UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

In the Matter of CROW BUTTE RESOURCES, INC. (Marsland Expansion Area)	Docket No. 40-8943-MLA-2 ASLBP No. 13-926-01-MLA-BD01

Hearing Exhibit

Exhibit Number: CBR017

Exhibit Title: Appendix GG - MEA Drawdown Impact Analysis

AquiferTek

Mr. Robert Tiensvold
Mine Manager
Cameco Resources
Crow Butte Facility
P.O. Box 169
Crawford, NE 69339

May 11, 2016

Re: Drawdown Impact Assessment, Marsland Expansion Area (MEA)

This report has been prepared in response to a request by the U.S. Nuclear Regulatory Commission (NRC) for an analysis of the drawdown impacts resulting from Marsland Expansion Area (MEA) operations, and the cumulative drawdown impacts resulting from the simultaneous operation of the MEA, Crow Butte (CBO), and Three Crow Expansion Area (TCEA) facilities. The scope of work for this analysis is provided in a summary of the April 6, 2016 teleconference between the NRC and Crow Butte Resources.

METHODOLOGY

Drawdown of the potentiometric surface of the Basal Chadron Aquifer was computed using the Theis solution for confined aquifers (Theis, 1935) included in AquiferWin32® analytical modeling software by Environmental Simulations Inc. Drawdown impacts were computed over the period 2011 through 2052, corresponding to the approximate historical groundwater monitoring period at MEA, future ISR facility operations, and aquifer recovery period. Cumulative drawdown impacts from multiple ISR facilities were computed by summing the drawdown impacts of individual facilities using the principal of superposition. Additional drawdown resulting from a lateral no-flow boundary was computed using image well theory (e.g. Ferris and others, 1962).

MODEL INPUT PARAMETERS

Aquifer transmissivity and storativity for MEA, CBO, and TCEA were obtained from results of site-specific aquifer testing (Aqui-Ver, 2015). Representative values of aquifer transmissivity and storativity for each facility were input into the analytical flow model as follows:

MEA: Transmissivity = 1012 ft^2/day

Storage Coefficient = 7.46×10^{-5}

CBO: Transmissivity = 479 ft^2/day (Initial Estimate)

Storage Coefficient = 8.8 x 10^{-5} (Initial Estimate)

TCEA: Transmissivity = 480 ft^2/day

Storage Coefficient = 8.8 x 10^{-5}

Transmissivity and storativity values for the CBO facility were lowered from initial estimates cited above as part of the model calibration process (described in more detail later in this report).

Pumping rates for the drawdown impact assessment were assigned based on future annual average consumptive use estimates provided by Cameco Resources for MEA, CBO, and TCEA (**Attachment A**). Future consumptive use estimates assume 25% Reverse Osmosis (RO) efficiency at CBO based on historical performance, and 30% RO efficiency at MEA and TCEA (conservative estimate). For the period 2011-2015, actual consumptive use rates were used for the CBO facility (**Attachment A**).

Simulated pumping well locations for MEA, CBO and TCEA are shown in **Figures 1 and 2**. The total discharge rate for each mine unit at MEA was distributed evenly between six wells per mine unit in order to provide a more detailed assessment of drawdown within ISR wellfields at MEA. Discharge from mine units at CBO and TCEA was assigned to a single well location in each mine unit given the regional nature of drawdown impacts from these facilities upon the MEA.

DRAWDOWN IMPACT ASSESSMENT (THEIS ANALYSIS)

ISR operations at MEA were initially projected to begin in 2015 (e.g. Appendix T of the MEA Technical Report). The projected start of ISR operations at MEA is assumed to be January 2020 for purposes of this assessment. Drawdown impacts resulting from MEA operations were computed over the period 2020 to 2042, the expected duration of MEA ISR operations. A 10-year aquifer recovery period was also simulated over the period 2042 through 2052.

The projected drawdown impact due to MEA operations using the Theis solution is illustrated on the drawdown contour map in **Figure 3** for the year 2028 (time of maximum cumulative drawdown impacts at MEA). Projected drawdown impacts resulting from MEA operations in site monitoring wells, wellfields, and at a 2.25-mile radius from the MEA permit boundary (Area of Review) using the Theis solution are provided in **Figures 4 thru 16**. Maximum drawdown impacts within ISR wellfields and monitor wells due to MEA operations are projected to be less than 54 feet using the Theis solution.

Drawdown impacts at MEA resulting from CBO and TCEA operations were also computed using the Theis solution. Drawdown impacts from CBO operations were simulated over the historical operating period through the expected end of CBO operations in 2028. Drawdown impacts resulting from TCEA operations were computed from 2023 to 2042, the expected duration of TCEA ISR operations. Aquifer recovery at CBO and TCEA was simulated from the end of operations through 2052.

Drawdown impacts at MEA resulting from CBO and TCEA operations using the Theis solution are illustrated in **Figures 4 thru 16**. Maximum drawdown in MEA wellfields and monitor wells resulting from CBO and TCEA operations is projected to be less than 28 and 14 feet, respectively, over the period 2011 through 2042 using the Theis solution.

Cumulative drawdown impacts resulting from the simultaneous operation of MEA, CBO, and TCEA facilities were computed by summing drawdown impacts using the Theis solution from individual facilities (principal of superposition). Maximum cumulative drawdown (in year 2028) at the MEA is illustrated on the drawdown contour map in **Figure 17,** and on hydrographs in **Figures 4 thru 16**. Maximum cumulative drawdown within MEA wellfields and monitor wells is projected to be less than 77 feet over the period 2011 through 2042 using the Theis solution.

DRAWDOWN IMPACT ASSESSMENT INCLUDING NO-FLOW BOUNDARY

The predicted drawdown in MEA monitor wells over the period 2011-2015 is approximately 9 to 11 feet using the Theis solution and initial estimates of aquifer transmissivity (**Figures 4 thru 16**). The observed drawdown in MEA monitoring wells from 2011-2015, presumably due to CBO operations, is approximately 20 to 23 feet. Thus, the Theis drawdown impact model under-predicts observed drawdown at the MEA using initial estimates of aquifer parameters (and assuming no other sources of drawdown impacts). Adjusting initial estimates of transmissivity and storativity at CBO over a range of reasonable values does not significantly improve the under-prediction of drawdown at MEA.

Degraw (1969, 1982) and Sibray (2010) presented geological data from regional boreholes and oil and gas wells that illustrated the distribution of the Basal Chadron Sandstone in northwestern Nebraska. The Basal Chadron Sandstone was deposited in a fluvial stream environment within a regional paleochannel possessing lateral boundaries (corresponding to zero sandstone thickness). The eastern MEA and CBO permit boundaries are located approximately 3 miles west of the lateral flow boundary, which trends northwest-southeast parallel to the main mineralized trend at MEA and CBO. The finite extent of the Basal Chadron Sandstone to the east of the MEA and CBO forms a lateral no-flow boundary that would act to increase drawdown and is not accounted for using the conventional Theis drawdown solution.

Lateral groundwater flow boundaries can be accounted for using analytical modeling techniques (e.g. Theis solution) and image well theory (e.g. Ferris, 1962). To account for a no-flow

boundary using image well theory, a mirror image of the actual wellfield is created with the "mirror" located at the presumed location of the no-flow boundary. Drawdowns resulting from the actual and image wellfields are then added together using the principal of superposition.

Image well theory was applied to predict the drawdown resulting from a lateral no-flow boundary at MEA and CBO. To accomplish this, the drawdown predicted using the Theis solution for MEA and CBO were first added together using the principal of superposition. The resulting drawdown distribution was then transposed uniformly by a distance of 39,000 feet east and 9,000 feet north to create a mirror image of the drawdown resulting from CBO and MEA on the opposite side of the no-flow boundary. The image wellfield drawdown was then added to the cumulative Theis drawdown distribution. **Figure 18** illustrates the projected cumulative drawdown at MEA including a lateral no-flow boundary in the year 2028 (corresponding to the period of maximum cumulative drawdown at MEA and CBO). **Figure 19** is a hydrograph of the Mine Unit 1 wellfield showing the maximum cumulative drawdown including a lateral no-flow boundary. The maximum cumulative drawdown in MEA wellfields and monitor wells is projected to be less than 111 feet over the period of ISR operations (2011 to 2042).

In order for model projected drawdown to closely match observed drawdown at the MEA over the period 2011-2015 (e.g. model calibration), the transmissivity and storativity of the CBO drawdown model was reduced slightly (in addition to the inclusion of a lateral no-flow boundary). The resulting calibrated transmissivity and storativity of the CBO drawdown model is 360 ft^2/day and 4.0×10^{-5}, respectively (values are similar to results of aquifer tests 1 thru 3 at CBO).

Results of model drawdown calculations including a lateral no-flow boundary and calibrated transmissivity are in close agreement with observed drawdown in MEA monitor wells over the period 2011-2015 (approximately 20 feet of observed drawdown and model calculated drawdown). The drawdown model can therefore be considered calibrated for purposes of drawdown prediction.

REGIONAL DRAWDOWN IMPACTS

The NRC has requested an assessment of regional drawdown impacts due to simultaneous operation of CBO, MEA, and TCEA facilities. Regional drawdown impacts, including a lateral no-flow boundary, were calculated in a manner identical to MEA drawdown calculations (e.g. Theis drawdown, image well theory, and superposition). The resulting cumulative regional drawdown in 2028 (time of maximum cumulative drawdown at CBO and MEA) is provided on the drawdown contour map in **Figure 20**.

PROJECTED AVAILABLE HEAD AND POTENTIOMETRIC SURFFACE

The NRC has requested an analysis of the available hydraulic head above the top of the Basal Chadron Sandstone at the MEA at the time of maximum projected cumulative drawdown. To accomplish this task, the available head in February 2011 was computed by subtracting the elevation of the top of the Basal Chadron Sandstone from the February 2011 water level elevation. The available head at MEA in February 2011 is illustrated in **Figure 21**. The projected available head at MEA in 2028 (time of maximum cumulative drawdown) was then computed by subtracting the projected drawdown in 2028 (**Figure 18**) from the available head in February 2011 (**Figure 21**). The resulting projected available head at MEA in 2028 is provided in **Figure 22**. The available head at MEA is projected to be greater than 320 feet within MEA wellfields and greater than 270 feet within the MEA permit boundary during ISR operations (2011-2042).

The projected Basal Chadron potentiometric surface at the time of maximum cumulative drawdown was computed by subtracting the projected maximum drawdown in 2028 (**Figure 18**) from the February 2011 water level elevation (**Figure 23**). The resulting projected potentiometric surface at MEA in 2028 is shown in **Figure 24**.

RESULTS AND CONCLUSIONS

A drawdown impact assessment has been completed for the Basal Chadron Aquifer at the MEA and for the simultaneous operation of MEA, CBO, and TCEA ISR facilities (e.g. cumulative drawdown assessment). An assessment of the projected available head and Basal Chadron potentiometric surface at the time of maximum cumulative drawdown has also been completed.

Results of the impact assessment indicates maximum cumulative drawdown at the MEA will be less than 111 feet over the period of combined ISR operations (2011-2042). Minimum available head at the MEA is projected to be greater than 320 feet within MEA ISR wellfields, and greater than 270 feet within the MEA permit area for the duration of combined ISR operations.

Model drawdown projections can be considered conservative because they do not include the impact of groundwater recharge on the Basal Chadron aquifer over a large radius of influence, and because consumptive use for the MEA and TCEA are based in part on a conservative 30% Reverse Osmosis (RO) efficiency during wellfield restoration (25% RO efficiency has been routinely achieved at the CBO facility).

The drawdown impact assessment does not include potential drawdown impacts resulting from groundwater withdrawals other than Cameco ISR operations, including large seasonal agricultural groundwater withdrawals from a tributary arm of the Basal Chadron Aquifer approximately 35 to 50 miles southwest of MEA in the North Platte drainage. Irrigation wells in

the North Platte Irrigation District have been operating for over 40 years. Although there may not be a direct hydraulic connection between the tributary arm of the Basal Chadron Aquifer in the North Platte drainage and the MEA (e.g. Sibray, 2010), there does appear to be less direct flow paths (on the order of 60 to 100 miles in length) that may hydraulically connect the MEA and the North Platte basin. Given the large reported seasonal groundwater withdrawals in excess of 1000 gpm from the Basal Chadron Aquifer in the North Platte drainage, some measurable drawdown impact at the MEA would not be unexpected in a confined aquifer over a long period of time. Some of the historical drawdown observed at the MEA may therefore be attributable to irrigation withdrawals southwest of the MEA, and not entirely due to CBO operations.

REFERENCES

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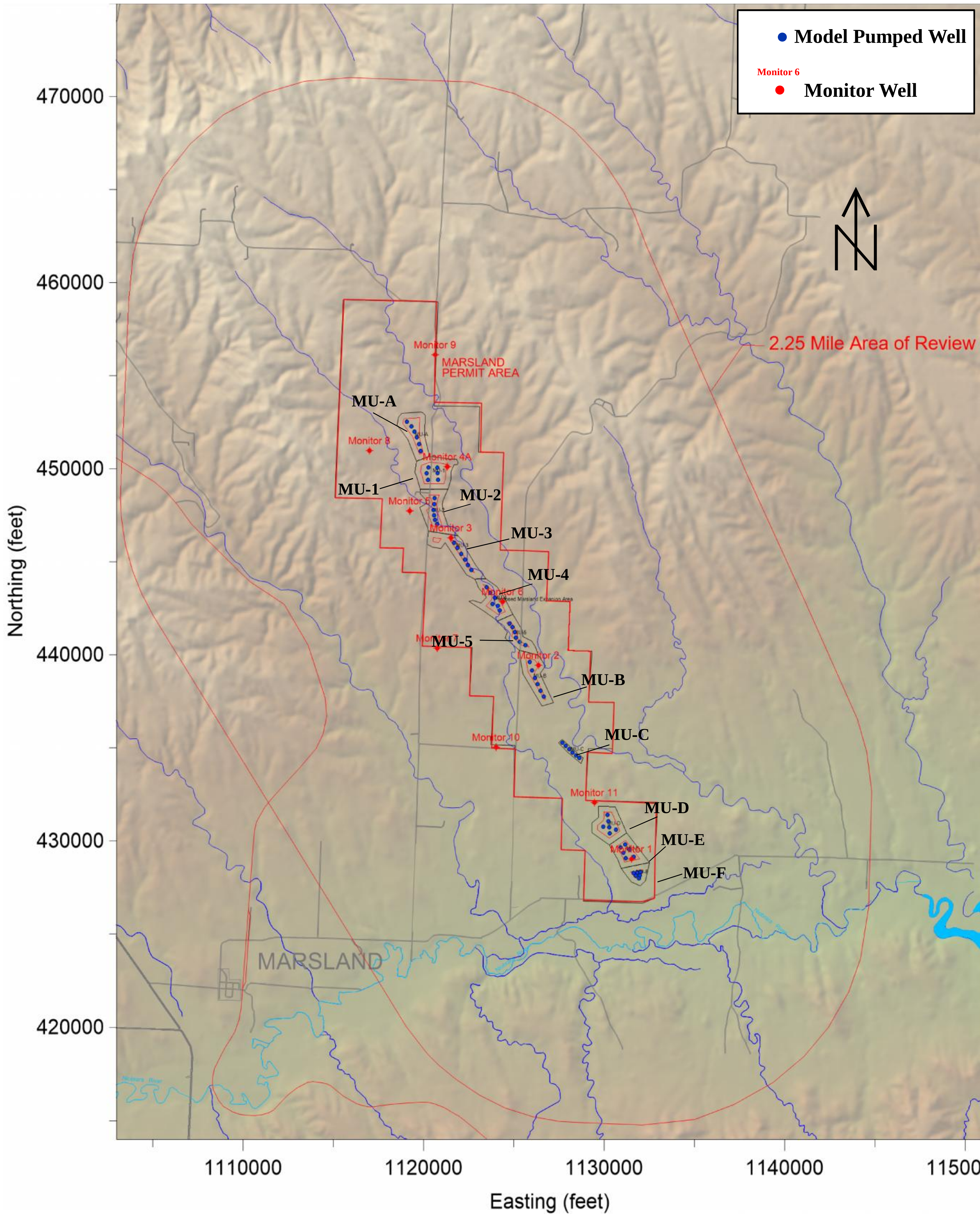
Ferris, J.G, Knowles, D.B., Brown, R.H, and R. W. Stallman (1962). Theory of Aquifer Tests, U.S. Geological Survey Water Supply Paper1536-E, 174p.

Sibray, S. (2010). White River Group Paleosols as Source Rocks for Uranium Mineralization in Western Nebraska, *The Mountain Geologist,* v.48, no.1, p.9-41.

Theis, C.V. (1935). The relation between lowering the potentiometric surface and the rate and duration of discharge of a well using groundwater storage, American Geophysical Union Transactions, vol. 16, pp. 519-524.

FIGURES



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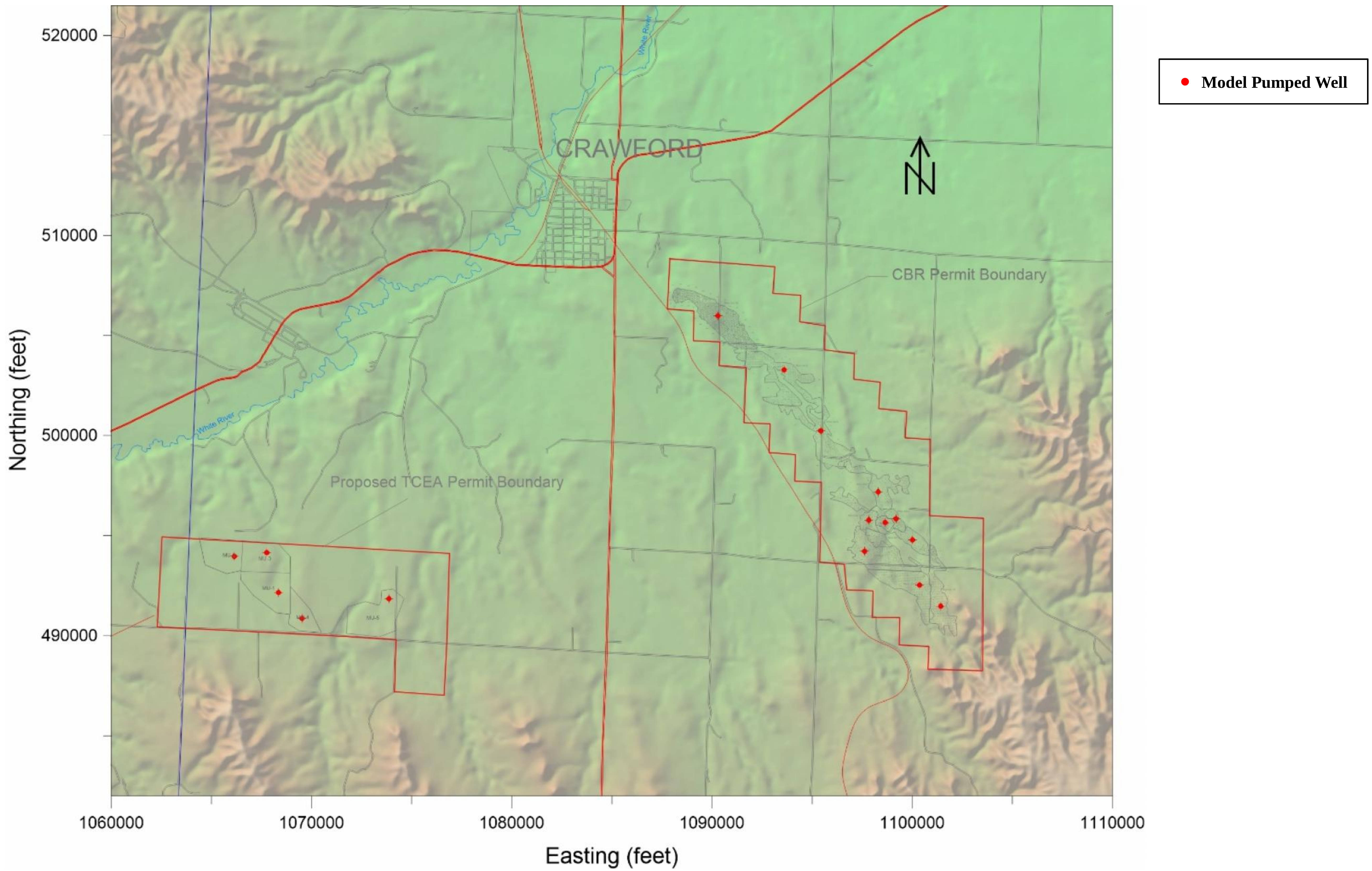
MEA Well Locations

Drawdown Impact Assessment
Marsland Expansion Area
Dawes County, Nebraska

Cameco

Figure 1



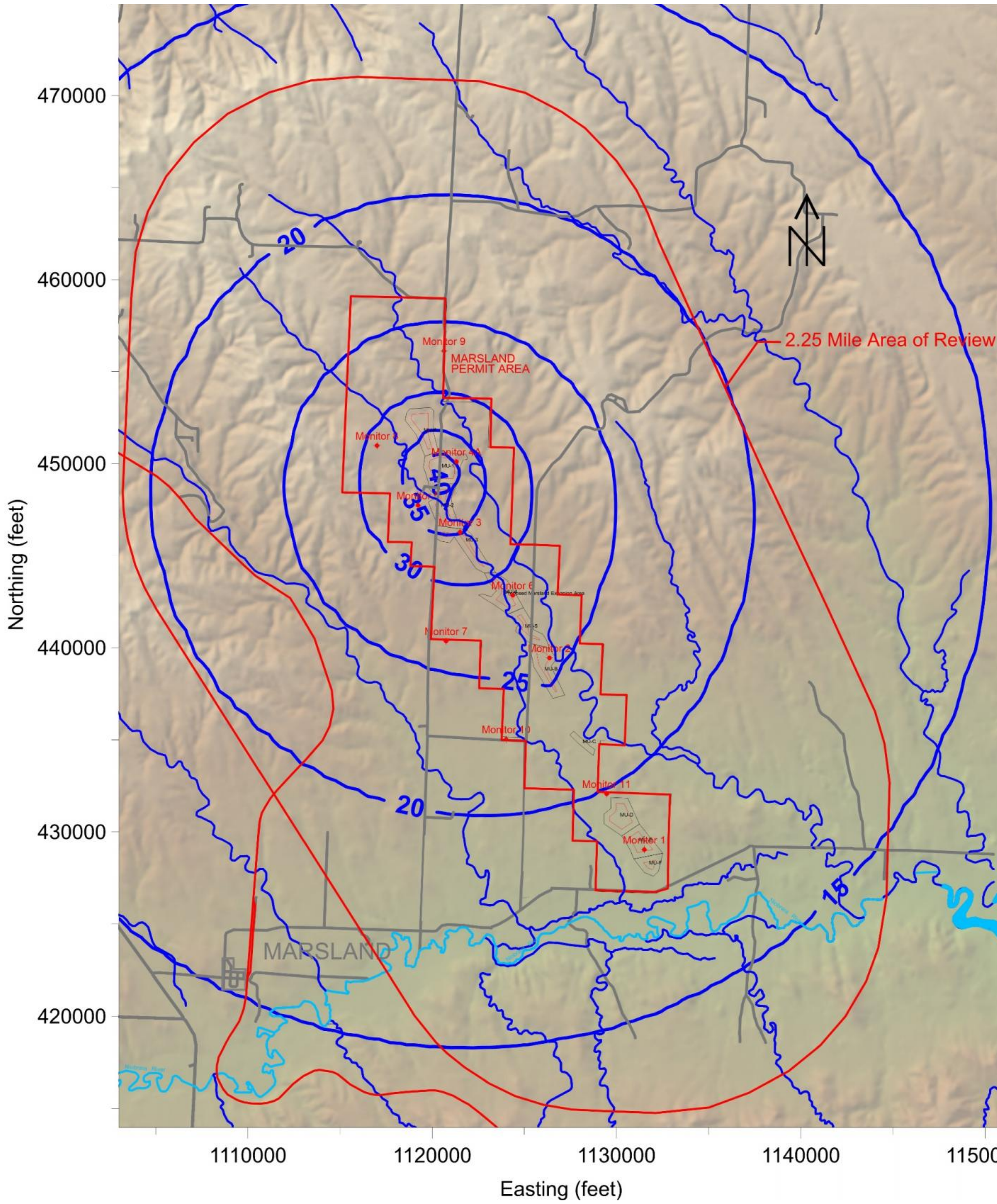
AquiferTek

CBO and TCEA Model Pumped Well Locations

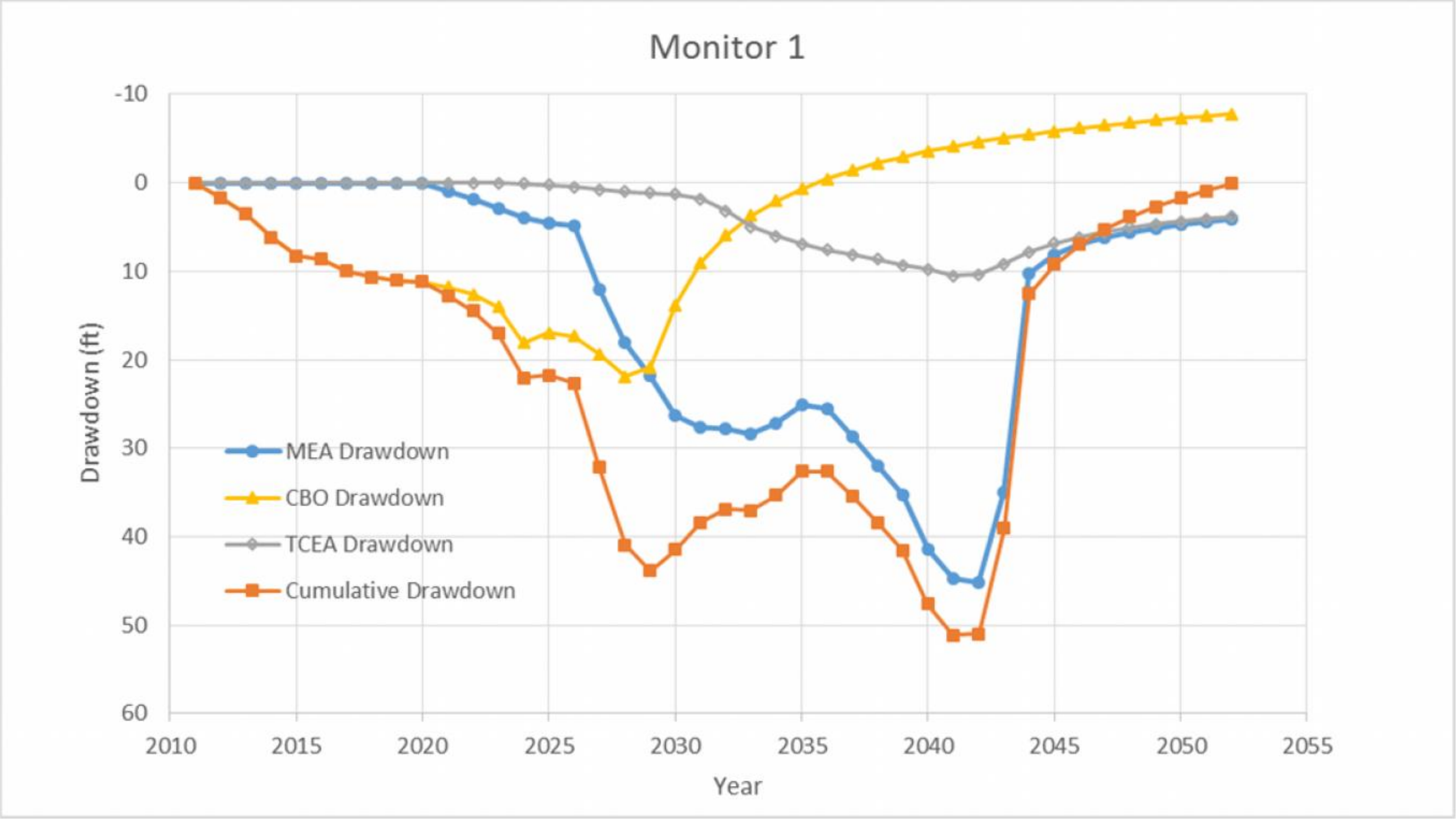
Drawdown Impact Assessment
Marsland Expansion Area
Dawes County, Nebraska

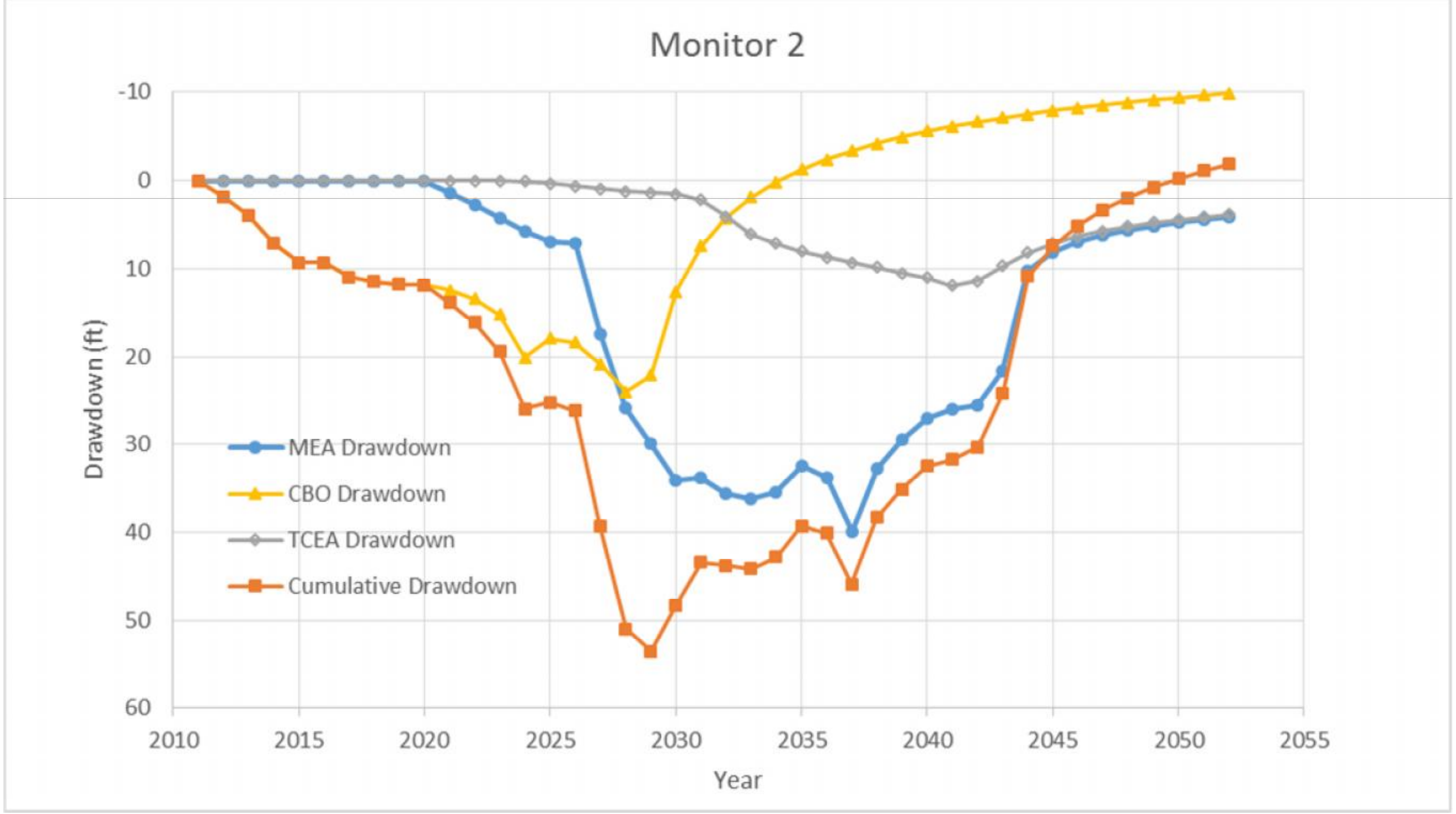
Cameco

Figure
2

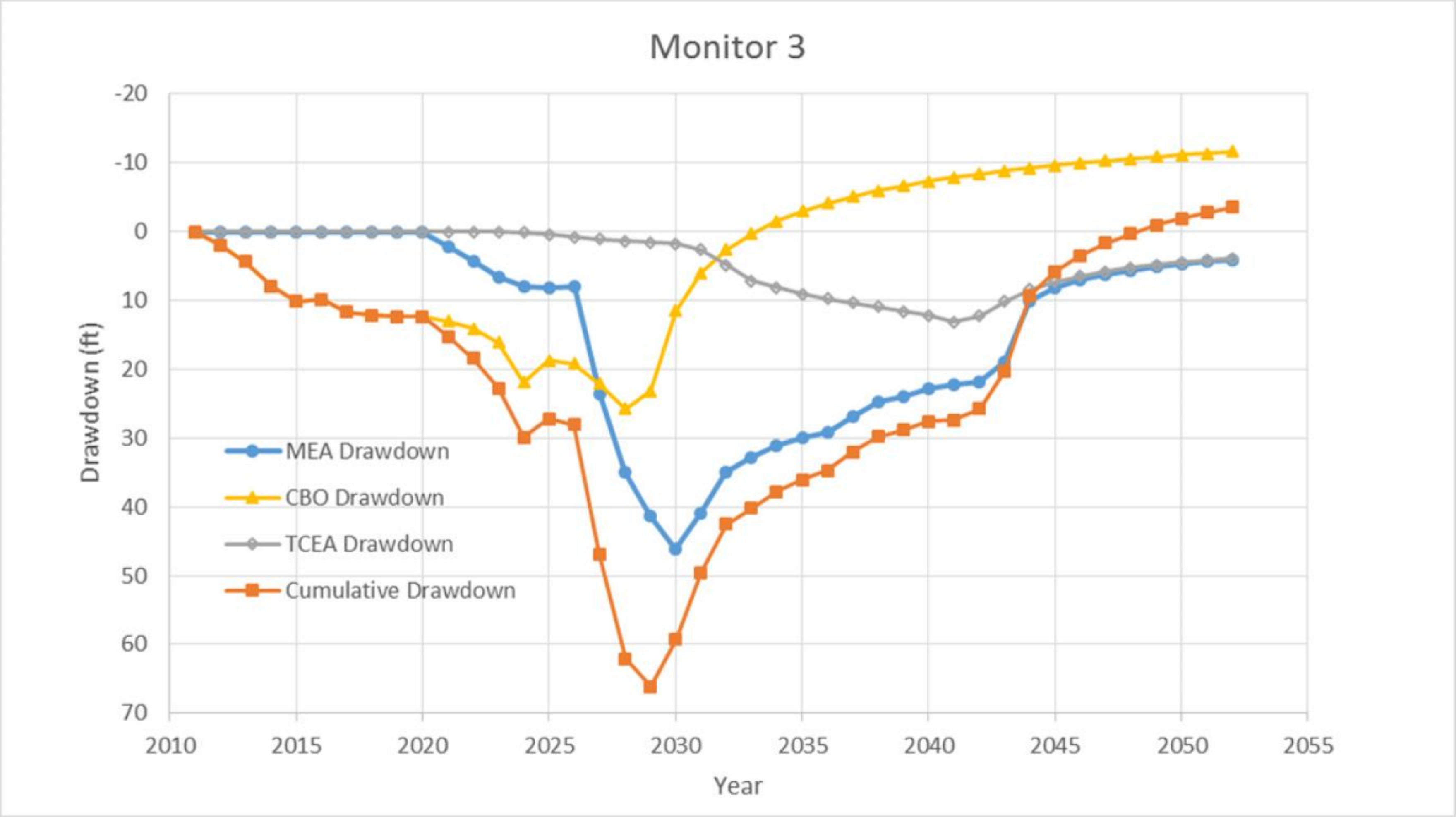


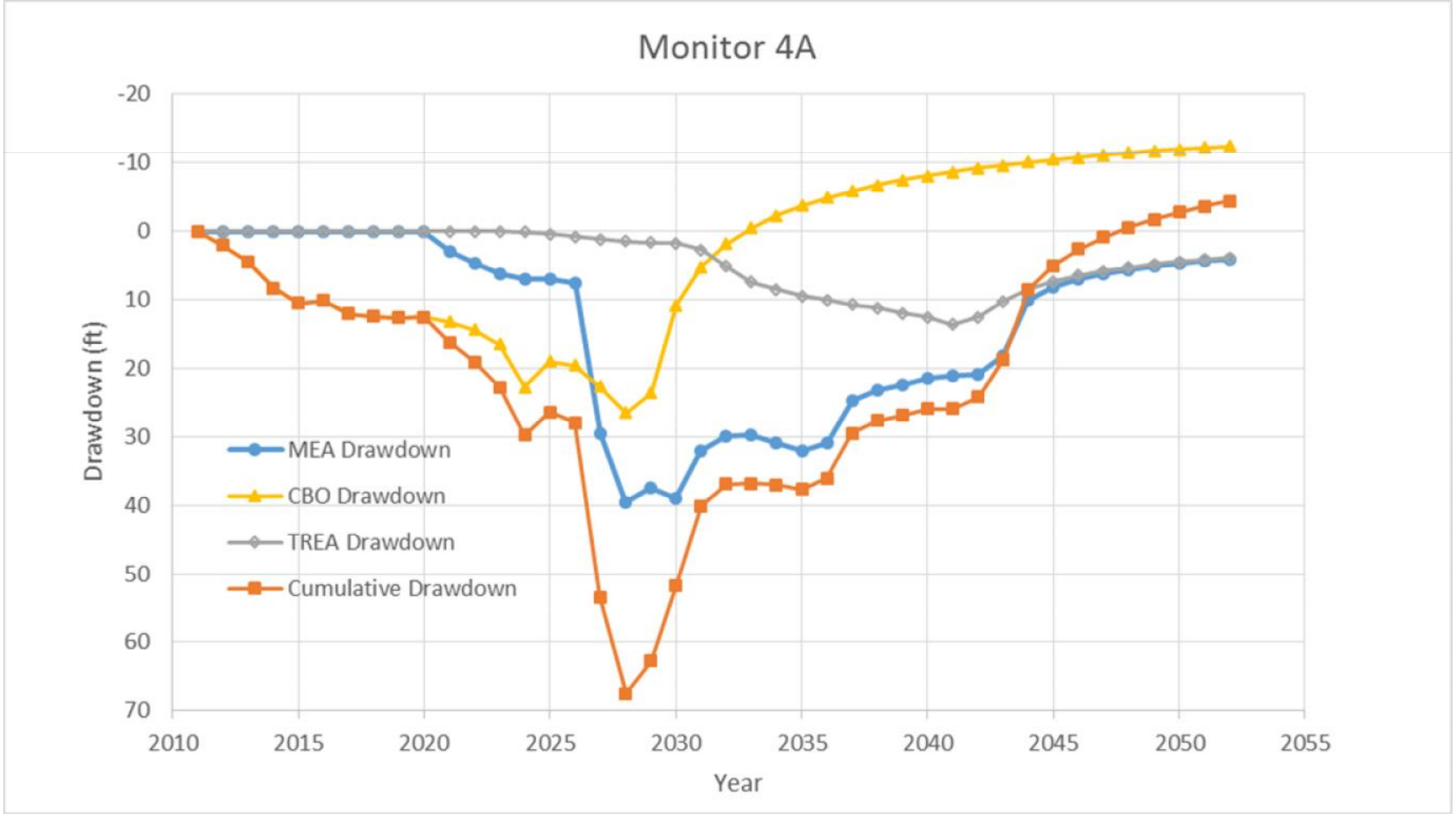
AquiferTek	**Model Projected Drawdown (feet)** **MEA Operations Year 2028** **Theis Analysis**	*Drawdown Impact Assessment* *Marsland Expansion Area* *Dawes County, Nebraska* Cameco	**Figure** **3**



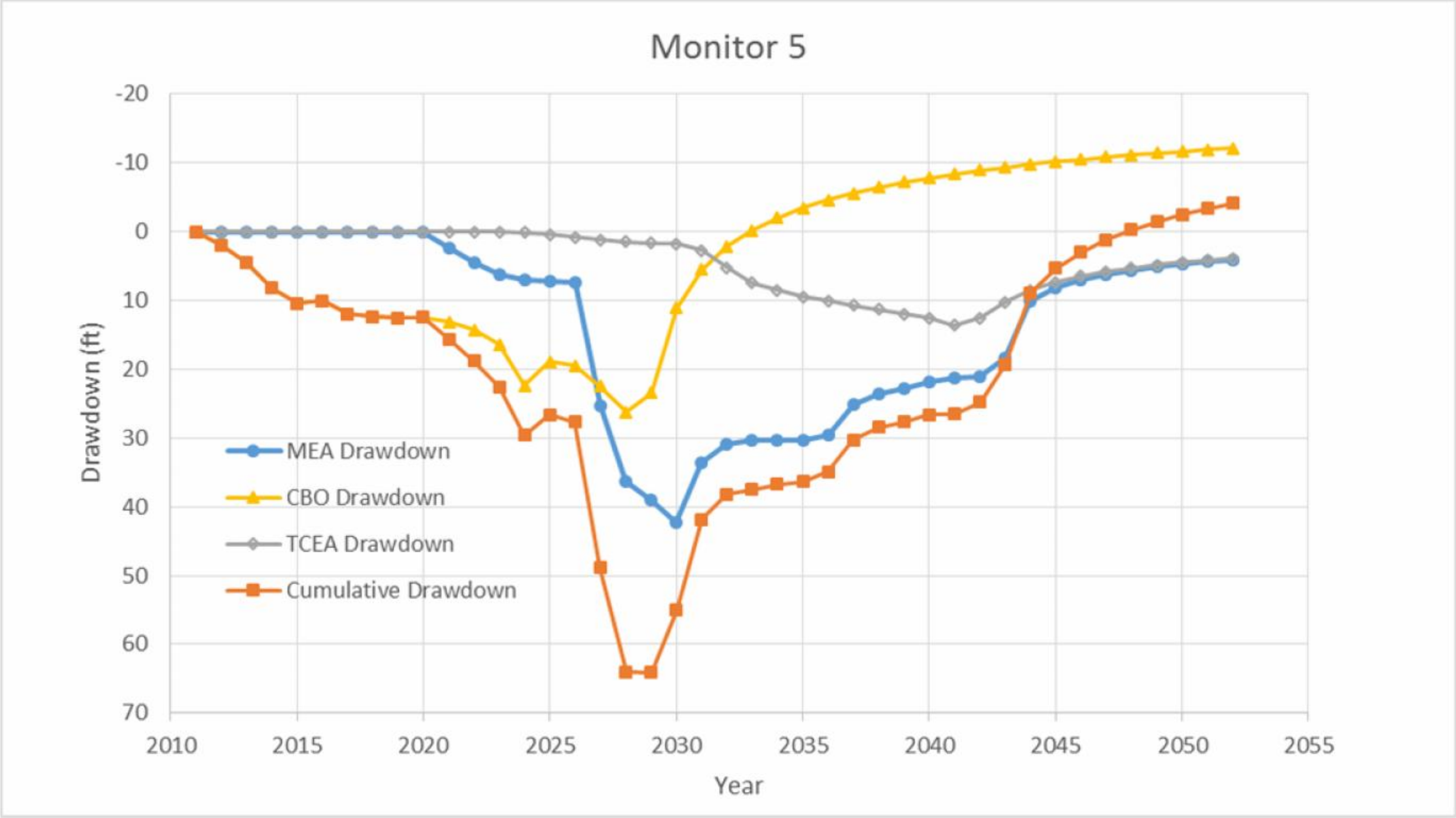


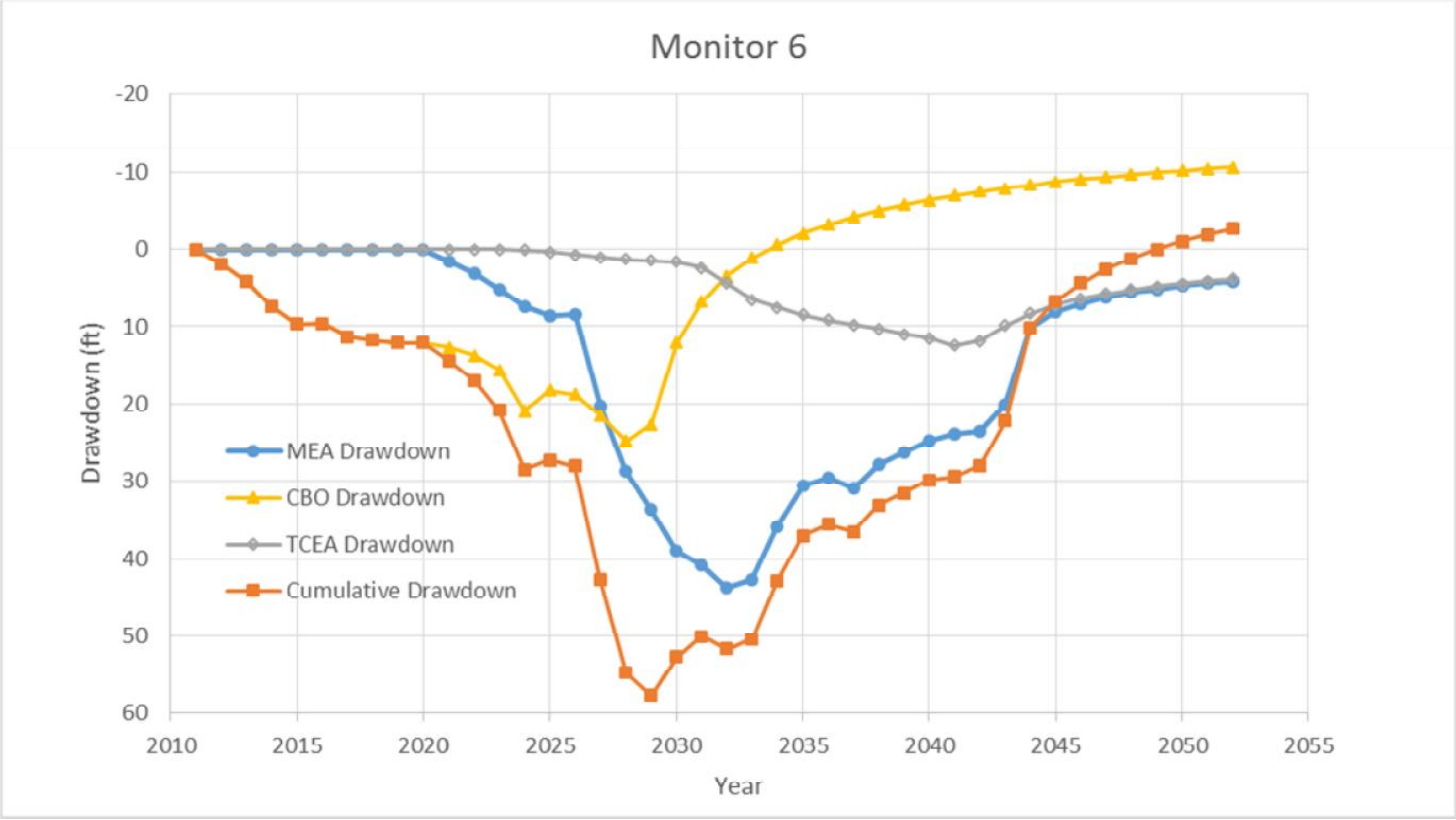
AquiferTek	**Model Drawdown Hydrographs** **MEA Monitor 1 and Monitor 2** **Theis Analysis**	*Drawdown Impact Assessment* *Marsland Expansion Area* *Dawes County, Nebraska* Cameco	**Figure** **4**



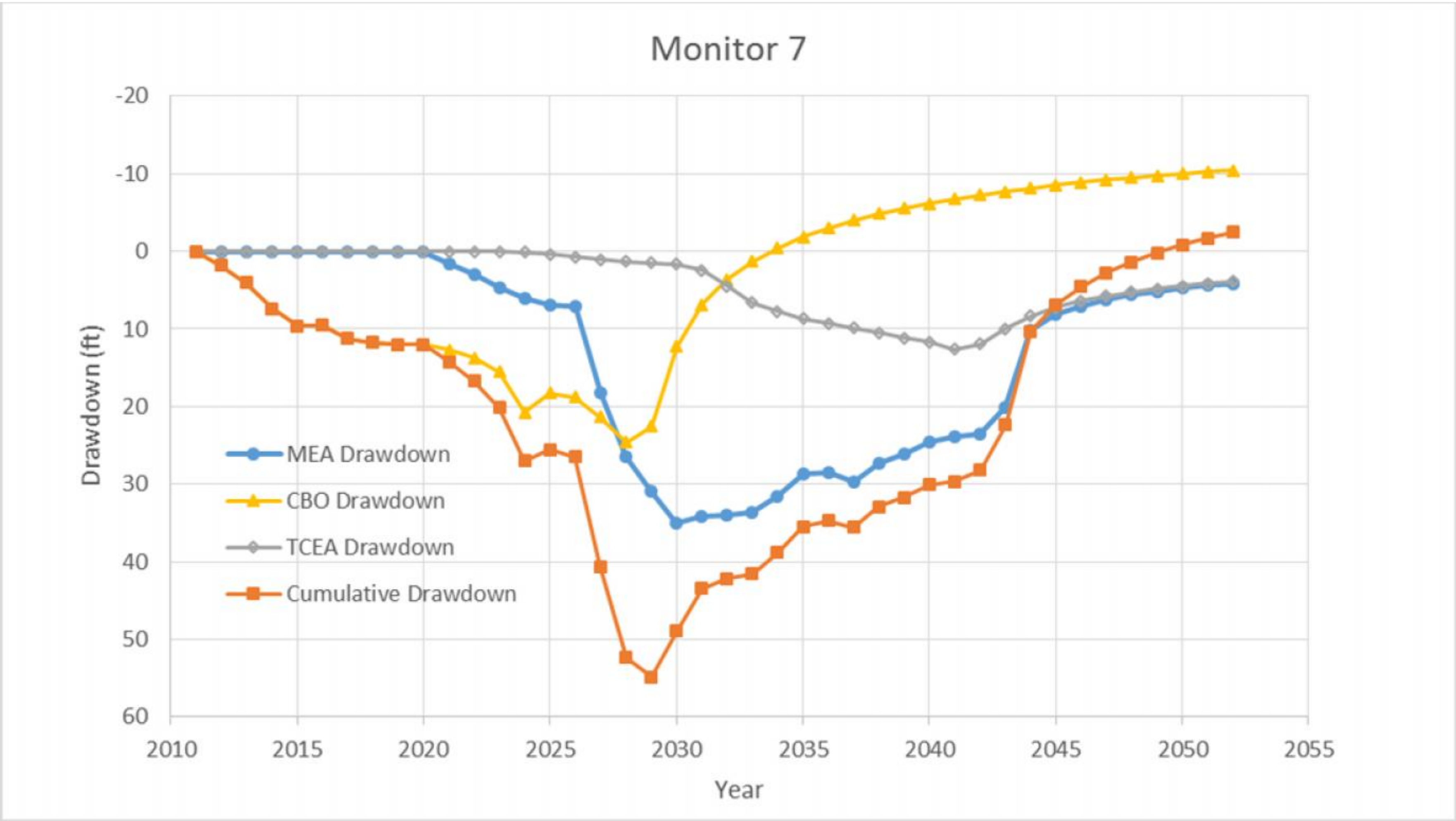


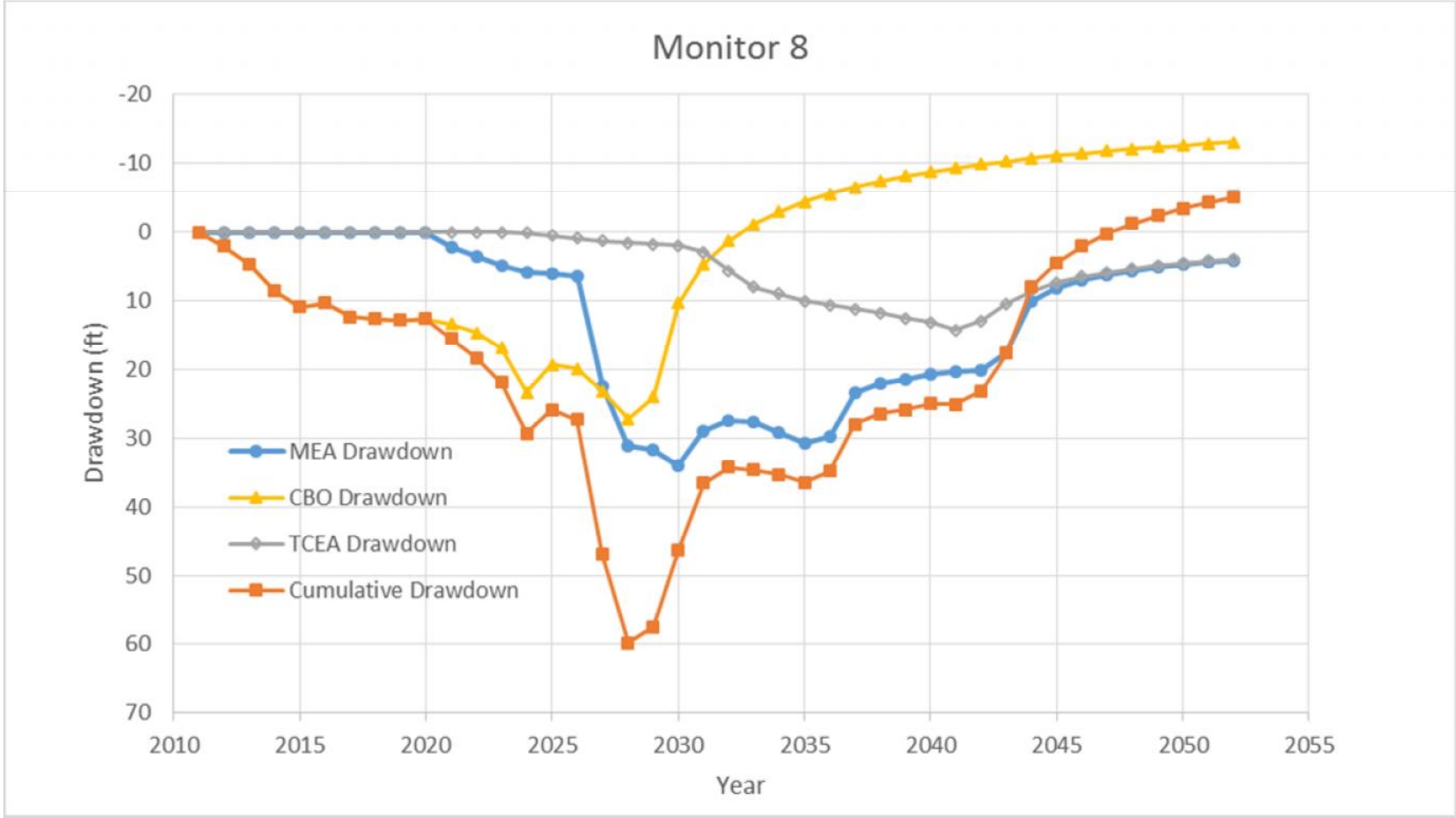
AquiferTek	**Model Drawdown Hydrographs** **MEA Monitor 3 and Monitor 4A** **Theis Analysis**	*Drawdown Impact Assessment* *Marsland Expansion Area* *Dawes County, Nebraska* Cameco	**Figure** **5**





AquiferTek	**Model Drawdown Hydrographs** **MEA Monitor 5 and Monitor 6** **Theis Analysis**	*Drawdown Impact Assessment* *Marsland Expansion Area* *Dawes County, Nebraska* Cameco	**Figure** **6**





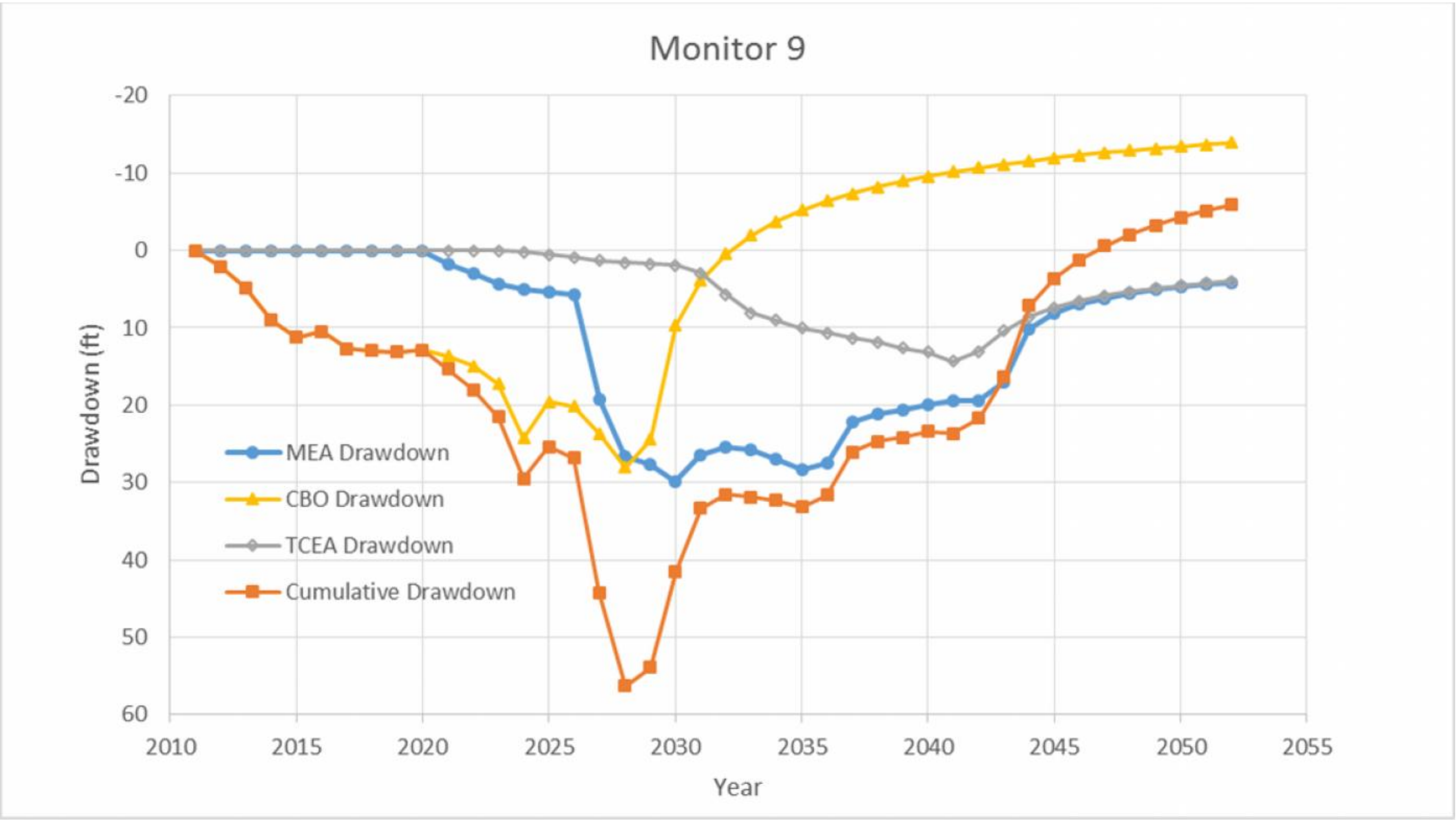
AquiferTek

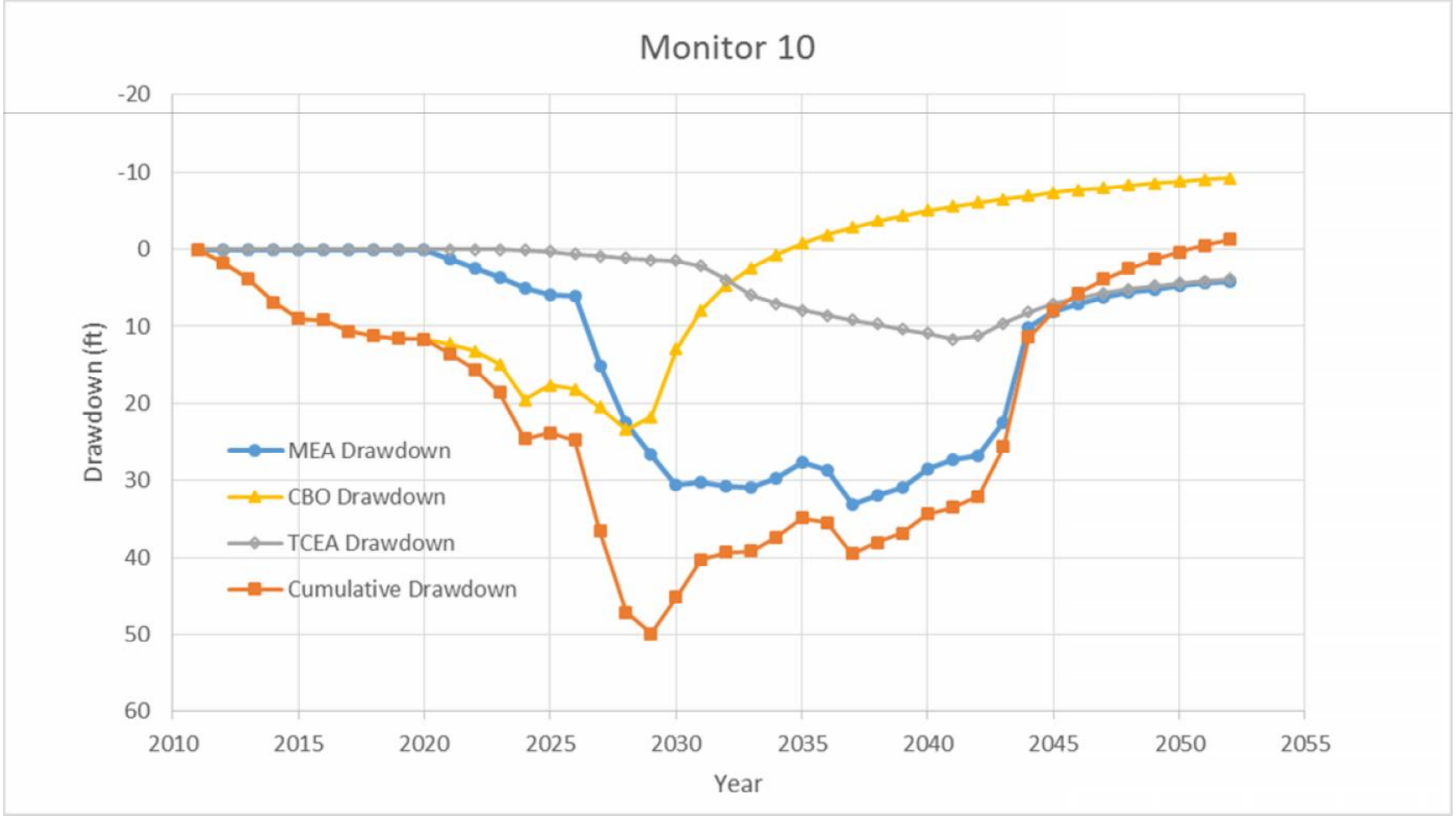
Model Drawdown Hydrographs
MEA Monitor 7 and Monitor 8
Theis Analysis

Drawdown Impact Assessment
Marsland Expansion Area
Dawes County, Nebraska

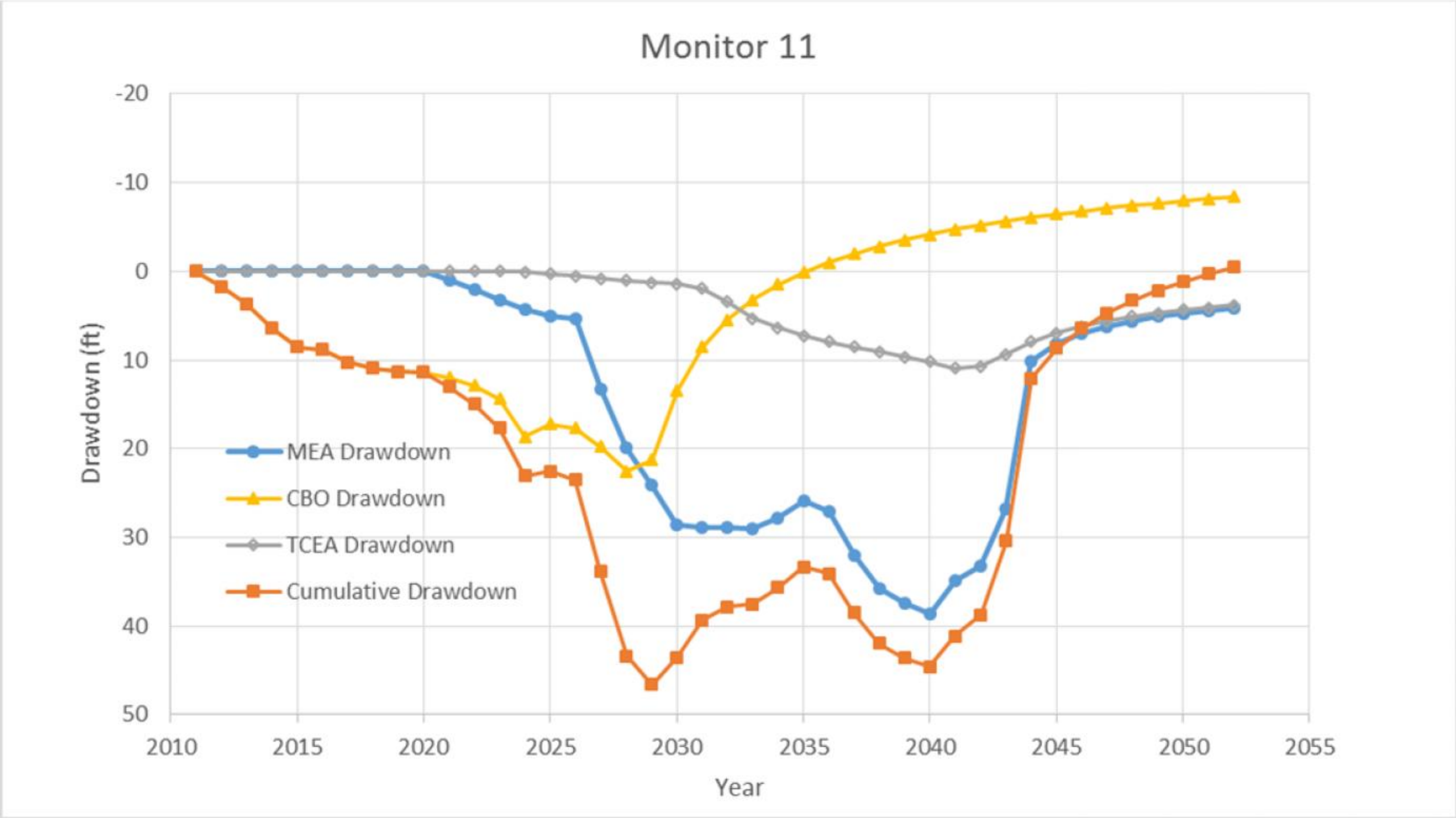
Cameco

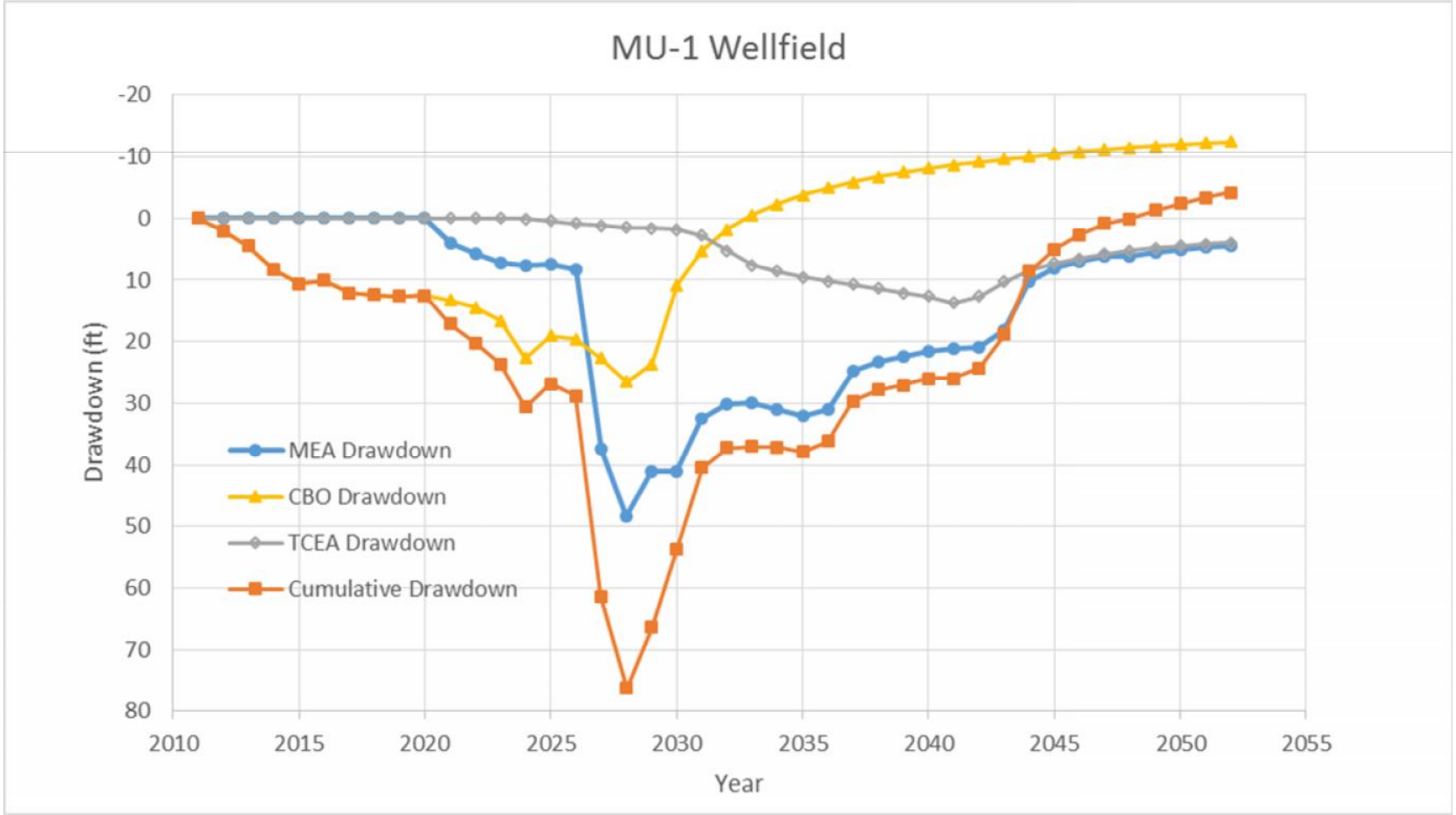
Figure
7





AquiferTek	**Model Drawdown Hydrographs MEA Monitor 9 and Monitor 10 Theis Analysis**	*Drawdown Impact Assessment Marsland Expansion Area Dawes County, Nebraska* Cameco	**Figure 8**





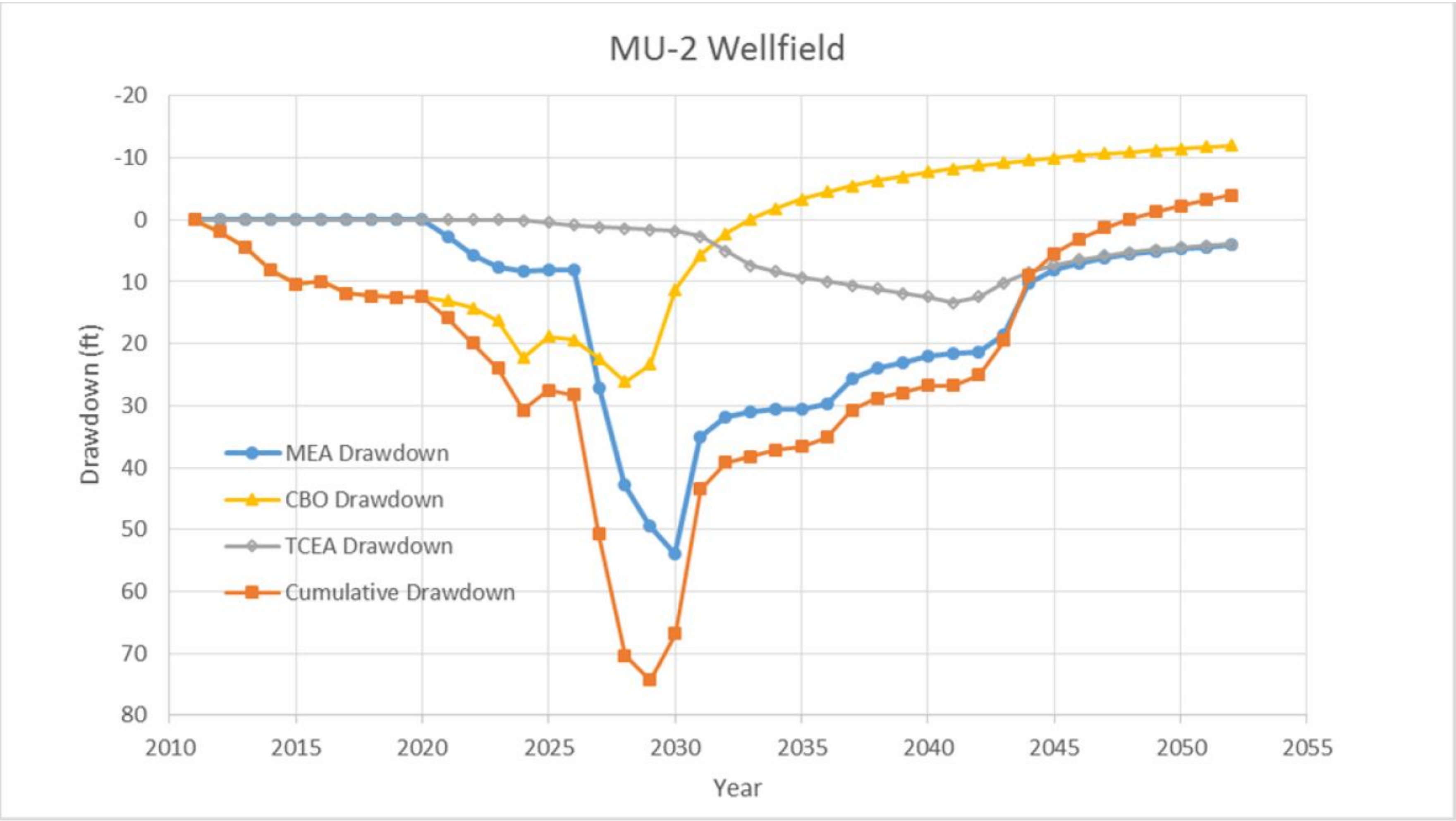
AquiferTek

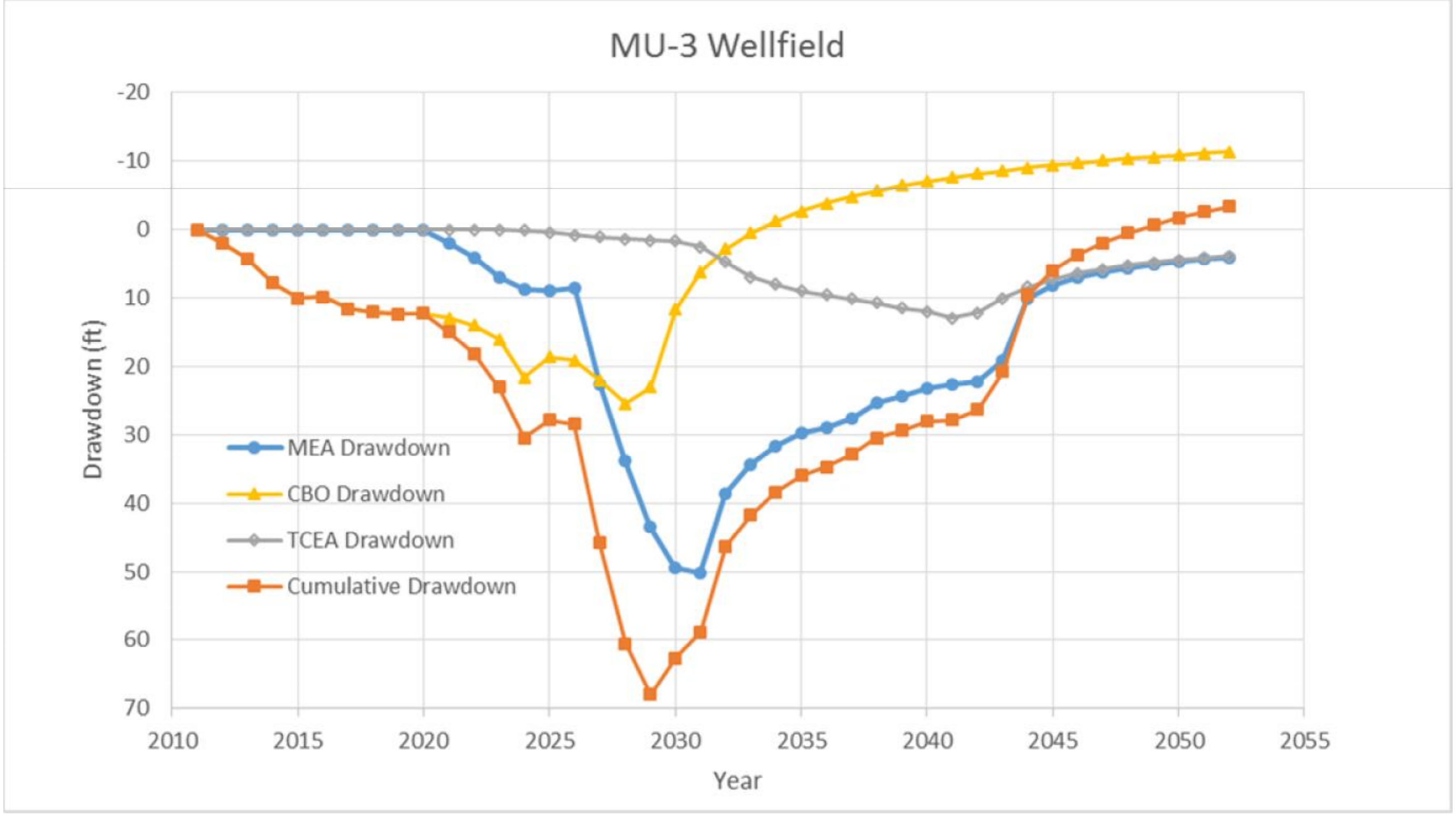
Model Drawdown Hydrographs
MEA Monitor 11 and MU-1 Wellfield
Theis Analysis

Drawdown Impact Assessment
Marsland Expansion Area
Dawes County, Nebraska

Cameco

Figure 9





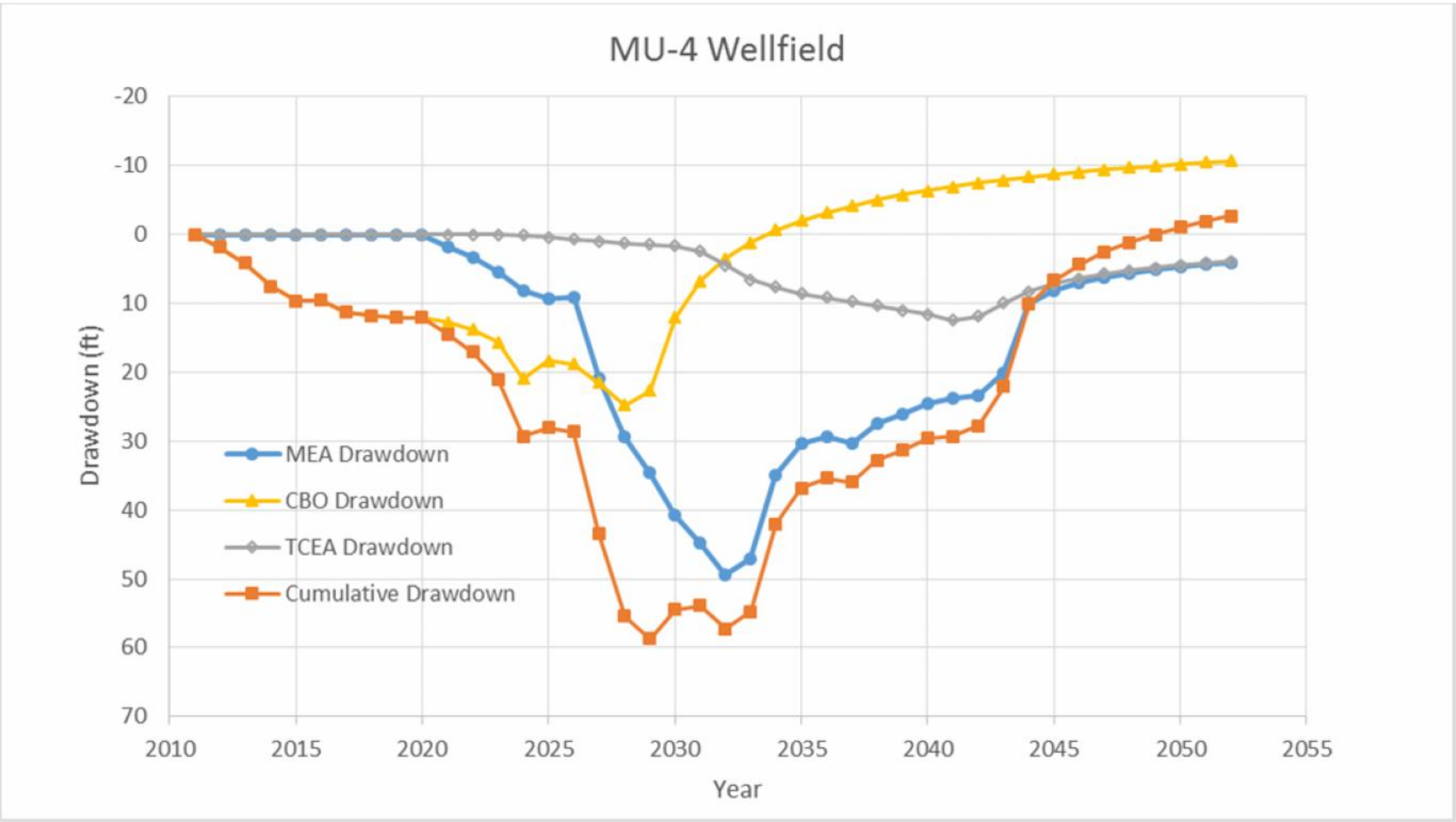
AquiferTek

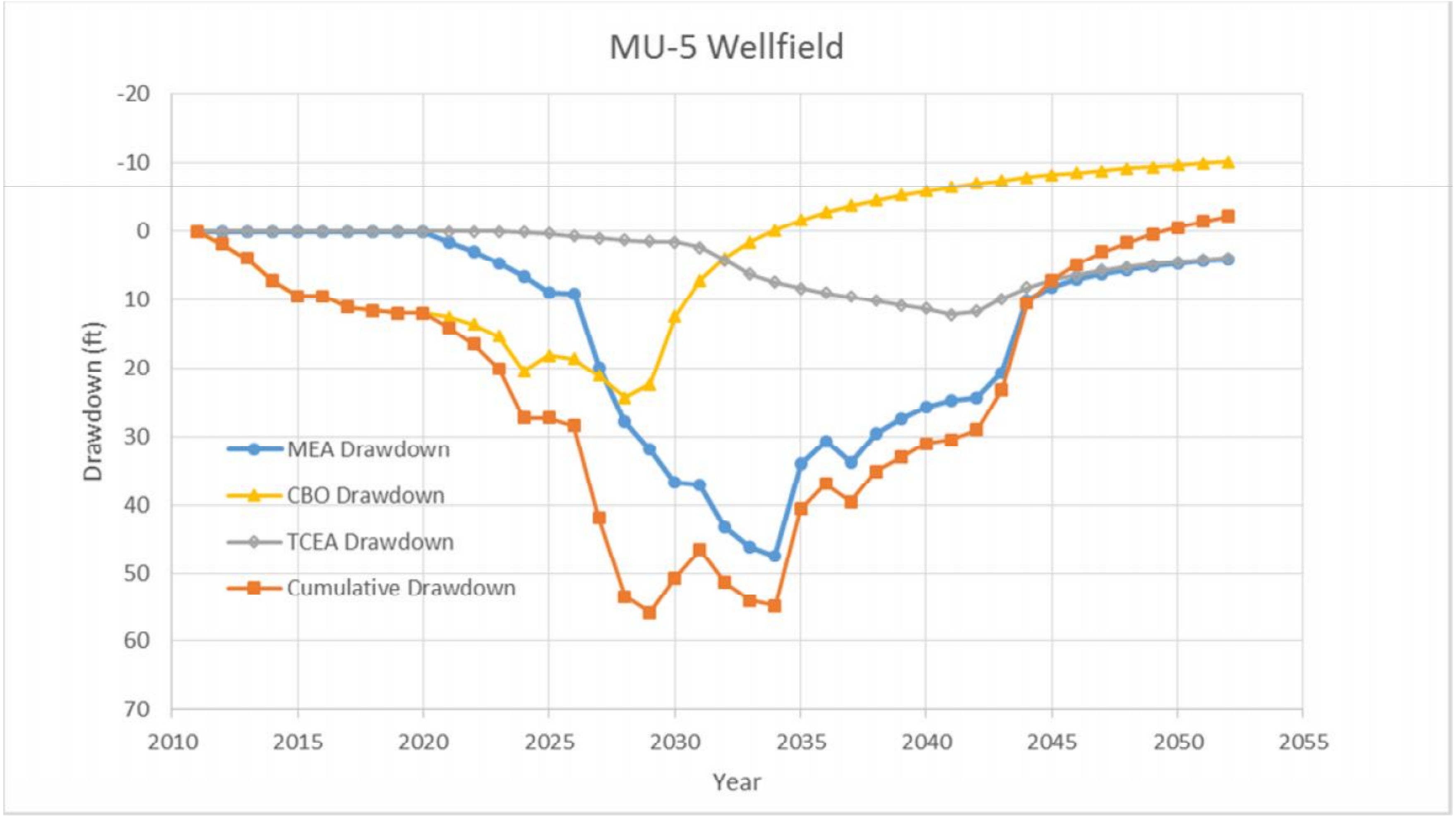
Model Drawdown Hydrographs
MEA MU-2 and MU-3 Wellfields
Theis Analysis

Drawdown Impact Assessment
Marsland Expansion Area
Dawes County, Nebraska

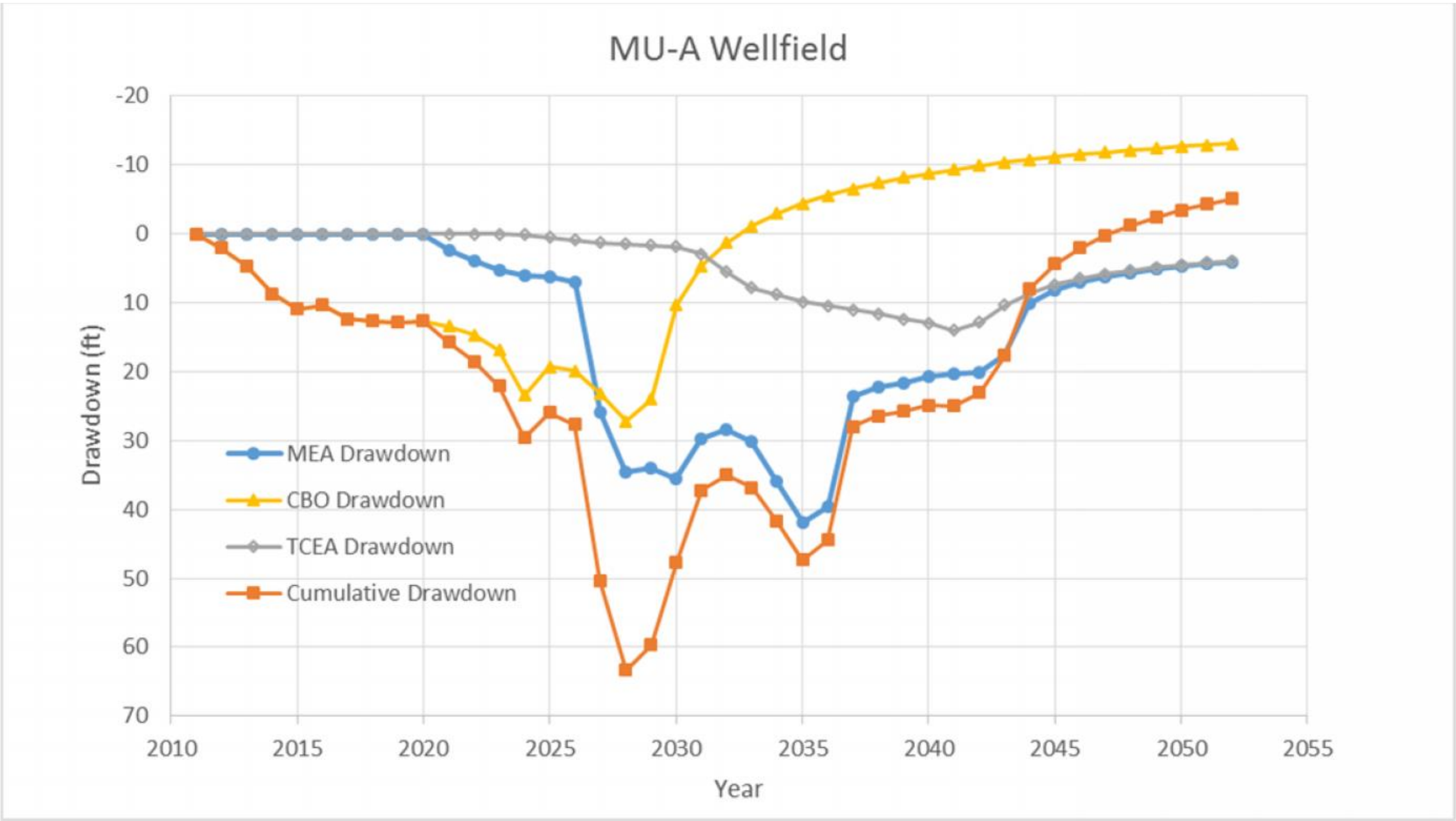
Cameco

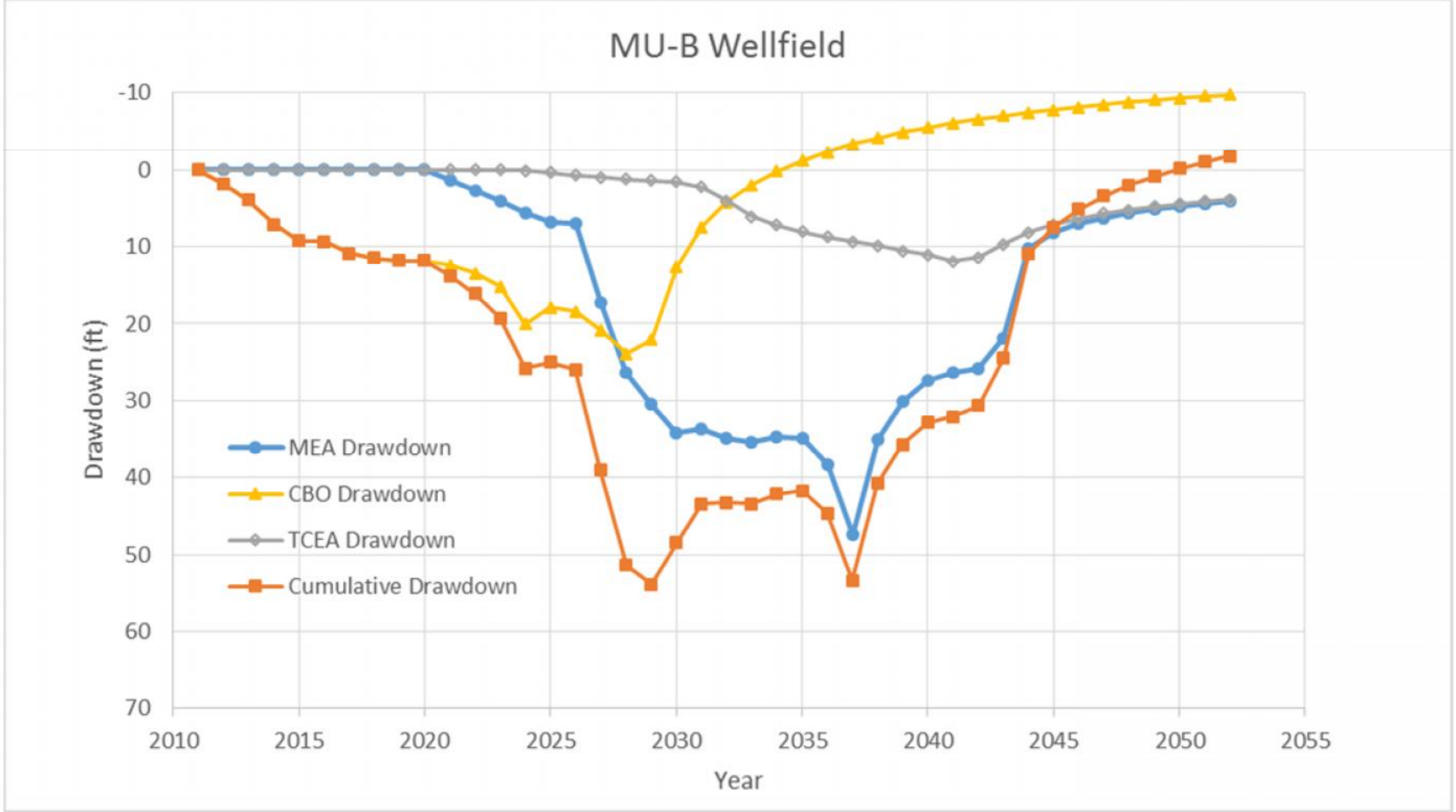
Figure
10





AquiferTek	**Model Drawdown Hydrographs MEA MU-4 and MU-5 Wellfields Theis Analysis**	*Drawdown Impact Assessment Marsland Expansion Area Dawes County, Nebraska* Cameco	**Figure 11**





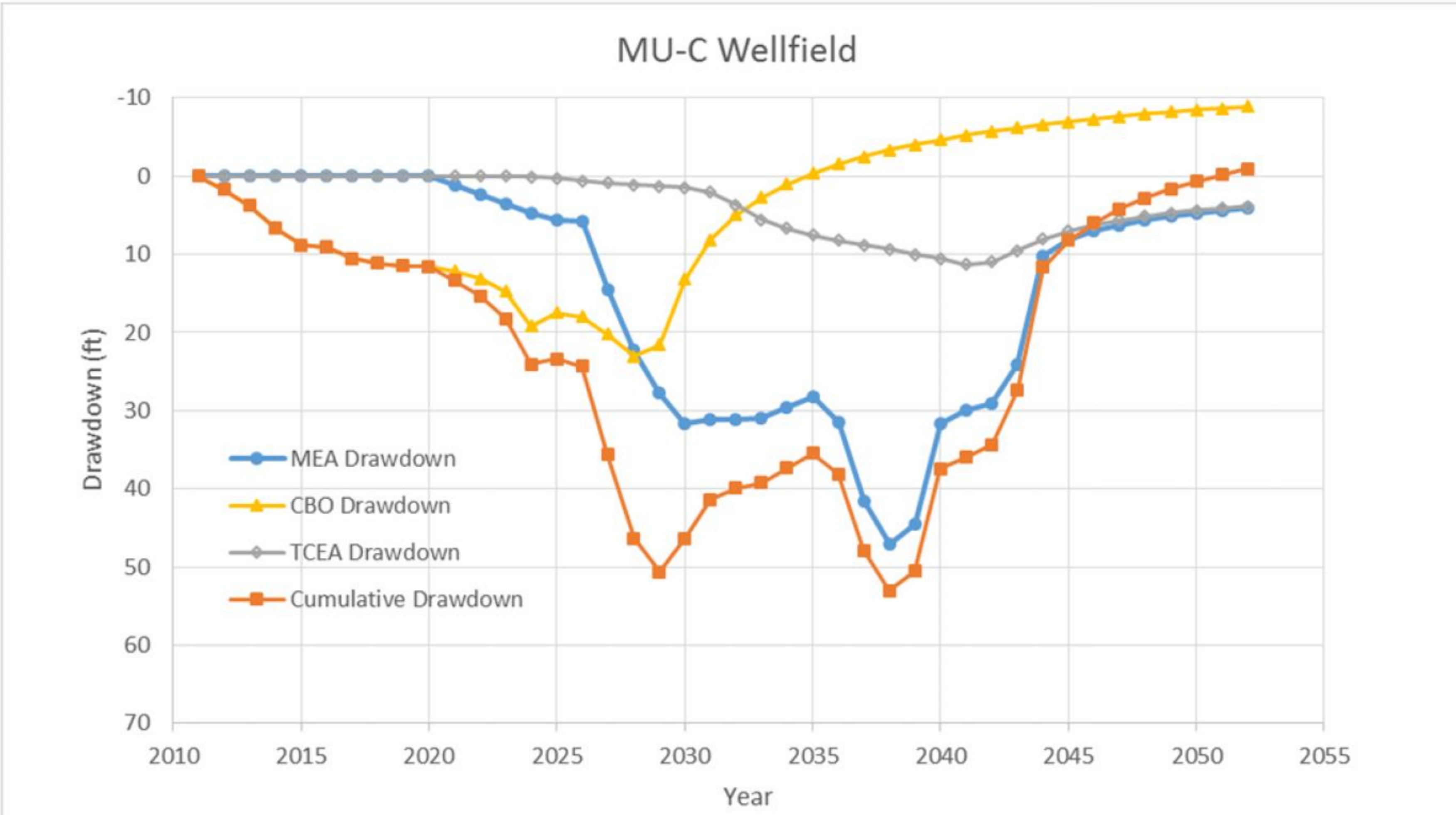
AquiferTek

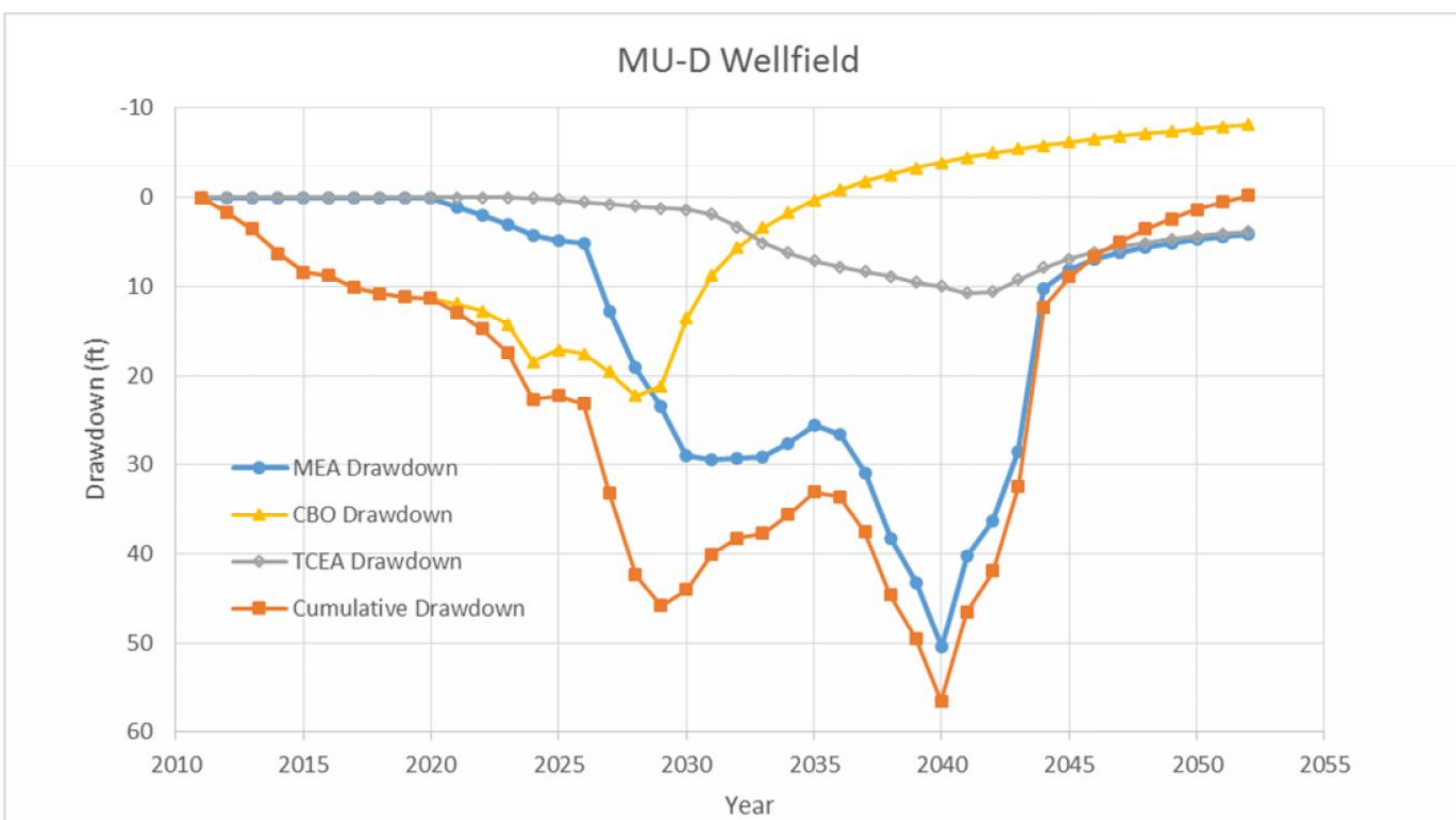
Model Drawdown Hydrographs
MEA MU-A and MU-B Wellfields
Theis Analysis

Drawdown Impact Assessment
Marsland Expansion Area
Dawes County, Nebraska

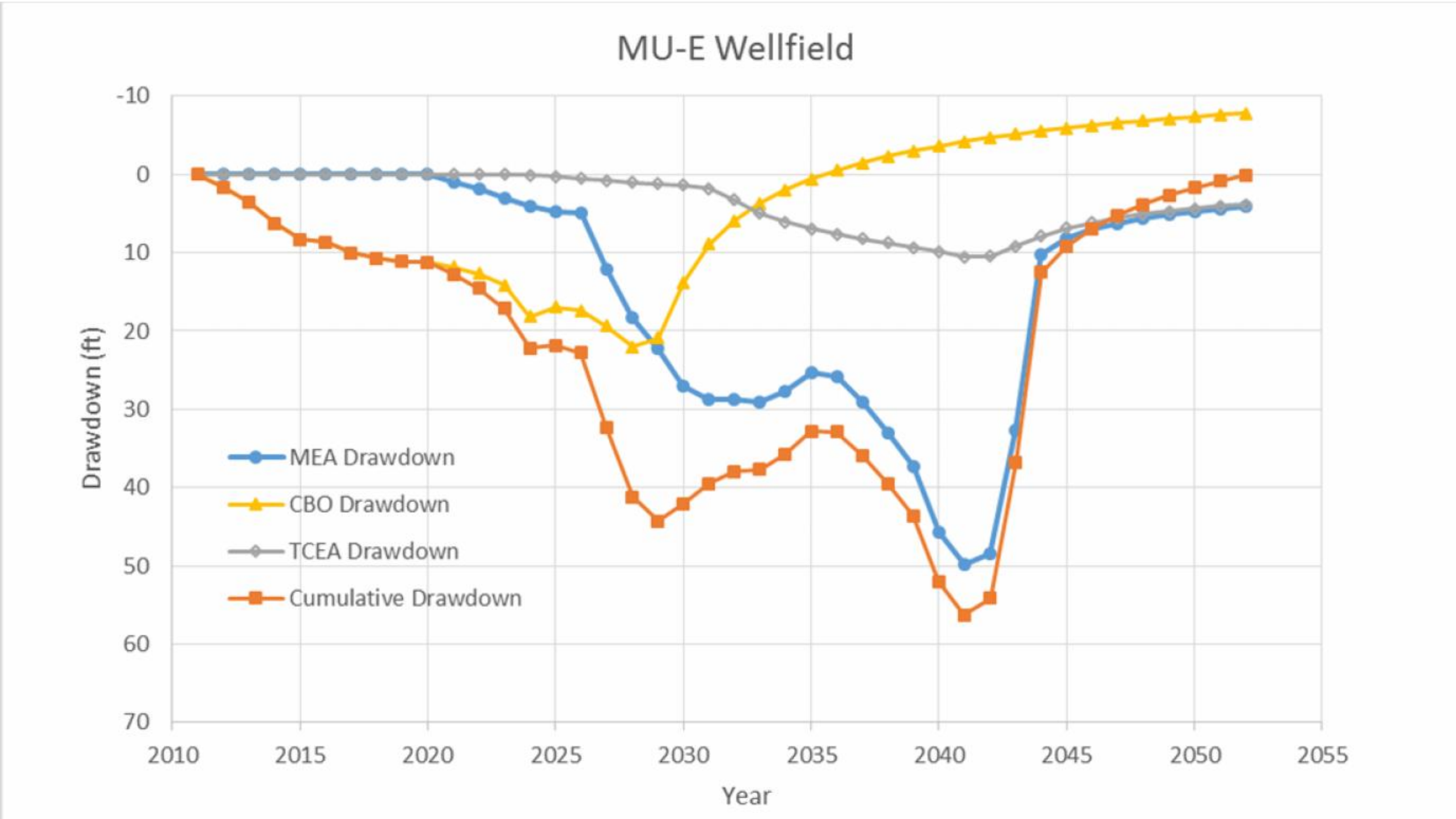
Cameco

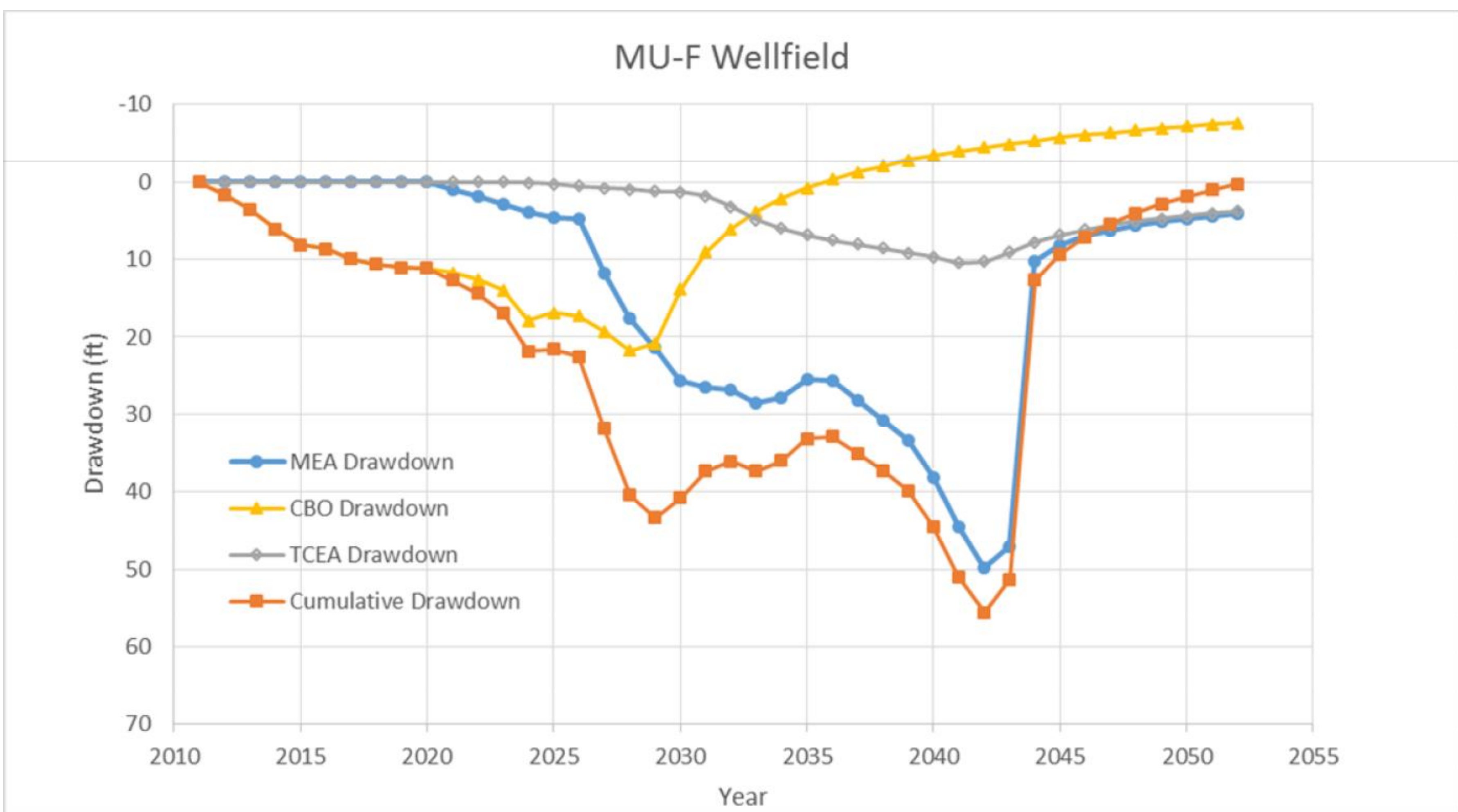
Figure 12





AquiferTek	**Model Drawdown Hydrographs** **MEA MU-C and MU-D Wellfields** **Theis Analysis**	*Drawdown Impact Assessment* *Marsland Expansion Area* *Dawes County, Nebraska* Cameco	**Figure** **13**





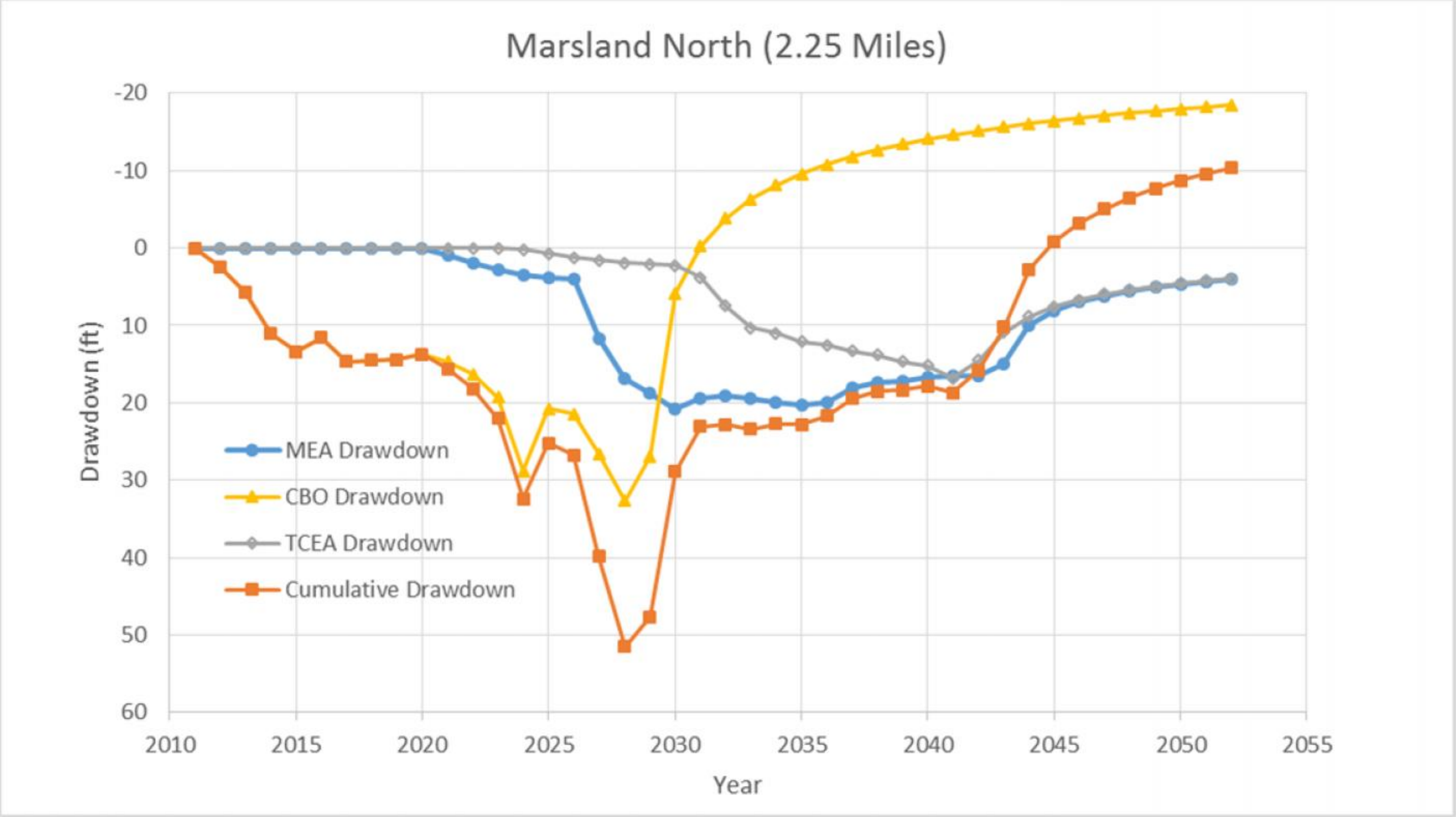
AquiferTek

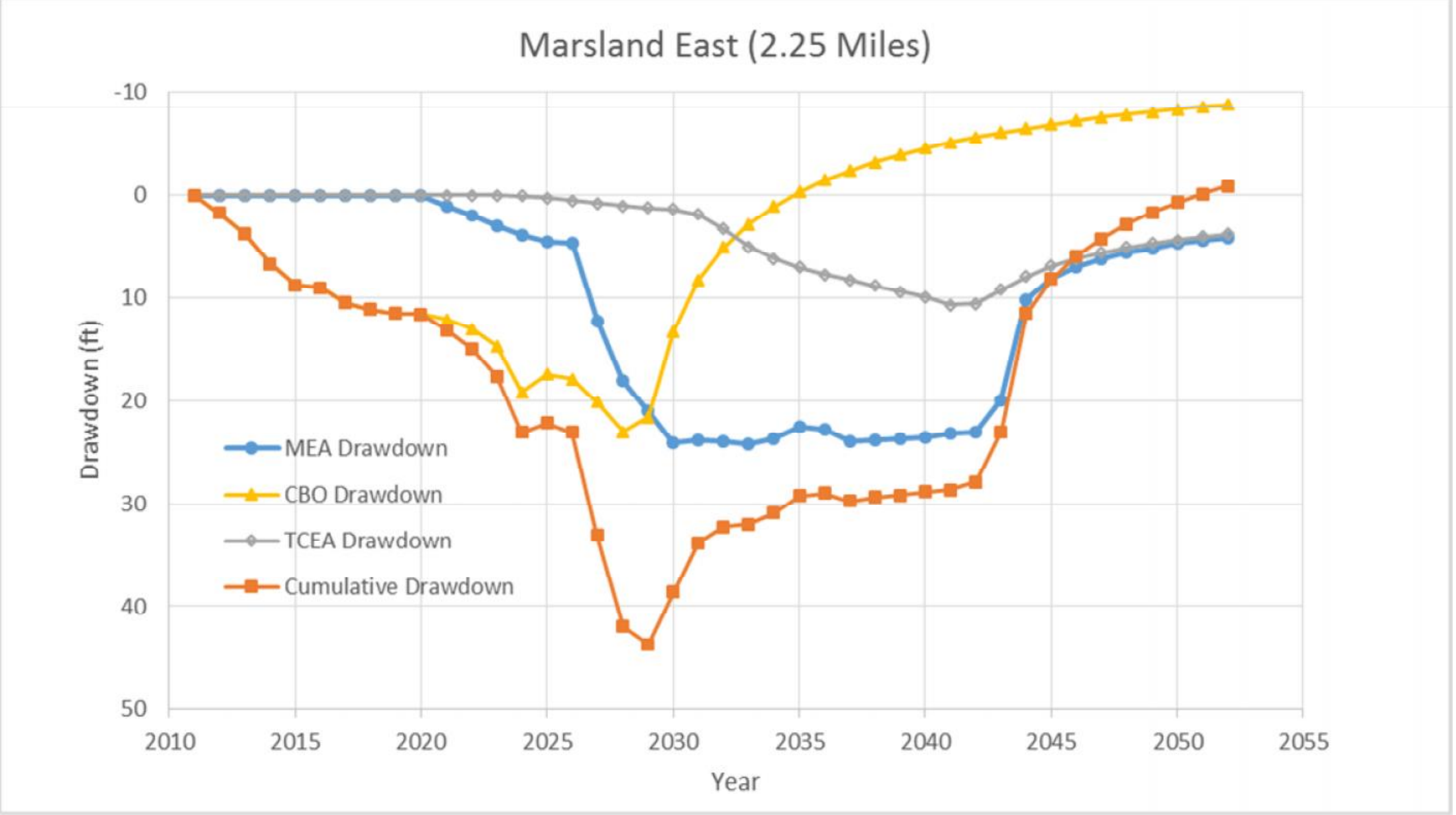
Model Drawdown Hydrographs
MEA MU-E and MU-F Wellfields
Theis Analysis

Drawdown Impact Assessment
Marsland Expansion Area
Dawes County, Nebraska

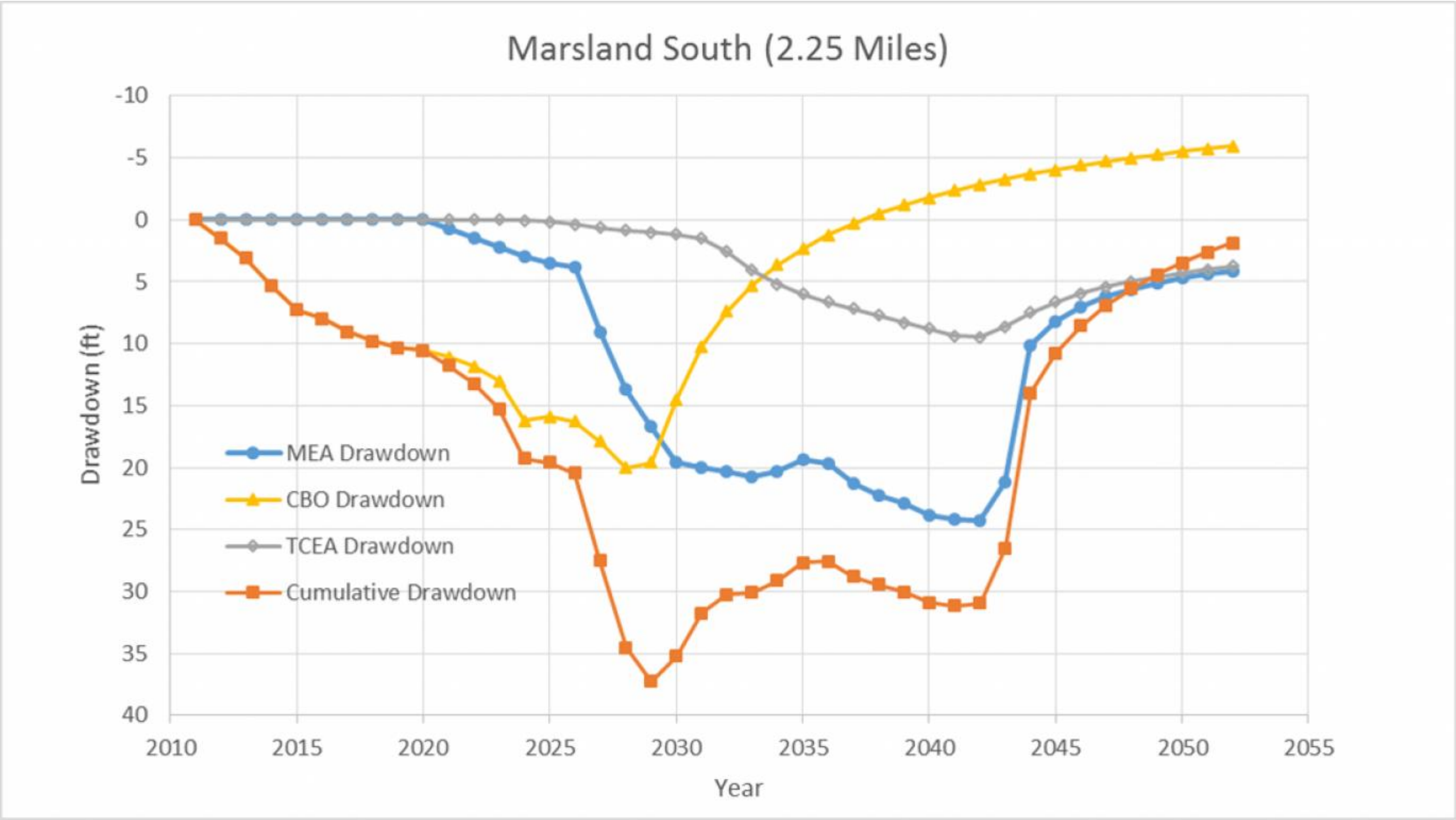
Cameco

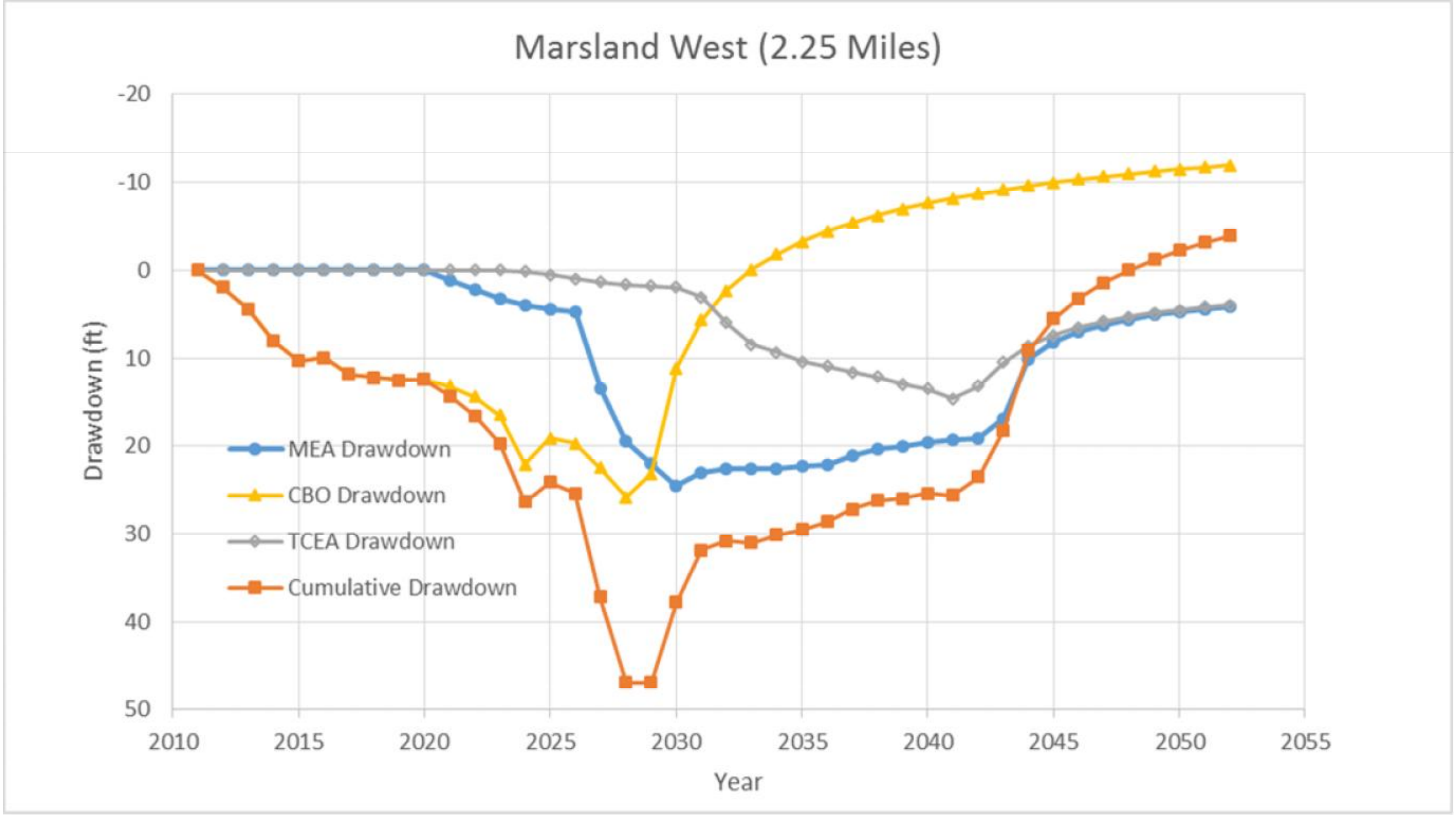
Figure 14





AquiferTek	**Model Drawdown Hydrographs** **MEA North and East 2.25 Mile Radius** **Theis Analysis**	*Drawdown Impact Assessment* *Marsland Expansion Area* *Dawes County, Nebraska* Cameco	**Figure** **15**





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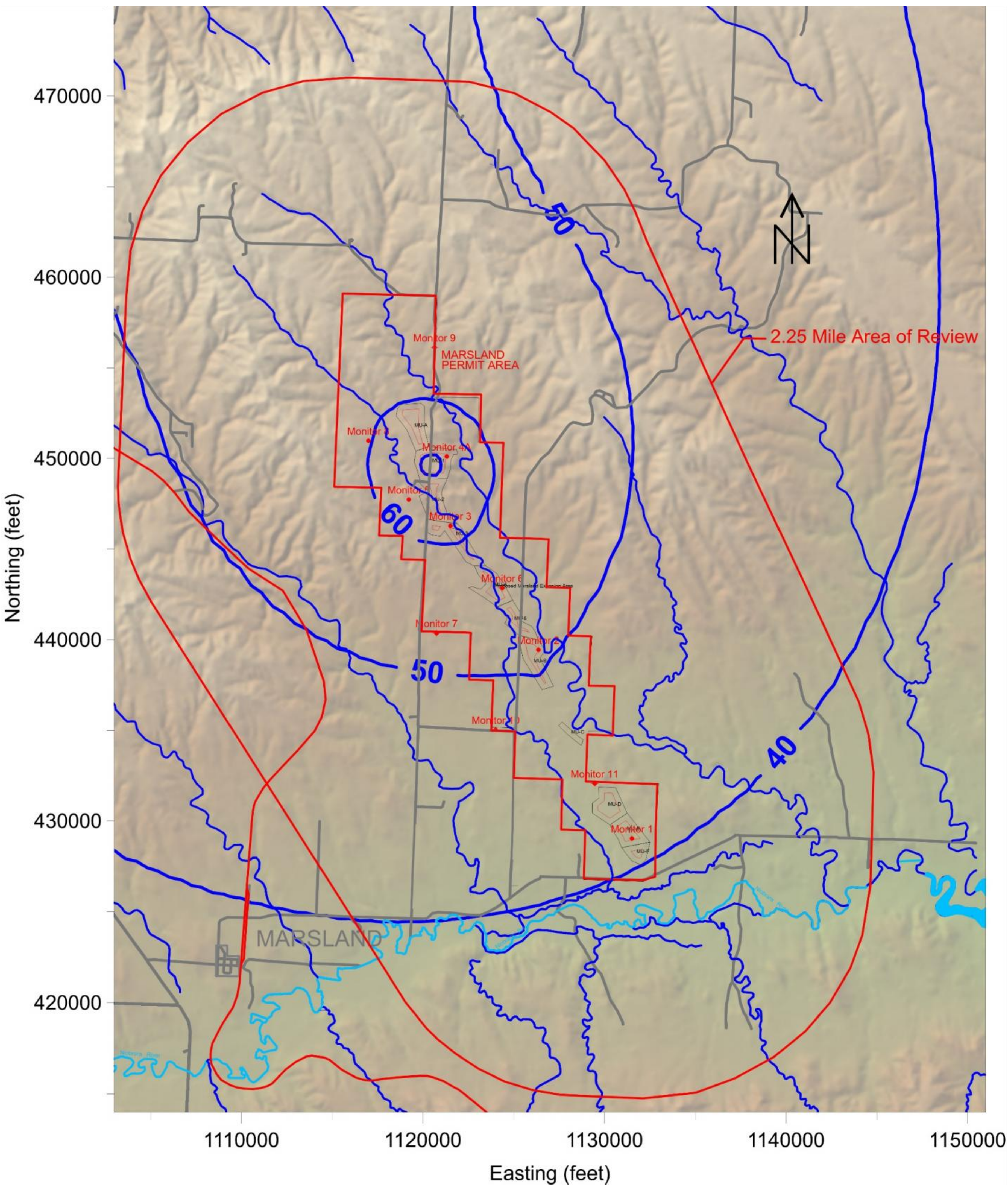
Model Drawdown Hydrographs
MEA South and West 2.25 Mile Radius
Theis Analysis

Drawdown Impact Assessment
Marsland Expansion Area
Dawes County, Nebraska

Cameco

Figure
16



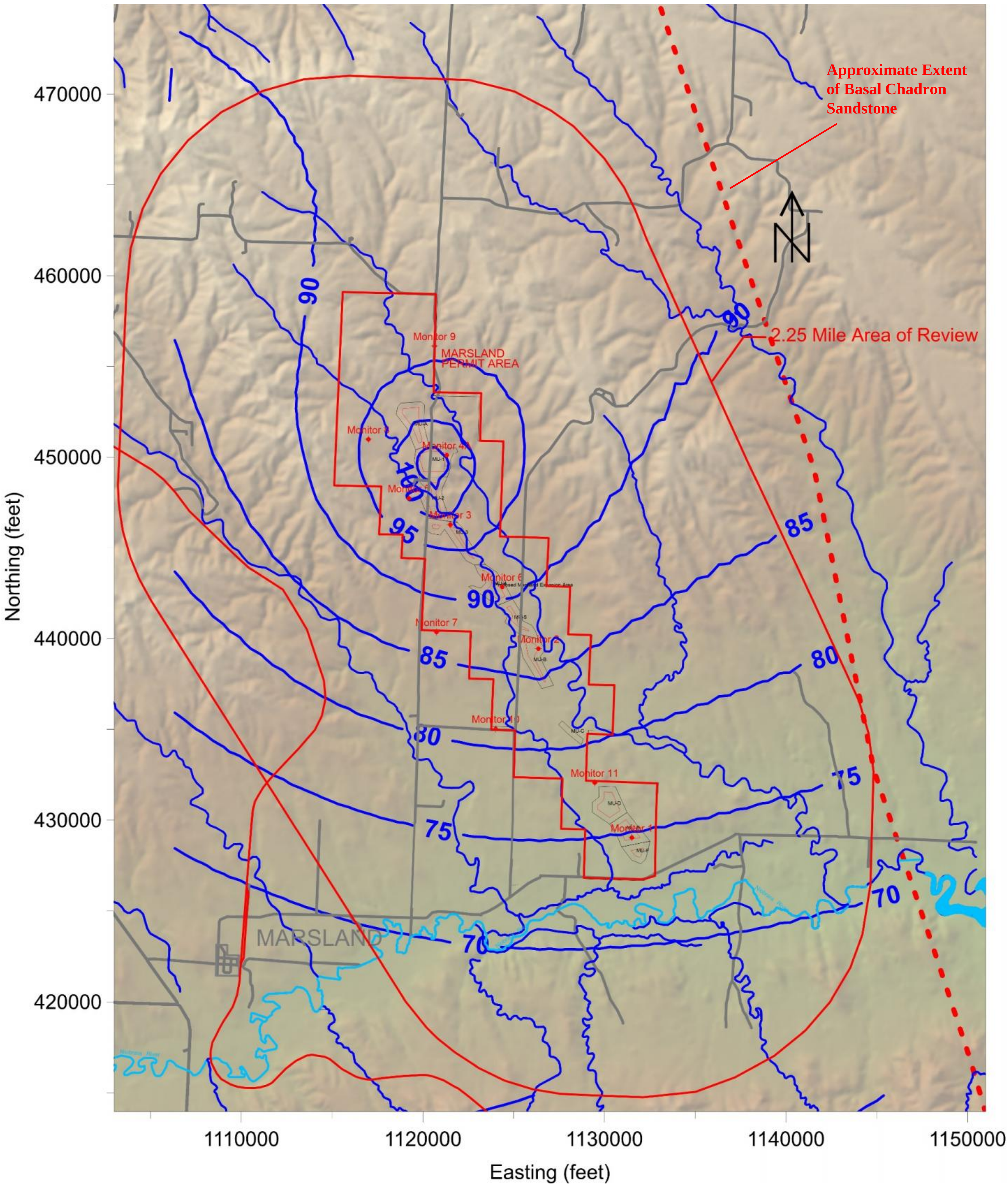
AquiferTek

Projected Cumulative Drawdown
Year 2028
Theis Analysis

Drawdown Impact Assessment
Marsland Expansion Area
Dawes County, Nebraska

Cameco

Figure
17



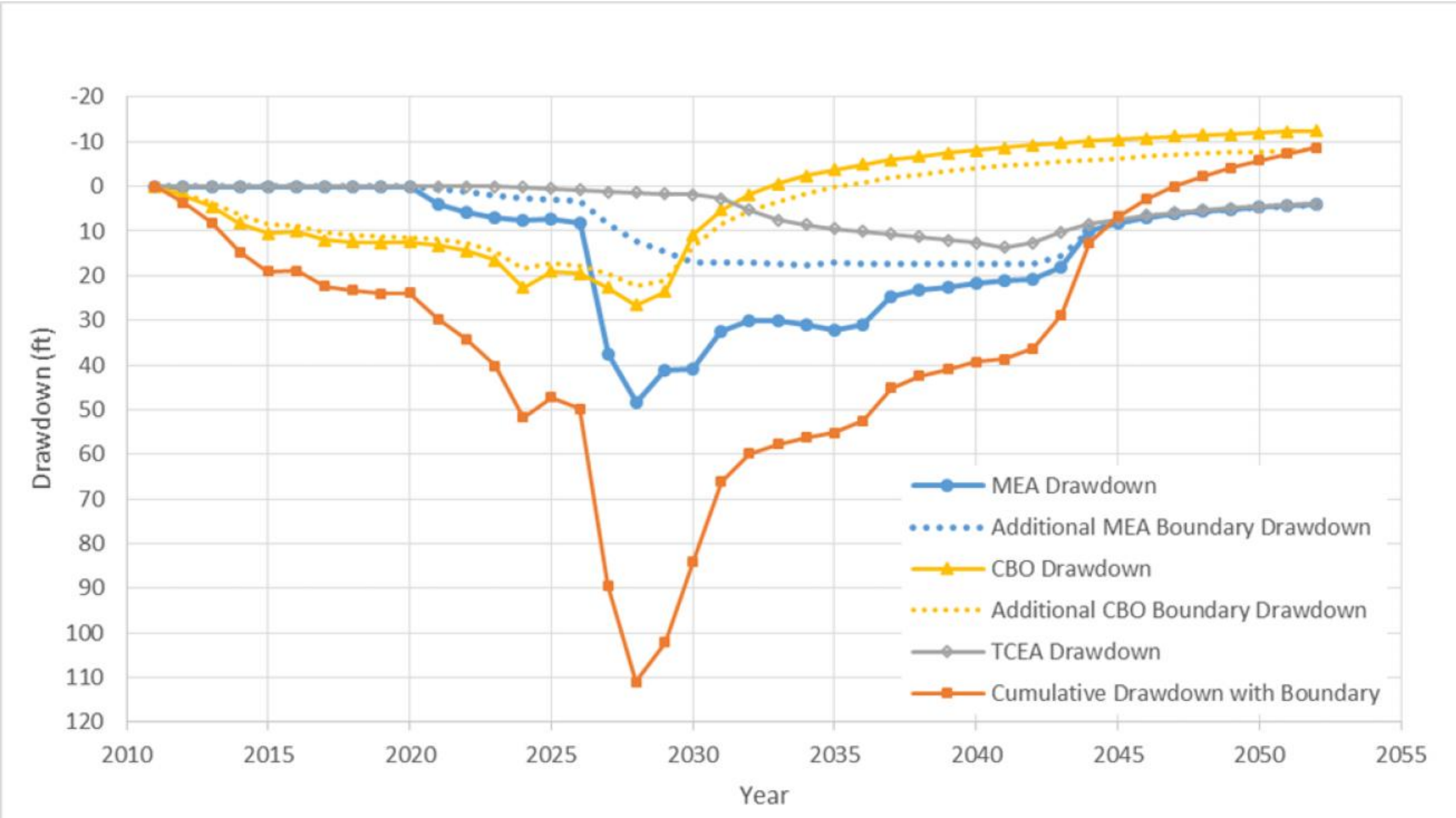
AquiferTek

Projected Cumulative Drawdown
Year 2028
Including No-Flow Boundary

Drawdown Impact Assessment
Marsland Expansion Area
Dawes County, Nebraska

Cameco

Figure 18



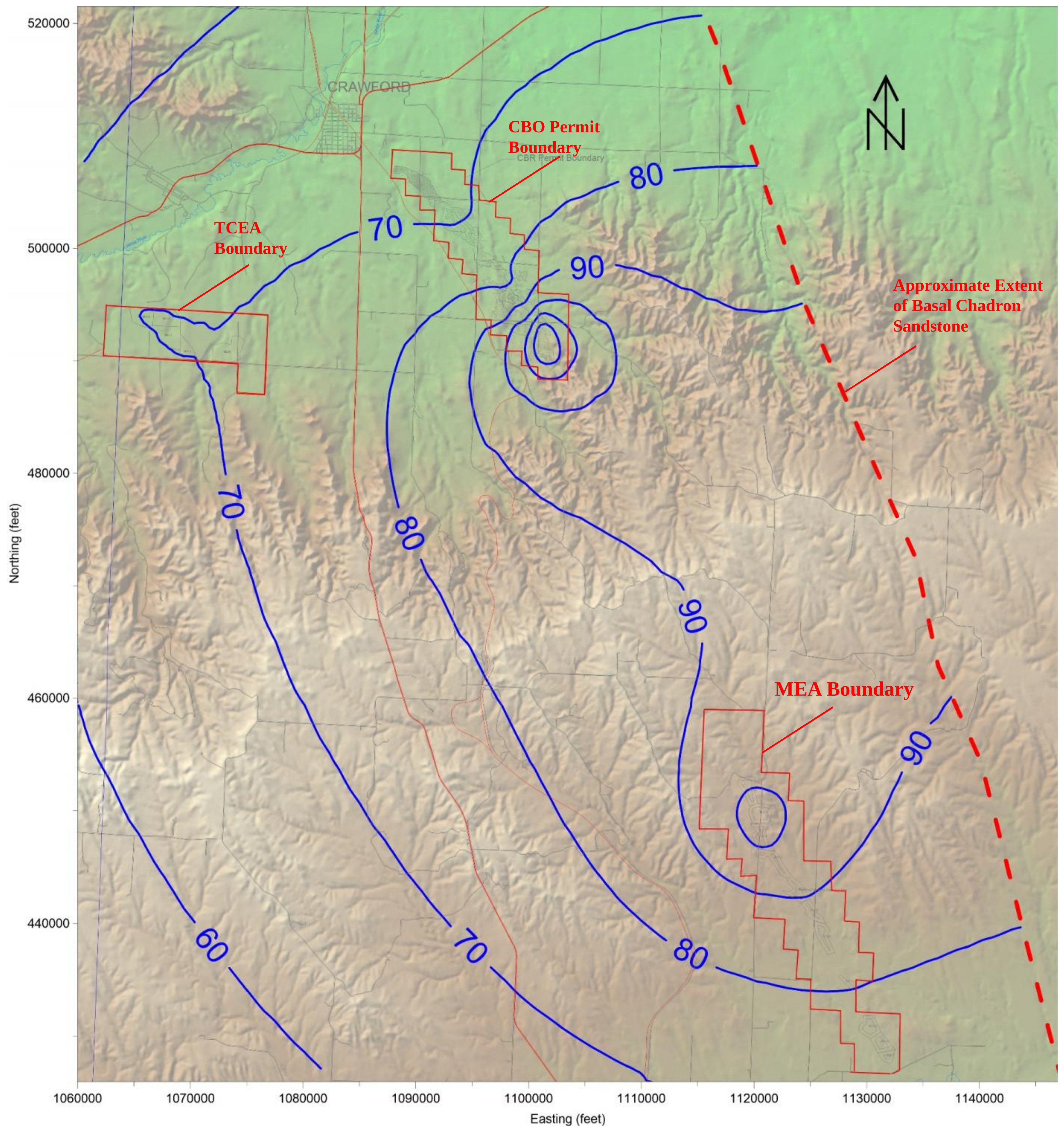
AquiferTek

Model Drawdown Hydrograph
MEA MU-1 Wellfield
Including No-Flow Boundary (Image Well Analysis)

Drawdown Impact Assessment
Marsland Expansion Area
Dawes County, Nebraska

Cameco

Figure
19



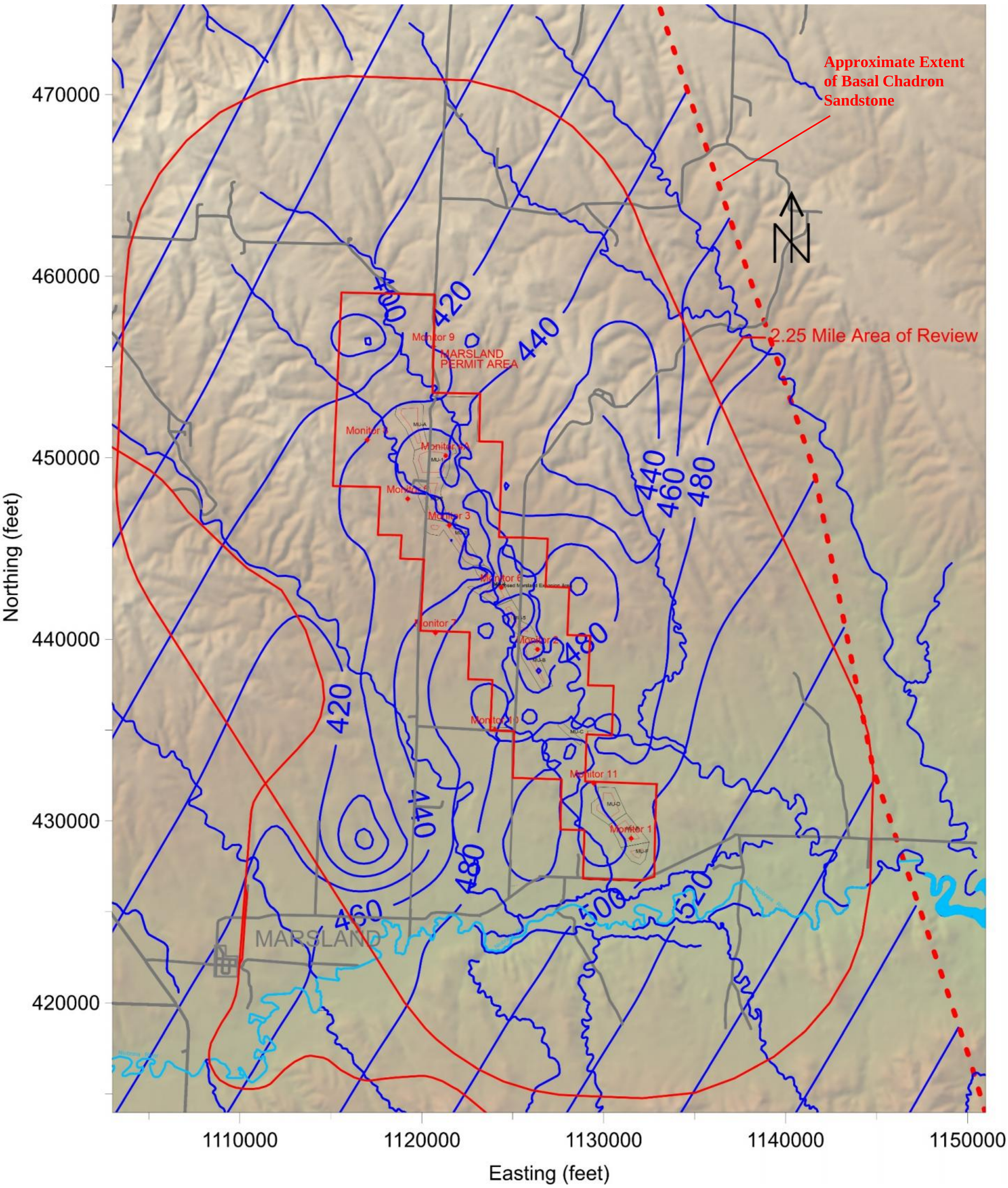
AquiferTek

Regional Cumulative Drawdown
Year 2028
Including No-Flow Boundary

Drawdown Impact Assessment
Marsland Expansion Area
Dawes County, Nebraska

Cameco

Figure 20



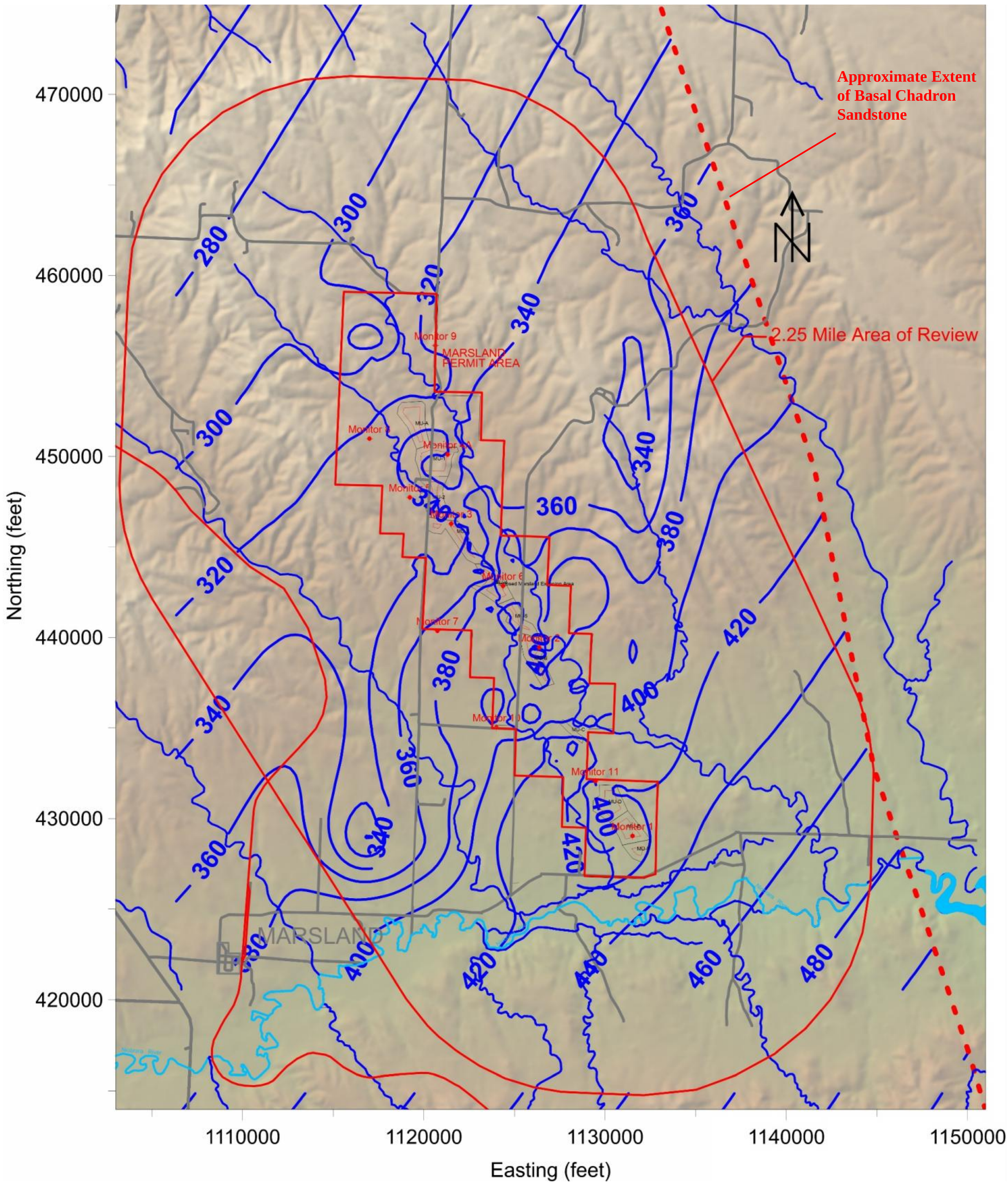
AquiferTek

MEA Available Head
Year 2011

Drawdown Impact Assessment
Marsland Expansion Area
Dawes County, Nebraska

Cameco

Figure 21



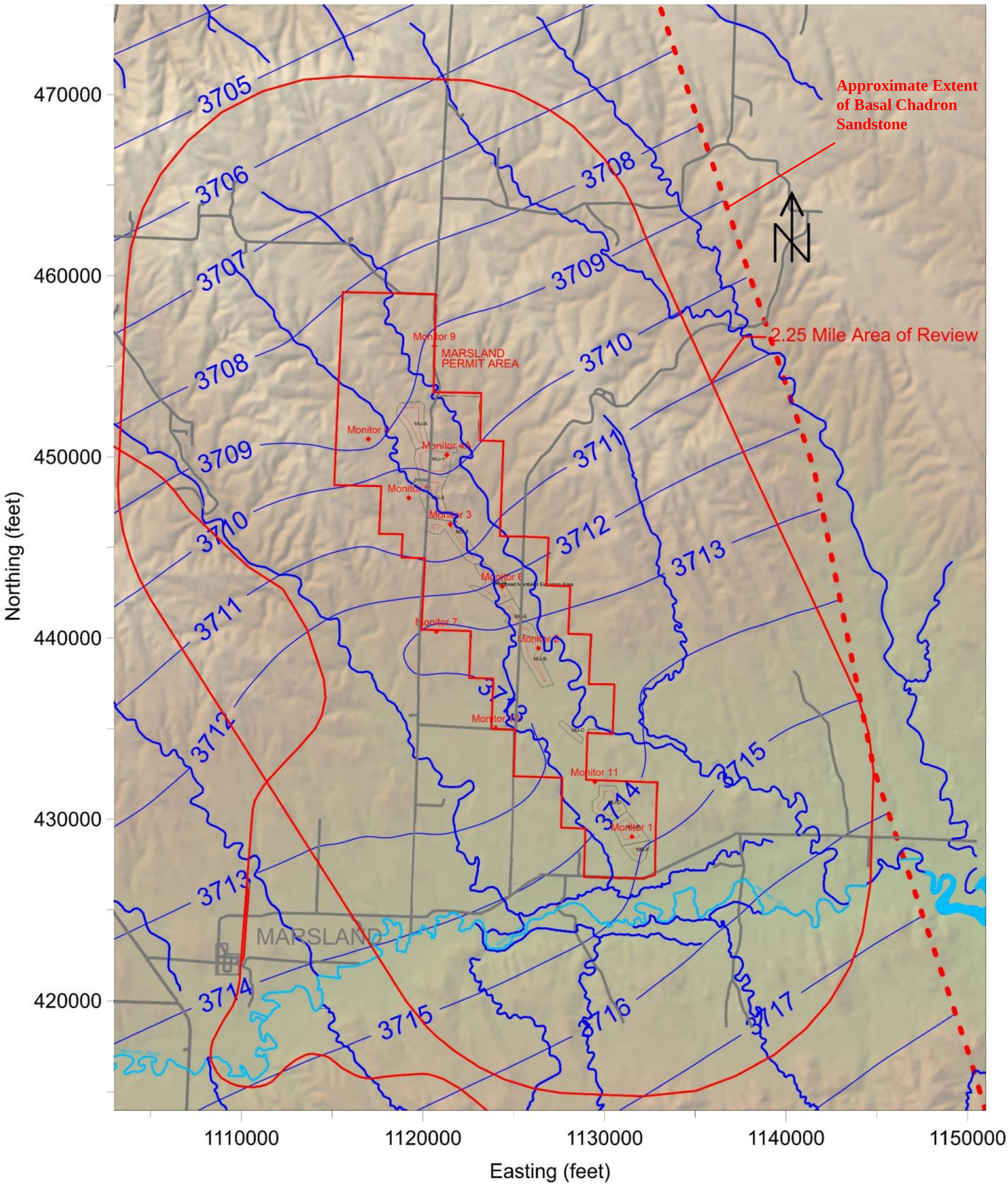
AquiferTek

Projected Minimum Available Head
Year 2028

Drawdown Impact Assessment
Marsland Expansion Area
Dawes County, Nebraska

Cameco

Figure
22



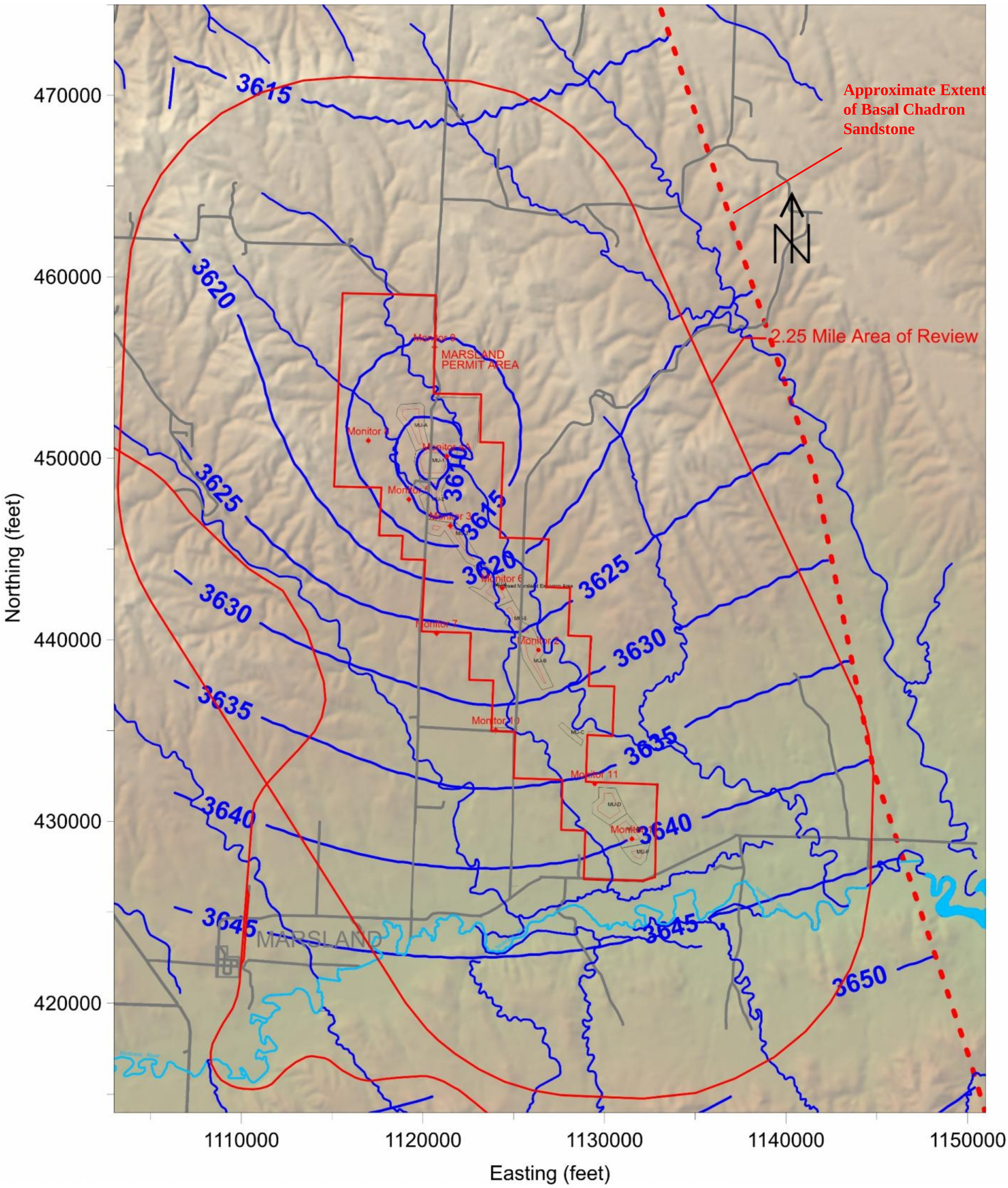
AquiferTek

MEA Basal Chadron Water Level Elevation
February 2011

Drawdown Impact Assessment
Marsland Expansion Area
Dawes County, Nebraska

Cameco

Figure 23



AquiferTek

Projected MEA Basal Chadron Water Level Elevation
Year 2028

Drawdown Impact Assessment
Marsland Expansion Area
Dawes County, Nebraska

Cameco

Figure 24

ATTACHMENT A

WATER BALANCE AND CONSUMPTIVE USE DATA

CBO Consumptive Use (gpm)	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
MU-1	20.00	10.00	8.33	7.50	8.75	8.10	10.56	8.16	6.99										
MU-2		10.00	8.33	7.50	8.75	8.10	10.56	8.16	6.99	10.37	8.96	9.45	10.09	8.31	9.72	14.04	12.17	12.51	15.07
MU-3			8.33	7.50	8.75	8.10	10.56	8.16	6.99	10.37	8.96	9.45	10.09	8.31	9.72	14.04	12.17	12.51	15.07
MU-4				7.50	8.75	8.10	10.56	8.16	6.99	10.37	8.96	9.45	10.09	8.31	9.72	14.04	12.17	12.51	15.07
MU-5						8.10	10.56	8.16	6.99	10.37	8.96	9.45	10.09	8.31	9.72	14.04	12.17	12.51	15.07
MU-6								8.16	6.99	10.37	8.96	9.45	10.09	8.31	9.72	14.04	12.17	12.51	15.07
MU-7									6.99	10.37	8.96	9.45	10.09	8.31	9.72	14.04	12.17	12.51	15.07
MU-8												9.45	10.09	8.31	9.72	14.04	12.17	12.51	15.07
MU-9													10.09	8.31	9.72	14.04	12.17	12.51	15.07
MU-10																	12.17	12.51	15.07
MU-11																			
Total CBO Consumptive Use (gpm)	**20.0**	**20.0**	**25.0**	**30.0**	**35.0**	**40.5**	**52.8**	**49.0**	**48.9**	**62.2**	**53.7**	**66.2**	**80.7**	**66.5**	**77.7**	**112.3**	**109.5**	**112.6**	**135.6**

CBO Consumptive Use (gpm)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
MU-1																			
MU-2	16.35	17.28	19.51																
MU-3	16.35	17.28	19.51	26.72	26.43	21.76													
MU-4	16.35	17.28	19.51	26.72	26.43	21.76	75.00												
MU-5	16.35	17.28	19.51	26.72	26.43	21.76	87.50	162.50	162.50	31.25									
MU-6	16.35	17.28	19.51	26.72	26.43	21.76	2.00	2.00	2.00	131.25	59.40								
MU-7	16.35	17.28	19.51	26.72	26.43	21.76	3.60	2.40	1.20	10.00	105.60	121.90							
MU-8	16.35	17.28	19.51	26.72	26.43	21.76	7.20	6.00	4.80	4.30	8.60	73.13	246.90						
MU-9	16.35	17.28	19.51	26.72	26.43	21.76	8.10	6.00	4.80	4.70	4.70	10.00	20.00	262.50					
MU-10	16.35	17.28	19.51	26.72	26.43	21.76	20.40	18.00	15.60	12.00	10.80	9.00	9.80	20.00	262.50	262.50	143.75		
MU-11	16.35	17.28	19.51	26.72	26.43	21.76	20.40	16.20	13.20	10.80	8.80	4.20	4.20	4.20	8.60	10.00	123.75	262.50	196.90
Total CBO Consumptive Use (gpm)	**163.5**	**172.8**	**195.1**	**240.4**	**237.9**	**195.9**	**224.2**	**213.1**	**204.1**	**204.3**	**197.9**	**218.2**	**280.9**	**286.7**	**271.1**	**272.5**	**267.5**	**262.5**	**196.9**

MEA Consumptive Use (gpm)	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
MU-1	18.3	17.4	14.1	10.2	5.7	13	150	150	37.5														
MU-2	2.7	15.3	17.7	14.1	10.2	5.4	14	75	131.5	150													
MU-3		2.7	15.3	17.7	14.1	10.2	5.4	16	75	93.75	150	37.5											
MU-4			2.7	15.3	17.7	14.1	10.2	5.4	8	24.75	75	131.25	112.5										
MU-5				2.7	15.3	17.7	14.1	10.2	5.4	8	8	58.25	93.75	150	37.5								
MU-A						4.5	18.3	16.8	13.2	9	4.2	6.6	24.75	75	131.25	112.5							
MU-B							4.5	18.3	16.8	13.2	9	4.2	3.8	8	58.25	93.75	150	37.5					
MU-C								4.5	18.3	16.8	13.2	9	4.2	2.4	6.6	24.75	75	131.25	112.5				
MU-D									4.5	18.3	16.8	13.2	9	4.2	2.4	3.8	8	58.25	93.75	150	37.5		
MU-E										4.5	18.3	16.8	13.2	9	4.2	2.4	2.4	6.6	24.75	75	131.25	112.5	
MU-F												2.7	15.3	17.7	14.1	10.2	5.4	2.4	3.8	8	58.25	112.5	168.75
Total MEA Consumptive Use (gpm)	**21**	**35.4**	**49.8**	**60**	**63**	**64.9**	**216.5**	**296.2**	**310.2**	**338.3**	**294.5**	**279.5**	**276.5**	**266.3**	**254.3**	**247.4**	**240.8**	**236**	**234.8**	**233**	**227**	**225**	**168.75**

TCEA Consumptive Use (gpm)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
MU-1	8.7	19.5	19.8	16.2	11.4	4.8	0.96	50.5	150	150										
MU-2		1.5	9	15.6	17.7	13.8	9	4.5	0.9	13	131.25	150	75							
MU-3					3.3	12.6	15.3	12.3	9.06	4.2	0.9	8	64.25	150	150					
MU-4							5.4	14.4	17.4	13.8	9.9	4.8	0.9	6	8	150	150	37.5		
MU-5									5.1	13.2	17.4	15.3	11.4	6.6	1.8	8	8	114.5	150	75
Total TCEA Consumptive Use (gpm)	**8.7**	**21**	**28.8**	**31.8**	**32.4**	**31.2**	**30.66**	**81.7**	**182.46**	**194.2**	**159.45**	**178.1**	**151.55**	**162.6**	**159.8**	**158**	**158**	**152**	**150**	**75**

Notes: Future consumptive use estimates assume 25% Reverse Osmosis (RO) efficiency at CBO based on historical performance, and 30% RO efficiency at MEA and TCEA as a conservative estimate.
Historical consumptive use at CBO (1991-2015) use actual disposal volumes evenly distributed over active mine units.