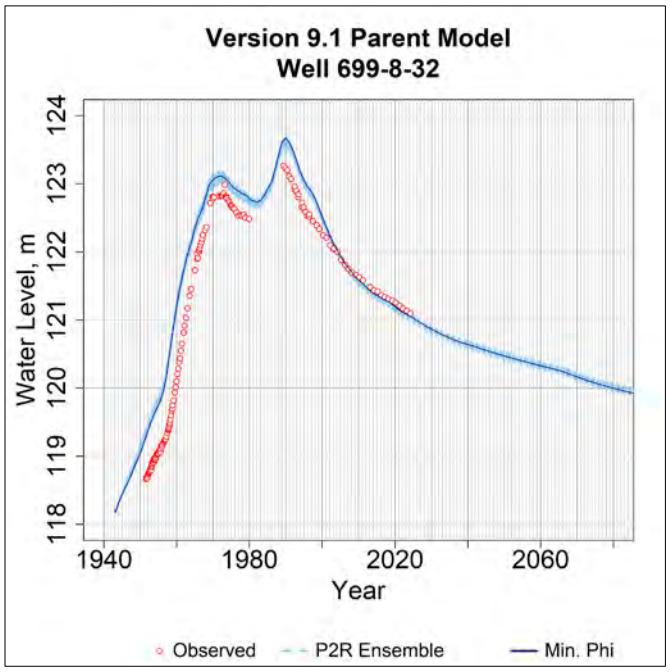

Figure B-586. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-8-32.

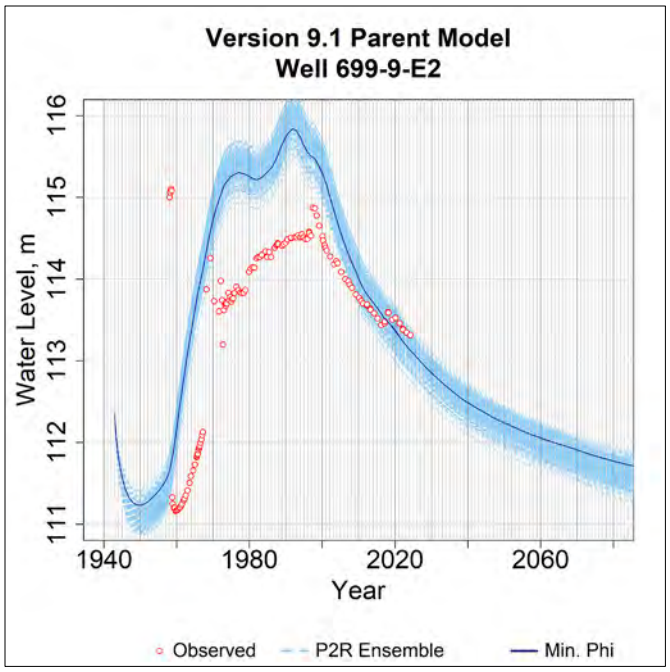

Figure B-587. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-9-E2.

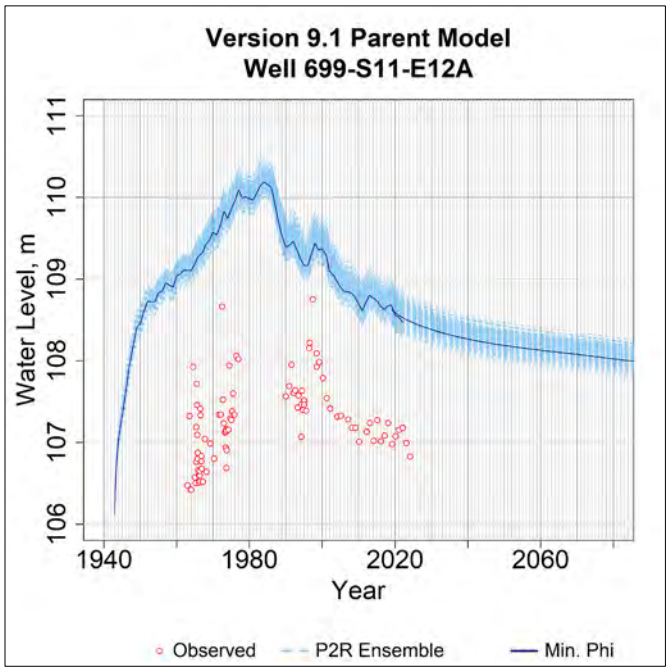

Figure B-588. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-S11-E12A.

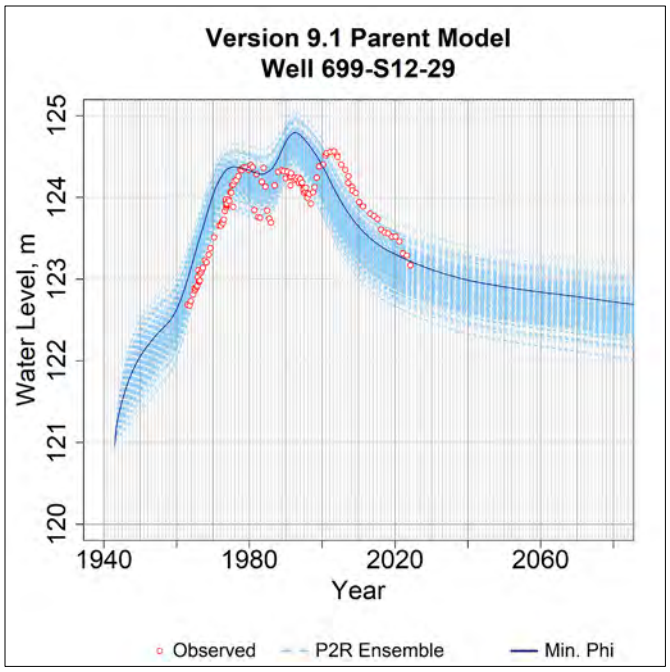

Figure B-589. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-S12-29.

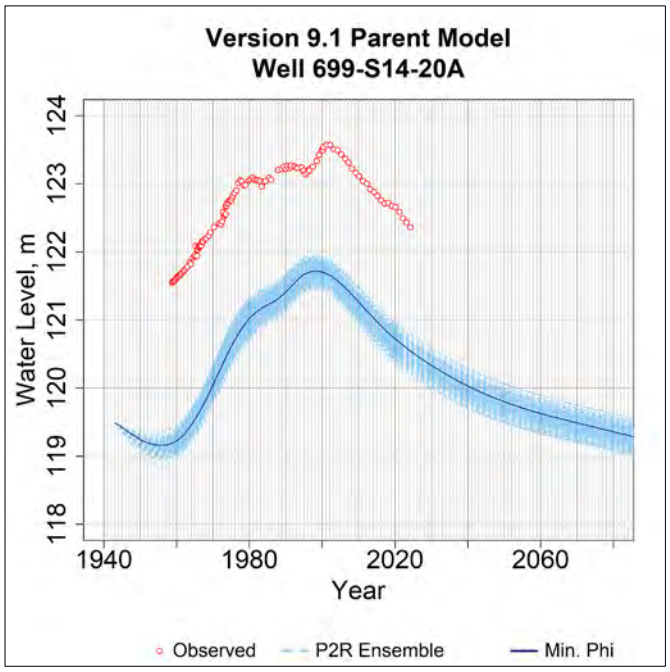

Figure B-590. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-S14-20A.

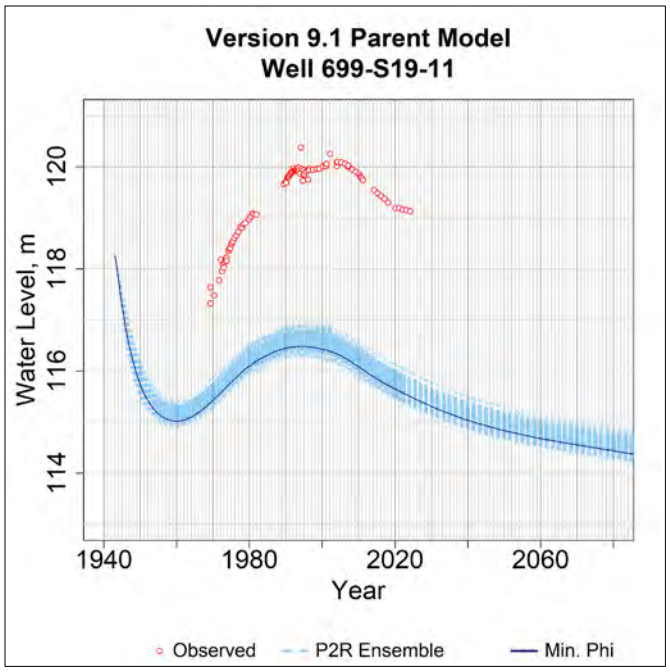

Figure B-591. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-S19-11.

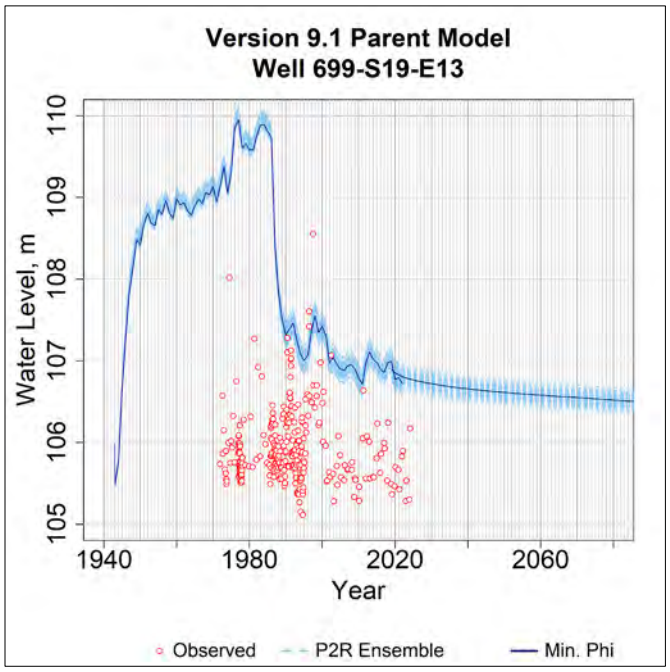

Figure B-592. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-S19-E13.

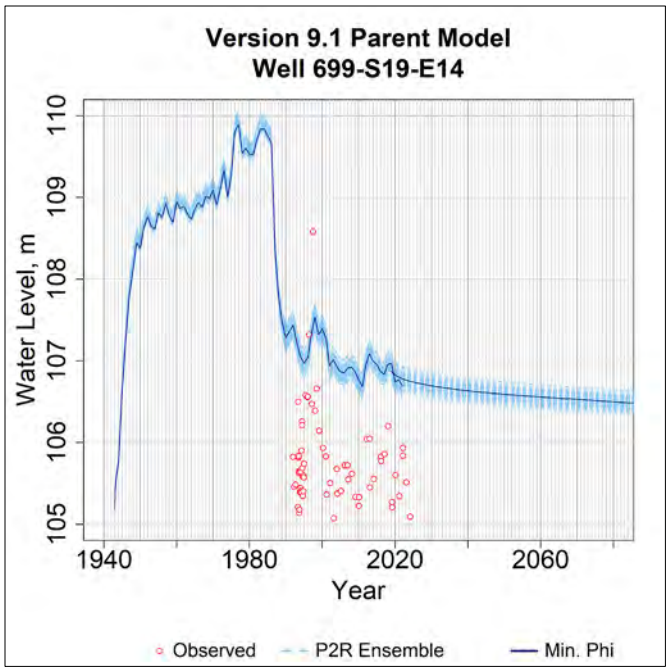

Figure B-593. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-S19-E14.

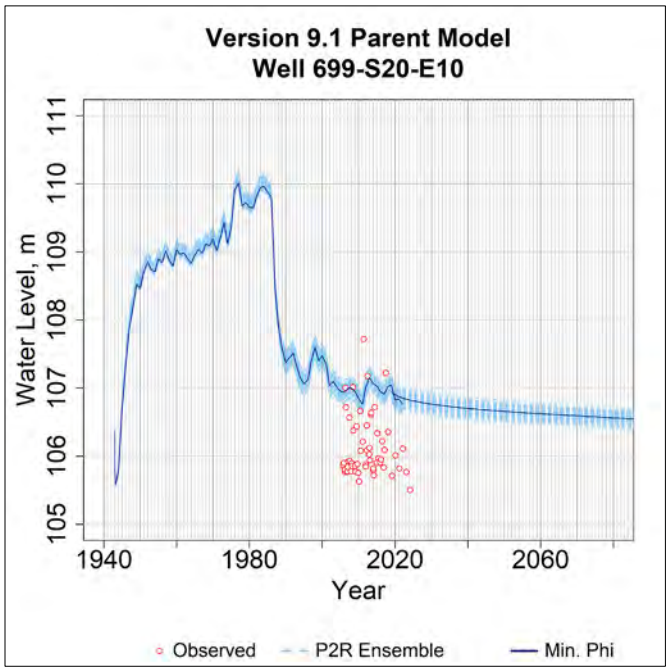

Figure B-594. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-S20-E10.

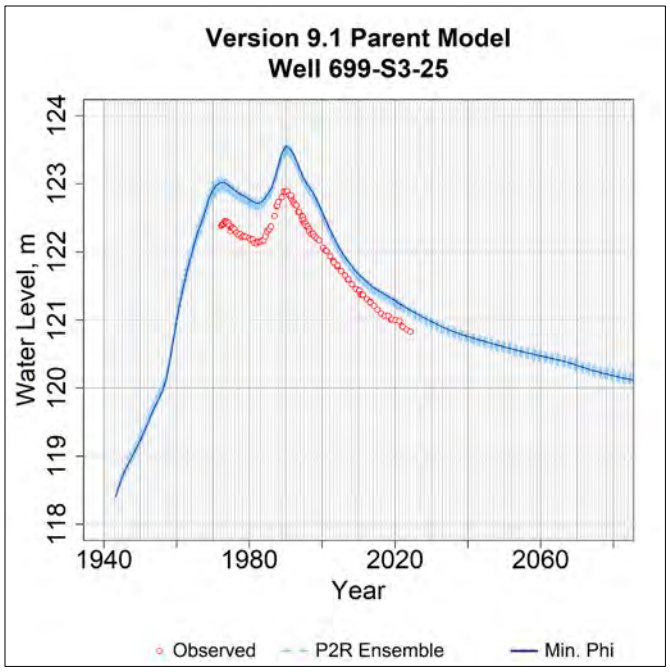

Figure B-595. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-S3-25.

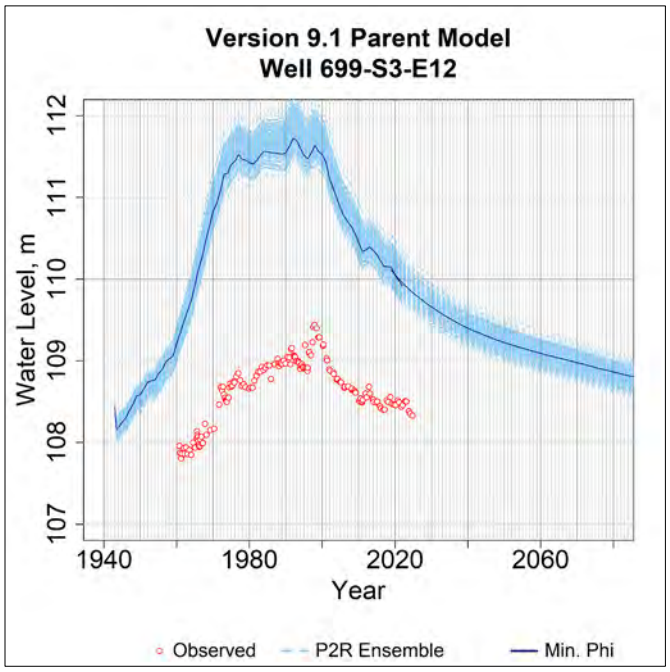

Figure B-596. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-S3-E12.

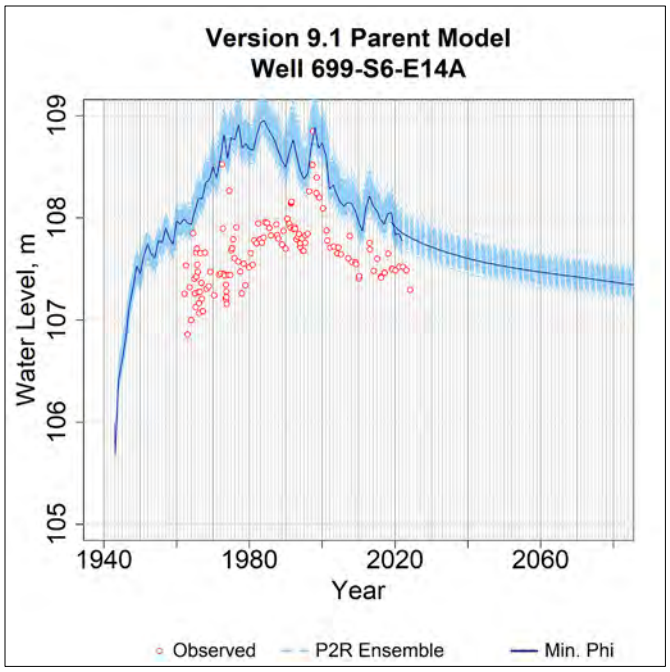

Figure B-597. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-S6-E14A.

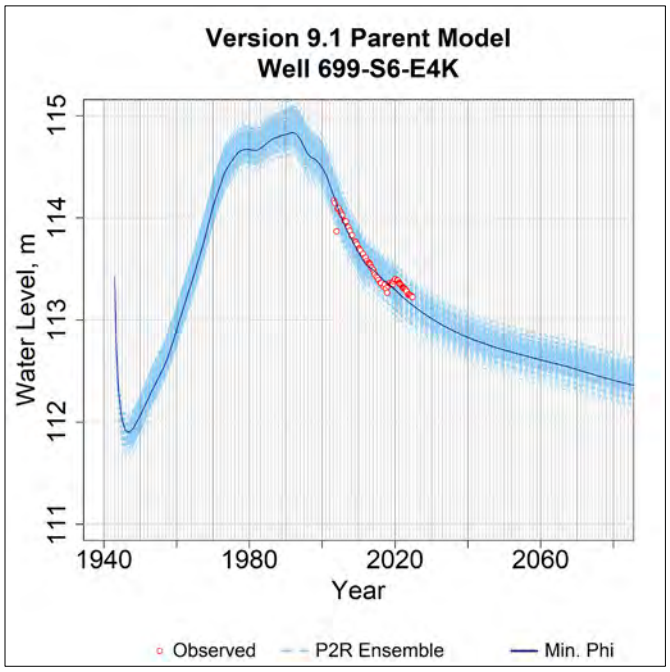

Figure B-598. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-S6-E4K.

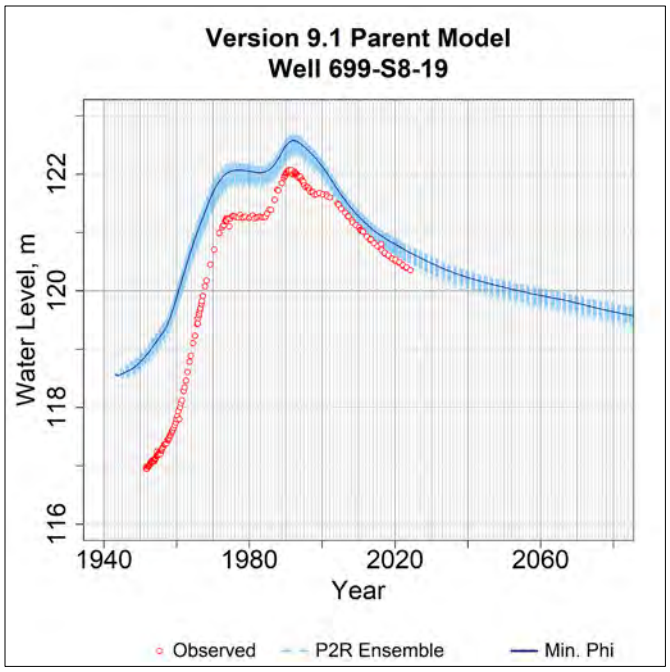

Figure B-599. Hydrograph Showing a Comparison of Observed Data to the Simulated Results of All Ensemble Realizations for Well 699-S8-19.

This page intentionally left blank.

Appendix C

EMDT-BC-0083 Cover Page

This page intentionally left blank.

ENVIRONMENTAL MODELING DATA TRANSMITTAL COVER PAGE

No.: EMDT-BC-0083 **Revision No:** 0

(Request EMDT number for Modeling Team Leader)

Title: Correspondence of Alternative Injection and Extraction Rates for Calendar Years 2023 through 2037 **Date:** Feb 22, 2023

1. Data Description

Provide the description of data set or data type.

Data included selected injection and extraction rates and locations for wells associated with the Central Plateau pump-and-treat system at the Hanford Site. Rates reflect the estimate of operations for the time period 2023 through 2037.

2. Data Intended Use

Identify the data's intended use. Describe the rationale for its selection and how the data will be incorporated into a model, report, or database. Include discussion of the extent to which the data demonstrates the properties of interest.

The data will be used for modeling applications that predict impacts of pumping rates on fate and transport of contaminants on the Central Plateau.

3. Data Sources

List databases, documents, etc. - provide sufficient detail to enable data to be located by independent reviewer.

Several separate communications were received that constitute the final set of rates. These were received primarily through email correspondence and attachments. Below is a list of the correspondence and attachments:

Email_IntitialScenarioReceipt_GregRuskauff.pdf - correspondence communicating a spreadsheet populated with well locations and rates that was reviewed by CPCCo project scientists. Source of pumpingscenario-Rev3.xlsx

pumpingscenario-Rev3.xlsx - Attachment to email containing observed 2022 pumping distribution and the expected injection/extraction rates.

Email_RateAdjustment_PaulHumphreys.pdf - correspondence of alterations to selected extraction wells in 200-UP-1 OU including well locations Ext-1 and Ext-2 that were not in the initial spreadsheet.

Email_Ext-1_Ext-2_Details_JohnMcDonald.pdf - correspondence of the locations of wells Ext-1 and Ext-2.

Email_WellLocation200-East_JohnMcDonald.pdf - correspondence of the location of four wells not received with the initial spreadsheet (299-E27-157, 299-E25-240, 299-W19-123, and 299-W19-134). Source of WellSpecification.xlsx.

WellSpecification.xlsx - Attachment to email with construction details to 299-E27-157, 299-E25-240, 299-W19-123, and 299-W19-134.

Email_FinalWellLocation_MargoAye.pdf - correspondence communicating the location of planned extraction wells to be installed in the during operations. Source of ZPDrillSeq21_23.zip and ZPMP2022009.png.

ZPDrillSeq21_23.zip - Attachment to email containing a Shapefile with the locations of extraction wells for the 200-ZP-1 OU.

Email_Final_Rates_RandalFox.pdf - Email detailing rates that superseded some rates in other spreadsheets that were reviewed by DOE and set as the final rates for 200-West extraction wells.

"ZZP-1 and UP-1 Extraction Well Flow Rates_projected_3-15-2023.xlsx" - Spreadsheet attached to Email_Final_Rates_RandallFox.pdf that have the extraction rates for 200-West extraction wells.

Concurrence_For_200East_FinalRates.pdf - correspondence detailing the decision to reduce extraction in 200-East Area wellse from 410 as originally estimated to 400 per the reviewed total by DOE in "ZZP-1 and UP-1 Extraction Well Flow Rates_projected_3-15-2023.xlsx"

ENVIRONMENTAL MODELING DATA TRANSMITTAL COVER PAGE (Continued)

No.: EMDT -BC-0083 Revision No: 0

(Request EMDT number for Modeling Team Leader)

Title: Correspondence of Alternative Injection and Extraction Rates for Calendar Years 2023 through 2037 Date: Feb 22, 2023

4. Impact of Use or Nonuse of Data

Describe the importance of the data to the model, report, and/or conclusions which they support. Identify the value added and discuss the impacts of not using the data.

Use is critical to evaluate impacts of predicted operations on mass removal from contaminant plumes.

5. Prior Use

Identify the data's prior uses. Describe whether the data have been used in similar applications by the scientific or regulatory community. Include the associated verification processes and prior reviews and review results.

Initial release so no prior use of data.

6. Data Acquisition Method(s)

Describe the data acquisition method and associated QA/QC, considering the following:

a. Qualifications of personnel or organizations generating the data;
b. Technical adequacy of equipment and procedures used;
c. Environmental and programmatic conditions if germane to the data quality;
d. The extent to which acquisition processes reflect modeling requirements;
e. The quality and reliability of the measurement control program;
f. The degree to which independent audits of the process were conducted;
g. Extent and reliability of the associated documentation.

Data are estimates provided by project scientists assigned to operable units. As predictions the continued use of these predictions should be considered when observed extraction and injection rates are available.

For databases, identify query language used to obtain data from database (SQL, etc.), briefly describe the query description and attach copy.

7. Corroborating Data

Identify and discuss any corroborating datasets. Provide any documentation that confirms the corroborating data substantiate existing parameter values, distributions, or data quality.

None available at this time.

8. Data Quality Considerations

Discuss data quality considerations not identified in other sections. Include discussion of data quality indicators (i.e., accuracy, precision, representativeness, completeness, and comparability).

The estimates cover all wells involved in pump-and-treat operations on the Central Plateau. However, as predictions, the observed values should be considered when available.

9. Assumptions and Limitations on Data Use

Document known uncertainties, assumptions, constraints or limits on data.

ENVIRONMENTAL MODELING DATA TRANSMITTAL COVER PAGE (Continued)

No.: EMDT-BC-0083 Revision No: 0

(Request EMDT number for Modeling Team Leader)

Title: Correspondence of Alternative Injection and Extraction Rates for Calendar Years 2023 through 2037 Date: Feb 22, 2023

9. Assumptions and Limitations on Data Use

Assumptions have been made regarding the location of some wells that have not been constructed and the rates at wells into the future. When available, the use of observed rates should be considered for applications.
For injection rates in the future, this data assumes that the relative distribution that occurs in 2022 carries on in the future.

DATA CONFIGURATION ITEM SUBMITTAL:

Data Provider Submittal:

Position: Senior Hydrogeologist

Trevor Budge
Print First and Last Name

TREVOR BUDGE (Affiliate)
Digitally signed by TREVOR BUDGE (Affiliate)
Date: 2024.04.03 17:18:41 -07'00'
Signature / Date

DATA CONFIGURATION ITEM REVIEW AND VERIFICATION:

10. Verification Process

Describe steps taken to verify that these data are appropriate for intended use, noting any limitations.

Data were reviewed for completeness and internal consistency and verified against transmittal information.

11. Summary of Data Review

The review shall ensure that the report meets the listed criteria. Consideration includes ensuring that the data collection method employed was appropriate for the type of data being considered an confidence in the data acquisition and subsequent processing methodology is warranted.

Is documentation technically adequate, complete, and correct? ☒ Yes ☐ No

Are uncertainties and limitations on appropriate use of data discussed? ☒ Yes ☐ No

Are the assumptions, constraints, bounds, or limits on the data identified? ☒ Yes ☐ No

APPROVAL OF DATA CONFIGURATION ITEM:

Data Reviewer Approval:

Position: Groundwater Modeler

Stephanie Tomusiak
Print First and Last Name

Stephanie Tomusiak
Digitally signed by Stephanie Tomusiak
Date: 2024.04.03 18:24:17 -06'00'
Signature / Date

This page intentionally left blank.