IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF NEW MEXICO

UNITED STATES OF AMERICA, for Itself and as Trustee for the Zuni Indian Tribe, Navajo Nation and Ramah Band of Navajos and STATE OF NEW MEXICO, ex rel. STATE ENGINEER, Plaintiffs, and ZUNI INDIAN TRIBE, NAVAJO NATION, Plaintiffs in Intervention, v. STATE OF NEW MEXICO COMMISSIONER OF PUBLIC LANDS, and A & R PRODUCTIONS, et al., Defendants.	**No. 01cv00072-MV/JHR** ZUNI RIVER BASIN ADJUDICATION Sub-areas 4 and 8 **Subfile No. ZRB-1-0148**

SECOND DECLARATION OF THOMAS W. LEY

I, Thomas W. Ley, do upon personal knowledge hereby declare and state that:

1. I am a Senior Supervisory Engineer at Natural Resources Consulting Engineers, Inc. ("NRCE") headquartered in Fort Collins, Colorado. Since August of 2013, I have conducted technical analysis on behalf of the United States concerning matters associated with the hydrographic survey of the Zuni River Basin and the Zuni River Basin Adjudication. As an employee of NRCE, I perform field visits to document

and verify water features within and throughout the Basin to support any technical analysis associated with the Zuni River Basin Adjudication. I also compute water quantities associated with these features based upon available information. I serve as the United States' expert witness in Subfile No. ZRB-1-0148.

2. I have prepared and previously provided expert witness analyses and two expert witness reports in this proceeding—*United States' Second Rule 26(a)(2)(D)(ii) Rebuttal Expert Disclosure* dated December 23, 2020 (NRCE Report: Subfile ZRB-1-0148—Dec2020 Water Use Determination_FINAL) and *United States' Third Rule 26(a)(2)(D)(ii) Rebuttal Expert Disclosure* dated March 12, 2021 (NRCE Report: Subfile ZRB-1-0148—Mar2021 Water Use Determination Update). These documents are attached to this Second Declaration as Attachments A and B, respectively. I have also prepared and provided a declaration in support of the *Plaintiffs United States of America's and State of New Mexico's Motion for Summary Judgment* dated March 15, 2021 (Doc. 3491-1). I now submit this Second Declaration to explain further how NRCE determined the annual pumping rate for Well 8B-1-W10 for the years 2001-2020 based on the records that C&E Concrete submitted to the New Mexico Office of the State Engineer ("NMOSE") during that time period and why the conclusions of Walter L. Meech and Alan Kuhn, Ph.D., the Meech's expert witness, are implausible based on those records.

3. I have reviewed all the material available concerning Subfile ZRB-1-0148, Norma M. Meech, individually and as the successor-in-interest to Walter V. Meech ("Defendant"). The material in my review included notes, photographs, and geospatial data collected by NRCE engineers during visits to the Defendant's

property; US Department of Justice ("USDOJ") April 5, 2006 consultation notes with Defendant; and correspondence between Defendant's legal counsel and USDOJ counsel in June 2017. Specifically in preparing this Second Declaration, I reviewed:

- Defendant's *Disclosures Under Rule 1-26(a)(2)(B), Federal Rules of Civil Procedure* dated July 17, 2020 ("July 2020 Disclosure");
- Defendant's *Answers to Plaintiff United States of America's First Combined Discovery Requests Directed to Subfile Defendant Norma M. Meech*, filed August 24, 2020 ("2020 Answer");
- Defendant's *Supplemental Disclosures Pursuant to Fed. R. Civ. P. 26(a)(2)(B)* dated November 9, 2020 ("Supplemental Disclosure");
- Defendant's *Response to Plaintiffs' Request for Records of Water Usage at the Tinaja Pit Mine* ("C&E Water Logs (2013-2020)");
- Defendant's *Supplemental Response to Plaintiffs' Requests for Well Meter Readings 2016-2020* ("Supplemental Well Meter Readings");
- *Expert Witness Report of Alan K. Kuhn,* Alan Kuhn Associates, LLC dated November 6, 2020;
- *How to Read Totalizing Flow Meters,* pamphlet produced by State of Oregon Department of Water Resources dated 12/1/2016. Accessed by NRCE in November 2020 at https://www.oregon.gov/owrd/WRDFormsPDF/HowtoReadTotalizingFlow%20Meters.pdf
  and referenced in NRCE Report: Subfile ZRB-1-0148—Dec2020 Water

Use Determination_FINAL. This document is attached to this Second Declaration as Attachment C.

- *Affidavit of Walter L. Meech* dated February 25, 2021. ("Meech 2/25/21 Affidavit");
- *Affidavit of Walter L. Meech*. Exhibit A in Defendant's *Response in Opposition to United States and the State of New Mexico Joint Motion for Summary Judgment* dated April 12, 2021 ("Meech 4/12/21 Affidavit"); and
- *Badger Meter Recordall Disc Meters, Lead-Free Bronze Alloy, Sizes 5/8, 5/8x3/4, 3/4 and 1 inch Meters.* Product Data Sheet downloaded from https://www.badgermeter.com/products/meters/nutating-disc-flow-meters/disc-series-meters/. This document is attached to this Second Declaration as Attachment D.

4. The parties agree that the quantity of water to which the Defendant is entitled for the well located on the real property associated with Subfile No. ZRB-1-0148 as identified by the hydrographic survey ID number 8B-1-W10 (NMOSE file number G-336) ("Well 8B-1-W10") is properly determined from the water meter readings associated with Well 8B-1-W10 and submitted to the NMOSE.

5. Well 8B-1-10 (OSE G-336) is equipped with a 1-inch meter (2020 Answer Exhibit H). A photo of the meter installed on Well 8B-1-W10 is shown in the 2020 Answer Exhibit O and Exhibit 1 Meech 4/12/21 Affidavit and is noted to be a 1" Badger Meter Model 55 Recordall.

6. The Badger Meter Model 55 Recordall meter on Well 8B-1-10 is capable of reading

cumulative volume in gallons. As noted in the manufacturer's product data sheet attached to this Second Declaration as Attachment D, the meter "register has a six-odometer wheel totalization display, 360° test circle with center sweep hand. …" The "odometer" portion of the meter can be read to the nearest 10 gallons from 0 to 9,999,990 gallons. The meter has a fixed zero (i.e., it is always zero) in the single digits place in the "odometer" portion of the meter. Meter readings to tenths of a gallon may be observed on this meter. The gallonage in the single digits and tenths of a gallon place range from 0.0 to 9.9 gallons and is read using the sweeping red dial arm or hand. The ***maximum*** valid meter reading that can be observed on this meter is 9,999,999.9 gallons (after which the odometer on the meter rolls over to all zeros).

7. The correct method of reading the 1-inch Recordall 55 meter installed on Well 8B-1-W10 was given in Section 2.1 of NRCE Report: Subfile ZRB-1-0148—Dec2020 Water Use Determination_FINAL. Attached to this Second Declaration as Attachment E is Figure 3 from that report. As stated, the maximum number of digits in the meter reading is 8, meaning that the meter rolls over when the cumulative gallons reaches 9,999,999.9. The correct meter reading for Attachment E (and making reference to Attachment C) is made by reading the entire string of digits as indicated by "A" or 0945540. Leaving out the leading zero and adding what is represented by the sweeping red dial arm, 6.5, the correct meter reading is 945,546.5 gallons. Readings of 94,554 ("B"), which are just the moving odometer wheel digits, or 945 ("C"), which are just the digits with white background, are clearly incorrect, and are of the same nature of mistakes present throughout C&E's

recorded raw meter readings. Readings such as those designated as "B" and "C" cannot be "corrected" by applying a multiplier. The meter does not have or use a multiplier that is to be applied after the reading. The meter is correctly read by accounting for all digits shown on the face of the meter. All numbers on the meter face are integers and do not represent fractional gallon quantities. Fractional gallon quantities are represented by the position of the red meter arm.

8. Meech has identified no meter other than the 1" Badger Meter Model 55 Recordall that was used on Well 8B-1-10 during the relevant time period.

9. Monthly meter readings for Well 8B-1-10 (OSE G-336) for the period January 1, 2001 to September 1, 2016 (2020 Answer Exhibit H and Meech 4/12/21 Affidavit Exhibit 2) as submitted to the NMOSE were analyzed to determine volume of water pumped from Well 8B-1-W10 on a monthly and annual basis. During this period, the meter readings for the following periods were recorded as follows: April through July 2011—out of service, August 1, 2012 through August 1, 2013—100 (indicating no pumping), September 1, 2013 to September 1, 2016—out of service. Meter reading data for Well 8B-1-10 (OSE G-336) for the period 2016 to January 1, 2021 submitted by the Defendant (Supplemental Well Meter Readings) showed the well was out of service for that entire period.

10. Monthly meter readings are reported as occurring on the first day of the month (2020 Answer Exhibit H and Meech 4/12/21 Affidavit Exhibit 2).

11. Annual total volume pumped for the year being analyzed was computed as the meter reading on January 1 of the following year minus the meter reading on January 1 of the year being analyzed.

12. Significant discrepancies were found in the recorded meter readings in terms of the number of digits recorded and submitted as the meter reading records to the NMOSE. In some instances, meter readings were noted to change by an order of magnitude (factor of 10) and decrease going from 5 digits to 4 digits for example.

13. In both of Meech 4/12/21 Affidavit (Exhibit 4) and the *Expert Witness Report of Alan K. Kuhn,* the Defendant and Defendant's expert attempted to correct the erroneous meter readings by arbitrarily placing the decimal point in different positions within the recorded meter readings submitted to the NMOSE. These adjustments were not done systematically, but variably. The adjustments made resulted in "corrected" meter readings during the period January 1, 2001 to November 1, 2004 that are physically impossible—in other words, the installed Recordall 55 meter is not physically capable of containing the number of digits in the "corrected" readings. The "correction" was arbitrary in the sense that the decimal was moved one place to the right from January 1 2001 to June 1, 2001; two places to the right from July 1, 2001 to February 1, 2003; and one place to the right from March 1, 2003 to November 1, 2004. The resulting "corrected" readings for this entire period ranged from 10,468,000 to 22,309,000 gallons. As previously noted, the maximum valid reading of this meter is 9,999,999.9 gallons.

14. NRCE resolved the meter reading discrepancies based on the photo of the meter on this well (see Para. 5 and 6), an understanding of the meter recording range, and the maximum number of digits in a valid meter reading (see Para. 6 and 7) to systematically determine the correct annual volume pumped by Well 8B-1-W10 (NRCE Report: Subfile ZRB-1-0148—Dec2020 Water Use

Determination_FINAL).

15. In the *Expert Witness Report of Alan K. Kuhn,* the Defendant's expert applied variable meter multipliers for different periods of time to the meter record for well 8B-1-W10 (page 3 and Table 1 of the *Expert Witness Report of Alan K. Kuhn*). The Recordall 55 meter does not use a multiplier. It is clearly an incorrect assumption to apply variable multipliers to the readings of this meter.

16. The amended well declaration for Well 8B-1-W10 (G-336) filed with NMOSE in July 2003 states the capacity of the well is 7 gallons per minute ("gpm") and it is in production 90% of the year. Under these constraints, this well would produce 10.16 acre-feet per annum. During the relevant time period (2002) Well 8B-1-W10 would not have been capable of producing the quantity of water determined by Kuhn in his report (*Expert Witness Report of Alan K. Kuhn*) and claimed by Walter Meech in his 4/12/21 Affidavit. Both Kuhn and Meech estimated pumping volumes for 2002 are 150% of the annual rate computed from the amended well declaration and considered implausible.

17. Annual pumping volume for Well 8B-1-W10 for the period 2001-2012 ranged from 0.046 acre-feet to 2.041 acre-feet. The maximum annual pumping volume of 2.041 acre-feet occurred in 2006 (See Table 1 in the NRCE Report: Subfile ZRB-1-0148—Dec2020 Water Use Determination_FINAL). It is noted that the Defendant's "corrected" readings (Meech 4/12/21 Affidavit) resulted in annual pumping volumes that match NRCE's analysis for 2006-2012, and that the Defendant's expert's "corrected" readings (*Expert Witness Report of Alan K. Kuhn*) resulted in annual pumping volumes that match NRCE's analysis for 2005-2012.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct. Executed on this 10th day of May 2021.

Thomas W. Ley, PhD, PE
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UPDATE AND REBUTTAL RESPONSE

ZUNI RIVER BASIN
DETERMINATION OF WATER USES
FOR
SUBFILE ZRB-1-0148

In the matter of
United States v. A&R Productions
Case # 01cv00072-MV/JHR

Prepared for:
United States Department of Justice

Rule 26(a)(2) Disclosure

Prepared by:

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December 23, 2020

Attachment A - NRCE Report Dec2020

Table of Contents

1 Introduction

1.1 Background

Natural Resources Consulting Engineers, Inc. (NRCE) is providing technical support to the United States Department of Justice (DOJ) in the adjudication of water rights in the Zuni River Basin of New Mexico (United States v. A & R Productions et al. Case No.01cv00072-MV/JHR UNITED STATES DISTRICT COURT FOR THE DISTRICT OF NEW MEXICO). The initial hydrographic surveys of the non-federal lands in the Basin have been completed and hydrographic survey reports have been filed with Court. The initial hydrographic surveys of the Zuni River Basin provide listings of water rights claims and estimated historical water uses throughout the basin. Claims (subfiles) are adjudicated by the court on a case by case basis.

This report is prepared to provide:

- in part, an update to the technical report prepared by NRCE for the United States Department of Justice titled: "ZUNI RIVER BASIN: DETERMINATION OF WATER USES FOR SUBFILE ZRB-1-0148" dated June 10, 2020; and,
- in part, a rebuttal response to the expert report submitted by Alan Kuhn & Associates (AKA) titled "Report on Expert Consultation in Zuni Basin Adjudication" dated November 6, 2020.

Subfile ZRB-1-0148 (Norma M. Meech, individually and as the successor in interest to Walter Meech, Claimant) concerns water rights claims to operate the Meech's business, C&E Concrete, Inc., (C&E), a limestone mining operation (the Tinaja Quarry). Water is required for dust abatement and the production of various materials. The water right features claimed under the most recent proposed Consent Order for subfile ZRB-1-0148 dated June 2019 included 4 ponds (8B-1-SP34, 8B-1-SP66, 8B-1-69A, 8b-1-69B) and three wells (8B-1-W09, 8B-1-W10, 8B-1-W11). At issue is the correct determination of water volume pumped from wells 8B-1-W10 (OSE File No. G-336) and 8B-1-W11 (OSE File No. G-337).

NRCE has prepared this updated technical analysis of water volume pumped from the two wells used to supply operations at the Tinaja Quarry after reviewing additional documentation provided in discovery by the Claimant, which was not previously available. NRCE revisited the raw meter logs and revised its previous interpretation of historical water use for wells 8B-1-W10 and 8B-1-W11. NRCE also made calculations of water used in dust suppression from water truck logs and compared results to those by C&E and AKA. The documentation from C&E and their expert cited in this report are referred to as follows: Exhibit O – Photos of Meters on Wells, Exhibit H – Meter Readings for G-336, Exhibit I – Meter readings for G-337, Water Truck Logs, and Alan Kuhn's (AKA) expert report.

1.2 Statement of Qualifications

NRCE is a civil, environmental, and water resources engineering consulting firm that specializes in agricultural engineering, hydrology, water resources engineering and providing expert support for water right disputes. The historical water use values calculated in this report are based upon the procedures described in the *Hydrographic Survey Report for Subareas 4 & 8* (NRCE, 2004) and information collected by NRCE engineers during consultations with the Claimant.

This report is prepared by NRCE Engineering staff under the direct supervision of Thomas W. Ley, PhD, PE, Senior Supervising Engineer with Natural Resources Consulting Engineers, Inc. in Fort Collins,

Colorado. He holds a Ph.D. in Irrigation Engineering and is a licensed Professional Engineer in the States of Colorado, Utah Arizona, Nevada and Washington. Mr. Ley has over 40 years of experience in water resources and irrigation engineering including water supply development, irrigation system design, hydraulic analysis, water demand studies. His experience also includes climate analysis, estimation of evapotranspiration, computing crop irrigation and diversion requirements, field work for surveying and documentation of water features and associated uses, producing cost estimates for irrigation systems and providing analysis for domestic and municipal water use studies. Mr. Ley's resume is in Appendix B.

1.3 Disclaimer

Pursuant to Rule 26 of the Federal Rules of Civil Procedure, the United States has compensated NRCE approximately $17,600 for this report and if Mr. Ley is required to testify concerning this report the United States will be charged an hourly rate of $240 plus any expenses.

2 Updated Understanding of Meter Readings

NRCE has developed an updated analysis on the calculation of water use for each of the two wells (G-336 and G-337) at the C&E mining facility. The raw meter data provided by C&E in Exhibits H and I for each of the two wells (G-336 and G-337), respectively, contained multiple inconsistencies in the recorded monthly meter readings that did not provide a straightforward method for calculating historical water use estimates. This prompted various interpretations of the raw data using meter multipliers in an attempt to achieve a reasonable dataset on which to base water use determinations. NRCE performed a deeper investigation into the raw meter data in Exhibits H and I compared with the respective meters presented in Exhibit O. With an improved understanding of how the meter readings should be taken[1], NRCE was able to piece together what the actual meter readings should have been during the period of record. The notion of meter multipliers was somewhat of a misunderstanding that led to improper interpretations by various parties. Rather, the problem stems from incorrect and inconsistent meter reading protocol by C&E staff. This was determined through comparison of the meter photos and raw data provided by C&E. These records indicated the size of the meter on each well, with all meter readings for G-336 taken on the 1-inch meter and all readings for G-337 taken from the 2-inch meter. The photos in Exhibit O included two additional meters, both sized 1 ½ inches, but C&E records do not indicate when these meters were in service.

The two meters used for recordkeeping were identified as a Model 55 Recordall[2] and a Model 170 Recordall[3], for G-336 and G-337, respectively. Both are from the company Badger Meter, and operate by positive displacement with a nutating disc. Pictures of these two meters from Exhibit O are shown in Figures 1 and 2.

[1] https://www.oregon.gov/owrd/WRDFormsPDF/HowtoReadTotalizingFlow%20Meters.pdf

[2] http://www.tinmith.net/wayne/projects/water-meter/badger-datasheet.pdf

[3] http://www.minerspisani.com/pdf/Badger/Badger%20Model%20170.pdf

Figure 1: Badger Meter Recordall Model 55

G-336 Well meter (1")

- Typical flow range 1-55 gpm with max continuous flow at 40 gpm
- 7 Maximum whole Digits (turnover after 9,999,999 gallons)
- One fixed zero in the ones place
- Gallons from 0.0 to 9.9 are read by the position of the red meter arm
- Correct reading for case shown in photo is 945,546.5 gallons

Figure 2: Badger Meter Recordall Model 170

G-337 Well meter (2")

- Typical flow range 2.5-170 gpm with max continuous flow at 100 gpm
- 8 Maximum whole digits (turnover after 99,999,999 gallons)
- Two fixed zeroes in the tens place and the ones place.
- Gallons from 0 to 99 are read by the position of the red meter arm
- Correct reading for case shown in photo is 4,883,239 gallons.

Based on the raw water meter data, it is NRCE's understanding that both water meters were read on the first of every month for the period of record. It is uncertain if the readings provided may have been digitized from handwritten records. If so, original handwritten records were not provided. The differences in the meter faces may have led to some confusion in the reading of both meters, and it appears that in most cases, personnel simply followed the reading method that was used in the previous month. This led to relatively long periods in which improper readings occurred. These meters track water use cumulatively in gallons, so any decrease in meter readings must be due to meter turnover, reset, replacement, or malfunction. C&E records do not indicate a replacement for either meter throughout the period for which raw data were available. Meter turnover for well G-337 is confirmed in C&E's raw records. For well G-336, a period of malfunction followed by quickly ascending readings has been interpreted as a meter reset by C&E, the State of NM and NRCE. Neither of the meters have multipliers to be applied after the reading and should be read accounting for all digits shown on the face of the meter. All numbers on the meter faces are integers

and do not represent fractional gallon quantities. Fractional gallon quantities are represented by the position of the red meter arm.

Incorrect readings of the meters appears to have occurred—in some cases,

- reading and recording just the digits with a white background before the color shift to black (shown in Figures 3 and 6 as method C) and ignoring the digits with a black background, the fixed zero(es) and the red dial reading, or,
- reading and recording the digits with a white background and the digits with a black background (shown in Figures 3 and 6 as method B) and ignoring the fixed zero(es) and the red dial reading.

This led to the parties' attempts to identify and apply an appropriate adjustment (multiplier) to some of the readings for each meter to obtain results that appeared to make sense. Records indicate that even if this was the idea for interpretation of raw meter data, C&E staff took meter readings by different methods in such a way that a single multiplier for the entire dataset is not reasonable.

Appendix A presents a table for each well of the C&E raw meter readings and NRCE's interpretation of the meter readings and how they should be adjusted.

Within the raw data, there also appeared to be mistakes in digitization, with meter readings for consecutive dates appearing out of order. These cases were present for G-336 in the readings from 6/1/2005 to 8/1/2005 and 7/1/2008 to 8/1/2008. For G-337, there was one case from 4/1/2014 to 8/1/2014. These can be found highlighted within Appendix A but ultimately these cases did not affect annual use calculations because none of these mis-ordered values fell in January.

The following two sections of this report explain in more detail NRCE's best interpretation of the raw data for each of the two wells in question, G-336 and G-337. An explanation of the likely mistakes that led to this state of raw data will also be discussed.

2.1 Well 8B-1-W10

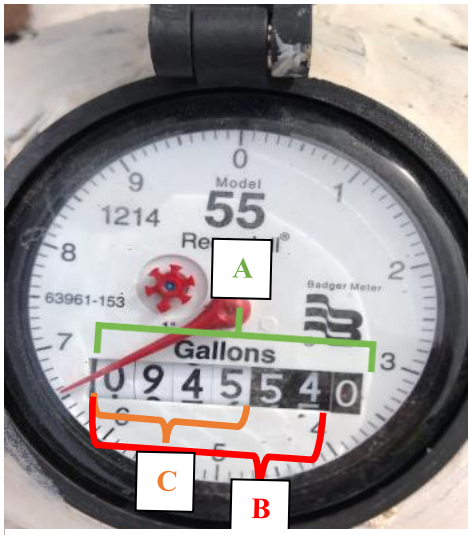


Figure 3: Well G-336 (1") Reading Methods

Meter records for well G-336 (Exhibit H) were provided from 1/1/2001 to 9/1/2016, but the meter was marked out of service August 2013 and did not contain any numeric data for the rest of the period of record provided (Aug 2013-Sept 2016). NRCE downloaded meter readings for well G-336 from the NMOSE New Mexico Water Rights Reporting System[4] and found the same data record.

When the meter on well G-336 is read correctly, the maximum number of digits in the meter reading is 8, meaning that the meter rolls over when the cumulative gallons reaches 9,999,999.9. Figure 3 shows the various methods that C&E personnel used to record meter readings throughout the study period. Figure 4 shows a graph of raw meter readings vs NRCE adjustments.

For the meter shown, the correct reading would be to use the entire string of digits as indicated by "A" in Figure 3. The

[4] http://nmwrrs.ose.state.nm.us/ReportDispatcher?type=PODGHTML&name=PodGroundSummaryHTML.jrxml&basin=G&nbr=00336&suffix=

exact meter reading for the meter shown would be 945,546.5 gallons, leaving out the first leading zero, and adding what is represented by the meter arm to the fixed zero at the right side of the meter. In this case the meter arm represents 6.5 gallons. While incorrect, readings of 945,540 or 945,000 maintain the order of magnitude of the true reading. However, readings of 94,554, or 945 are clearly incorrect, and are of the same nature of mistakes present throughout C&E's raw data. Failing to include the other digits compromised the meter reading data by altering the order of magnitude of the actual reading.

The meter was read in this manner (method A) from 1/1/2001 to 6/1/2001 with the fixed zero being consistently reported in records, until the magnitude of reported meter readings was suddenly dropped by a factor of 10 starting with the reading on 7/1/2001.

For the period between 7/1/2001 and 2/1/2003, the digits recognized by the meter reader left out the last zero, shown in Figure 3 as method B. The meter readings then jumped back up to the correct readings from 3/1/2003 to 11/1/2004 with fixed zeroes being reported consistently for this period.

The 11/1/2004 reading was 223,090, there was not a December 2004 reading, but on 1/1/2005 the reported reading was 226. There is no indication that this was the result of a meter reset or a turnover (noting as discussed earlier, that the meters were not changed out during the period analyzed). Given the previous reading, it is likely the correct reading in this case would have been closer to 226,000, and the meter was read incorrectly reflected by what is shown as method C in Figure 3, i.e., only reporting what was shown by digits with a white background. Meter readings were taken in this fashion (method C) through March 2011. This underestimated meter readings by a factor of 1000 for the period January 2005 through March 2011.

The meter was reported out of service between 4/1/2011 and 7/1/2011. It appears the meter was reset or a new meter installed, because the recorded meter reading goes from 1,185 in March 2011 to 4 in August 2011. There were no indications in Exhibit H of meter turnover or replacement. Meter readings continued to be read using method C from 7/2011 to the end of the available data for the period of record—the last recorded reading was July 2013.

Figure 4 shows a comparison of the C&E raw data and the results of NRCE's adjustment of the data based on the above interpretation of the raw meter readings.

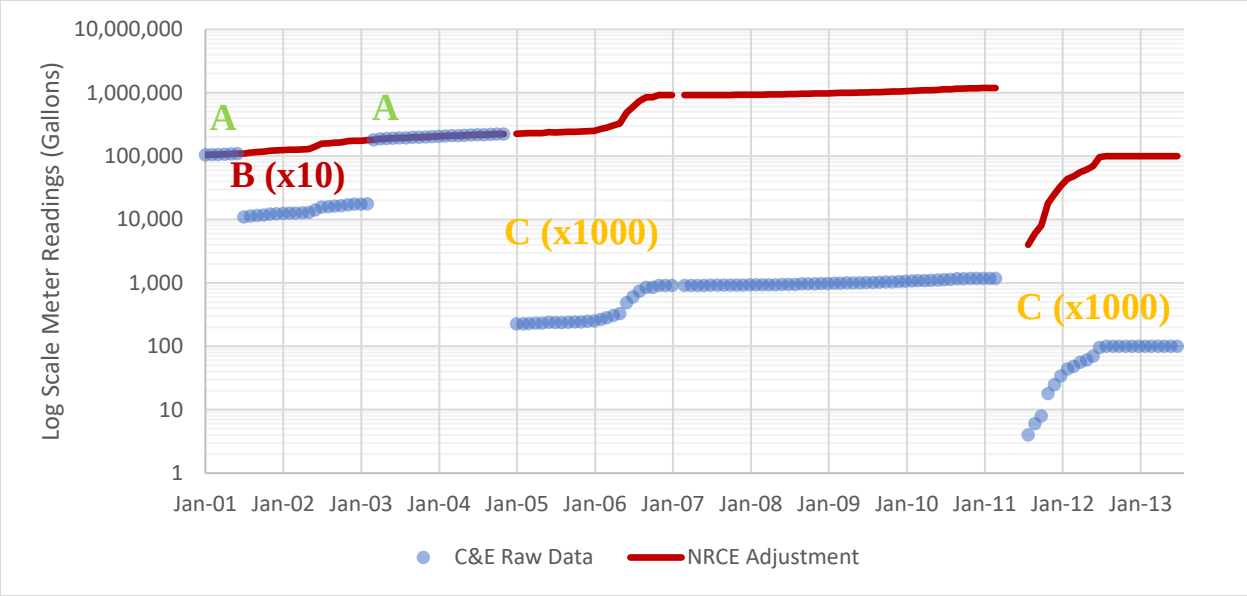


Figure 4: C&E Raw Meter Data for G-336 with NRCE Adjustments

Table 1 shows a comparison of the various calculated annual volumes of water pumped from well G-336 including NRCE's previous results and those of the NMOSE, C&E, and AKA. NRCE's current estimate is shown on the far right and is shaded green. Annual water volume pumped in acre feet was determined by subtracting that year's January meter reading from the subsequent year's January meter reading, with the result converted to acre feet. With the meter out of service after August 2013, annual pumping volume was only calculated from 2001 to 2012.

Table 1: Comparison of Annual Water Volume Pumped Calculations for G-336

Year	Previous NRCE Estimate (AF)	NMOSE Estimate (AF)	C&E Estimate (AF)	AKA Estimate (AF)	NRCE Estimate 2020 (AF)
2001	0.061	0.059	5.809	6.15	0.062
2002	0.154	0.157	15.458	15.44	0.154
2003	0.093	0.091	9.185	9.28	0.093
2004	0.064	0.063	5.886	6.16	0.064
2005	0.061	0.072	0.758	0.07	0.074
2006	2.041	2.042	2.05	2.04	2.041
2007	0.046	0.046	0.04	0.05	0.046
2008	0.089	0.148	0.144	0.15	0.150
2009	0.255	0.254	0.233	0.25	0.255
2010	0.368	0.369	0.393	0.37	0.368
2011	0.104	0.113	0.095	0.11	0.114
2012	0.203	0.203	0.23	0.2	0.203
Max:	**2.04**	**2.04**	**15.46**	**15.44**	**2.04**
Average:	**0.136**	**0.143**	**3.476**	**3.356**	**0.144**

Figure 5 displays a bar graph of the annual volume pumped as calculated by NRCE, representing the last column in Table 1. The water pumped in 2006 is much greater than any other year. It is uncertain why this spike in pumping rates occurred in 2006.

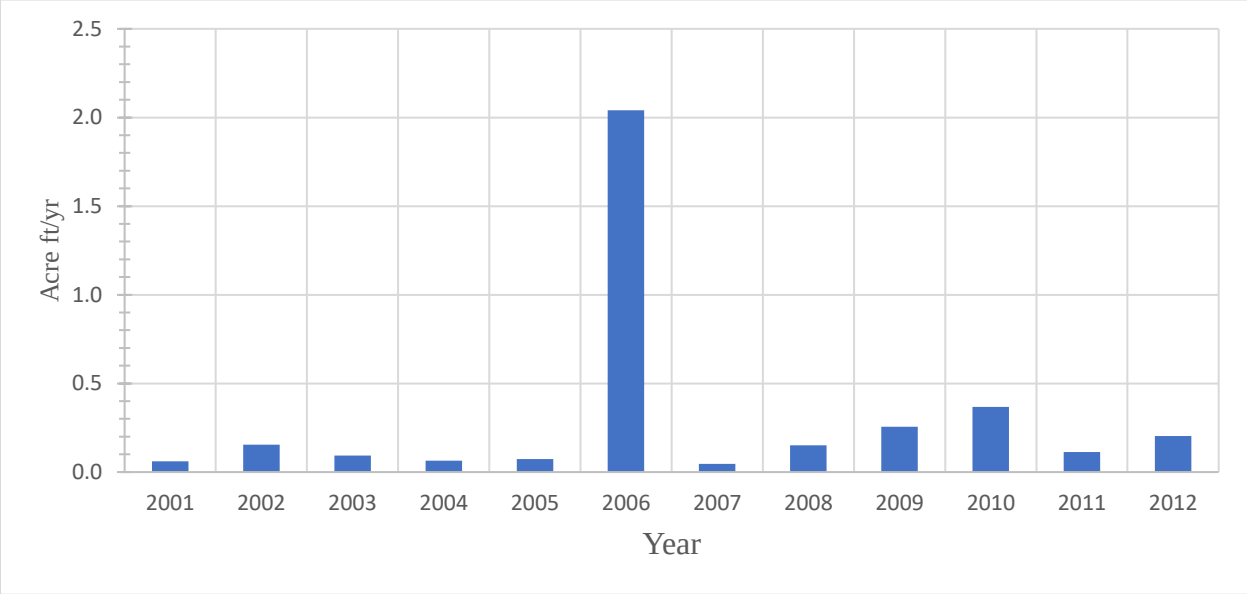


Figure 5: Annual Pumping Volume as Computed for Well G-336 by NRCE in 2020.

2.2 Well 8B-1-W11

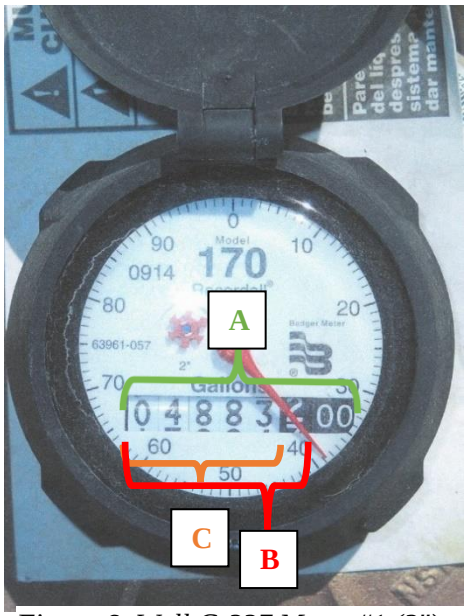


Figure 6: Well G-337 Meter #1 (2")

Meter records for well G-337 (Exhibit I) were provided from 1/1/2001 to 10/1/2016. NRCE downloaded meter readings for well G-337 from the NMOSE New Mexico Water Rights Reporting System[5] and found the data record also included data for 1/3/2000-9/1/2000 and actually ended on 3/1/2016. When the meter on well G-337 is read correctly, the maximum number of digits in the meter reading is 8, meaning that the meter rolls over when the cumulative gallons reaches 99,999,999. The records indicate a meter turn over at 11/1/2009, so NRCE was able to confirm the correct number of digits that should have been reported directly before a turnover. Figure 6 shows the 2" meter, with indications as to how the meter was being read in the time period. The correct manner to read this meter is using method A, but there is no indication that method A was performed at any time during the period of record. Figure 7 shows the raw data plotted on a log scale, indicating places where the various methods were used and the appropriate corrections.

Directly before meter turnover on 10/1/2009, the reported meter reading was 99,443 gallons. For the meter to turn over the next

[5] http://nmwrrs.ose.state.nm.us/ReportDispatcher?type=PODGHTML&name=PodGroundSummaryHTML.jrxml&basin=G&nbr=00336&suffix=S

month, the correct reading would have to be 99,443,000. It is clear that the person taking the meter reading reported only the digits with the white background, indicated as method C in Figure 6, perhaps assuming that the transition in digit color indicated a decimal point. This is incorrect and underestimates the reading by a factor of 1,000.

C&E records show handwritten notes on the side of the meter data correcting the 1/1/2006 reading from 50,775 to 50,775,000 and the 12/1/2006 reading from 62,762 to 62,762,000; and, written above "Has 3 Zero's". This is consistent with NRCE's interpretation of the raw data with readings during this time having been multiplied by 1000 to correct for the incorrect reading method C.

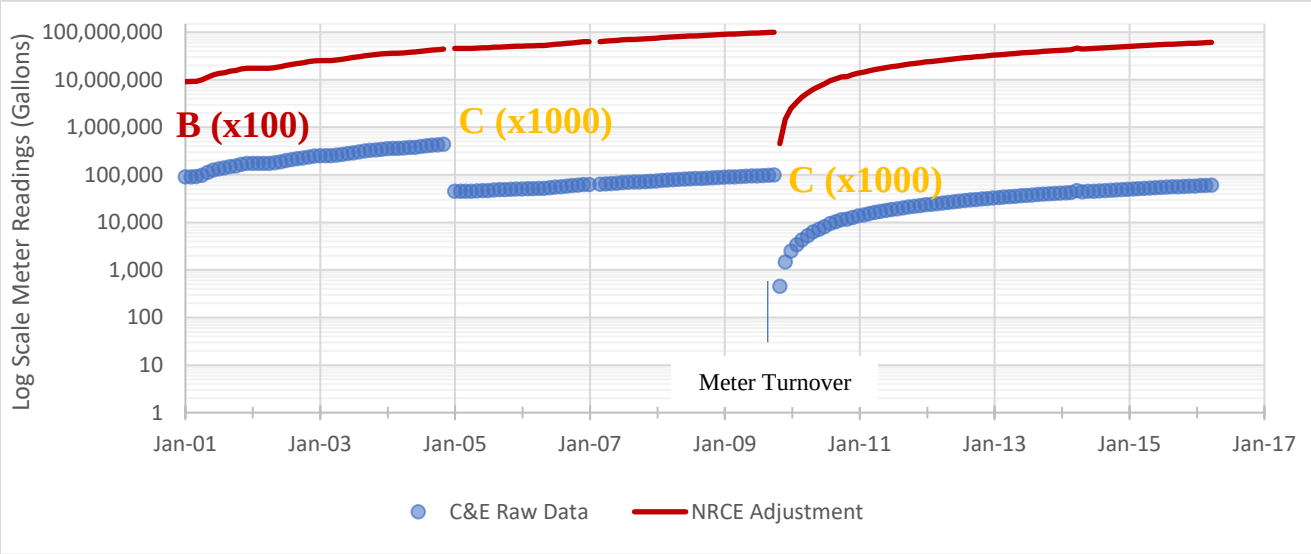


Figure 7: C&E Raw Meter Data for G-337 with NRCE Adjustments

There were no other reported meter replacements or turnovers during the provided period of record. Thus, moving backward through time one would expect a relatively steady decline in reported meter readings. This was true from just before turnover on 10/1/2009 back to 1/1/2005, but from the beginning of the period of record to 11/1/2004, the magnitude of reported readings is greater than those after it by a factor of 10. During this period, it appears C&E staff reported all the unfixed digits on the face of the meter, but ignored the last two fixed zeroes whose value is represented by the meter dial. This is shown in Figures 6 and 7 as method B and underestimates the true meter reading by a factor of 100.

After meter turnover, method C continued to be used for the rest of the period of record. On 5/1/2016, it appears the meter may have been reset, because the subsequent readings rise rapidly, and monthly use is indicative of the application of method C. A complete year of meter readings for the year 2016 were not available for analysis and thus an annual pumping volume for 2016 could not be calculated.

The final calculations of pumped water volume from the parties are presented below in Table 2, including NRCE's previous estimates. The new estimates of annual pumped water volume in acre feet were developed after proper adjustment of raw data records. Values after the turnover date had 100,000,000 gallons added to them to account for the cumulative water use. Final yearly estimates were calculated using the January value of subsequent years. . The dataset available for evaluation ends in October 2016. Thus, a full year of data is not available to make the calculation of annual water volume pumped for 2016 or any year thereafter.

Table 2: Comparison of Annual Water Volume Pumped Calculations for G-337.

Year	Previous NRCE Estimate (AF)	NMOSE Estimate (AF)	C&E Estimate (AF)	AKA Estimate (AF)	NRCE Estimate 2020 (AF)
2001	0.258	0.256	25.751	25.75	25.75
2002	0.238	0.237	22.652	23.77	23.77
2003	0.314	0.293	30.369	31.37	31.37
2004	0.304	0.285	28.516	30.37	30.37
2005	0.167	0.198	19.831	16.72	16.72
2006	0.386	0.046	37.64	38.61	38.61
2007	0.357	0.036	33.469	35.72	35.72
2008	0.450	0.046	45.628	44.99	44.98
2009	0.395	N/A	27.101	39.53	42.54
2010	0.344	0.035	34.393	34.38	34.38
2011	0.304	0.029	30.962	30.43	30.42
2012	0.278	0.027	28.037	27.78	27.78
2013	0.263	0.16	27.328	26.32	26.32
2014	0.274	0.352	24.204	27.45	27.45
2015	NA	NA	26.8	25.8	25.75
Max:	**0.45**	**0.35**	**45.63**	**44.99**	**44.98**
Average	**0.309**	**0.154**	**29.512**	**30.599**	**30.795**

Figure 8 shows the results of NRCE's final annual calculations presented in the last column of Table 2. A decline in production of well G-337 is apparent starting in 2009.

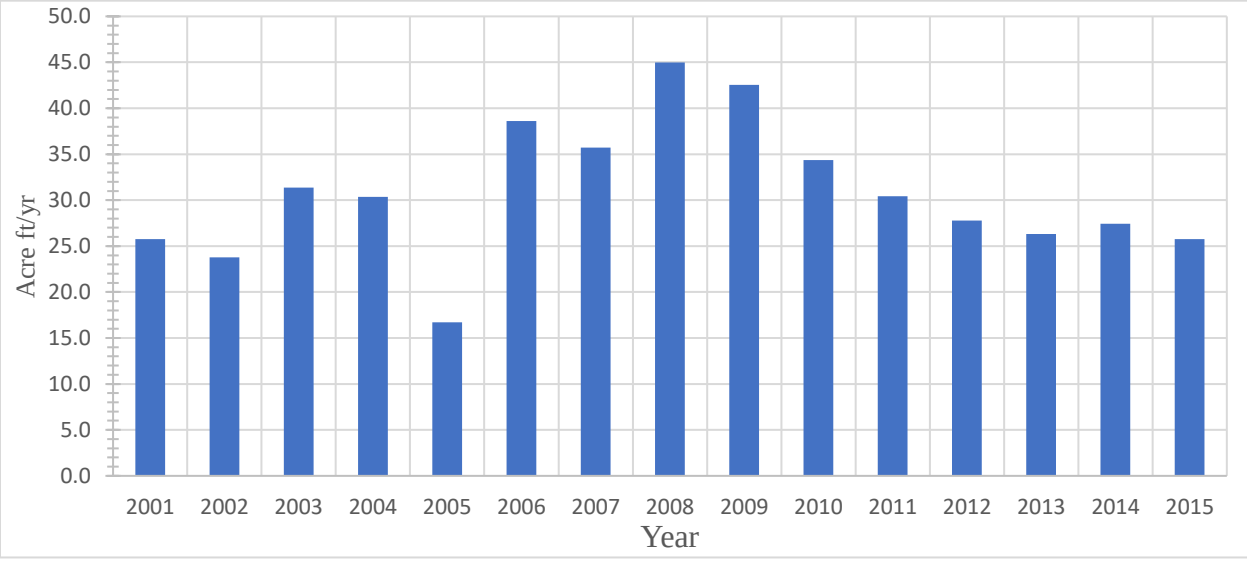
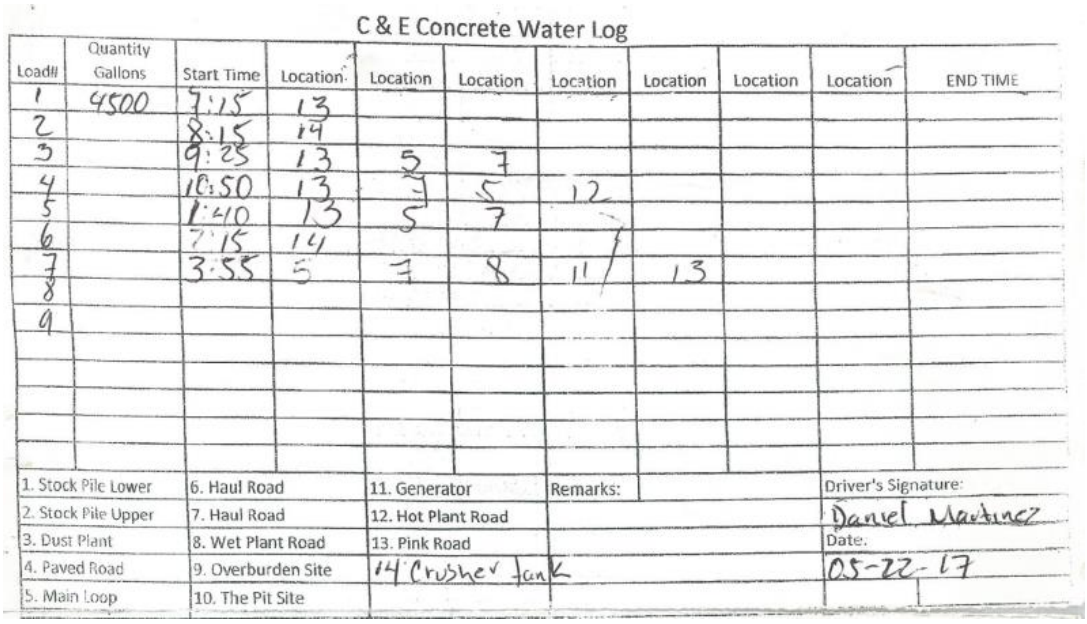


Figure 8: Annual Pumping Volume as Computed for Well G-337 by NRCE in 2020

3 Water Truck Logs Analysis

Logs tracking water use for dust suppression were identified in the AKA report. Upon request to the Claimant's legal counsel, these were provided for review in November 2020. The water truck logs were evaluated by C&E, AKA and NRCE to compute annual water used for dust suppression. Columns in the logs appeared either incomplete or filled preemptively in many places, where some columns, such as the load column, would be filled in while others were left blank. Throughout the log interpretation, NRCE counted rows as loads if they had information in at least 2 of the 11 columns. In the expert report by AKA, it is noted that the capacity of the water trucks is 4000 gallons, and this was taken into the analysis. NRCE also applied this interpretation to restrict all load volumes to 4000 gallons, including missing entries where a load could still be interpreted. Figure 9 shows an example of one of the concrete water logs that were used in calculations. In this case, loads 1-7 were counted, 4000 gallons each. Loads 8 and 9 appear to be intended but no start time or location of use was included and therefore were not counted. The total water use for this particular day (5-22-17) was calculated as 28,000 gallons.

Other issues including missing or incorrect dates and varying degrees of inconsistency made interpretation of truck logs somewhat subjective. All years interpreted by NRCE had similar water use estimates to C&E and AKA, except in 2014. See Table 3. It is not entirely clear why C&E and AKA estimates exceed NRCE's estimates for that year.



C & E Concrete Water Log

Load#	Quantity Gallons	Start Time	Location	Location	Location	Location	Location	Location	Location	END TIME
1	4500	7:15	13							
2		8:15	14							
3		9:25	13	5	7					
4		10:50	13	5	5	12				
5		1:40	13	5	7					
6		7:15	14							
7		3:55	5	7	8	11	13			
8										
9										

1. Stock Pile Lower	6. Haul Road	11. Generator	Remarks:	Driver's Signature: Daniel Martinez
2. Stock Pile Upper	7. Haul Road	12. Hot Plant Road		
3. Dust Plant	8. Wet Plant Road	13. Pink Road		Date:
4. Paved Road	9. Overburden Site	14 Crusher tank		05-22-17
5. Main Loop	10. The Pit Site			

Figure 9: Example C&E Concrete Water Log

Table 3: Water use calculations in ac-ft/yr as interpreted by C&E, AKA, and NRCE.

Year	2013	2014	2015	2016	2017	2018	2019	Average
C&E	2.72	17.53	11.04	12.86	14.15	14.15	9.74	11.74
AKA	2.39	17	10.09	12.53	13.27	12.36	7.15	10.68
NRCE	2.49	14.29	9.44	11.05	13.20	12.05	8.42	10.14

4 Rebuttal Response

The AKA report (page 2) states that the Claimant's average annual consumptive water use for dust control on roads, in rock production (blasting, crushing and screening), and in sand washing operations for 2013-2019 is 24.56 AFY. And, on page 3, AKA stated that "NRCE did not compare their calculated pumping rates to documented water use rates."

Response: *Prior to receipt of data and other information in Claimant's discovery and supplemental discovery responses, NRCE only had well pumping records for documentation of water supply and use at the mine. Claimant provided the water truck logs for documentation of water use for dust control on roads. To date this is the only documented water use. As stated on page 2 of the AKA report AKA provides estimates of the water use for rock production* ***not direct measurements****. AKA provides an estimate of water use of sand washing from a report, again not a direct measurement. Thus, the water truck logs represent the only documented water use by Claimant . The sources for this use are Wells G-336 and G-337. Ultimately it is the well meter logs that provide documentation for water use at the Tinaja Quarry. Water imported from Milan is outside the scope of the claims.*

On page 3 of its report, AKA states: "It is not clear why NRCE did not include well pumping data for 2015-2019."

Response:

- *Meter records for well G-336 (Exhibit H) were provided from 1/1/2001 to 9/1/2016, but the meter was marked out of service August 2013 and did not contain any numeric data for the rest of the period of record provided (Aug 2013-Sept 2016). NRCE downloaded meter readings for well G-336 from the NMOSE New Mexico Water Rights Reporting System and found the same data record. Table 1in the AKA report and Table 1 in this report have matching periods of analysis of the meter readings for well G-336.*
- *Meter records for well G-337 (Exhibit I) were provided from 1/1/2001 to 10/1/2016. NRCE downloaded meter readings for well G-337 from the NMOSE New Mexico Water Rights Reporting System and found the data record also included data for 1/3/2000-9/1/2000 and actually ended on 3/2/2016. Table 2 in the AKA Report contains well-pumping data for some portion of 2016-2019 for well G-337. These data were not provided to NMOSE or to the US as part of Claimant's disclosures or discovery responses.*

In its evaluation of meter data for Well G336, on page 3 AKA concludes pumping rates for this well averaged 3.36 AFY from 2001-2012.

Response: *Based on the analyses presented in this report, NRCE believes the C&E/AKA result is overstated due to incorrect meter reading adjustment during the period 2001-2004. The correct average annual rate for Well G-336 is 0.144 AFY with a maximum of 2.04 AFY pumped in 2006. Note that both C&E and AKA compute a pumping rate of 15.45 AFY for 2002 (see Table 1). The amended well declaration for Well G-336 filed with NMOSE in July 2003 states the capacity of the well is 7 gpm and it is in production 90% of the year. Under these constraints, Well G-336 would produce 10.16 AFY. C&E's and AKA's estimated pumping volume is 150% of this rate and considered implausible.*

5 Conclusion

Given the information and data made available by Claimant in discovery and supplemental disclosures, the updated interpretation and evaluation of well meter data given in this report represents the closest estimate of actual historical water volume pumped by the two wells and is summarized below:

Well 8B-1-W10 (G-336):

Period of record available for evaluation: 1/1/2001-9/1/2016

Maximum annual pumping rate during period analyzed: 2.04 AFY (2006)

Average annual pumping volume during period analyzed: 0.144 AFY.

Well 8B-1-W11 (G-337):

Period of record available for evaluation: 1/1/2001-10/1/2016

Maximum annual pumping rate during period analyzed: 44.98 AFY (2008)

Average annual pumping volume during period analyzed: 30.8 AFY.

6 Appendix A

Table A1: Raw meter records and NRCE interpretation for well G-336

Date	Raw Data Submitted by C&E (gallons)	Meter method	Multiplier	NRCE interpretation (gallons)	NRCE use with turnover/reset (gallons)
Jan-01	104,680	A	1	104,680	104,680
Feb-01	105,500	A	1	105,500	105,500
Mar-01	105,880	A	1	105,880	105,880
Apr-01	107,330	A	1	107,330	107,330
May-01	107,900	A	1	107,900	107,900
Jun-01	109,060	A	1	109,060	109,060
Jul-01	11,028	B	10	110,280	110,280
Aug-01	11,370	B	10	113,700	113,700
Sep-01	11,589	B	10	115,890	115,890
Oct-01	11,724	B	10	117,240	117,240
Nov-01	12,130	B	10	121,300	121,300
Dec-01	12,361	B	10	123,610	123,610
Jan-02	12,472	B	10	124,720	124,720
Feb-02	12,565	B	10	125,650	125,650
Mar-02	12,657	B	10	126,570	126,570
Apr-02	12,747	B	10	127,470	127,470
May-02	12,964	B	10	129,640	129,640
Jun-02	14,152	B	10	141,520	141,520
Jul-02	15,692	B	10	156,920	156,920
Aug-02	15,951	B	10	159,510	159,510
Sep-02	16,216	B	10	162,160	162,160
Oct-02	16,547	B	10	165,470	165,470
Nov-02	17,164	B	10	171,640	171,640
Dec-02	17,398	B	10	173,980	173,980
Jan-03	17,504	B	10	175,040	175,040
Feb-03	17,776	B	10	177,760	177,760
Mar-03	180,370	A	1	180,370	180,370
Apr-03	186,610	A	1	186,610	186,610
May-03	188,350	A	1	188,350	188,350
Jun-03	190,760	A	1	190,760	190,760
Jul-03	192,990	A	1	192,990	192,990
Aug-03	194,880	A	1	194,880	194,880
Sep-03	197,580	A	1	197,580	197,580
Oct-03	199,250	A	1	199,250	199,250

Nov-03	201,630	A	1	201,630	201,630
Dec-03	203,910	A	1	203,910	203,910
Jan-04	205,290	A	1	205,290	205,290
Feb-04	207,720	A	1	207,720	207,720
Mar-04	209,030	A	1	209,030	209,030
Apr-04	211,200	A	1	211,200	211,200
May-04	212,900	A	1	212,900	212,900
Jun-04	214,010	A	1	214,010	214,010
Jul-04	216,890	A	1	216,890	216,890
Aug-04	218,350	A	1	218,350	218,350
Sep-04	219,980	A	1	219,980	219,980
Oct-04	222,150	A	1	222,150	222,150
Nov-04	223,090	A	1	223,090	223,090
Dec-04					
Jan-05	226	C	1000	226,000	226,000
Feb-05	227	C	1000	227,000	227,000
Mar-05	230	C	1000	230,000	230,000
Apr-05	231	C	1000	231,000	231,000
May-05	232	C	1000	232,000	232,000
Jun-05	239	C	1000	239,000	239,000
Jul-05	236	C	1000	236,000	236,000
Aug-05	238	C	1000	238,000	238,000
Sep-05	241	C	1000	241,000	241,000
Oct-05	243	C	1000	243,000	243,000
Nov-05	244	C	1000	244,000	244,000
Dec-05	247	C	1000	247,000	247,000
Jan-06	250	C	1000	250,000	250,000
Feb-06	267	C	1000	267,000	267,000
Mar-06	281	C	1000	281,000	281,000
Apr-06	305	C	1000	305,000	305,000
May-06	327	C	1000	327,000	327,000
Jun-06	485	C	1000	485,000	485,000
Jul-06	600	C	1000	600,000	600,000
Aug-06	740	C	1000	740,000	740,000
Sep-06	848	C	1000	848,000	848,000
Oct-06	848	C	1000	848,000	848,000
Nov-06	915	C	1000	915,000	915,000
Dec-06	915	C	1000	915,000	915,000
Jan-07	915	C	1000	915,000	915,000
Feb-07					
Mar-07	915	C	1000	915,000	915,000

Apr-07	915	C	1000	915,000	915,000
May-07	916	C	1000	916,000	916,000
Jun-07	918	C	1000	918,000	918,000
Jul-07	921	C	1000	921,000	921,000
Aug-07	923	C	1000	923,000	923,000
Sep-07	924	C	1000	924,000	924,000
Oct-07	925	C	1000	925,000	925,000
Nov-07	926	C	1000	926,000	926,000
Dec-07	928	C	1000	928,000	928,000
Jan-08	930	C	1000	930,000	930,000
Feb-08	933	C	1000	933,000	933,000
Mar-08	935	C	1000	935,000	935,000
Apr-08	937	C	1000	937,000	937,000
May-08	939	C	1000	939,000	939,000
Jun-08	944	C	1000	944,000	944,000
Jul-08	950	C	1000	950,000	950,000
Aug-08	948	C	1000	948,000	948,000
Sep-08	964	C	1000	964,000	964,000
Oct-08	969	C	1000	969,000	969,000
Nov-08	972	C	1000	972,000	972,000
Dec-08	975	C	1000	975,000	975,000
Jan-09	979	C	1000	979,000	979,000
Feb-09	987	C	1000	987,000	987,000
Mar-09	992	C	1000	992,000	992,000
Apr-09	997	C	1000	997,000	997,000
May-09	1,001	C	1000	1,001,000	1,001,000
Jun-09	1,006	C	1000	1,006,000	1,006,000
Jul-09	1,011	C	1000	1,011,000	1,011,000
Aug-09	1,017	C	1000	1,017,000	1,017,000
Sep-09	1,023	C	1000	1,023,000	1,023,000
Oct-09	1,032	C	1000	1,032,000	1,032,000
Nov-09	1,041	C	1000	1,041,000	1,041,000
Dec-09	1,051	C	1000	1,051,000	1,051,000
Jan-10	1,062	C	1000	1,062,000	1,062,000
Feb-10	1,070	C	1000	1,070,000	1,070,000
Mar-10	1,081	C	1000	1,081,000	1,081,000
Apr-10	1,093	C	1000	1,093,000	1,093,000
May-10	1,101	C	1000	1,101,000	1,101,000
Jun-10	1,112	C	1000	1,112,000	1,112,000
Jul-10	1,128	C	1000	1,128,000	1,128,000
Aug-10	1,140	C	1000	1,140,000	1,140,000

Sep-10	1,159	C	1000	1,159,000	1,159,000
Oct-10	1,162	C	1000	1,162,000	1,162,000
Nov-10	1,173	C	1000	1,173,000	1,173,000
Dec-10	1,179	C	1000	1,179,000	1,179,000
Jan-11	1,182	C	1000	1,182,000	1,182,000
Feb-11	1,182	C	1000	1,182,000	1,182,000
Mar-11	1,185	C	1000	1,185,000	1,185,000
Apr-11					
May-11					
Jun-11					
Jul-11					
Aug-11	4	C	1000	4,000	1,189,000
Sep-11	6	C	1000	6,000	6,000
Oct-11	8	C	1000	8,000	8,000
Nov-11	18	C	1000	18,000	18,000
Dec-11	25	C	1000	25,000	25,000
Jan-12	34	C	1000	34,000	38,000
Feb-12	44	C	1000	44,000	50,000
Mar-12	48	C	1000	48,000	56,000
Apr-12	56	C	1000	56,000	74,000
May-12	61	C	1000	61,000	86,000
Jun-12	70	C	1000	70,000	104,000
Jul-12	96	C	1000	96,000	140,000
Aug-12	100	C	1000	100,000	148,000
Sep-12	100	C	1000	100,000	156,000
Oct-12	100	C	1000	100,000	161,000
Nov-12	100	C	1000	100,000	170,000
Dec-12	100	C	1000	100,000	196,000
Jan-13	100	C	1000	100,000	200,000
Feb-13	100	C	1000	100,000	200,000
Mar-13	100	C	1000	100,000	200,000
Apr-13	100	C	1000	100,000	200,000
May-13	100	C	1000	100,000	200,000
Jun-13	100	C	1000	100,000	200,000
Jul-13	100	C	1000	100,000	200,000
Aug-13	Out of service				

Table A2: Raw meter records and NRCE interpretation for well G-337

Date	Raw Data Submitted by C&E (gallons)	Meter method	Multiplier	NRCE interpretation (gallons)	NRCE use with turnover/reset (gallons)
Jan-01	90,752	B	100	9,075,200	9,075,200
Feb-01	91,835	B	100	9,183,500	9,183,500
Mar-01	91,984	B	100	9,198,400	9,198,400
Apr-01	99,124	B	100	9,912,400	9,912,400
May-01	112,736	B	100	11,273,600	11,273,600
Jun-01	126,544	B	100	12,654,400	12,654,400
Jul-01	135,241	B	100	13,524,100	13,524,100
Aug-01	140,600	B	100	14,060,000	14,060,000
Sep-01	150,449	B	100	15,044,900	15,044,900
Oct-01	155,481	B	100	15,548,100	15,548,100
Nov-01	168,032	B	100	16,803,200	16,803,200
Dec-01	174,661	B	100	17,466,100	17,466,100
Jan-02	174,661	B	100	17,466,100	17,466,100
Feb-02	174,661	B	100	17,466,100	17,466,100
Mar-02	174,661	B	100	17,466,100	17,466,100
Apr-02	175,443	B	100	17,544,300	17,544,300
May-02	180,499	B	100	18,049,900	18,049,900
Jun-02	188,431	B	100	18,843,100	18,843,100
Jul-02	200,038	B	100	20,003,800	20,003,800
Aug-02	210,359	B	100	21,035,900	21,035,900
Sep-02	218,880	B	100	21,888,000	21,888,000
Oct-02	227,186	B	100	22,718,600	22,718,600
Nov-02	239,524	B	100	23,952,400	23,952,400
Dec-02	248,472	B	100	24,847,200	24,847,200
Jan-03	252,113	B	100	25,211,300	25,211,300
Feb-03	252,278	B	100	25,227,800	25,227,800
Mar-03	252,753	B	100	25,275,300	25,275,300
Apr-03	260,000	B	100	26,000,000	26,000,000
May-03	269,860	B	100	26,986,000	26,986,000
Jun-03	280,894	B	100	28,089,400	28,089,400
Jul-03	292,945	B	100	29,294,500	29,294,500
Aug-03	305,827	B	100	30,582,700	30,582,700
Sep-03	318,150	B	100	31,815,000	31,815,000
Oct-03	328,470	B	100	32,847,000	32,847,000
Nov-03	337,670	B	100	33,767,000	33,767,000
Dec-03	347,429	B	100	34,742,900	34,742,900
Jan-04	354,319	B	100	35,431,900	35,431,900

Feb-04	360,875	B	100	36,087,500	36,087,500
Mar-04	361,546	B	100	36,154,600	36,154,600
Apr-04	368,801	B	100	36,880,100	36,880,100
May-04	377,140	B	100	37,714,000	37,714,000
Jun-04	381,252	B	100	38,125,200	38,125,200
Jul-04	395,530	B	100	39,553,000	39,553,000
Aug-04	409,620	B	100	40,962,000	40,962,000
Sep-04	421,050	B	100	42,105,000	42,105,000
Oct-04	429,960	B	100	42,996,000	42,996,000
Nov-04	440,350	B	100	44,035,000	44,035,000
Dec-04					
Jan-05	45,327	C	1000	45,327,000	45,327,000
Feb-05	45,330	C	1000	45,330,000	45,330,000
Mar-05	45,344	C	1000	45,344,000	45,344,000
Apr-05	45,633	C	1000	45,633,000	45,633,000
May-05	45,888	C	1000	45,888,000	45,888,000
Jun-05	46,675	C	1000	46,675,000	46,675,000
Jul-05	47,138	C	1000	47,138,000	47,138,000
Aug-05	48,254	C	1000	48,254,000	48,254,000
Sep-05	48,720	C	1000	48,720,000	48,720,000
Oct-05	49,374	C	1000	49,374,000	49,374,000
Nov-05	50,007	C	1000	50,007,000	50,007,000
Dec-05	50,497	C	1000	50,497,000	50,497,000
Jan-06	50,775	C	1000	50,775,000	50,775,000
Feb-06	51,226	C	1000	51,226,000	51,226,000
Mar-06	51,738	C	1000	51,738,000	51,738,000
Apr-06	52,146	C	1000	52,146,000	52,146,000
May-06	52,250	C	1000	52,250,000	52,250,000
Jun-06	53,859	C	1000	53,859,000	53,859,000
Jul-06	55,380	C	1000	55,380,000	55,380,000
Aug-06	56,783	C	1000	56,783,000	56,783,000
Sep-06	58,277	C	1000	58,277,000	58,277,000
Oct-06	59,627	C	1000	59,627,000	59,627,000
Nov-06	61,139	C	1000	61,139,000	61,139,000
Dec-06	62,762	C	1000	62,762,000	62,762,000
Jan-07	63,355	C	1000	63,355,000	63,355,000
Feb-07					
Mar-07	63,400	C	1000	63,400,000	63,400,000
Apr-07	64,500	C	1000	64,500,000	64,500,000
May-07	65,962	C	1000	65,962,000	65,962,000
Jun-07	67,351	C	1000	67,351,000	67,351,000

Jul-07	68,719	C	1000	68,719,000	68,719,000
Aug-07	70,119	C	1000	70,119,000	70,119,000
Sep-07	70,721	C	1000	70,721,000	70,721,000
Oct-07	71,337	C	1000	71,337,000	71,337,000
Nov-07	72,449	C	1000	72,449,000	72,449,000
Dec-07	73,713	C	1000	73,713,000	73,713,000
Jan-08	74,995	C	1000	74,995,000	74,995,000
Feb-08	76,512	C	1000	76,512,000	76,512,000
Mar-08	77,891	C	1000	77,891,000	77,891,000
Apr-08	79,046	C	1000	79,046,000	79,046,000
May-08	80,256	C	1000	80,256,000	80,256,000
Jun-08	81,386	C	1000	81,386,000	81,386,000
Jul-08	82,911	C	1000	82,911,000	82,911,000
Aug-08	83,782	C	1000	83,782,000	83,782,000
Sep-08	85,027	C	1000	85,027,000	85,027,000
Oct-08	86,276	C	1000	86,276,000	86,276,000
Nov-08	87,596	C	1000	87,596,000	87,596,000
Dec-08	88,581	C	1000	88,581,000	88,581,000
Jan-09	89,653	C	1000	89,653,000	89,653,000
Feb-09	90,800	C	1000	90,800,000	90,800,000
Mar-09	91,848	C	1000	91,848,000	91,848,000
Apr-09	92,968	C	1000	92,968,000	92,968,000
May-09	94,023	C	1000	94,023,000	94,023,000
Jun-09	95,116	C	1000	95,116,000	95,116,000
Jul-09	96,244	C	1000	96,244,000	96,244,000
Aug-09	97,327	C	1000	97,327,000	97,327,000
Sep-09	98,410	C	1000	98,410,000	98,410,000
Oct-09	99,443	C	1000	99,443,000	99,443,000
Nov-09	453	C	1000	453,000	100,453,000
Dec-09	1,489	C	1000	1,489,000	101,489,000
Jan-10	2,515	C	1000	2,515,000	102,515,000
Feb-10	3,395	C	1000	3,395,000	103,395,000
Mar-10	4,292	C	1000	4,292,000	104,292,000
Apr-10	5,279	C	1000	5,279,000	105,279,000
May-10	6,308	C	1000	6,308,000	106,308,000
Jun-10	7,176	C	1000	7,176,000	107,176,000
Jul-10	8,189	C	1000	8,189,000	108,189,000
Aug-10	9,452	C	1000	9,452,000	109,452,000
Sep-10	10,487	C	1000	10,487,000	110,487,000
Oct-10	11,380	C	1000	11,380,000	111,380,000
Nov-10	11,718	C	1000	11,718,000	111,718,000

Dec-10	12,696	C	1000	12,696,000	112,696,000
Jan-11	13,717	C	1000	13,717,000	113,717,000
Feb-11	14,483	C	1000	14,483,000	114,483,000
Mar-11	15,294	C	1000	15,294,000	115,294,000
Apr-11	16,252	C	1000	16,252,000	116,252,000
May-11	17,019	C	1000	17,019,000	117,019,000
Jun-11	17,829	C	1000	17,829,000	117,829,000
Jul-11	18,813	C	1000	18,813,000	118,813,000
Aug-11	19,501	C	1000	19,501,000	119,501,000
Sep-11	20,331	C	1000	20,331,000	120,331,000
Oct-11	21,192	C	1000	21,192,000	121,192,000
Nov-11	22,001	C	1000	22,001,000	122,001,000
Dec-11	22,785	C	1000	22,785,000	122,785,000
Jan-12	23,631	C	1000	23,631,000	123,631,000
Feb-12	24,098	C	1000	24,098,000	124,098,000
Mar-12	24,869	C	1000	24,869,000	124,869,000
Apr-12	25,715	C	1000	25,715,000	125,715,000
May-12	26,435	C	1000	26,435,000	126,435,000
Jun-12	27,234	C	1000	27,234,000	127,234,000
Jul-12	28,066	C	1000	28,066,000	128,066,000
Aug-12	28,820	C	1000	28,820,000	128,820,000
Sep-12	29,696	C	1000	29,696,000	129,696,000
Oct-12	30,327	C	1000	30,327,000	130,327,000
Nov-12	31,101	C	1000	31,101,000	131,101,000
Dec-12	31,921	C	1000	31,921,000	131,921,000
Jan-13	32,684	C	1000	32,684,000	132,684,000
Feb-13	33,417	C	1000	33,417,000	133,417,000
Mar-13	34,120	C	1000	34,120,000	134,120,000
Apr-13	34,857	C	1000	34,857,000	134,857,000
May-13	35,677	C	1000	35,677,000	135,677,000
Jun-13	36,392	C	1000	36,392,000	136,392,000
Jul-13	37,152	C	1000	37,152,000	137,152,000
Aug-13	37,900	C	1000	37,900,000	137,900,000
Sep-13	38,670	C	1000	38,670,000	138,670,000
Oct-13	39,381	C	1000	39,381,000	139,381,000
Nov-13	40,068	C	1000	40,068,000	140,068,000
Dec-13	40,826	C	1000	40,826,000	140,826,000
Jan-14	41,260	C	1000	41,260,000	141,260,000
Feb-14	42,237	C	1000	42,237,000	142,237,000
Mar-14	42,865	C	1000	42,865,000	142,865,000
Apr-14	46,490	C	1000	46,490,000	146,490,000

May-14	44,287	C	1000	44,287,000	144,287,000
Jun-14	45,067	C	1000	45,067,000	145,067,000
Jul-14	45,721	C	1000	45,721,000	145,721,000
Aug-14	46,408	C	1000	46,408,000	146,408,000
Sep-14	47,143	C	1000	47,143,000	147,143,000
Oct-14	47,887	C	1000	47,887,000	147,887,000
Nov-14	48,684	C	1000	48,684,000	148,684,000
Dec-14	49,409	C	1000	49,409,000	149,409,000
Jan-15	50,203	C	1000	50,203,000	150,203,000
Feb-15	50,898	C	1000	50,898,000	150,898,000
Mar-15	51,555	C	1000	51,555,000	151,555,000
Apr-15	52,269	C	1000	52,269,000	152,269,000
May-15	53,077	C	1000	53,077,000	153,077,000
Jun-15	53,855	C	1000	53,855,000	153,855,000
Jul-15	54,597	C	1000	54,597,000	154,597,000
Aug-15	55,362	C	1000	55,362,000	155,362,000
Sep-15	56,017	C	1000	56,017,000	156,017,000
Oct-15	56,722	C	1000	56,722,000	156,722,000
Nov-15	57,474	C	1000	57,474,000	157,474,000
Dec-15	58,138	C	1000	58,138,000	158,138,000
Jan-16	58,594	C	1000	58,594,000	158,594,000
Feb-16	59,621	C	1000	59,621,000	159,621,000
Mar-16	60,332	C	1000	60,332,000	160,332,000
Apr-16	60,700	C	1000	60,700,000	160,700,000
May-16	740	C	1000	740,000	161,440,000
Jun-16	1,424	C	1000	1,424,000	162,124,000
Jul-16	2,106	C	1000	2,106,000	162,806,000
Aug-16	2,850	C	1000	2,850,000	163,550,000
Sep-16	3,601	C	1000	3,601,000	164,301,000
Oct-16	4,355	C	1000	4,355,000	165,055,000

UPDATE OF HISTORIC PUMPING FOR WELLS 8B-1-W10 (G336) AND 8B-1-W11 (G337)

ZUNI RIVER BASIN DETERMINATION OF WATER USES FOR SUBFILE ZRB-1-0148

In the matter of
United States v. A&R Productions
Case # 01cv00072-MV/JHR

Prepared for:
United States Department of Justice

Rule 26(a)(2) Disclosure

Prepared by:

Natural Resources Consulting Engineers, Inc.
131 Lincoln Avenue, Suite 300
Fort Collins, Colorado 80524
(970) 224-1851 / Fax (970) 224-1885

March 8, 2021

1 Introduction

1.1 Background

Natural Resources Consulting Engineers, Inc. (NRCE) is providing technical support to the United States Department of Justice (DOJ) in the adjudication of water rights in the Zuni River Basin of New Mexico (United States v. A & R Productions et al. Case No.01cv00072-MV/JHR UNITED STATES DISTRICT COURT FOR THE DISTRICT OF NEW MEXICO). The initial hydrographic surveys of the non-federal lands in the Basin have been completed and hydrographic survey reports have been filed with Court. The initial hydrographic surveys of the Zuni River Basin provide listings of water rights claims and estimated historical water uses throughout the basin. Claims (subfiles) are adjudicated by the court on a case by case basis.

This report is prepared to provide:

- an update to the technical report prepared by NRCE for the United States Department of Justice titled: "ZUNI RIVER BASIN: DETERMINATION OF WATER USES FOR SUBFILE ZRB-1-0148" dated December 16, 2020.

Subfile ZRB-1-0148 (Norma M. Meech, individually and as the successor in interest to Walter Meech, Claimant) concerns water rights claims to operate the Meech's business, C&E Concrete, Inc., (C&E), a limestone mining operation (the Tinaja Quarry). Water is required for dust abatement and the production of various materials. The water right features claimed under the most recent proposed Consent Order for subfile ZRB-1-0148 dated June 2019 included 3 ponds (8B-1-SP34, 8B-1-SP66, 8B-1-69B) and two wells (8B-1-W10, 8B-1-W11). At issue is the correct determination of water volume pumped from wells 8B-1-W10 (OSE File No. G-336) and 8B-1-W11 (OSE File No. G-337).

NRCE has prepared this updated technical analysis of water volume pumped from the two wells used to supply operations at the Tinaja Quarry after reviewing additional meter data provided by Claimant's legal counsel on March 2, 2021. NRCE updated its previous calculation of historical water use for well 8B-1-W10 to include 2013-2020, and well 8B-1-W11 to include 2016-2020.

1.2 Statement of Qualifications

NRCE is a civil, environmental, and water resources engineering consulting firm that specializes in agricultural engineering, hydrology, water resources engineering and providing expert support for water right disputes. The historical water use values calculated in this report are based upon the procedures described in the *Hydrographic Survey Report for Subareas 4 & 8* (NRCE, 2004) and information collected by NRCE engineers during consultations with the Claimant.

This report is prepared by NRCE Engineering staff under the direct supervision of Thomas W. Ley, PhD, PE, Senior Supervising Engineer with Natural Resources Consulting Engineers, Inc. in Fort Collins, Colorado. He holds a Ph.D. in Irrigation Engineering and is a licensed Professional Engineer in the States of Colorado, Utah Arizona, Nevada and Washington. Mr. Ley has over 40 years of experience in water resources and irrigation engineering including water supply development, irrigation system design,

hydraulic analysis, water demand studies. His experience also includes climate analysis, estimation of evapotranspiration, computing crop irrigation and diversion requirements, field work for surveying and documentation of water features and associated uses, producing cost estimates for irrigation systems and providing analysis for domestic and municipal water use studies.

2 Well Historic Use Update

The following two subsections of this report provide updated historic pumping for the two wells in question, G-336 and G-337.

2.1 Well 8B-1-W10

Additional meter records for well G-336 (8B-1-W10) for the period 2013-2020 were provided. In earlier data disclosed by Claimant, the meter was marked out of service August 2013 and did not contain any numeric data for the rest of the period of record provided (Aug 2013-Sept 2016). NRCE downloaded meter readings for well G-336 from the NMOSE New Mexico Water Rights Reporting System[1] and found the same data record. The additional meter data provided show the well and meter continued to be out of service from 2017 through 2020.

Table 1 shows a comparison of the various calculated annual volumes of water pumped from well G-336 including NRCE's previous results and those of the NMOSE, C&E, and AKA. NRCE's current estimate is shown on the far right and is shaded green. Annual water volume pumped in acre feet was determined by subtracting that year's January meter reading from the subsequent year's January meter reading, with the result converted to acre feet. The well and the meter were reported out of service after August 2013 through 2020. The maximum and average annual pumping volume shown in Table are based only on the actual pumping recorded from 2001 through 2012.

Figure 1 displays a bar graph of the annual volume pumped as calculated by NRCE, representing the last column in Table 1.

[1] http://nmwrrs.ose.state.nm.us/ReportDispatcher?type=PODGHTML&name=PodGroundSummaryHTML.jrxml&basin=G&nbr=00336&suffix=

Table 1: Comparison of Annual Water Volume Pumped Calculations for G-336 (updated through 2020).

Year	Annual Use Estimated by NRCE previously (AF)	Annual Use Estimated by State Records (AF)	Annual Use Estimated by C&E (AF)	Annual Use Estimated by AKA (AF)	Updated NRCE Estimate (AF)
2001	0.061	0.059	5.809	6.15	0.062
2002	0.154	0.157	15.458	15.44	0.154
2003	0.093	0.091	9.185	9.28	0.093
2004	0.064	0.063	5.886	6.16	0.064
2005	0.061	0.072	0.758	0.07	0.074
2006	2.041	2.042	2.05	2.04	2.041
2007	0.046	0.046	0.04	0.05	0.046
2008	0.089	0.148	0.144	0.15	0.150
2009	0.255	0.254	0.233	0.25	0.255
2010	0.368	0.369	0.393	0.37	0.368
2011	0.104	0.113	0.095	0.11	0.114
2012	0.203	0.203	0.23	0.2	0.203
2013	NA	NA	0.00	0.00	0.00
2014	NA	NA	0.00	0.00	0.00
2015	NA	NA	0.00	0.00	0.00
2016	NA	NA	0.00	0.00	0.00
2017	NA	NA	0.00	NA	0.00
2018	NA	NA	0.00	NA	0.00
2019	NA	NA	0.00	NA	0.00
2020	NA	NA	0.00	NA	0.00
2001-2012 only:					
Max:	**2.04**	**2.04**	**15.46**	**15.44**	**2.04**
Average:	**0.136**	**0.143**	**3.476**	**3.356**	**0.302**

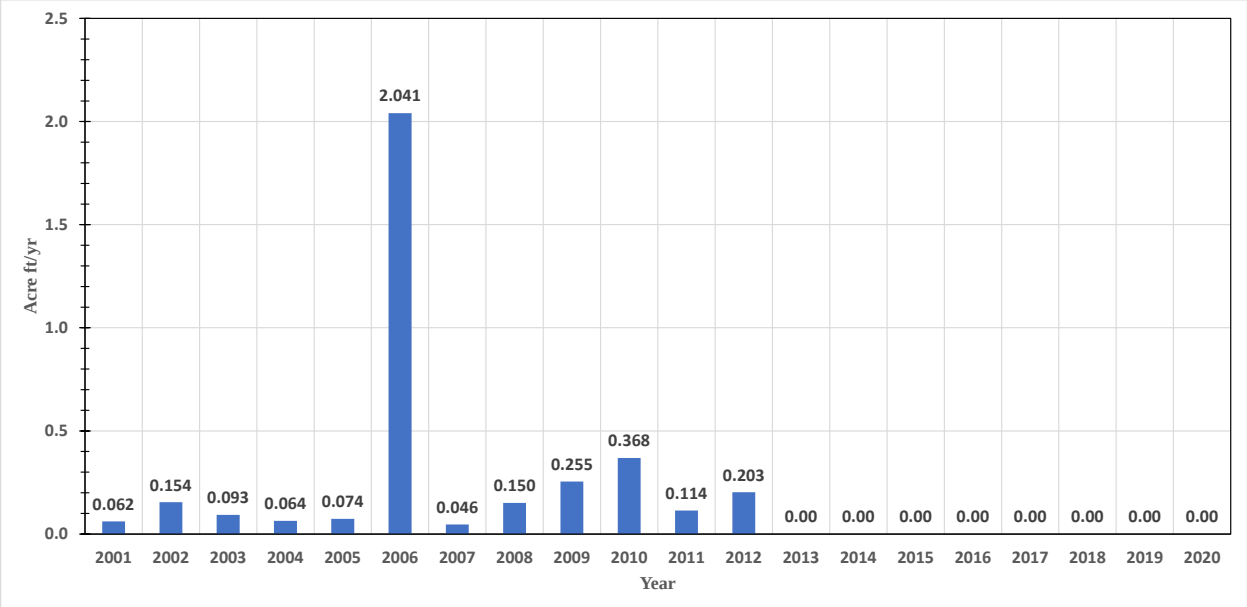


Figure 2: Annual Pumping Volume as Computed for Well G-336 (updated through 2020).

2.2 Well 8B-1-W11

Additional meter records for well G-337 (Well 8B-1-W11) for November 2016 to January 1, 2021 were provided. During this period, C&E meter records submitted to the State of NM indicate the well was out of service from January through June 2017, the well was out of service December 2017-January 2018, March 2018 and August 2020; a new pump was installed in July 2017; and a new meter was installed in May 2018.

Table 2 shows a comparison of the various calculated annual volumes of water pumped from well G-336 including NRCE's previous results and those of the NMOSE, C&E, and AKA. NRCE's current estimate is shown on the far right and is shaded green. Annual water volume pumped in acre feet was determined by subtracting that year's January meter reading from the subsequent year's January meter reading, with the result converted to acre feet. The maximum and average annual pumping volume shown in Table 2 are based on the actual pumping recorded from 2001 through 2020.

Figure 2 displays a bar graph of the annual volume pumped as calculated by NRCE, representing the last column in Table 2.

Table 2: Comparison of Annual Water Volume Pumped Calculations for G-337 (updated through 2020).

Year	Annual Use Estimated by NRCE Previously (AF)	Annual Use Estimated by State Records (AF)	Annual Use Estimated by C&E (AF)	Annual Use Estimated by AKA (AF)	Annual Use Estimated by NRCE (AF)
2001	0.258	0.256	25.751	25.75	25.75
2002	0.238	0.237	22.652	23.77	23.77
2003	0.314	0.293	30.369	31.37	31.37
2004	0.304	0.285	28.516	30.37	30.37
2005	0.167	0.198	19.831	16.72	16.72
2006	0.386	0.046	37.64	38.61	38.61
2007	0.357	0.036	33.469	35.72	35.72
2008	0.450	0.046	45.628	44.99	44.98
2009	0.395	N/A	39.613	39.53	42.54
2010	0.344	0.035	34.393	34.38	34.38
2011	0.304	0.029	30.962	30.43	30.42
2012	0.278	0.027	28.037	27.78	27.78
2013	0.263	0.16	27.328	26.32	26.32
2014	0.274	0.352	26.313	27.45	27.45
2015	NA	NA	26.816	25.75	25.75
2016	NA	NA	22.848	21.45	21.45
2017	NA	NA	17.115	17.12	17.12
2018	NA	NA	45.978	45.99	45.99
2019	NA	NA	61.761	54.62	67.93
2020	NA	NA	50.956	NA	56.39
Max:			**61.76**	**54.62**	**67.93**
Average			**32.799**	**31.480**	**33.540**

Notes:
1) assumes meter readings are taken on 1st day of month and annual volume equals January 1 reading minus January 1 reading of previous year (adjusted as necessary for meter turnover, reset or replacement)
2) AKA total for 2019 is Jan-Nov only.
3) C&Eannual values in 2019 was December 1 reading - January 1 reading.

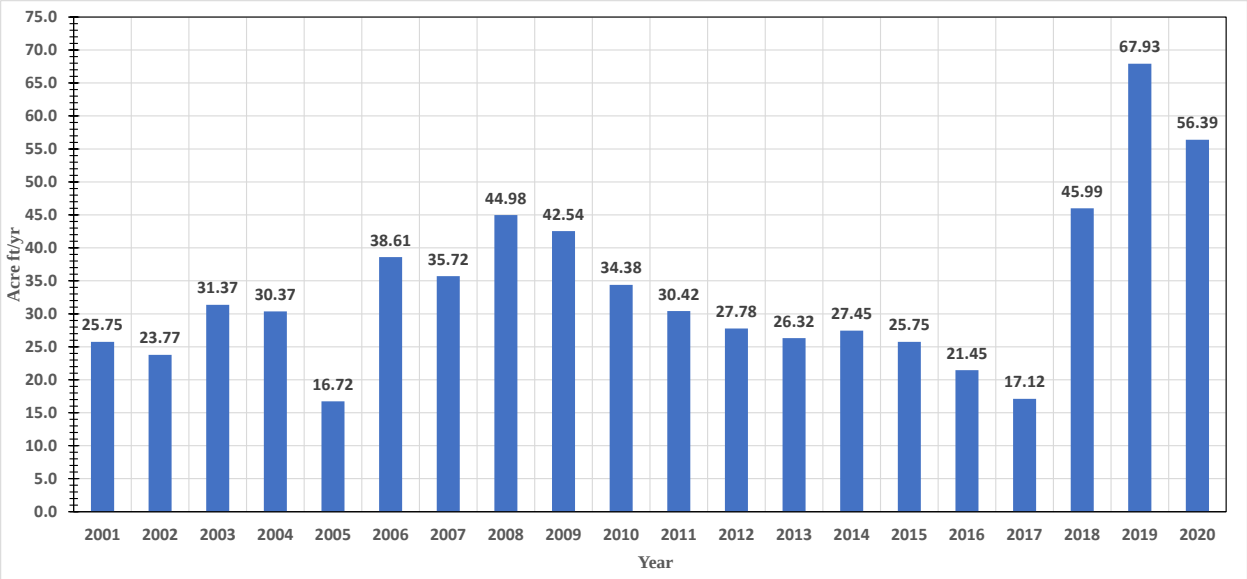


Figure 2: Annual Pumping Volume as Computed for Well G-337 (updated through 2020).

3 Conclusion

Given the information and data recently made available by Claimant in discovery and supplemental disclosures, the updated interpretation and evaluation of well meter data given in this report represents the closest estimate of actual historical water volume pumped by the two wells and is summarized below:

Well 8B-1-W10 (G-336):

Period of record available for evaluation: 1/1/2001-12/31/2020. The well is noted to be our of service from August 2013 through December 2020. However, the meter readings indicate no well pumping occurred after August 2012.

Maximum annual pumping rate during the period 2001-2012 occurred in 2006 and was 2.04 AFY.

Average annual pumping volume during the same period was 0.302 AFY.

Well 8B-1-W11 (G-337):

Period of record available for evaluation: 1/1/2001-1/1/2021.

Maximum annual pumping rate during the period 2001-2020 occurred in 2019 and was 67.93 AFY.

Average annual pumping volume during the same period was 33.54 AFY.

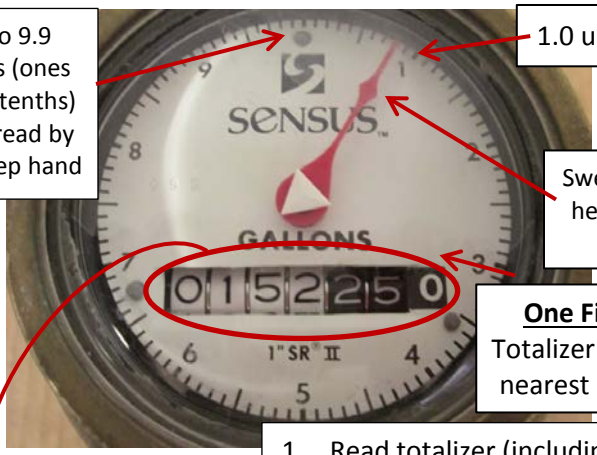
How to Read Totalizing Flow Meters

Reading a water meter is similar to reading the odometer in your car. Reading your meter can help you identify leaks, track pumping costs, and discover ways to conserve water. To determine water use for a period of time between two meter readings, subtract the earlier reading from the later reading. (*Example: July 31 reading minus June 30 reading = amount of water used in July.*) Below are examples of two common types of meters.

If your meter does not look like these examples, contact the manufacturer or the meter installer for information.

Example 1: Meter Face Shows Only Cumulative Volume—

Totalizer Has 1 or 2 Fixed 0s as Place-holders + Sweep Hand Shows Amounts Represented by Zero Place-holders

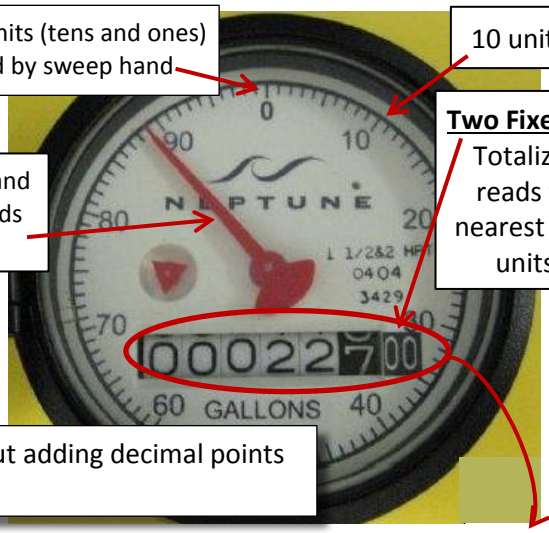


Up to 9.9 units (ones and tenths) are read by sweep hand

1.0 unit

Sweep hand here reads 0.8

One Fixed 0
Totalizer reads to nearest 10 units



Up to 99 units (tens and ones) are read by sweep hand

10 units

Sweep hand here reads 89

Two Fixed 0s
Totalizer reads to nearest 100 units

1. Read totalizer (including all fixed "0"s) without adding decimal points
2. Then add amount shown by sweep hand

0	1	5	2	2	5	0

Totalizer reading: 0,152,250
Sweep hand reading: + 0.8
Amount: = 152,250.8 G
Unit of measurement = Gallons (G)

0	0	0	2	2	6	0	0

Totalizer reading: 00,022,600 (not quite to 700)
Sweep hand reading: + 89
Amount: = 22,689 G
Unit of measurement = Gallons (G)

Example 2: Meter Face Shows Both Instantaneous Flow Rate and Cumulative Volume—

Sweep Hand Shows Instantaneous Rate, and "Odometer-like" Totalizer Shows Cumulative Volume

Instantaneous Flow Rate

Sweep hand shows instantaneous flow rate around the dial from 0 to 2500 gallons per minute (showing 700+ gpm in this example). If water is not flowing, the sweep hand will show "0". Note: This rate of flow is separate, and not to be added to the totalizer reading.

Cumulative Volume

Totalizer shows cumulative water volume.

Multiplier to be applied to totalizer reading (0.001 in this example, but it could be 10, 100, 1,000, etc.)

Measurement unit (acre feet in this example, but it could be gallons, cubic feet, etc.) Note: The totalizer unit of volume measurement may be different from the unit of instantaneous flow rate.

0	0	3	2	5	5

Water Volume (read the totalizer numbers from left to right, without any decimal points)
Totalizer Reading: 003255
Multiplier: X 0.001
Amount: = 3.255 AF
Unit of measurement = Acre Feet (AF)

Badger Meter

Recordall® Disc Meters

Lead-Free Bronze Alloy, Sizes 5/8, 5/8 x 3/4, 3/4 & 1 inch
NSF/ANSI Standards 61 and 372 Certified

Model 25—5/8 in., 5/8 × 3/4 in.

Model 35—3/4 in.

Model 55—1 in.

Model 70—1 in.

DESCRIPTION

The Recordall Disc Series meters meet or exceed the most recent revision of AWWA Standard C700 and are available in a lead-free bronze alloy. The meters comply with the lead-free provisions of the Safe Drinking Water Act, are certified to NSF/ANSI Standards 61 and 372 (Trade Designations: M25-LL, M35-LL, M55-LL, M70-LL) and carry the NSF-61 mark on the housing. All components of the lead-free bronze alloy meter (housing, measuring element, seals, and so on) comprise the certified system.

Applications: For use in measurement of potable cold water in residential, commercial and industrial services where flow is in one direction only.

Operation: Water flows through the meter's strainer and into the measuring chamber where it causes the disc to nutate. The disc, which moves freely, nutates on its own ball, guided by a thrust roller. A drive magnet transmits the motion of the disc to a follower magnet located within the permanently sealed register. The follower magnet is connected to the register gear train. The gear train reduces the disc nutations into volume totalization units displayed on the register or encoder face.

Operating Performance: The Recordall Disc Series meters meet or exceed registration accuracy for the low flow rates (95%), normal operating flow rates (100 ±1.5%), and maximum continuous operation flow rates as specifically stated in AWWA Standard C700.

Construction: Recordall Disc meter construction, which complies with ANSI/AWWA standard C700, consists of three basic components: meter housing, measuring chamber and permanently sealed register or encoder. The meter is available in a lead-free bronze alloy with externally threaded spuds. A corrosion-resistant engineered polymer material is used for the measuring chamber.

Magnetic Drive: Direct magnetic drive, through the use of high-strength magnets, provides positive, reliable and dependable register coupling for straight-reading or AMR/AMI meter reading options.

Tamper-Proof Features: Unauthorized removal of the register or encoder is inhibited by the option of a tamper detection seal wire screw, TORX® tamper-resistant seal screw or the proprietary tamper-resistant keyed seal screw. Each can be installed at the meter site or at the factory.

Maintenance: Badger Meter Recordall Disc Series meters are designed and manufactured to provide long-term service with minimal maintenance. When maintenance is required, it can be performed easily either at the meter installation or at any other convenient location.

To simplify maintenance, the register, measuring chamber, and strainer can be replaced without removing the meter housing from the installation. No change gears are required for accuracy calibration. Interchangeability of parts among like-sized meters and meter models also minimizes spare parts inventory investment. The built-in strainer has an effective straining area of twice the inlet size.

Connections: Tailpieces/Unions for installations of meters on various pipe types and sizes, including misaligned pipes, are available as an option.

Meter Spud and Connection Sizes

Model	Size Designation (in.)	×	"L" Laying Length (in.)	"B" Bore Dia. (in.)	Coupling Nut and Spud Thread (in.)	Tailpiece Pipe Thread (NPT) (in.)
25	5/8	×	7-1/2	5/8	3/4 (5/8)	1/2
	5/8 x 3/4	×	7-1/2	5/8, 3/4	1 (3/4)	3/4
35	3/4	×	7-1/2	3/4	1 (3/4)	3/4
	3/4	×	9	3/4	1 (3/4)	3/4
	3/4 x 1	×	9	3/4	1-1/4 (1)	1
55	1	×	10-3/4	1	1-1/4 (1)	1
70	1	×	10-3/4	1	1-1/4 (1)	1

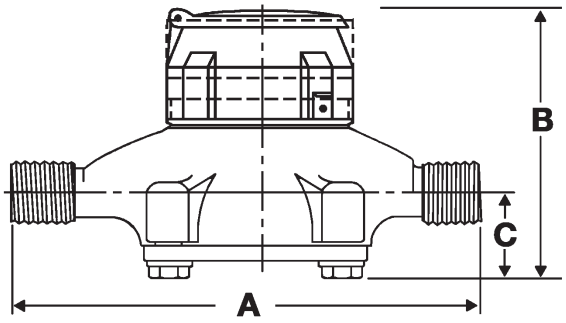
SPECIFICATIONS

	Model 25 (5/8 in. & 5/8 × 3/4 in.)	**Model 35 (3/4 in.)**	**Model 55 (1 in.)**	**Model 70 (1 in.)**
Typical Operating Range (100% ±1.5%)	0.5…25 gpm (0.11…5.7 m^3/hr)	0.75…35 gpm (0.17…7.9 m^3/hr)	1…55 gpm (0.23…12.5 m^3/hr)	1.25…70 gpm (0.28…16 m^3/hr)
Low Flow	0.25 gpm (0.057 m^3/hr) Min. 98.5%	0.375 gpm (0.085 m^3/hr) Min. 97%	0.5 gpm (0.11 m^3/hr) Min. 95%	0.75 gpm (0.17 m^3/hr) Min. 95%
Maximum Continuous Operation	15 gpm (3.4 m^3/hr)	25 gpm (5.7 m^3/hr)	40 gpm (9.1 m^3/hr)	50 gpm (11.3 m^3/hr)
Pressure Loss at Maximum Continuous Operation	**5/8 in. size**: 3.5 psi @ 15 gpm (0.24 bar @ 3.4 m^3/hr) **5/8 × 3/4 in. size**: 2.8 psi @ 15 gpm (0.19 bar @ 3.4 m^3/hr)	5 psi @ 25 gpm (0.37 bar @ 5.7 m^3/hr)	3.4 psi @ 40 gpm (0.23 bar @ 9.1 m^3/hr)	6.5 psi @ 50 gpm (0.45 bar @ 11.3 m^3/hr)
Maximum Operating Temperature	80° F (26° C)			
Maximum Operating Pressure	150 psi (10 bar)			
Measuring Element	Nutating disc, positive displacement			
Meter Connections	*Available in NL bronze and engineered polymer to fit spud thread bore diameter sizes:*			
	5/8 in. size: 5/8 in. (DN 15 mm) **5/8 × 3/4 in. size**: 3/4 in. (DN 15 mm)	3/4 in. (DN 20 mm)	1 in. (DN 25 mm)	1 in. (DN 25 mm)

MATERIALS

	Model 25 (5/8 in. & 5/8 × 3/4 in.)	**Model 35 (3/4 in.)**	**Model 55 (1 in.)**	**Model 70 (1 in.)**
Meter Housing	Lead-free bronze alloy			
Housing Bottom Plates	Cast iron, lead-free bronze alloy, engineered polymer	Cast iron, lead-free bronze alloy		
Measuring Chamber	Engineered polymer			
Disc	Engineered polymer			
Trim	Stainless steel			
Strainer	Engineered polymer			
Disc Spindle	Stainless steel	Stainless steel	Engineered polymer	Stainless steel
Magnet	Ceramic	Ceramic	Ceramic	Ceramic
Magnet Spindle	Engineered polymer	Stainless steel	Engineered polymer	Stainless steel
Register Lid and Shroud	Engineered polymer, bronze			

DIMENSIONS



Meter Size	Model	A Laying Length	B Height Reg.	C Centerline Base	Width	Approx. Shipping Weight
5/8 in. (15 mm)	25	7-1/2 in. (190 mm)	4-15/16 in. (125 mm)	1-11/16 in. (42 mm)	4-1/4 in. (108 mm)	4-1/2 lb (2 kg)
5/8 in. × 3/4 in. (15 mm)		7-1/2 in. (190 mm)	4-15/16 in. (125 mm)	1-11/16 in. (42 mm)	4-1/4 in. (108 mm)	4-1/2 lb (2 kg)
3/4 in. (20 mm)	35	7-1/2 in. (190 mm)	5-1/4 in. (133 mm)	1-5/8 in. (41 mm)	5 in. (127 mm)	5-1/2 lb (2.5 kg)
3/4 in. (20 mm)		9 in. (229 mm)	5-1/4 in. (133 mm)	1-5/8 in. (41 mm)	5 in. (127 mm)	5-3/4 lb (2.6 kg)
3/4 in. × 1 in. (20 mm)		9 in. (229 mm)	5-1/4 in. (133 mm)	1-5/8 in. (41 mm)	5 in. (127 mm)	6 lb (2.7 kg)
1 in. (25 mm)	55	10-3/4 in. (273 mm)	6 in. (152 mm)	2-1/32 in. (52 mm)	6-1/4 in. (159 mm)	8-3/4 lb (3.9 kg)
1 in. (25 mm)	70	10-3/4 in. (273 mm)	6-1/2 in. (165 mm)	2-5/16 in. (59 mm)	7-3/4 in. (197 mm)	11-1/2 lb (5.2 kg)

REGISTERS / ENCODERS

Standard—Sweep-Hand Registration

The standard register is a straight-reading, permanently sealed magnetic drive register. Dirt, moisture, tampering and lens fogging problems are eliminated. The register has a six-odometer wheel totalization display, 360° test circle with center sweep hand, and flow finder to detect leaks. Register gearing is made of self-lubricating engineered polymer, which minimizes friction and provides long life. The multi-position register simplifies meter installation and reading. The register capacity is 10,000,000 gallons (1,000,000 ft^3, 100,000 m^3).

A Model 25 register is used in the following example:

Model	Gallon	Cubic Feet	Cubic Meter
25 (5/8 in.)	10	1	0.1/0.01
25 (5/8 × 3/4 in.)	10	1	0.1/0.01
35	10	1	0.1
55	10	1	0.1
70	10	1	0.1

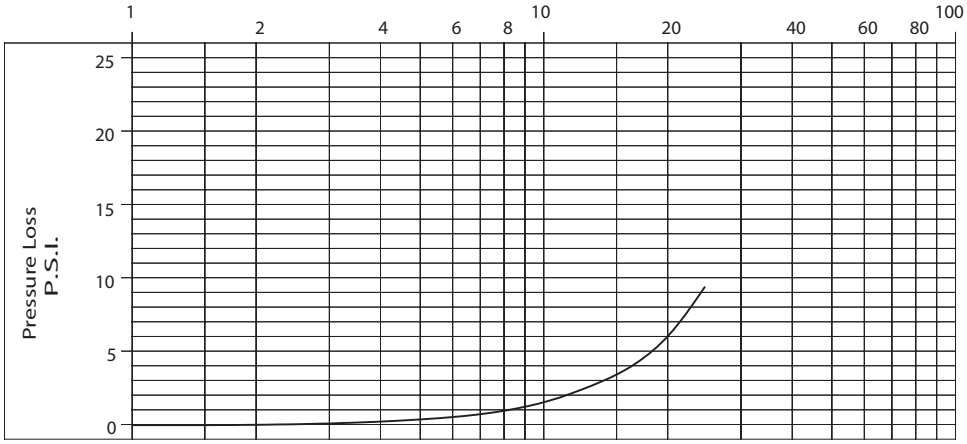
Optional—Encoders for AMR/AMI Reading Solutions

AMR/AMI solutions are available for all Recordall Disc Series meters. All reading options can be removed from the meter without disrupting water service. Badger Meter encoders provide years of reliable, accurate readings for a variety of applications. See details at ***www.badgermeter.com***.

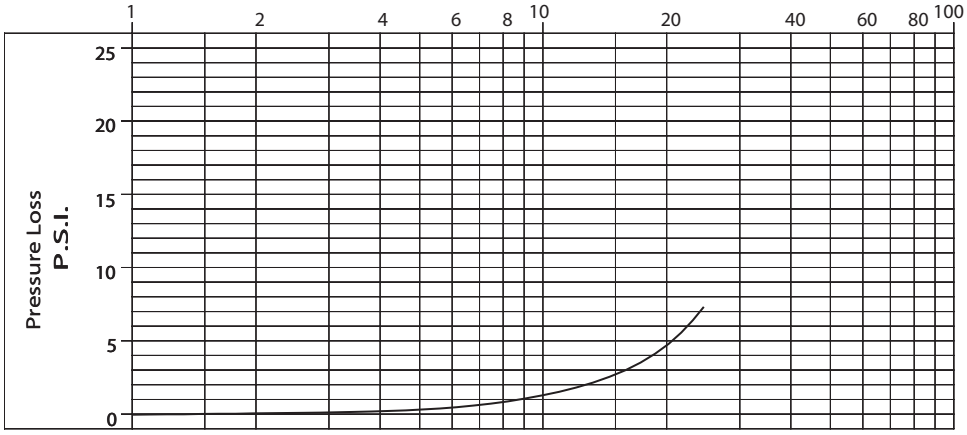
PRESSURE LOSS CHARTS

Rate of Flow in Gallons per Minute

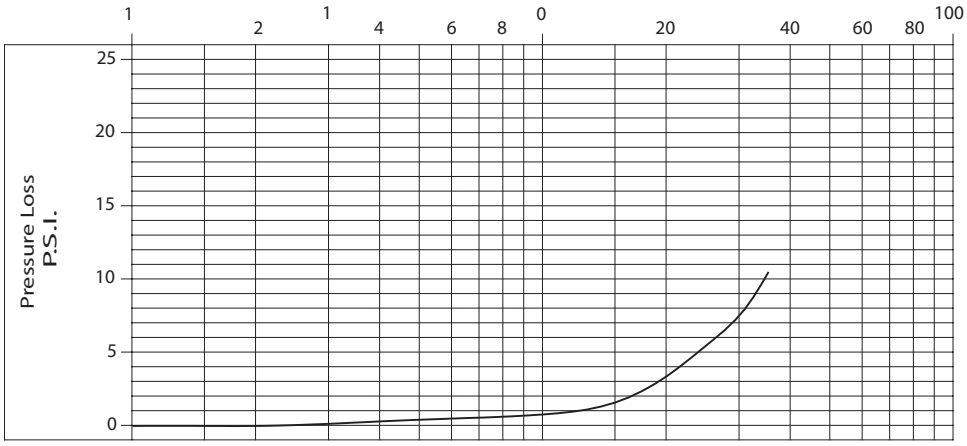
Model 25 5/8 in.



Model 25 5/8 × 3/4 in.



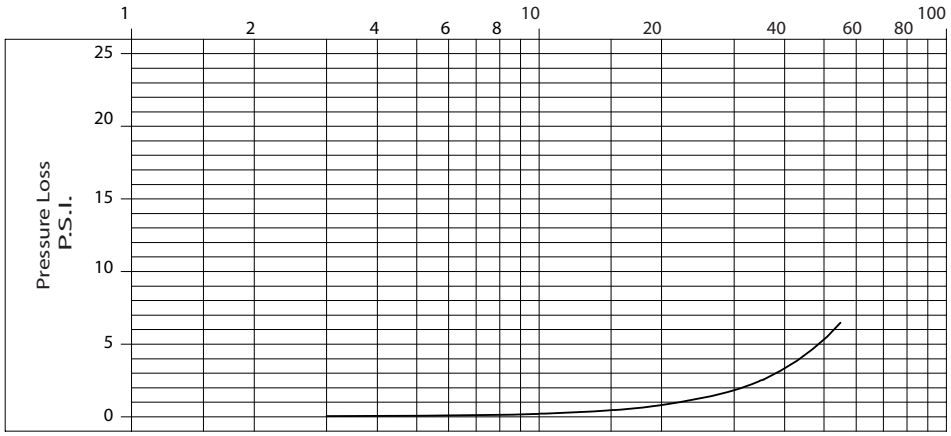
Model 35 3/4 in.



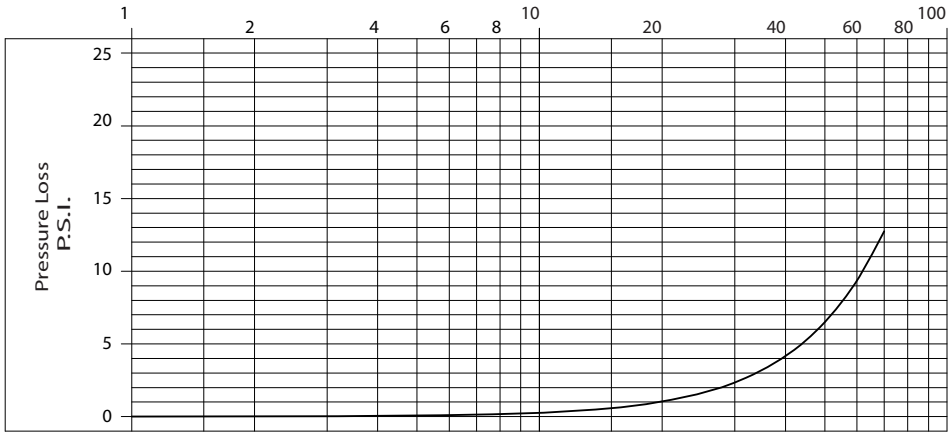
PRESSURE LOSS CHARTS (CONTINUED)

Rate of Flow in Gallons per Minute

Model 55 1 in.

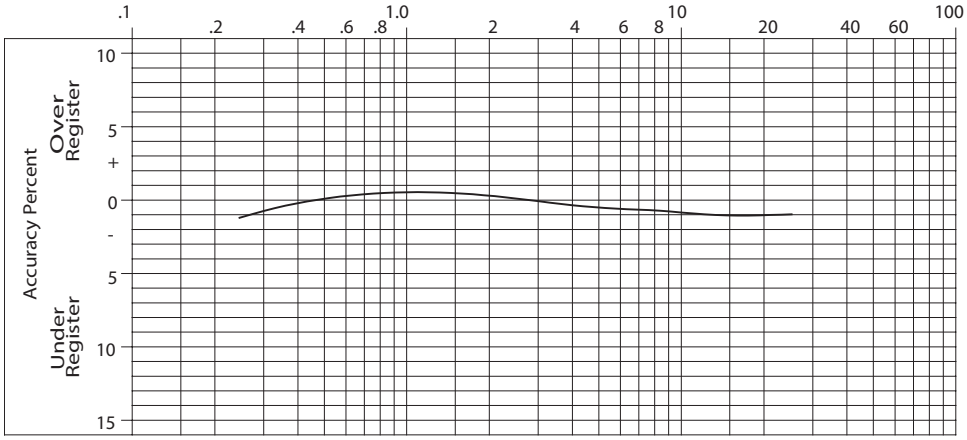


Model 70 1 in.

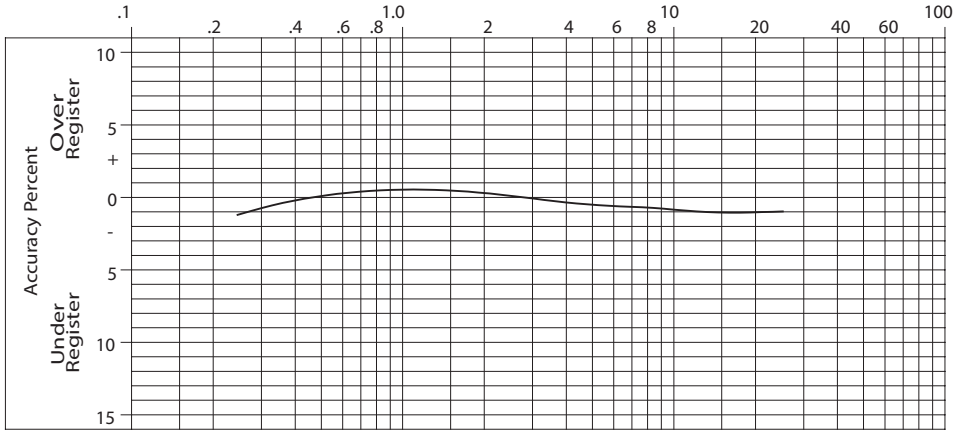


ACCURACY CHARTS

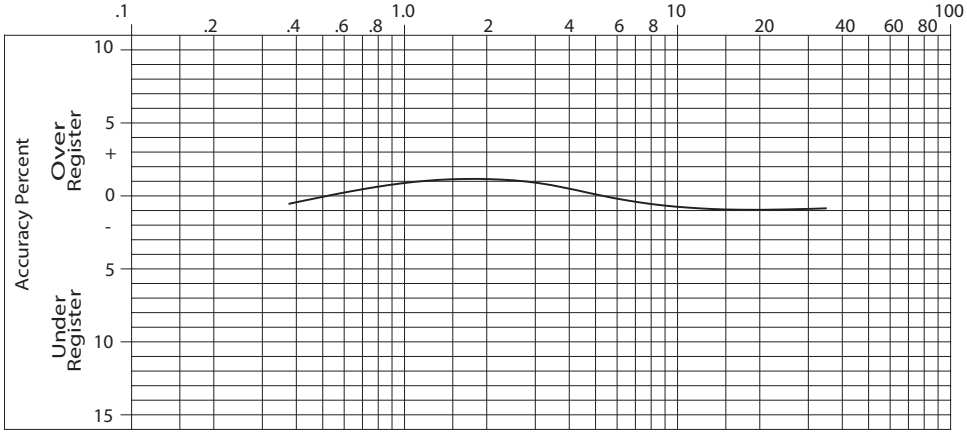
Model 25 5/8 in.



Model 25 5/8 × 3/4 in.

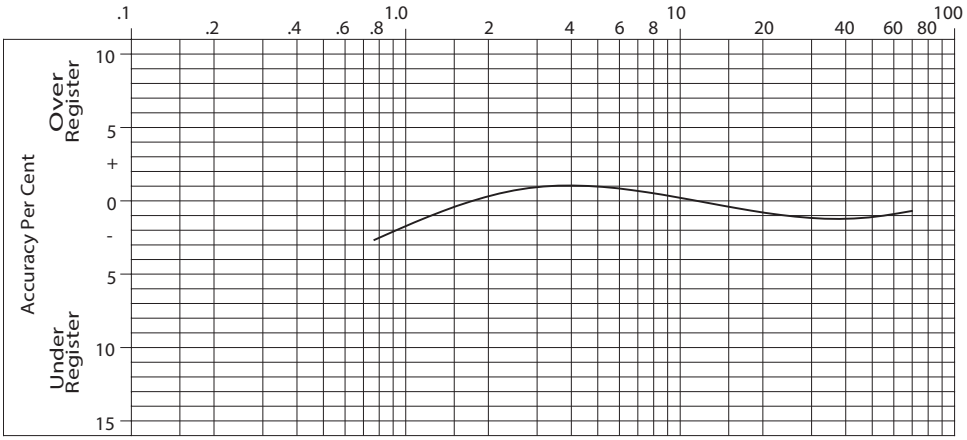


Model 35 3/4 in.

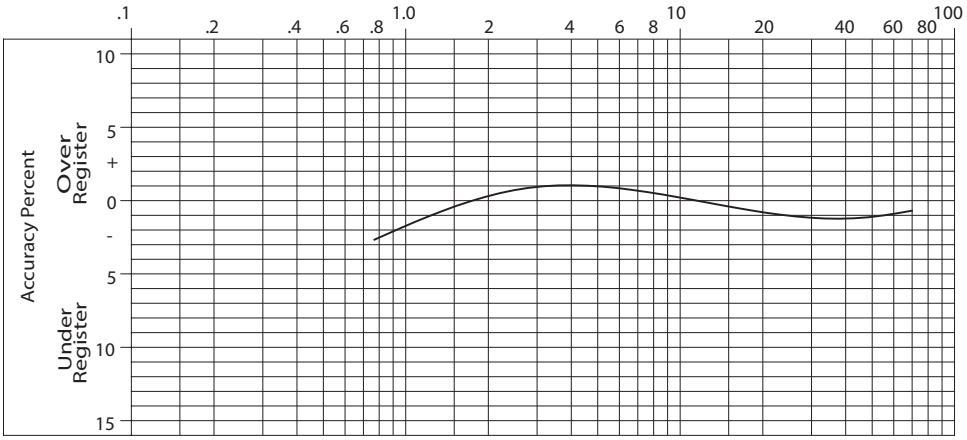


ACCURACY CHARTS (CONTINUED)

Model 55 1 in.



Model 70 1 in.



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Legacy Document Numbers: RDM-DS-00062, 63, 64, 65, 66, and 74

Exhibit 3. Badger Meter Recordall 55 meter installed on Well 8B-1-W10.