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15 **BEFORE THE ARIZONA NAVIGABLE STREAM**
16 **ADJUDICATION COMMISSION**
17

18 IN RE: DETERMINATION OF
19 NAVIGABILITY OF THE SAN
20 PEDRO RIVER

Case No. 03-004-NAV

**FREEPORT-McMoRAN
CORPORATION'S OPENING POST-
HEARING MEMORANDUM**

1 Freeport-McMoRan Corporation (Freeport) respectfully submits its Opening Post-
2 Hearing Memorandum concerning the non-navigability of the San Pedro River. Whereas
3 the Colorado River is exceptional in this region, the San Pedro is a typical southwest desert
4 river, bearing the hallmarks of a non-navigable stream: it is shallow, highly variable, and
5 has low discharge. Moreover, in its ordinary and natural condition, the San Pedro was both
6 discontinuous and riddled with beaver dams, and was typified by other significant
7 impediments to navigation including marshes, cienegas, riffles, and sandbars.

8 Given these stream characteristics, it is not surprising that the Arizona Center for Law
9 in the Public Interest (Center), the only proponent of navigability in these proceedings, had to
10 resort to a mathematic model in support of its position, rather than historical evidence of
11 commercial navigation, historical accounts of the stream, or other empirical evidence. This is
12 because there is no history of commercial navigation on the San Pedro – even if stream
13 conditions would have permitted commercial navigation, the beaver dams, cienegas, and
14 other obstructions would have prevented it. Similarly, the historical accounts of the San
15 Pedro in its ordinary and natural condition reveal a small, shallow, and discontinuous stream
16 that explorers, surveyors, and military personnel traveled alongside but could not navigate.

17 Applying the standard for navigability that is well-established through longstanding
18 United States Supreme Court precedent, the evidence requires a determination that the San
19 Pedro was neither navigable nor susceptible to navigation in its ordinary and natural
20 condition on or before statehood.

21 **I. THE APPLICABLE LEGAL STANDARD MANDATES A FINDING THAT**
22 **THE SAN PEDRO IS NOT NAVIGABLE.**

23 The proponents of navigability for the San Pedro River bear the burden of proof and
24 must demonstrate by a preponderance of the evidence that specific segments of the River
25 were navigable in their ordinary and natural condition. *State of Arizona v. Arizona Navigable*
26 *Stream Adjudication Comm.*, 224 Ariz. 230, 239, 229 P.3d 242, 251, ¶17 (App. 2010).

27 The test of navigability for title is a federal test based on more than 150 years of case
28 law. *PPL Montana v. Montana*, 132 S.Ct. 1215, 1227 (2012). The most important of these

1 cases were decided by the United States Supreme Court, beginning with *The Daniel Ball*, 77
2 U.S. 557 (1870). Although *The Daniel Ball* addressed federal power to regulate navigation,
3 its statement of the test of navigability has become the standard test of navigability for title
4 purposes. See *PPL Montana*, 132 S.Ct. at 1228. In fact, Arizona's statutory definition of a
5 navigable waterway paraphrases *The Daniel Ball* test:

6 "Navigable" or "navigable watercourse" means a watercourse that was in
7 existence on February 14, 1912, and at that time was used or was susceptible
8 to being used, in its ordinary and natural condition, as a highway for
commerce, over which trade and travel were or could have been conducted in
the customary modes of trade and travel on water.

9 A.R.S. § 37-1101(5).

10 During the long history of Supreme Court consideration of this issue, several
11 important legal principles have become well-established. First, this test is one of
12 "navigability in fact." *PPL Montana*, 132 S.Ct. at 1227. Accordingly, the focus is on "rivers
13 really navigable." *Id.* (quoting *Shively v. Bowlby*, 152 U.S. 1, 31 (1894)). Furthermore, it is
14 "not every small creek in which a fishing skiff or gunning canoe can be made to float at high
15 water which is deemed navigable, but, in order to give it the character of a navigable stream,
16 it must be generally and commonly useful to some purpose of trade or agriculture." *United*
17 *States v. Rio Grande Dam & Irrigation Co.*, 174 U.S. 690, 698-99 (1898) (quoting *The*
18 *Montello*, 20 Wall. 430, 442). On this basis, the Supreme Court concluded that

19 [o]bviously, the Rio Grande within the limits of New Mexico is not a stream
20 over which in its ordinary condition trade and travel can be conducted in the
21 customary modes of trade and travel on water. Its use for any purposes of
transportation has been and is exceptional, and only in times of temporary
high water.

22 *Id.* at 699. The Rio Grande is the largest and longest river in New Mexico, flowing from the
23 northern border with Colorado to the southern border with Texas. Yet, because it is a desert
24 river with insufficiently reliable flows, the Supreme Court held that the entire river in New
25 Mexico is non-navigable.

26 Similarly, the Supreme Court concluded that the entire length of the Red River in the
27 State of Oklahoma, more than 500 miles in all, was non-navigable due to variable water flows
28 and river bed conditions such that

1 trade and travel neither do nor can move over that part of the river, in its
2 natural and ordinary condition, according to the modes of trade and travel
3 customary on water; in other words, that it is neither used, nor susceptible of
4 being used, in its natural and ordinary condition as a highway for commerce.
5 Its characteristics are such that its use for transportation has been and must be
6 exceptional, and confined to the irregular and short periods of temporary high
7 water. A greater capacity for practical and beneficial use in commerce is
8 essential to establish navigability.

9 *Id.* at 591.

10 Most recently, the Supreme Court has reconfirmed that evidence of navigability “must
11 be confined to that which shows the river could sustain the kinds of commercial use that, as a
12 realistic matter, might have occurred at the time of statehood.” *PPL Montana*, 132 S.Ct. at
13 1233. Moreover, “[n]avigability must be assessed as of the time of statehood, and it concerns
14 the river’s usefulness for ‘trade and travel,’ rather than for other purposes.” *Id.* For these
15 reasons, “[m]ere use by initial explorers or trappers, who may have dragged their boats in or
16 alongside the river despite its nonnavigability in order to avoid getting lost, or to provide
17 water for their horses and themselves, is not itself enough.” *Id.* Finally, the Court stated that
18 a finding of navigability must be founded on the kind of trade and travel on water that
19 constitutes “a commercial reality.” *PPL Montana*, 132 S.Ct. at 1234.

20 Based on these standards, the Supreme Court rejected a lower court ruling that the
21 Madison River in Montana was navigable because the lower court had relied primarily on
22 evidence of modern-day boating. While the Supreme Court noted that such evidence could
23 be considered, it would only support a finding of navigability if “[a]t a minimum, ... the party
24 seeking to use present-day evidence for title purposes” can show that “(1) the watercraft are
25 meaningfully similar to those in customary use for trade and travel at the time of statehood;
26 and (2) the river’s post-statehood condition is not materially different from its physical
27 condition at statehood.” *Id.* The Court noted that these requirements are critical because
28 “[m]odern recreational fishing boats, including inflatable rafts and lightweight canoes or
kayaks, may be able to navigate water much more shallow or with rockier beds than the boats
customarily used for trade and travel at statehood.” *Id.*

1 **II. THE EVIDENCE DEMONSTRATES CONCLUSIVELY THAT THE SAN**
2 **PEDRO RIVER WAS NOT NAVIGABLE IN ITS ORDINARY AND**
3 **NATURAL CONDITION AT OR BEFORE STATEHOOD**

4 **A. Mr. Burtell Has Significant Expertise Evaluating the Nature and**
5 **Occurrence of Surface Water in Arizona Streams**

6 Freeport retained Richard Burtell, PG, to identify and compile available evidence
7 concerning the San Pedro and evaluate whether it was navigable or susceptible to navigation
8 in its ordinary and natural state. Mr. Burtell prepared a declaration (Declaration),¹ attended
9 all three days of the hearing, and testified in support of his findings that the San Pedro was
10 not navigable in its ordinary and natural condition on or before statehood.

11 Mr. Burtell's *Curriculum Vitae* is Attachment A to his Declaration. Mr. Burtell is a
12 Registered Geologist with a Masters of Science in Hydrology. Mr. Burtell has over twenty-
13 five years of experience as an environmental scientist dealing with a host of water and
14 environmental matters, and his experience and expertise extend to matters involving geology,
15 hydrology, and hydrogeology. Mr. Burtell worked at the Arizona Department of Water
16 Resources (ADWR) for twelve years. For the majority of his tenure Mr. Burtell served as the
17 Manager of the Adjudications Section at ADWR. As Manager of the Adjudications Section,
18 Mr. Burtell was frequently involved in evaluating the nature and occurrence of surface water
19 in Arizona streams. The San Pedro River was a major focus of the technical work Mr. Burtell
20 performed at ADWR. Mr. Burtell is intimately familiar with the river and its hydrology.²

21 **B. The San Pedro Was in its Ordinary and Natural Condition from the**
22 **1840s–1870s and through Statehood in the Upper San Pedro.**

23 Mr. Burtell's initial task was to familiarize himself with *State v. ANSAC* and *PPL*
24 *Montana*, and he was therefore aware at the outset of the importance of evaluating the San
25 Pedro in its ordinary and natural condition.³ The historical evidence clearly demonstrates that
26 the 1840s up to the 1870s was a time in which there were few if any diversions affecting the

27 ¹ See Declaration of Rich Burtell on the Nonnavigability of the San Pedro River at and Prior
28 to Statehood dated March 2013, Exh. X001 (Declaration).

² Aug. 1 Trans. 125:24 – 128:15.

³ Aug. 1 Trans. 128:16 – 130:4.

1 San Pedro, and the river was therefore in its ordinary and natural condition. Prior to that time
2 period, the region was inhabited by Sobaipuri Indians and Spanish and Mexican settlers that
3 diverted water from the San Pedro for farming. However, Apache Indians increased their
4 presence in the area in the late 1700s, leading to the departure of the Sobaipuri, and by the
5 1840s the Spanish and Mexican settlements in the San Pedro watershed were also abandoned.
6 The Apaches largely controlled the area until the 1870s when military camps were
7 established along the San Pedro. Only then did settlers resume diverting water for farming.⁴

8 The Apaches engaged in little if any farming during this time, so the period from the
9 1840s to the 1870s represents a time when the San Pedro was in its natural and ordinary
10 condition.⁵ Accordingly, Mr. Burtell was able to rely on a significant wealth of historical
11 accounts describing the river in this time period.

12 Additionally, while settlement and diversions began at certain locations along the San
13 Pedro in the 1870s and into the early 1900s, the San Pedro in places remained in its ordinary
14 and natural condition free from significant diversions through statehood. In other reaches, the
15 diversions that began in the late 1800s can be quantified along with their impacts on stream
16 flow. Accordingly, Mr. Burtell was also able to evaluate stream flow data from the
17 Charleston and Fairbanks gauging stations from 1904-1911.

18 **C. The Historical Accounts from the 1850s Demonstrate that the San Pedro**
19 **River was not Navigable in its Ordinary and Natural Condition.**

20 The historical accounts evaluated by Mr. Burtell are compiled in Table 1 to his
21 Declaration. Mr. Burtell noted that most of the people who recorded their observations of the
22 stream were either military personnel or surveyors, *i.e.* people who are scientifically trained
23 to make careful accounts of their observations.⁶ Their observations consistently paint the
24 picture of a narrow and shallow stream permeated by beaver and obstructed by beaver dams.

25 In the upper San Pedro, a surveyor named Andrew Gray noted “a **small stream** at this
26 stage, about eight feet wide, **and shallow**” in April of 1854, a time of approximately median

27 ⁴ Aug. 1 Trans. 134:9 – 136:3 and 174:20 – 179:20.

28 ⁵ Aug. 1 Trans. 248:14 – 250:5.

⁶ Aug. 1 Trans. 153:3-11.

1 flow.⁷ In the middle San Pedro in 1858, the surveying team of Hutton and Leach observed “a
2 width of about twelve (12) feet, and **depth of twelve (12) inches**, ... and from **beaver dams**
3 **and other obstructions** overflows a large extent of bottom land, **forming marshes, densely**
4 **timbered with cottonwood and ash**, thus forcing the road over and around the sides of
5 impinging spurs. This stream is **not continuous all the year**, but **in the months of August**
6 **and September disappears in several places**, rising again, however, clear and limpid.”⁸
7 These observations were made in March and April of 1858, months with greater than median
8 flow and median flow, respectively. A few months later, Hutton and Leach made the
9 following observation, also of the middle San Pedro:

10 Exceedingly to the surprise of every member of the expedition who had
11 passed over this route in the months of March and April it was discovered
12 after a march of a few miles that **the waters of the San Pedro had entirely**
13 **disappeared from the channel of the stream...** Where the present reporter
took quantities of fine trout in March and April 1858 **not a drop of water was**
to be seen.⁹

14 As Mr. Burtell noted during the hearing, this observation was not in the dry period before the
15 monsoon in early summer, but in September, after the monsoon. This is compelling evidence
16 that the San Pedro was not a perennial stream throughout its length.¹⁰

17 A similar observation of the middle San Pedro was made by another surveyor, John
18 Parke, in 1854. Parke noted that “[t]he flow of water, however, is **not continuous**. One or
19 two localities were observed where **it entirely disappeared**, but to rise again a few miles
20 distant, clear and limpid.”¹¹

21 Consistent observations were made of the lower San Pedro, including by Parke. When
22 he made his way to the lower San Pedro in 1854, Parke again noted a discontinuous stream:
23 “[w]ater **sinks below the surface and rarely runs above it.**”¹² In November 1846,
24 surveyors Emory and Johnson made similar observations. Emory observed “[a]n

25 ⁷ Declaration at Table 1; Aug. 1 Trans. 152:17 – 155:8.

26 ⁸ Declaration at Table 1; Aug. 1 Trans. 155:9 – 156:11.

27 ⁹ Declaration at Table 1; Aug. 1 Trans. 156:12 – 157:4.

28 ¹⁰ Aug. 1 Trans. 157:5-10.

¹¹ Declaration at Table 1; Aug. 1 Trans. 157:11 – 158:5.

¹² Declaration at Table 1; Aug. 1 Trans. 159:2-6.

1 insignificant stream, a few yards wide and only a foot deep,” while Johnson noted that
2 “[a]n active man could jump across.”¹³

3 In late 1857, in an unspecified location of the San Pedro upstream of the mouth of
4 Aravaipa, an explorer named James Tevis made the following account:

5 The Sanpedro river as they Call it – is a stream **one foot deep six feet wide &**
6 **runs a mile & half an hour & in ten minutes fishing we Could Catch as many**
7 **fish as we Could use & about Every 5 miles is a beaver dam** this is a great
8 **County for them – & we have went to the river & watterd & it was running**
9 **fine & half mile below the bed of the river would be as dry as the road – it**
10 **sinks & rises again & we went down as far as the aravipa & 8 miles below**
11 **that the pedro Emties into the hela river.**¹⁴

12 The foregoing accounts are just a sampling from Table 1. The historical accounts
13 during this period, in which the San Pedro River was in its ordinary and natural condition,
14 paint a compelling picture of a small stream, both narrow and shallow, that was discontinuous
15 in several locations. The regular occurrence of beaver dams and marshy conditions¹⁵ are also
16 well-chronicled in these accounts.

17 These historical accounts clearly describe a river that is not susceptible to commercial
18 navigation. Not only was Mr. Hjalmarson unable to meaningfully undermine these historical
19 accounts, but he was unable to rationalize for the Commission why *not even one* of these
20 explorers, surveyors, or military personnel was able to navigate the San Pedro, despite
21 traversing on land alongside the stream, and despite exhibiting such keen interest in the San
22 Pedro and its characteristics. The reason is simple: the San Pedro was not susceptible to
23 navigation in its ordinary and natural condition.

24 **D. Stream Flow Data Support the Historical Accounts and Also Demonstrate**
25 **that the Upper San Pedro Was not Susceptible to Navigation.**

26 Mr. Burtell also evaluated stream flow data at the Charleston gauge and the Fairbanks
27 gauge from the early 1900s. While diversions for farming had begun by this time in some
28 locations along the San Pedro, Mr. Burtell was able to determine that an insignificant number

¹³ Declaration at Table 1; Aug. 1 Trans. 158:6 – 159:1.

¹⁴ Declaration at Table 1; Aug. 1 Trans. 159:14 – 161:9.

¹⁵ See also Hendrickson and Minckley (1984) map, Exh. X007 (depicting cienga and riverine
marsh conditions along the San Pedro) and Aug. 2 Trans 137:10 – 139:14 (describing riffles).

1 of acres were being farmed upstream of the Charleston gauge, and the diversions that
2 impacted the flows at the Fairbanks gauge were accounted for by the USGS in its adjusted
3 data. Accordingly, these data represent the San Pedro in its ordinary and natural condition.¹⁶

4 These stream flow data are described in Table 2 to Mr. Burtell's Declaration, and they
5 depict a stream with low discharges and shallow depths. The depths at the Charleston gauge
6 were one foot or less 40% of the time – even Mr. Hjalmarson concedes that less than a foot of
7 water is not enough depth for navigation.¹⁷ Flows and depths spike in July and August during
8 the monsoons, a time when discharges will be high on some days in response to storm events
9 and lower on others. Even when discharges and depths are high, navigation is often
10 unfeasible or unsafe.¹⁸

11 Moreover, even during short durations of increased flow, the San Pedro remained a
12 shallow stream relative to other streams that have been adjudicated navigable – or non-
13 navigable – under the equal-footing doctrine. For example, in determining that a segment of
14 the Colorado River was navigable, it was noted that the river's depth was four feet or greater
15 for all but 17 days in the year.¹⁹ The San Juan River was determined to be *non-navigable*
16 with depths between one and three feet “for 219 days” each year, and for the other “146 days
17 a depth of over three feet.”²⁰ The San Pedro's shallow depths were accompanied by low
18 discharge rates, which Mr. Burtell put into context as follows:

19 more times than not, the flows that were recorded at these gages were more on
20 the order of 20 CFS.... [T]here are some court cases where other streams have
21 been deemed non-navigable. And when you compare the amount of flow in
22 those streams that were not navigable to the amount of flow in the San Pedro,
it's almost laughable. Streams that were deemed non-navigable have
thousands of CFS of flow.²¹

23 ¹⁶ Aug. 1 Trans. 163:24 – 166:12.

24 ¹⁷ Aug. 1 Trans. 73:21-24, 100:3-16, and 166:13 – 169:19.

25 ¹⁸ Aug. 1 Trans. 181:3-17; June 7 Trans. 55:2-15.

26 ¹⁹ 1930 Special Master's Report, Exh. X012, at pp. 150; *Utah*, 283 U.S. at 80, 51 S. Ct. at 442
(recognizing that “it appears that the average depths range from between 3 and 4 feet for 17
27 days in the year to over 8 feet for 124 days in the year...”).

28 ²⁰ 1930 Special Master's Report at pp. 167; *see also id.* at 169 (“there is a depth of no more
than 2 feet” five months per year and “at other times there are places where the depth is less
than 2 feet...”), and 180 (“The evidence as to depth makes it clear that boats with a draft of
two feet could navigate not more than half the year...”).

²¹ Aug. 1 Trans. 166:21 – 167:13.

1 The non-navigable San Juan River, for instance, has a daily discharge that exceeds 1,000 CFS
2 for 284 days per year.²²

3 Mr. Burtell aptly observed that, not only do these data independently depict a stream
4 that is not susceptible to commercial navigation in its ordinary and natural condition, “they
5 substantiate and verify the historic accounts,” which “paint a picture of a very shallow stream
6 at various seasons of the year. These stream flow data support that and are very consistent
7 with that.”²³

8 **E. The Absence of Commercial Boating Further Confirms that the San**
9 **Pedro Was Non-Navigable.**

10 Perhaps the most compelling evidence of non-navigability is the complete absence of
11 commercial navigation at any time during the thousands of years that the San Pedro region
12 has been inhabited by various peoples. As described in the Fuller Report, despite these
13 thousands of year of inhabitance, “[n]o evidence of prehistoric boating on the San Pedro
14 River, or of river conditions that would support navigation, was identified during the
15 archaeological investigation and literature search.”²⁴ Instead, “the primary means of
16 transportation along the San Pedro River has *always* been overland.”²⁵

17 This absence of navigation continued throughout the period of ordinary and natural
18 condition evaluated by Mr. Burtell. While the absence of commercial navigation is not
19 dispositive “where conditions of exploration and settlement explain the infrequency or
20 limited nature of such use,” *United States v. Utah*, 283 U.S. 64, 82, 51 S. Ct. 438, 443 (1931),
21 it is clear that the San Pedro would have been used to transport personnel and supplies if the

22 _____
23 ²² See, e.g., 1930 Special Master’s Report at p. 168 (finding that the discharges for the San
24 Juan, a non-navigable river, ranged from below 1,000 to 2,000 CFS “for 171 days in the
25 year,” and that for the rest of the year the discharge ranged from 2,000 CFS to over 10,000
26 CFS); see also Selected U.S. Watercourses submitted by SRP, Exh. X006, at summary page
27 for each watercourse listing various information including discharge figures.

28 ²³ Aug. 1 Trans. 169:13-19.

²⁴ JE Fuller Hydrology & Geomorphology, Inc., *Arizona Stream Navigability Study for the
San Pedro River: Gila River Confluence to the Mexican Border* (revised September 1997),
Exh. 6, (1997 Fuller Report) at 2-9.

²⁵ JE Fuller/Hydrology & Geomorphology, Inc., *Arizona Stream Navigability Study for the
San Pedro River: Gila River Confluence to the Mexican Border* (revised January 2004), Exh.
16, (2004 Fuller Report) at 3-22 through 3-26 (emphasis added).

1 San Pedro were susceptible to navigation.²⁶

2 Multiple military installations were established along the San Pedro during this period,
3 including Fort Breckinridge, Camp Grant, and Fort Wallen, and supplies were regularly
4 transported to these installations. However, this transportation did not occur by navigating
5 the San Pedro, but by *traveling a road alongside the stream*. Typically, ox carts were used.
6 Supplies were transported overland alongside the river, *not on the river*, for the simple reason
7 that the San Pedro was not susceptible to navigation. Again, this was a period when the
8 stream was in its ordinary and natural condition.²⁷

9 A substantial history has been recorded describing how these supplies were
10 transported. The military did use rivers to transport supplies where it was feasible. In fact,
11 supplies were shipped from San Francisco and transported by boat up the Colorado River to
12 Yuma and La Paz. However, from there, supplies were distributed to military installations
13 overland via wagon trains, not by watercraft. Aside from use of the lower Colorado River,
14 there is no record of the military using the San Pedro or any other Arizona stream as a means
15 to transport supplies to its various installations.²⁸

16 **III. MR. GOOKIN'S FINDINGS COMPLEMENT MR. BURTELL'S**

17 The Gila River Indian Community (Community) engaged T. Allen J. Gookin to
18 evaluate the navigability of the San Pedro. Mr. Gookin is an engineer, surveyor, and
19 hydrologist. In the interest of avoiding undue repetition, Freeport briefly summarizes Mr.
20 Gookin's findings below while refraining from duplicating the more complete discussion
21 contained in the Community's opening memorandum.

22 Like Mr. Burtell, Mr. Gookin evaluated a variety of historical evidence concerning the
23 San Pedro's stream characteristics as well as the absence of navigation despite a clear need to
24 transport people and supplies in connection with a variety of activities. In particular, Mr.
25 Gookin examined the mining activities that began in the late 1800s, which entailed a need to
26

27 ²⁶ Aug. 1 Trans. 179:21 – 181:2.

28 ²⁷ Aug. 1 Trans. 174:20 – 181:2.

²⁸ Declaration at 4-5; Aug. 1 Trans. 174:20 – 179:20.

1 transport supplies, equipment, and ore.²⁹ The fact that the San Pedro was not used for these
2 purposes is additional evidence that the stream was not susceptible to travel for commercial
3 purposes in its ordinary and natural condition.

4 Mr. Gookin also evaluated and demonstrated several significant flaws in Mr.
5 Hjalmarson's model, and suggested some alternative methodologies that would result in a
6 more reliable model.³⁰ Consistent with the evidence of stream conditions and the lack of
7 navigation, Mr. Gookin's results reflect a stream that is not susceptible to navigation.³¹

8 **IV. THE CENTER'S EVIDENCE IS FLAWED AND INSUFFICIENT TO** 9 **SATISFY ITS BURDEN OF PROOF**

10 The Center bears the burden of proof in these proceedings. As discussed in detail
11 below, neither the testimony of the Center's witness, Win Hjalmarson, nor any of the
12 Center's documentary evidence satisfies this burden on a *prima facie* basis, much less in the
13 context of the much more persuasive analyses and testimony by Messrs. Burtell and Gookin.

14 **A. Mr. Hjalmarson Focused Solely on Modern Day Recreational Canoes and** 15 **Failed to Evaluate Susceptibility to Navigation for Commercial Uses.**

16 Mr. Hjalmarson's methodologies and conclusions are flawed in several respects. First,
17 and most fundamentally, Mr. Hjalmarson either misunderstood or disregarded the applicable
18 legal standard. As he readily acknowledged during the hearing, Mr. Hjalmarson's
19 PowerPoint, analysis, and testimony related solely to recreational boating. Mr. Hjalmarson
20 identified a set of recreational boating standards specifying the minimum depths required for
21 modern recreational canoes.³² Essentially, Mr. Hjalmarson adopted an assumption that any
22 stream with a maximum depth of one foot for most of the year is navigable.³³ Mr.
23 Hjalmarson then constructed a mathematical model from which he concluded that "[f]or
24 about 80% of the time during a typical year, the width, depth and velocity were acceptable for

25 ²⁹ Aug. 2 Trans. 112:13 – 113:1.

26 ³⁰ See, e.g., Aug. 2 Trans. 163:17 – 165:9.

27 ³¹ Aug. 2 Trans. 179:15 – 180:12.

28 ³² PowerPoint, Exh. X004, at 143 (chart showing required depths for *recreational craft*)
(relying on Hyra, R., 1978, Methods of assessing instream flows for recreation: Instream
Flow Information Paper No. 6, U. S. Fish and Wildlife Service and others).

³³ June 7 Trans. 90:16 – 91:5.

1 use of small craft such as canoes, kayaks, drift boats, row boats and rafts.”³⁴ According to
2 Mr. Hjalmarson, the San Pedro River was therefore susceptible to navigation.³⁵

3 Of course, *The Daniel Ball* test does not turn on whether the river has enough water to
4 float a modern recreational canoe, yet Mr. Hjalmarson made no effort to apply the
5 conclusions that he derived from his model to commercial uses or commercial watercraft.³⁶
6 In fact, neither the words “commerce” nor “commercial” appear anywhere in Mr.
7 Hjalmarson’s analysis, whereas “recreation” and “recreational” are repeated several times
8 throughout his PowerPoint.³⁷

9 Mr. Hjalmarson’s analysis and opinions are inconsistent with binding United States
10 Supreme Court precedent, including the Supreme Court’s recent decision in *PPL Montana* in
11 which the Supreme Court roundly rejected the idea that evidence of modern recreational
12 boating is sufficient to demonstrate navigability. 132 S. Ct. at 1234 (holding that “**present**
13 **day recreational use of the river did not bear on navigability,**” and that “**reliance upon**
14 **the State’s evidence of present-day, recreational use,** at least without further inquiry, **was**
15 **wrong as a matter of law.**”) (emphasis added). The Supreme Court expressly stated that it is
16 evidence of susceptibility to *commercial* use that must be considered in evaluating
17 navigability. *Id.* at 1233 (holding that “**evidence must be confined to that which shows the**
18 **river could sustain the kinds of commercial use that, as a realistic matter, might have**
19 **occurred at the time of statehood.**”) (emphasis added). Having misunderstood or
20 disregarded the applicable standard, Mr. Hjalmarson’s analysis, testimony, and opinions
21 provide no basis for a finding that the San Pedro River was navigable in its ordinary and
22 natural state on or before statehood.

23 _____
24 ³⁴ PowerPoint at 169.

25 ³⁵ PowerPoint at 169.

26 ³⁶ June 7 Trans. 25:21-25. In contrast, Mr. Gookin provided clear testimony that put to rest
27 any notion that a modern day recreational canoe is somehow equivalent to watercraft from the
28 time of statehood. Birch bark cedar canoes and canvas canoes were significantly more fragile
than modern canoes. Aug. 2 Trans. 177:1-5 (“I am an engineer. I did look up the breaking
point of cedar versus fiberglass. I don't remember the numbers, but it's a soft wood. Canvas
has very little structural strength, and of course birch bark wouldn't either.”). The same is
true of dugout canoes. Aug. 2 Trans. 177:6 – 178:2.

³⁷ June 7 Trans. 58:16-25; *see, generally*, PowerPoint.

1
2 **B. Mr. Hjalmarson's Methodologies Are Flawed and his Conclusions are**
3 **Therefore Erroneous and Unreliable.**

4 Even if Mr. Hjalmarson had applied the appropriate standard, his analysis suffers from
5 multiple fatal flaws that render his results and opinions unreliable. Specifically, Mr.
6 Hjalmarson relies almost exclusively on a mathematical model to estimate predevelopment
7 depth. Modeling was unnecessary because we have a significant amount of historical
8 empirical data.³⁸ Moreover, Mr. Hjalmarson's model is fundamentally flawed in multiple
9 respects, rendering Mr. Hjalmarson's depth calculations completely unreliable.

10 Mr. Hjalmarson's approach was as follows: evaluate predevelopment discharge in
11 cubic feet per second (CFS) and its variability throughout the year; input the discharge (Q)
12 into an equation to estimate active channel width (W); and, finally, input discharge and width
13 into a second equation to estimate depth (D). Each step of this process suffers from flaws that
14 invalidate Mr. Hjalmarson's ultimate results.

15 **1. Mr. Hjalmarson Used Erroneous Discharge Model Inputs that**
16 **Ultimately Result in Inflated Depths.**

17 Mr. Hjalmarson selectively relied upon the "Krug Report"³⁹ as a resource for some,
18 but not all, of his discharge inputs. The Krug Report sets forth average annual discharge
19 figures for gauge stations and sub-watersheds on the San Pedro River and other streams. The
20 Krug Report adjusts the discharge figures for diversions where necessary so that the
21 discharge figures reflect predevelopment flows.⁴⁰ Mr. Hjalmarson took Krug's figure for the
22 "Join" (which Mr. Hjalmarson also calls the "Upper") at face value and used that sub-
23 watershed discharge figure in his calculations.⁴¹

24 The Krug Report also included discharge figures for the Charleston gauge and the
25 Winkelman gauge (*i.e.*, the Mouth). However, Mr. Hjalmarson chose not to use these

26 ³⁸ Aug. 1 Trans. 132:8 – 133:12.
27 ³⁹ Krug, Gebert, and Graczyk, *Preparation of Average Annual Map of the United States,*
28 *1951-80*, Exh. X007, (Krug Report).
⁴⁰ See Krug Report at 4 (*see* "Adjustment for Diversion"); Aug. 1 Trans. 221:7 – 224:8.
⁴¹ June 7 Trans. 82:17 – 83:6.

1 discharge figures. Instead, Mr. Hjalmarson replaced them with alternative discharge model
2 inputs that are both significantly overstated.

3 For the Charleston gauge, Mr. Hjalmarson started with a discharge figure of 52 CFS
4 that he derived from daily mean stream flow records that he accessed from the Internet.⁴² Mr.
5 Hjalmarson added an extra 10 CFS, for a total of 62 CFS, purportedly to account for
6 predevelopment base flow. Mr. Hjalmarson believed or assumed that the predevelopment
7 base flow contribution to the San Pedro River no longer exists.⁴³

8 Mr. Hjalmarson's decision to add an additional 10 CFS was clear error. Readily
9 available empirical data demonstrates conclusively that the entire 10 CFS base flow has not
10 been removed at the Charleston gauge. To the contrary, throughout most of the year, the
11 existing base flow contribution remains 10 CFS or greater.⁴⁴ This means that, by adding in
12 10 CFS for base flow that remains in place to this day, Mr. Hjalmarson double-counted base
13 flow, and thereby overstated the amount of discharge passing through the system.⁴⁵ The
14 ultimate result is that Mr. Hjalmarson incorporated inflated depths in his model.

15 The Krug Report also includes discharge figures for the flow gauge at Winkelman, *i.e.*
16 the Mouth. The Krug figure, which equates to approximately 63 CFS, is even corrected for
17 diversions. Inexplicably, however, Mr. Hjalmarson chose not to use Krug's discharge figure
18 for Winkelman.⁴⁶ Instead, Mr. Hjalmarson combined discharges from two separate sub-
19 watersheds that resulted in a significantly inflated discharge of 113 CFS.⁴⁷

20 ⁴² June 7 Trans. 86:5 – 87:19; Aug. 1 Trans. 218:3-7.

21 ⁴³ June 7 Trans. 84:11 – 85:16; Aug. 1 Trans. 216:24 – 218:14.

22 ⁴⁴ USGS Professional Paper 1712; Aug. 1 Trans. 218:15 – 221:1. For the months of the year
23 when the base flow contribution falls below 10 CFS, that seasonal change is directly
24 attributable to evapotranspiration related to riparian vegetation. Aug. 1 Trans. 219:8 –
25 220:13; Aug. 2 Trans. 55:7 – 58:9.

26 ⁴⁵ Mr. Hjalmarson created a graph to attempt validate his 62 CFS discharge figure, but his
27 approach to creating the graph was as unsound as his discharge calculation. Mr. Hjalmarson
28 selectively omitted his "Mexico" data point, which was Mr. Hjalmarson's point of lowest
29 discharge, and the gauge station next upstream from Charleston. Removing this low data
30 point obviously permitted a higher overall curve. Aug. 1 Trans. 225:3 – 227:10. Mr. Burtell
31 generated a chart including all of Mr. Hjalmarson's data points, and the predictable result was
32 that the CFS dropped from approximately 62 CFS to 55 CFS. *Id.*; *Hjalmarson's San Pedro
33 River Predevelopment Runoff vs drainage Area Graph*, Exh. X012.

34 ⁴⁶ Krug Report p. 317; Aug. 1 Trans. 221:7 – 224:8.

35 ⁴⁷ Aug. 1 Trans. 221:15 – 224:8.

1 **2. Mr. Hjalmarson's Width Equation Is Erroneous.**

2 Mr. Hjalmarson input his discharge figures into an equation for determining the width
3 of the active channel. However, Mr. Hjalmarson's width equation significantly
4 underestimates the width of the active channel. We know this because the Fuller Report
5 contains a significant compilation of cross-sectional data including discharges and widths,
6 and it was therefore easy to calibrate the width equation using real world empirical data. Mr.
7 Burtell performed a series of comparison calculations that demonstrated that Mr.
8 Hjalmarson's width equation significantly underestimates the actual, measured width.⁴⁸ By
9 underestimating width – *i.e.* constraining the same amount of discharge to a narrower cross-
10 section – Mr. Hjalmarson necessarily overstated the depth.

11 **3. Mr. Hjalmarson's Depth Equation Is Erroneous.**

12 Mr. Hjalmarson then input his erroneously high discharges and his underestimated
13 widths into an equation to generate a maximum depth. Compounding these significant flaws,
14 Mr. Hjalmarson's depth equation inappropriately assumes a smooth parabolic channel.⁴⁹ As
15 the cross-sections included in Appendix E to the Fuller Report demonstrate, the San Pedro
16 does not consist of a smooth parabolic channel and, indeed, each cross-section varies
17 considerably from the next; there is no typical or "representative" cross-section for the San
18 Pedro.⁵⁰ Each cross-section contains several peaks and valleys and is as unique as a
19 snowflake. Mr. Hjalmarson conceded that his conceptual cross-section does not exist
20 anywhere along the San Pedro River.⁵¹ Quite simply, a parabolic depth equation cannot be
21 used to reliably calculate the maximum depth of a variable and non-parabolic stream channel.

22 The San Pedro's non-parabolic channel has additional significance. Mr. Hjalmarson's
23 calculations are for the channel's maximum depth, meaning that where a channel cross-
24 section has a series of peaks and valleys, navigation of even a modern recreational canoe

25
26 ⁴⁸ Aug. 1 Trans. 227:15 – 235:25.

⁴⁹ Aug. 1 Trans. 236:16-21.

27 ⁵⁰ See, e.g., Declaration at 3 n. i ("Cross sections of desert streams are rarely uniform in shape
and often exhibit high points (islands and point bars) and low points (pools). The San Pedro
River is no exception and is characterized by Fuller (2004, p.9-2) as a braided channel.").

28 ⁵¹ Aug. 1 Trans. 104:14 – 105:14.

1 depends upon the person's ability to ascertain precisely where the deepest point of the
2 channel resides. Whereas a smooth parabolic channel has its maximum depth in the very
3 center of the channel, the San Pedro's channel is irregular, variable, and far from smooth,
4 meaning that there is no way to predict where the deepest point at any particular cross-section
5 is located. If a cross-section has a maximum depth of 1 foot but the craft is 18 inches off of
6 that precise location, it will become beached on a sandbar or a ribbon in the channel.⁵²

7 4. **Mr. Hjalmarson Failed to Calibrate His Model.**

8 From a scientific perspective, when employing a model it is important to calibrate the
9 results to evaluate whether the model renders reliable results. Mr. Hjalmarson's only efforts
10 to calibrate were his erroneous graph for the Charleston gauge station and his apples to
11 oranges comparison of stream widths to surveyed channel widths. These efforts to calibrate
12 were as flawed as the model they purported to evaluate.⁵³

13 In the absence of appropriate calibration by Mr. Hjalmarson, Mr. Burtell attempted his
14 own calibration, which he memorialized in a document titled *Comparison between Historic*
15 *Observations of the San Pedro River Stream Flow Conditions and Hjalmarson's Estimates of*
16 *Predevelopment Flows*. Mr. Burtell compared actual empirical evidence of stream conditions
17 drawn from the historic accounts to the outputs that would result from Mr. Hjalmarson's
18 model. The missing pieces of empirical data were velocity figures, so Mr. Burtell turned to
19 the Fuller Report and used the full range of velocities drawn from actual stream flow
20 measurements provided in Appendix E. Mr. Burtell found that without exception Mr.
21 Hjalmarson's approach overestimates the stream discharge and thereby overstates depths.⁵⁴

22 Mr. Hjalmarson's model also calibrates poorly because it results in a flow duration
23 curve that reflects a continuous perennial stream. Mr. Hjalmarson contended that the San
24 Pedro was continuous and perennial in its ordinary and natural state in reliance upon the
25 USGS Hydrologic Atlas 664. However, the groundwater budget for the Hydrologic Atlas
26 664 demonstrates very clearly that there was no base flow contribution at multiple points

27 ⁵² Aug. 1 Trans. 236:4 – 241:1.

28 ⁵³ Aug. 1 Trans. 241:7 – 248:24.

⁵⁴ Aug. 1 Trans. 241:7 – 250:20.

1 along the San Pedro. At least in this region, a stream without base flow contribution cannot
2 be perennial, and this means that the San Pedro was not perennial through its entire reach in
3 its ordinary and natural condition. Rather, consistent with the historical accounts, the San
4 Pedro was discontinuous and ephemeral or intermittent in certain locations.⁵⁵

5 The fact that Mr. Hjalmarson misinterpreted the Hydrologic Atlas 664 is further
6 confirmed by reference to foundational sources to that document. The Brown and Others
7 map⁵⁶ is foundational to both the Hydrologic Atlas 664 and the Hendrickson and Minckley
8 map,⁵⁷ and Brown and Others clearly shows that the San Pedro was ephemeral or intermittent
9 in its ordinary and natural state.⁵⁸ The Ecology and Conservation report submitted into the
10 record by the Center also described the San Pedro as “interrupted, spatially intermittent in the
11 lower reaches with the dry discontinuities outdistancing limited surface water flow from
12 groundwater outcroppings.”⁵⁹

13 Several lines of evidence demonstrate that the San Pedro was not perennial throughout
14 its reach. In isolation, the stream’s discontinuous condition including ephemeral or
15 intermittent reaches weighs heavily against a finding of navigability. In the context of Mr.
16 Hjalmarson’s flow duration curves, the stream’s discontinuity provides further confirmation
17 that Mr. Hjalmarson’s model does not calibrate and that his findings are unreliable.

18 **C. Mr. Hjalmarson Failed to Adequately Address the Impacts of Beaver**
19 **Dams and Other Obstructions.**

20 Mr. Hjalmarson also failed to adequately account for the proliferation of beavers and
21 beaver dams throughout the river – a river that was so heavily inhabited by beavers that
22 explorers referred to it as the “Beaver River.” Mr. Hjalmarson’s PowerPoint included a slide
23 of persons in a modern recreational canoe overtopping a beaver dam. A modern day
24 recreationalist may find it amusing to overtop a beaver dam in a fiberglass canoe, but a
25 trapper or shipper in 1912 would have quickly gone out of business replacing his cedar or

26 ⁵⁵ Hydrologic Atlas 664, Exh. X012, at Plate 3; Aug. 1 Trans. 188:23 – 193:6.

27 ⁵⁶ Exh. X012; see also Hydrologic Atlas 664 (references).

28 ⁵⁷ Exh. X007.

⁵⁸ Aug. 1 Trans. 250:21 – 256:4; Brown & Others.

⁵⁹ Aug. 1 Trans. 259:1 – 261:6.

1 canvas canoe every few miles. Nowhere did Mr. Hjalmarson attempt to address whether the
2 “Beaver River” was susceptible to meaningful commercial travel given the existence of
3 numerous beavers and dams that were significant impediments to commercial travel. Again,
4 Mr. Hjalmarson’s misunderstanding concerning the federal standard is fatal to his analysis.

5 **D. Mr. Hjalmarson Erroneously Disregarded the Historic Accounts and**
6 **Streamflow Data Relied Upon by Mr. Burtell.**

7 **1. Mr. Hjalmarson Inappropriately Assumed that River**
8 **Entrenchment was Caused by Human Actions.**

9 Mr. Hjalmarson disagrees that the San Pedro was in its ordinary and natural condition
10 after 1850. Mr. Hjalmarson repeatedly referenced an Arizona Geological Survey Report,
11 referred to as the “Huckleberry Report,” in support of his argument that observations of
12 entrenchment in the mid-1800s demonstrate that the river was no longer in its ordinary and
13 natural condition. However, Mr. Hjalmarson mischaracterizes the Huckleberry Report. The
14 Huckleberry Report merely inferred that the existence of Sobaipuri irrigation in the 1690s
15 meant that that these locations were unentrenched because gravity fed irrigation is very
16 difficult if the active channel is entrenched below the floodplain. Mr. Hjalmarson improperly
17 expanded this inference to the entire watershed, asserting that there was no entrenchment
18 anywhere along the San Pedro in the 1690s and that entrenchment observed in the mid-1800s
19 must therefore have resulted from human impacts.⁶⁰

20 Mr. Hjalmarson’s mischaracterization of the Huckleberry Report is easily dispelled.
21 Nowhere does that report indicate that there was no entrenchment along the San Pedro.
22 Instead, the report states that “irrigation ditches described by Kino and Manje [citation] imply
23 that the river in 1697 was unentrenched, *at least at the Sobaipuri villages.*”⁶¹ Irrigation at
24 these locations tells us nothing about whether any other locations along the San Pedro were
25 unentrenched at the time. Moreover, Huckleberry does not describe any human impacts that
26 would have caused entrenchment pre-1850.⁶²

27 ⁶⁰ Aug. 1 Trans. 136:4 – 151:5.

28 ⁶¹ Huckleberry Report, Exh. X012, at 12; August 1 Trans. 137:9-24.

⁶² Aug. 1 Trans. 136:4 – 151:5; *see generally* Huckleberry Report; Ecology and Conservation
of San Pedro River, Exh. X002, (Ecology and Conservation) at 242-43.

1 The logical fallacy of Mr. Hjalmarson's argument is further confirmed by reference to
2 a map titled "Canals Diverting Water from the San Pedro River in March 1899." This map
3 describes gravity-fed canals that were diverting from the San Pedro in 1899, nearly 50 years
4 after the observations of entrenchment that Mr. Hjalmarson finds so important, and during the
5 period of more extreme entrenchment that began in the 1890s. Mr. Burtell explained that,
6 "what you find is *there's actually more irrigation canals and diversions in 1899 up and*
7 *down the river* than there was when Kino went -- observed the Indian villages in 1690."
8 There is absolutely no evidence that the entrenchment observed in the early 1800s was not
9 present in the 1690s, much less any evidence suggesting that this observed entrenchment,
10 whenever it occurred, was anything other than a natural occurrence.⁶³

11 2. Any Impacts From Feral Cattle on the Stream Were Minor.

12 Mr. Hjalmarson also argued that the Commission should ignore the historic accounts
13 of stream conditions in the mid-1800s because of the existence of feral cattle. This argument
14 was tantamount to asking the Commission to throw the baby out with the bathwater; Mr.
15 Burtell was able to readily demonstrate that any impact that the cows could have on stream
16 flows was minimal.

17 As an initial matter, it is highly likely that the herds of cattle had diminished greatly
18 prior to the 1850s accounts of the stream. The report of significant herds of feral cattle was
19 made by Cook in 1846. Bell passed through eight years later in 1854 on a cattle drive to
20 California. Bell made an account of his own, noting that Cook had reported numerous wild
21 cattle, but stating that "[w]e saw no signs of them." Bell went on to document crossing the
22 San Pedro several times, but he never mentions seeing a single feral cow. Noting that the
23 "[w]ild herds appear to dwindle rather quickly," scholars have hypothesized that the
24 disappearance was "possibly due to hunting by Apaches, military expeditions, and 49ers."⁶⁴

25 Even if the herds remained in the watershed, and were all located directly upstream of
26 the location of a historic account, the feral cattle are a mere red herring. Mr. Hjalmarson

27 ⁶³ Aug. 1 Trans. 144:1 – 147:17.

28 ⁶⁴ *Desert Plants Special Issue* by Dean Hendrickson and W.L. Minckley, from Vera Kornylak, March 10, 2003, Exh. 12, at 144. This is a document submitted by the Center.

1 asserted that the cattle could have an impact of 2 CFS on flows, an essentially *de minimus*
2 impact. Moreover, Mr. Hjalmarson has overstated the impacts. ADWR guidelines for cattle
3 consumption are less than half that the amount Mr. Hjalmarson assumed, meaning that the
4 impacts would likely be 1 CFS or less, truly *de minimus*.⁶⁵

5 **3. There Is No Evidence That Water Use Associated with Mining**
6 **Impacted any of the Evidence Relied upon by Mr. Burtell.**

7 Mr. Hjalmarson also argued that water uses associated with mining could have
8 impacted the San Pedro. This argument is another red herring. First, Mr. Hjalmarson made
9 no attempt to estimate or quantify potential impacts, and he did not include any alleged
10 mining impacts in his model.⁶⁶ Second, mining did not begin in the region until decades after
11 the historic accounts relied upon by Mr. Burtell.⁶⁷ Third, the evidence is undisputed that most
12 of Cananea's water impacts were in the Rio Sonora watershed in Mexico, not the San Pedro
13 watershed.⁶⁸ Fifth, regardless what impacts may have occurred on the San Pedro side, the
14 Charleston and Fairbanks gauges are 40 miles removed from Cananea, and there is no
15 evidence to suggest that groundwater impacts could have migrated that distance in the very
16 short period before the stream flow data were collected.⁶⁹ Sixth, there is no evidence that
17 mining in the region could have impacted the gauge data from the early 1900s that Mr.
18 Burtell analyzed. To the contrary, the data used by Mr. Burtell to demonstrate that Mr.
19 Hjalmarson was double-counting base flow at the Charleston gauge also confirms that none
20 of the mining operations in the region were impacting the base flow at that gauge.⁷⁰

21 **CONCLUSION**

22 Not only has the Center failed to satisfy its burden of proof, but the overwhelming
23 weight of the evidence clearly demonstrates that the San Pedro was neither navigable nor
24 susceptible to navigation in its ordinary and natural condition at or before statehood.

25 _____
26 ⁶⁵ Aug. 1 Trans. 212:22 – 215:11.

27 ⁶⁶ Aug. 1 Trans. 100:22 – 101:7; Aug. 1 Trans. 197:4 – 198:6.

28 ⁶⁷ Aug. 1 Trans. 197:4 – 198:6.

⁶⁸ Ecology and Conservation at 222; Aug. 1 Trans. 201:1 – 202:12.

⁶⁹ Aug. 1 Trans. 201:1 – 206:4.

⁷⁰ Aug. 1 Trans. 198:7 – 206:4; USGS Trends in Streamflow, Exh. X012.

1 RESPECTFULLY SUBMITTED this 13th day of September, 2013.

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1 MAILING CERTIFICATE

2 ORIGINAL AND SIX COPIES of the foregoing
3 hand-delivered for filing this 13th day of September,
4 2013 to:

5 Arizona Navigable Stream Adjudication Commission
6 1700 West Washington, Room B-54
7 Phoenix, AZ 85007

8 COPY mailed this 13th day of September,
9 2013 to:

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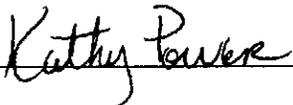
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