IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEW MEXICO

UNITED STATES OF AMERICA, and STATE OF NEW MEXICO, ex rel. STATE ENGINEER,	**No. CV 01-00072 MV/JHR**
Plaintiffs,	**ZUNI RIVER BASIN ADJUDICATION**
and	
ZUNI INDIAN TRIBE, NAVAJO NATION,	**Subfile No. ZRB-1-0148**
Plaintiffs in Intervention,	
v.	
A & R PRODUCTIONS, et al. **Defendants.**	

SUPPLEMENTAL DISCLOSURES PURSUANT TO FED. R. CIV. P. 26(a)(2)(B)

Norma M. Meech, individually and as the successor in interest to Walter Meech, by and through her counsel of record, Law & Resource Planning Associates, P.C., pursuant to Fed. R. Civ. P. 26(a)(2)(B) and the Court's Amended Order Setting Case Management Deadlines [ECF 3478], hereby makes the following disclosures regarding the expert witness who is expected to testify during the trial of this matter.

Alan K. Kuhn, Ph.D, P.E.
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a. Dr. Kuhn is a registered Professional Engineer, Registered Geologist/Engineering Geologist. Dr. Kuhn's Resume is attached hereto as Exhibit A.

b. Dr. Kuhn will testify regarding the nature and extent of the mineral deposit at the La Tinaja Mine owned and operated by C&E Concrete, Inc., including the anticipated years that mining will take place at the mine. In addition, Mr. Irving will testify regarding past water usage at La Tinaja Mine and how that water usage compares to industry practices.

c. The facts and opinions to which Dr. Kuhn is expected to testify are set forth in the report attached hereto as Exhibit B.

d. The facts and data considered by Dr. Kuhn in forming his opinions are set forth in Exhibit B.

e. An exhibit that will be used to support his opinions has already been produced as Exhibit C to the previous report of Doug Irving, P.E.

f. A list of Dr. Kuhn's publications in the previous ten years is attached hereto as Exhibit C.

g. A list of those matters where Dr. Kuhn has testified in trial or in deposition in the previous four years is attached as Exhibit D.

h. Dr. Kuhn's compensation for services is set forth in Exhibit E.

Respectfully submitted,

LAW & RESOURCE PLANNING ASSOCIATES,
A Professional Corporation

By: Tanya L. Scott

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REPORT ON EXPERT CONSULTATION IN ZUNI BASIN ADJUDICATION

UNITED STATES FEDERAL DISTRICT COURT PROCEEDING, *UNITED STATES V. NORMA MEECH,* NO. CV 01-0072 MV/JHR, SUBFILE ZRB-1-0148

11/06/2020

This report documents the results of the scope of work defined for ALAN KUHN ASSOCIATES LLC (AKA) in the letter of September 9, 2020 from LAW & RESOURCE PLANNING ASSOCIATES to AKA for expert consultation to complete and supplement the technical consultation regarding the Tinaja limestone quarry owned and operated by C&E Concrete (C&E). This consultation was initially performed by Mr. Douglas Irving prior to his death in August 2020. Mr. Irving's scope of work was to address two questions:

1. What are the water requirements for a typical rock-quarrying operation comparable in size to that of C&E Concrete's Tinaja quarry?
2. Is the limestone resource on the property sufficient to sustain the operation well into the future?

Limestone Resource

I found Mr. Irving's assessment of the limestone resource to be sufficient without further work on my part. Based on Mr. Irving's estimation of the horizontal extent and thickness of the limestone units within the mine resource area, I concur with Mr. Irving's estimate of approximately 100 million tons of limestone accessible for mining. At an anticipated mining rate of one million tons per year, the Tinaja quarrying operation should be able to continue for about 100 years. The resource is of such quality and quantity that C&E should be able to respond to demands across a broad range of construction, concrete, and electric power markets for years to come.

Water Requirements

I reviewed Mr. Irving's assessment of water requirements to be reasonable, and I continued where he left off by looking at actual water consumption and quarry production records to better quantify water requirements. My assessment of water requirements considered primarily two types of information:

a. The history of water pumping and use at the Tinaja quarry based on C&E records, and

b. Information about water use in New Mexico and elsewhere for similar quarry operations.

<u>History of Water Pumping and Use at the Tinaja Quarry</u>

Tinaja Quarry records available to me included:

- Records of water used in quarry operations from 2001 through 2019, and
- Records of well pumping for 2001-2019.

EXHIBIT A

Water Use

C&E Concrete uses water for dust control on roads, in rock production (blasting, crushing, and screening), and in sand washing. They started keeping records of water used for dust control in the 4th quarter 2013. Daily logs of water used for dust control were prepared by the water truck drivers. Some of the logs recorded water loads above 4000 gallons, the capacity of the water tanker according to Chris Meech (email, 10/15/20). When the records were adjusted to limit each load to not more than 4000 gallons, the calculated average water use for dust control was 11.47 AFY for the 2013-2019 period. The value is slightly higher than the 10.2 AFY calculated by C&E staff, probably because of a difference in interpretation of missing entries on some logs. This average use is consistent with C&E Concrete's reported annual use (i.e.; water pumped) in the 2001-2019 period. The water used for dust control alone far exceeds the NRCE/OSE estimate of water by more than an order of magnitude.

Although C&E Concrete did not take direct measurements of water used for dust control on rock blasting, crushing and screening operations., they stated that they estimate this use at approximately 5000 gal/day For an average 312 working days per year, the consumptive water use for this purpose is 4.8 AFY. However, this estimate is probably low and will increase as production increases.

Water is also used in sand washing. In its report *Crusher Fines/Water Demand Trials; 7/6/20*, Concrete, Aggregate & Asphalt Testing LLC determined that 1630 gal/T or 218 cf/T is used to wash sand to ASTM C33 specification, the standard for sand used in concrete. Of this quantity of water, 81.5 gal/T or 10.9 CF/T is retained on the sand after draining, leaving approximately 1548 gal/T recycled, not accounting for evaporation. Average annual sand production was 33,143 T/Y, so the average consumptive water use for sand production is 8.29 AFY.

Water that is captured in sedimentation ponds receiving discharge from sand washing and rock crushing/ screening operations. Some water is recycled in the sand-washing circuit, and the remainder is evaporated directly during the washing and crushing/ screening processes. No measurement or estimate of these losses is available, so evaporation and infiltration losses are disregarded for this analysis.

The total average annual consumptive water use from 2013 through 2019 included:

- Dust control on roads and operation areas – 11.47 AFY
- Dust control for crushing and screening – 4.8 AFY
- Sand washing – 8.29 AFY

Total average annual water use for 2013-2019 was 24.56 AFY. This is the purposeful use of water and does not include evaporation and infiltration. Future year-to-year use will vary according to well-pumping capacity, product sales and weather conditions, but the annual water use rates are likely to increase as the quarry footprint expands and C&E's asphalt operations come on line. The disparity between the very low pumping rates calculated by both NRCE and the OSE and the much higher pumping capacity of at least 72.6 AFY available to C&E begs the question – if well pumping capacity is sufficient, why would C&E not pump their wells at rates that would support its water needs of at least 24.56 AFY?

Water Pumping

In its report titled *ZUNI RIVER BASIN DETERMINATION OF WATER USES FOR SUBFILE ZRB-1-0148*, June 10, 2020, Natural Resources Consulting Engineers, Inc. (NRCE) examined water meter data for 2001-2012 for the two wells, Well 8B-1-W10 (POD G-0336) and Well 8B-1-W11 (POD G-00337), used to supply water for quarry operations. It is not clear why NRCE did not include the well pumping data for 2015-2019. For the 2001-2014 period, they concluded that inconsistencies and errors in application of multipliers to well meter readings caused C&E Concrete to report pumping rates much higher (10-1000) times than the actual rates when appropriate multipliers were applied. NRCE concluded that the actual annual pumping rates of the two wells averaged 0.368 AFY and 0.450 AFY for a total of 0.818 AFY for the 2001-2014 period, and apparently assumed that the pumping rates that they calculated were representative of the water use rates; NRCE did not compare their calculated pumping rates to documented water use rates.

AKA performed an independent assessment of water meter reading multipliers that started with examination of C&E's records and realistic water use references for quarry operations of the size of the Tinaja Quarry. It was apparent that pumping rates of less than 1 AFY are not realistic; sand washing alone requires much more water than 0.818 AFY. C&E's application of multipliers varied, and the multipliers were not systematically recorded, complicating the task that was undertaken by both NRCE and OSE. However, with a few exceptions C&E's multipliers produced results that are in line with records of water consumed in C&E's quarry operations.

Tables 1 and 2 list the meter readings and the multipliers that AKA determined to be consistent with actual water consumption records and estimates for the Tinaja quarry. A higher multiplier would yield an excessive value, and a lower multiplier would yield a number substantially below the amount of water needed to support quarry operations. Table 1 shows that pumping rates of well G-336 averaged 3.36 AFY from 2001 to 2012 but declined sharply after 2004.

Table 2 shows that Well G-337 produced at approximately ten times more than G-336 at 31.48 AFY average during 2001 to 2019 with a low of 16.72 AF in 2005 and a high of 54.62 AF in 2019. The combined average pumping rates for the two wells is 34.84 AFY, but production in G-336 has declined to nearly zero, so going forward water production will depend on Well G-337.

The variability in pumping is attributable in part to variations in product sales and weather, with drought conditions in recent years being evident in the spike in water pumping from G-337 in 2018-2019. However, the decline in pumping rates from 2008 to 2017 (see Figure 1 and Figure 2) is due to a steady deterioration in the performance of Well G -337. During that time, C&E made a number of efforts to rehabilitate the well, including testing and downhole video imaging, and chemical and mechanical treatments. None of the efforts was successful, and well production steadily declined, limiting water availability that, in turn, limited quarry production. During 2016-2018, water was imported from Milan to supplement the water supply until G-337 production could be restored. In 2017, G-337 was substantially worked over; the well was deepened by 315 feet to increase the depth to 1200 feet, and new stainless steel casing and screen were installed. The increase in G-337 production after 2017 is evident in Figures 1 and 2.

Water supply (both pumping from on-site wells and importing from Milan) and water use are illustrated on Figure 1. Quantities calculated by both C&E and AKA are shown for comparison; there are only slight differences between the two sets of numbers. The graph shows that no water uses in the quarry operations could be satisfied by less than 4.8 AFY, and combined uses will likely increase above the 24.56 AFY average as the quarry expands.

Figure 2 illustrates that water supplied at the pumping rates in Table 1 and Table 2 have usually been sufficient to match or exceed the water consumption rates but have been somewhat lower in the years of 2008-2017 because the limitation on available water forced limitation of rock production. However, C&E's estimate of 4.8 AFY for rock production is conservative and will increase with increasing production, pushing water consumption higher.

Comparison to Mining Industry Water Use

Water is commonly used by surface mines and quarries to control dust and process product. The amount of water used varies widely depending on factors including location, weather, rock and product type, production levels, and mining methods.

A study conducted for the National Stone Council found that water use averages 12.1 gal/T of quarry rock extracted, and five times that amount is used for processed rock:

> *"A 2008 survey of the natural stone industry … indicated that quarries consume an average of approximately 21 gallons of water per day for every net cubic foot of stone extracted, while processors average about 100 gallons per day per net cubic foot of stone produced."(Natural Stone Council 2011)*

Assuming an average 2000T/day extracted (quarried) and 312 days per year of quarry operations (624,000 T/Y), the Tinaja Quarry would use 23.2 AFY of water for rock production (blasting, crushing, screening, dust control). If sand production is classified as processing, the 33143 T/Y would use 60.5 gal/T or 6.15 AFY for sand washing. Applying the results of this study, Tinaja production rates averaging 2000T/day of rock for 312 days and 33,143 T/year of sand should consume a total of 29.35 AFY, versus the Tinaja average annual water use of 24.56 AFY, so the Tinaja water consumption has been less than the industry norm. Dieter et al (2018) estimated that 44,137 AFY (39.4 million gal/day) of fresh groundwater were withdrawn for mining in New Mexico in 2015; Tinaja Quarry withdrawals represent a small fraction of one percent of that total.

A different study by the US Geological Survey (Lovelace 2009) compared relative water uses based on water-use coefficients, defined as gallons per ton, for a broad range of non-metallic mines and quarries. Below is Table 3 from that study, with the Tinaja water use quantities inserted for comparison purposes. The Gal/T column values are from the USGS study, and the remaining columns are input from C&E records. The USGS water-use coefficients (gal/T) range from a low of 30 gal/T to a high of 997 gal/T for mines evaluated in this study. The average Tinaja Quarry water use for the period 2013-2019 (24.56 or 12.8 gal/T) is below even the minimum rate of use identified in this study and would just reach 30.6 AFY for a production rate of 2500 T/day. This does not include future needs for additional water as the quarry footprint expands and C&E brings its asphalt operations on line.

Table 1 WATER METER READINGS WELL G-336 TINAJA QUARRY

2001-2016

								multiplier used		
	METER READINGS			ADJUSTED READINGS				10	100	1000
YEAR	START	END	YEAR TOTAL	START	END	YEAR TOTAL	ADJUSTMENT MADE	AF	AF	AF
2001	104680	12472	-92208	10468000	12472000	2004000	START X 100, END X 1000			6.15
2002	12472	17504	5032	12472000	17504000	5032000	START & END X 1000			15.44
2003	17504	20529	3025	17504000	20529000	3025000	START & END X 1000			9.28
2004*	20529	226	2007	20529000	226000	2007000	START & END X 1000			6.16
2005	226	250	24	226000	250000	24000	START & END X 1000			0.07
2006	250	915	665	250000	915000	665000	START & END X 1000			2.04
2007	915	930	15	915000	930000	15000	START & END X 1000			0.05
2008	930	979	49	930000	979000	49000	START & END X 1000			0.15
2009	979	1062	83	979000	1062000	83000	START & END X 1000			0.25
2010	1062	1182	120	1062000	1182000	120000	START & END X 1000			0.37
2011**	1182	1219	37	1182000	1219000	37000	START & END X 1000			0.11
2012	34	100	66	34000	100000	66000	START & END X 1000			0.20
2013	0	0	0			0				
2014	0	0	0			0				
2015	0	0	0			0				
2016	0	0	0			0				
							AF totals =			**40.29**
							Average 2001-2012 =	**3.36**	**AFY**	

* Re-set Late 2004. Total meter reading = 22309-20528+226 = 2007

** Out of operation at 1185, then resumed at re-set to zero

Table 2 WATER METER READINGS WELL G-337 TINAJA QUARRY

2001-2019

	METER READINGS			ADJUSTED READINGS				multiplier used 10	100	1000
YEAR	START	END	YEAR TOTAL	START	END	YEATR TOTAL	ADJUSTMENT MADE	AF	AF	AF
2001	90752	174661	83909	9075200	17466100	8390900	START & END X 100		25.75	
2002	174661	252113	77452	17466100	25211300	7745200	START & END X 100		23.77	
2003	252113	354319	102206	25211300	35431900	10220600	START & END X 100		31.37	
2004 *	354319	45327	-308992	35431900	45327000	9895100	START x 100, END X 1000			30.37
2005	45327	50775	5448	45327000	50775000	5448000	START & END X 1000			16.72
2006	50775	63355	12580	50775000	63355000	12580000	START & END X 1000			38.61
2007	63355	74995	11640	63355000	74995000	11640000	START & END X 1000			35.72
2008	74995	89653	14658	74995000	89653000	14658000	START & END X 1000			44.99
2009 **	89653	2515	-87138	89653000	2515000	12880000	START & END X 1000			39.53
2010	2515	13717	11202	2515000	13717000	11202000	START & END X 1000		34.38	
2011	13717	23631	9914	13717000	23631000	9914000	START & END X 1000		30.43	
2012	23631	32684	9053	23631000	32684000	9053000	START & END X 1000		27.78	
2013	32684	41260	8576	32684000	41260000	8576000	START & END X 1000		26.32	
2014	41260	50203	8943	41260000	50203000	8943000	START & END X 1000		27.45	
2015	50203	58594	8391	50203000	58594000	8391000	START & END X 1000		25.75	
2016 ***	58594	4883	-53711	58594000	4883000	6989000	START & END X 1000***		21.45	
2017	4883	10460	5577	4883000	10460000	5577000	START & END X 1000		17.12	
2018****	10460	14021	3561	1046000	1402100	14985000	START & END X 1000****		45.99	
2019	14021	31817	17796	14021000	31817000	17796000	START & END X 1000		54.62	
2020										
							AF totals =		392.18	205.94

2011-2019 Average AFY = 31.48

lowest 16.72

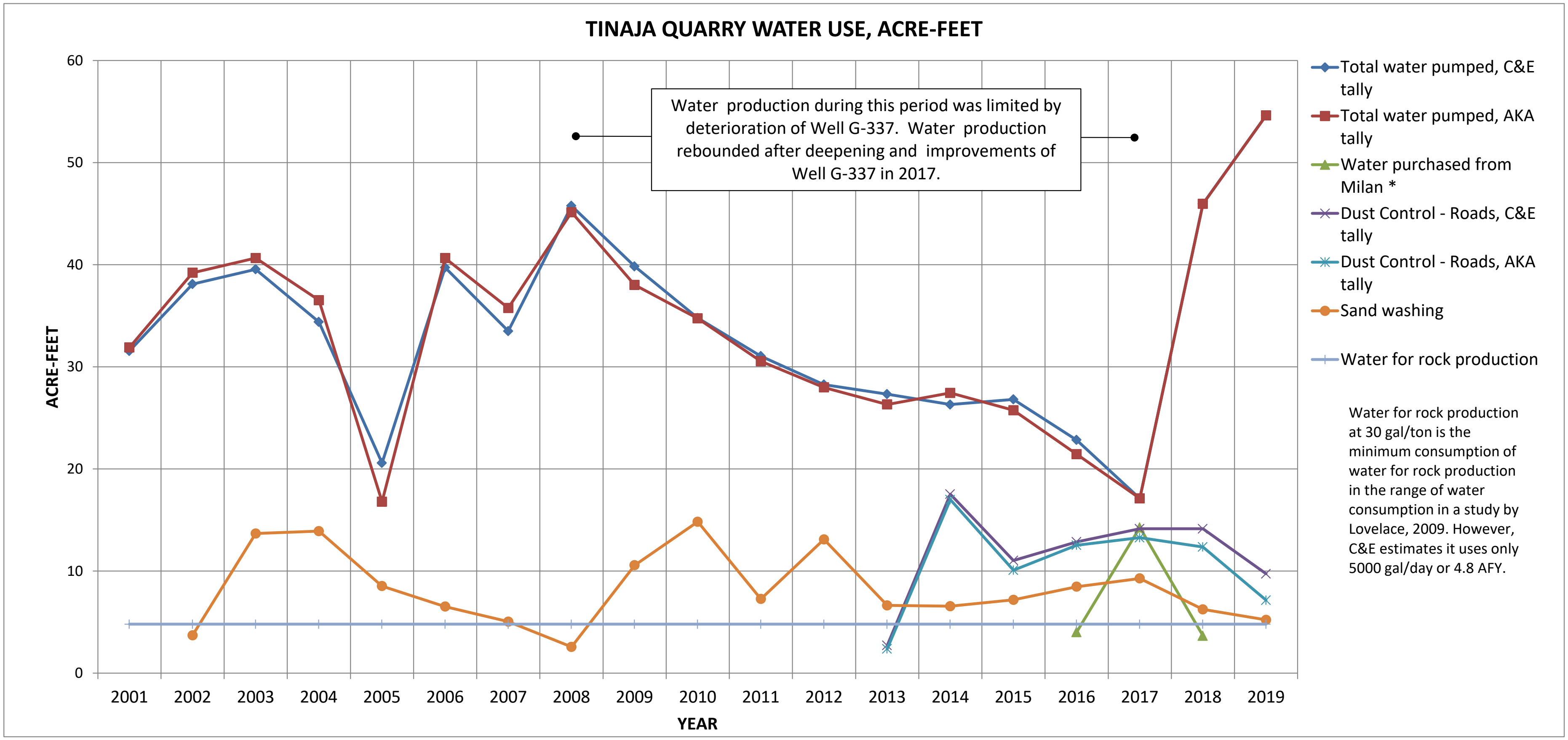
highest 54.62

*	End multiplier changed from 100 to 1000	
**	Re-set to zero in October at 100,000	Corrected meter reading = 100,000-89635+2515= 12880
***	Re-set to zero in April at 60700	Corrected meter reading = 60700-58594+4883 =6989
****	Re-set to zero at end of April at 11414	Corrected meter reading = 11424-10460+14021 = 14985

Due to problems with Well 8B-1-W11 (POD G-00337) during 2016-2018, it was off line much of that time for rehabilitation and repair.

During this time, water was imported from Milan to supplement the water supply.

FIGURE 1 TINAJA QUARRY WATER USE



Annual Water Use, AF

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total water pumped, C&E tally	31.6	38.1	39.6	34.4	20.6	39.7	33.5	45.8	39.8	34.8	31.1	28.3	27.3	26.3	26.8	22.8	17.1	46.0	54.6
Total water pumped, AKA tally	31.9	39.2	40.7	36.5	16.8	40.7	35.8	45.1	38.0	34.7	30.5	28.0	26.3	27.5	25.8	21.5	17.1	46.0	54.6
Water purchased from Milan																4.015	14.27	3.66	
Dust Control - Roads, C&E tally													2.72	17.53	11.04	12.86	14.15	14.15	9.74
Dust Control - Roads, AKA tally													2.39	17.00	10.09	12.53	13.27	12.36	7.15
Sand washing		3.71	13.68	13.91	8.53	6.52	5.05	2.57	10.57	14.83	7.27	13.1	6.64	6.56	7.18	8.47	9.28	6.25	5.22
Water for rock production	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80

FIGURE 2 TINAJA QUARRY WATER SUPPLY VS WATER CONSUMPTION

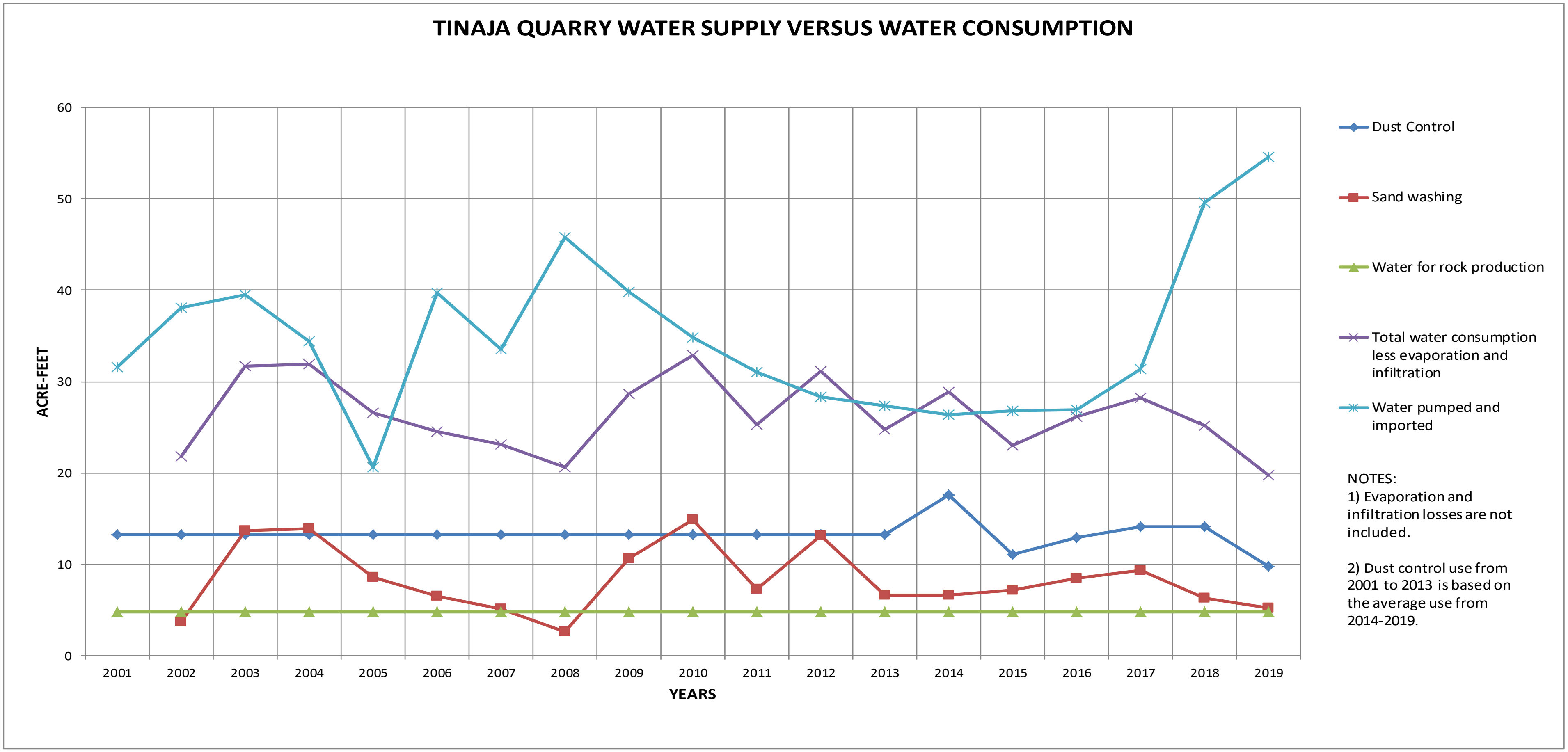


Table 3. Water-use coefficients for mining in the United States by major Standard Industrial Classification group (Office of Management and Budget, 1987). Mining and quarrying of nonmetallic minerals, except fuels.

Gal/T		T/day	at 312 DAY/YR		Gal/yr	AF/yr
min	30	**2500**	780,000	T/yr	23,400,000	71.8
max	997	**2500**	780,000	T/yr	777,660,000	2,386.7
min	30	**1500**	468,000	T/yr	14,040,000	43.1
max	997	**1500**	468,000	T/yr	466,596,000	1,432.0

The USGS study also states:

> *"Estimates of water withdrawals for mining have been included in U.S. Geological Survey reports describing water withdrawals for all categories of use in the United States since 1950 but were included in the self-supplied industrial use category from 1950 to 1980. Mining withdrawals typically are less than one percent of total national water use and are relatively minor in most states when compared to withdrawals for other use categories of use such as public supply, irrigation, self-supplied industry and thermoelectric power generation."*

Conclusions

There are large differences in how the well meter readings are interpreted and multiplied; It is evident that the meter readings as interpreted by NRCE and NM OSE are not realistic when compared to the Tinaja quarry water consumption records. The difference is a factor of at least 10 between the NRCE/OSE water pumping rates and the C&E water consumption rates. When both numbers (NRCE/OSE versus C&E) are compared to values in the cited references for typical water consumption at similar surface mines/ quarries, it is clear that no operation the size of the Tinaja Quarry could operate with the miniscule water use, less than 1 AFY, represented by the NRCE/OSE interpretation of the well meter data. By industry standards, C&E's water consumption is minimal; similar operations consume substantially more water.

Although the quarry production records probably have errors and omissions (common in handwritten records in all industries), they are not reasonably large enough or pervasive enough to reduce the documented water consumption by a significant amount. It is more likely that a systematic defect or error accounts for the discrepancies in meter readings.

Respectfully submitted,

Alan Kuhn, PhD, PE, RG, D.GE, F.ASCE

Alan Kuhn Associates LLC

References

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