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C.H. HUCKELBERRY
County Administrator

October 18, 2018

Mr. William James, National Mining Expert
US Army Corps of Engineers
3701 Bell Road
Nashville, Tennessee 37214-2660

Elizabeth Goldmann
US Environmental Protection Agency
75 Hawthorne Street
San Francisco, California 94105

Re: Response to Hudbay Regarding Intermittency and Surface Water Impacts

Dear Mr. James and Ms. Goldmann:

New information obtained from the Army Corps of Engineers (Corps) via a Freedom of Information Act request indicates Hudbay has provided you with rainfall and runoff data that were not previously available.

In this letter, my staff uses Hudbay's new data to support our contention that the impact of flow reduction by the mine has been greatly underestimated. Hudbay's rainfall and runoff data also confirm the presence of intermittent flow on Barrel Canyon as well as other streams in the Rosemont area. Hudbay's mischaracterization of flow conditions as entirely ephemeral does not obviate the need for the federal agencies to fulfill their responsibilities under the Clean Water Act to protect existing uses for these streams.

This letter will present additional information substantiating intermittent flow derived from U.S. Geological Survey and will correct Hudbay's misinformation concerning aquatic invertebrates.

Hudbay's data show impacts of fills are underestimated

In their July 17, 2017 letter to you, Hudbay attached a report by their subcontractor, Water and Earth Technologies (WET), which shows the amount of flow generated on the mine site contributing to Davidson Canyon is much greater than the fractions predicted by Zeller (2011[1]) and used in the Final Environmental Impact Statement. Based on the observed watershed runoff reported in WET 2017, the Zeller method cannot be considered

[1] Zeller, M. E. 2011. Predicted Regulatory (100-Yr) Hydrology and Average-Annual Runoff Downstream of the Rosemont Copper Project. Tucson, Arizona: Tetra Tech. July 11

"conservative"[2] as alleged by Hudbay in their April 2017 presentation to the Corps. In fact, Barrel watershed's observed outflows during 2013-2016 provided over half of the flow to Hudbay's Davidson gage station (Attachment 1). This is a much greater proportion of flow than would be predicted by the Zeller method.

Hudbay's Own Data Confirm Intermittent Flow in McCleary and Barrel

In the past few years, Hudbay has taken numerous opportunities to discredit the assertion that Barrel Canyon has intermittent flow. This was highlighted most recently in a report by Westland[3] in which it is stated that Barrel Canyon flows "only in response to storm events" (page 6). In light of this effort to discredit, Hudbay's July 17, 2017 letter and accompanying reports from WET are a fascinating read because data from the company's own consultant validate what we and others have been saying for years: Barrel Canyon and contributing streams such as McCleary have intermittent flow.

Despite the monitoring effort taking place during one of the driest periods on record, the result of stream discharge monitoring by WET can be nicely summarized by the following paragraph:

> "At some Rosemont stations, *bank storage flow has been observed as flowing water not directly attributed to precipitation events*. At some Rosemont stations, bank storage flow is often very low flows of the trailing limb of hydrographs (e.g., < 1.0 cfs) that *persists for several days or weeks following large runoff events*. Bank storage flows have been observed at station RS-MC-3 and to a lesser extent at stations RS-SC-4 and RS-BC-2." (Emphasis added; "Hydrologic Data Summaries", Page 4).

What is particularly relevant to this topic is that Hudbay's flow (stage) sensor in Barrel Canyon (RS-BC-2) is actually located in alluvial deposits and further upstream of the Barrel Spring and USGS gages that demonstrate intermittent flow. Hudbay fails to mention this fact.

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[2] The term "conservative" was used 15 times in Hudbay's presentation to the Corps in April 18, 2017. Exactly what this word means is undefined, but assumed to mean an overestimate of impacts.

[3] "Response to Pima County Comments Regarding Intermittent Status, Sept. and Nov. 2017 Rosemont Copper Project, Clean Water Act Section 404 Permit, CoE File No.: 2008-00816-MB". Transmitted to Mr. William James (U. S. Army Corps of Engineers) by Hudbay on January 25, 2018.

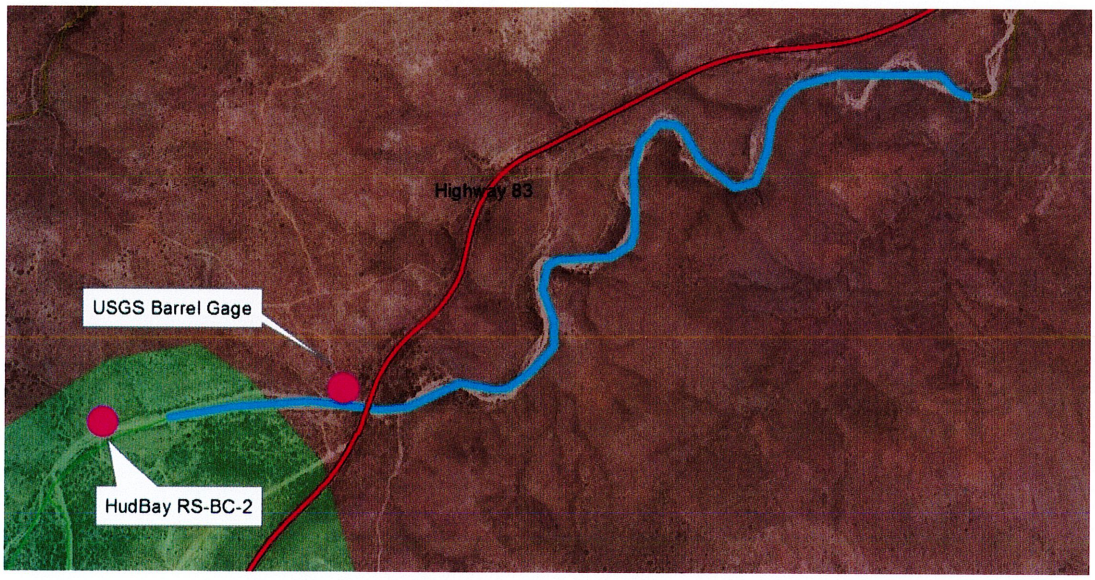

Figure 1. Location of the two stage sensors in Barrel Canyon in relationship to alluvial deposits (green) and bedrock (red)[4]. Intermittent flow reach of Barrel Canyon[5] is noted in blue.

Despite this, it should be noted that by the company's own data in the January 25, 2018 letter, anything that is "Bank Storage" is flow, by definition, characteristic of intermittent or perennial streams because it is not associated with storm events.

- 2016 (from "Data Analysis for December 2016"):
  - WET station McCleary Canyon RS-MC-3 had a total Event Runoff of 47.55 acre feet (AF) but a Bank Storage Flow of 384.70 AF (Table 9).
  - Barrel Canyon USGS gage showed a runoff volume of 157.65 AF and a Bank Storage flow of 10.42 AF (Table 10) and the HudBay sensor in Barrel (RS-BC-2) also showed Bank Storage Flow (Table 9).
  - Discharge at the Barrel gage showed two separate periods of continuous flow in what appears to be for 68 days in January to March and 78 days from August to October) (Page 56).

- 2015:
  - WET station McCleary Canyon RS-MC-3 had a total Event Runoff of 73.13 acre feet (AF) but Bank Storage Flow of 112.83 AF (Table 9, "Data Analysis for December 2016").
  - McCleary ran for 88 days from August through November and 18 days in December (Page 54). Note, there were no measurement taken from January through the middle of May).

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[4] See http://gis.pima.gov/data/contents/metadet.cfm?name=hgbasin1 for metadata.
[5] See: http://gis.pima.gov/data/contents/metadet.cfm?name=istreams.

The USGS gage also provides important information showing intermittent flow on the Barrel Canyon. Figure 2 shows flow during three distinct periods of continuous flow since 2015 and Figure 3 shows Barrel Canyon on August 16, 2017, just downstream of the Highway 83 bridge.

Additional information regarding Dr. Bogan's aquatic invertebrate observation.
Westland's 2017 report takes issue with a number of assertions made by Pima County with regards to the winter stonefly species (*Mesocapnia arizonensis*) studied by Bogan (2017)[6], who documented the life cycle and distribution this species throughout its range in Arizona and California.

In April 2010, multiple specimens were collected in Barrel Canyon approximately 1500 feet downstream from the Highway 83 bridge and USGS gage[7], near "Barrel Spring" where shallow bedrock likely enhances the expression of surface flow. The collection occurred just after an extremely dry three-year period (Figure 3), but heavy rains elevated groundwater levels and Barrel Canyon began flowing on January 22, 2010.

[6] Bogan, M. T. 2017. Hurry up and wait: life cycle and distribution of an intermittent stream specialist (*Mesocapnia arizonensis*). Freshwater Science 36(4):805-815.
[7] According to Dr. Bogan, the specimen reported as being collected from "Davidson Canyon" was actually collected in Barrel Canyon near the Barrel Canyon USGS gage (Michael Bogan, *personal communication*). The latitude and longitude reported in Bogan (2017) are correct, and indicate that specimens were collected near Barrel Spring, a seasonal spring downstream of the USGS gage.

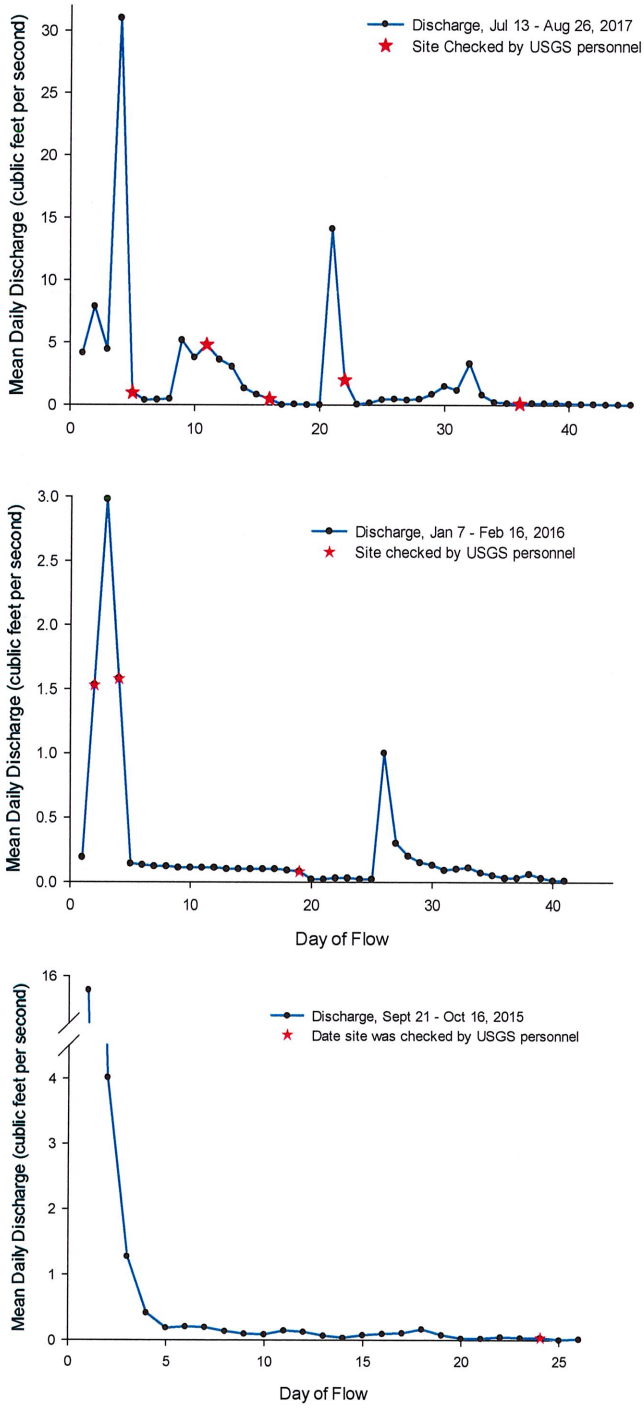

Figure 2. Days of flow recorded at the USGS 09484580 Barrel Canyon gage at various times since 2015. Data are "Approved for Publication".

Figure 3. A proportion of Barrel Canyon's intermittent reach; in this site just downstream of the Highway 83 bridge. Photo taken on August 16, 2017.

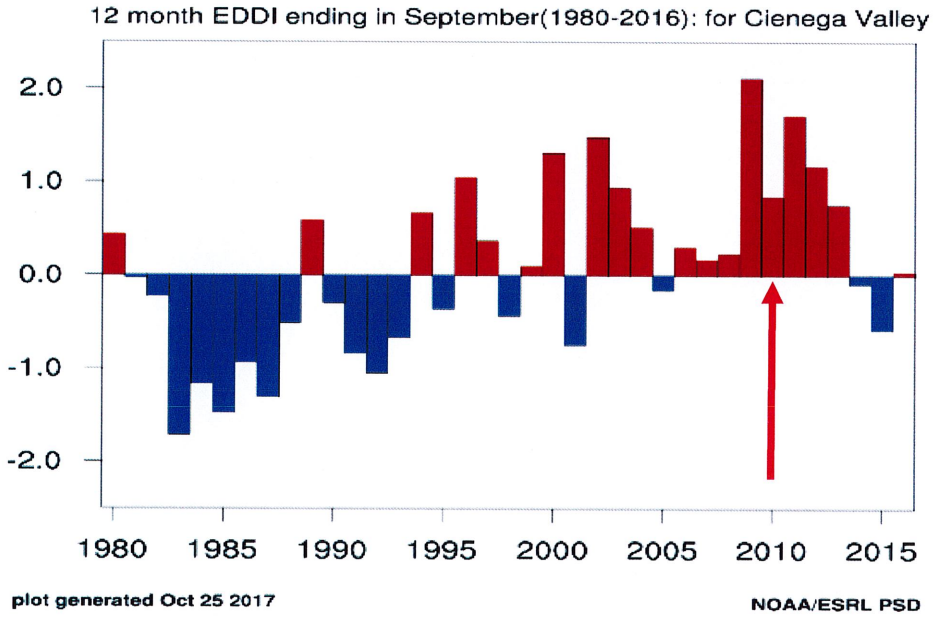

Figure 3. Evaporative Demand Drought Index[8] graph showing the drought conditions (in red). Collection year for the stonefly is noted, but because of the biology of the species, its presence at the site in early 2010 is especially important because of the extremely dry conditions in 2009.

[8] Hobbins, M., A. Wood, D. McEvoy, J. Huntington, C. Morton, M. Anderson, and C. Hain. 2016. The Evaporative Demand Drought index: Part I – Linking Drought Evolution to Variations in Evaporative Demand. Journal of Hydrometeorology 17:1745-1761.

For one population of this species in Arizona, Bogan (2017) noted "Nymphs were abundant within days of flow resumption, grew rapidly as a single cohort, and started emerging as adults 42 d after flow resumed". In California, Bogan and Carlson (2018[9]) found that adults of *M. arizonensis* emerged from intermittent reaches an average of 51 days after flow resumed. In other words, for this species to mature, it needs at least 42 consecutive days with water. This is clearly a species that relies on intermittent surface water conditions for survival.

In personal communications to Brian Powell (Pima County Office and Sustainability and Conservation), Dr. Bogan conveyed the following:

- Multiple adult individuals were collected, not just one individual as Hudbay reported; these specimens represented a breeding population with both larvae and adults observed at the site;

- Hudbay posited that females could potentially fly in from time to time from the closest nearest populations. This is possible, but this speculation could not explain presence of mature larvae and emerging adults given the simultaneous emergence of adults in those nearby drainages (i.e. adults were not present earlier in the winter and thus could not have flown to Davidson/Barrel in January and lain the eggs needed to produce mature larvae in March/April);

- Stonefly larvae can mature in as few as 43 days, and were found to take an average of 51 days to emerge in California, so that means the reach was flowing at least 6 or 7 weeks when emerging adults were collected, or had grown in an adjacent upstream reach and then were connected by flow with the downstream reach. At the time of sampling, however, the reach above the study reach was dry (see Barrel Canyon UGSG gage flow record), so drift was not a possible source of colonists;

- Hudbay's assertion that ephemeral streams can also be characterized by such aquatic invertebrates misrepresents the data. The only way the species occurs in ephemeral reaches is via drift from upstream intermittent reaches. Drift from populations in intermittent Sabino Canyon were the source of individuals collected in the ephemeral Rillito in Tucson in February 2017;

- The stonefly species is an intermittent stream specialist, only occurring in streams that dry during the early summer and fall but have flow during the winter season when temperatures are appropriate (Dec-April). They need to have this sustained winter flow period to complete their life cycle.

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[9] Bogan, M.T. and S.M. Carlson. 2018. Diversity and phenology of stoneflies (Plecoptera) from intermittent and perennial streams in Pinnacles National Park, California, U.S.A. Illiesia 14:144-154. https://doi.org/10.25031/2018/14.08.

Federal Agencies Must Protect Existing Uses, Even if They Are Not Designated Uses

The Clean Water Act requires states to develop antidegradation policies to establish a level of water quality necessary to protect existing uses of a stream, which includes "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards." 40 C.F.R. § 131.12, 131.3(e). Arizona "Antidegradation" rules implementing this federal obligation are unequivocal, stating, "The level of water quality necessary to support an existing use **shall** be maintained and protected." R18-11-107 (emphasis added). This "Tier 1" protection is considered the minimum protection level for surface water quality and applies to all surface waters regardless of existing water quality, including effluent dependent waters, ephemeral waters, intermittent waters and certain canals. R18-11-107.01. Despite this clear mandate, water quality standards used and analyzed in the FEIS did not take into consideration the existing aquatic wildlife uses of the intermittent streams at Barrel and McCleary Canyons, nor the existing livestock uses mentioned in our letter of September 28, 2017.

In conclusion, Pima County and the Regional Flood Control District appreciate the Corps' thorough analysis of Rosemont's impacts to public trust values, including existing uses of the streams at the mine site and its impact area. This latest set of evidence should leave little doubt that portions of Barrel and McCleary canyons must be considered intermittent with uses that would include aquatic wildlife characteristic of intermittent flow.

If you require any additional information, my staff are available to answer any questions you may have.

Respectfully,

C. H. Huckelberry
County Administrator

CHH/lab

Attachment

c: Deanna Cummings, US Army Corps of Engineers

Date: 10-15-18
From: Evan Canfield
To: Brian Powell
Subject: July 17, 2017 Watershed Yield Data

Background:
SWCA (08-28-2012 [SWCA 2012]) provided an estimate of 4.3% reduction of flow at the Davidson Canyon confluence, citing the method of Zeller, 2011. Pima County has long contended that the methods used by Hudbay to estimate the contribution of the watershed occupied by the proposed mine to Davidson Canyon and the Outstanding Arizona Waters (OAW) is underestimated (e.g comment #2 (Pima County's response to Westland Resources et al. (2016)). *The data summarized by Water and Earth Technologies in Hudbay's July 17, 2017 transmittal to William James, U. S. Army Corps, indicate that the fraction of flow generated on the mine site contributing to Davidson Canyon is much greater than the fractions presented by Hudbay.*

Datasets:
The data presented by Water and Earth Technologies (WET) with the contributing watershed is as follows:

Table 1
Ac-ft Runoff (from WET, June 2017)

	Area (sq. mi) *	2013	2014	2015	2016
Davidson at DC-3	50.5	24.05	86.72	204.64	>219.62
Barrel at USGS	14.1	42.02	58.68	186.91	168.07
Barrel at BC -2	13.83	18.93	99.81	127.83	149.55
SC-6	3.1			39.23	>6.72
SC-4	2.44			52.05	90.09
MC-4	2.29			19.14	1.78
MC-3	1.75			185.96	432.25
TC-4	1.41			0.47	0.0001
TC-3	0.87			0.87	0.0002

* From USGS site data or USGS Streamstats, based on coordinates provided by WET

This original relationship by Zeller, 2011 is:

$$Q_{AA} = (8.44885x10^{-6})A^{0.9821}\,P^{2.1198}E^{1.2101}$$

Q_{AA} – Average annual runoff (acre-ft)
A – Area in (square miles)
P - Annual Precipitation (inches)

E – Mean Elevation (feet)

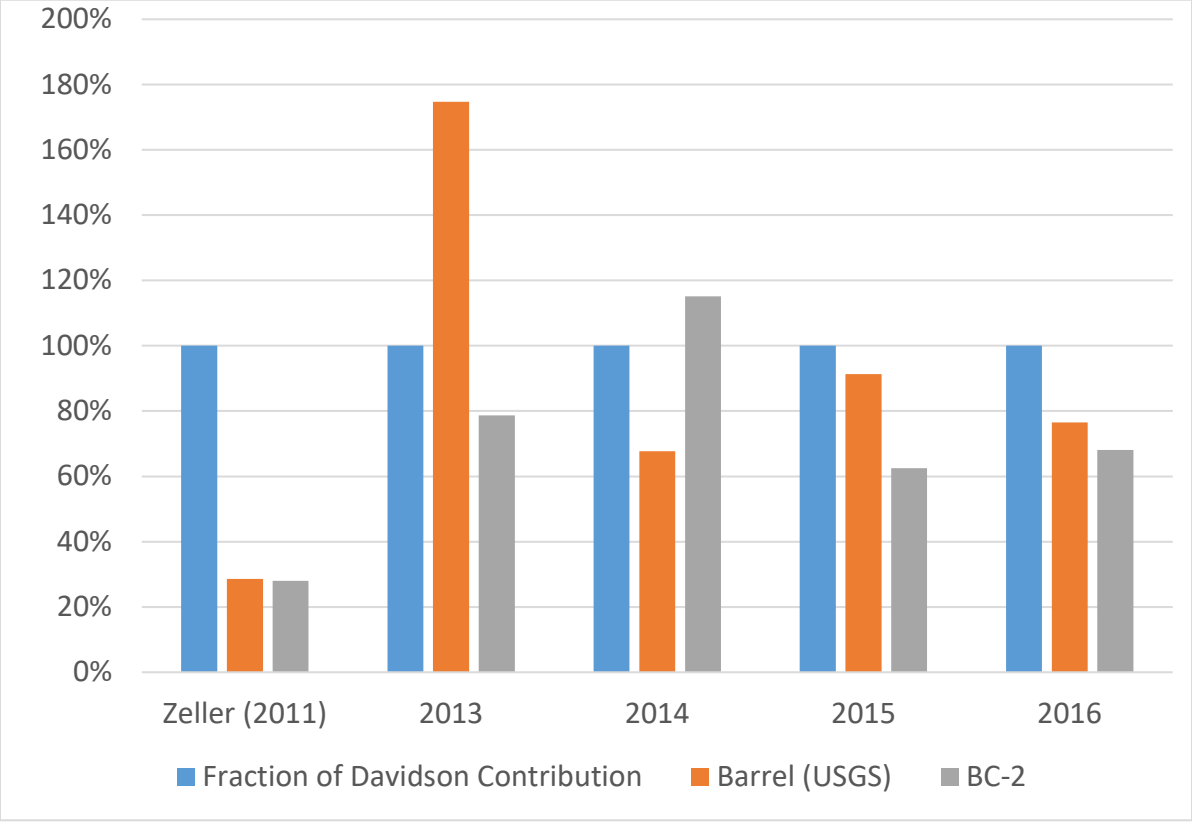
The simplified relationship cited in SWCA 2012 assumes a constant elevation and annual precipitation, so that the regression equation is based solely on the watershed area. While Pima County contends that assumption underestimate the importance of these inputs, the estimates using area as the only variable demonstrate a dramatic underestimate when compared to the observed data.

Using a ratio approach where the fraction from the portion of the watershed contributing to Davidson, the Zeller (2011) approach would mean that 29% of the flow at Davidson DC-3 could have come from Barrel).

In fact, comparing the observed measurements for the period from 2013 to 2016 (based on data in Table 1), the fraction contributing from Barrel is always more than half of the observed flow at Davidson (Table 2 and Figure 1).

Table 2 – Fraction of the Observed Flows Contributing to Davidson

	Davidson at DC-3	Barrel at USGS	Barrel at BC-2
	50.5 (sq. mi)	**14.1 (sq. mi)**	**13.8 (sq. mi)**
Zeller (2011)	**100%**	**29%**	**28%**
2013	100%	175%	79%
2014	100%	68%	115%
2015	100%	91%	62%
2016	100%	77%	68%



A similar argument could be made for the smaller, more-recently gaged watersheds on the mine site, though results would be more variable because of the smaller dataset, and local rainfall variability.

Conclusion:

Hudbay in their 2017 letter to U. S. Army Corps focuses on the observed flows being less than the model predictions:

> *…..As we have stated, the 1,404 acre-feet per year is approximately 10 times any flow volume that we have seen using an average 18-inch per year rainfall for the calculations. (cover page of 07-17-17 data transmittal).*

However, their consultant's datasets attached to the transmittal letter confirm that flows from the mine site to Davidson Canyon are significantly higher than predicted by the Zeller method, and the estimate of 4.3% reduction in flows to Davidson indicated in SWCA 2012. Outflows predicted by the Zeller method cannot be considered "conservative" based on the observed data. Barrel watershed's observed outflows during 2013-2016 provided more than half of the observed flows to Davidson.

References:

HudBay, 2017. July 17, 2017 Transmittal letter Re: Stormwater Information to William James, U. S. Army Corps of Engineers.

Pima County's Response to Westland Resources et al. (2016) 5/24/2016. Seeing the Water for the Models: Pima County's Modeling of Rosemont Mine Impacts on Water Resources in Davidson Canyon Remains Robust Despite Comments by Westland Resources et al. (2016)

SWCA. 2012 Method for estimating flow in Davidson Canyon. Memorandum to file from DeAnne Rietz dated August 28, 2012.

Water and Earth Technologies, 2017. Hydrologic Data Summary, January 1, 2013 – May 31, 2017. Rosemont Project dated 6/29/2017. In Hudbay 2017.

Zeller, M. E. 2011. Predicted Regulatory (100-Yr) Hydrology and Average-Annual Runoff Downstream of the Rosemont Copper Project. Tucson, Arizona: Tetra Tech. July 11.