TECHNICAL MEMORANDUM

Date: May 16, 2023

To: File

From: Andy Zdon, P.G., CEG, C.Hg.

Subject: **Water Features – Proposed Chuckwalla National Monument**
Chuckwalla National Monument, California

This Water Feature Report (WFR) was prepared by Roux Associates, Inc. (Roux) to identify springs and other water features in the proposed Chuckwalla National Monument. Although geologically the area is considered part of the Mojave Desert Geomorphic Province (California Geologic Survey, 2002), ecologically the proposed monument is in a transitional zone between the Mojave and Sonoran Deserts (Figure 1). The author has 36 years of hydrogeological and water resources experience and is a California-licensed Professional Geologist, California Certified Hydrogeologist and California Certified Engineering Geologist with extensive experience relating to desert springs and the environmental forensics associated with sourcing spring discharges.

Both the groundwater and surface water in the region support isolated, unique, and diverse ecosystems, while also supporting human needs through domestic, wildlife, mining, and other industrial uses. Relatively small variations in the groundwater elevation can have considerable effects on the ability for springs to maintain surface flow. While isolated portions of the California desert have been investigated for site-specific projects, or larger areas studied in more densely populated areas (e.g., Coachella Valley), most of the region has seen little in the way of regional hydrogeologic investigations related to springs until recently starting with a Mojave Desert Spring Survey conducted during 2015-16 (Andy Zdon & Associates, 2016). A subsequent study of springs in a portion of the proposed Chuckwalla National Monument followed that work (Partner Engineering, 2018). Many of these springs are overlooked in regional hydrologic investigations due to their small size despite their substantial importance to wildlife.

Increasing pressures on the region's water resources are well-documented. Population growth in the region and ongoing and proposed renewable energy projects (e.g., in Chuckwalla Valley and other proposed projects) all put pressure on an already precarious water supply in this region of sparse precipitation and limited groundwater recharge.

LOCATION AND PHYSIOGRAPHIC SETTING

The proposed Chuckwalla National Monument area is generally on lands managed by the U.S. Bureau of Land Management (BLM) field offices of Palm Springs and El Centro. This roughly corresponds to an area bounded on the west by the Mecca Hills and Chiriaco Summit along Interstate 10, on the east by the Palo Verde Mountains, on the south by the San Andreas Fault and Chocolate Mountains, and on the north by the Eagle Mountains and portions of Chuckwalla Valley inclusive of Ford Dry Lake (Figure 2).

Unlike many other states, California has defined its groundwater basins based on the extent of the valley fill within the basin and not the extent of the watershed. Therefore, only a fraction of the lands in California are part of groundwater basins. For the purposes of this report, the groundwater basins described are assumed to include their respective watersheds. This simplifies the discussions concerning potential impacts to springs outside of a specific basin as defined by the State of California with groundwater withdrawals within the alluvial portion of a specific basin. The regional summaries in the following subsections give brief descriptions about each groundwater basin based on the California Department of

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Water Resources (2003). Figure 3 presents the groundwater basin boundaries and the proposed boundary of the Chuckwalla National Monument.

The area is within the Mojave Desert Geologic Province (California Geologic Survey, 2002). The Mojave Desert Geologic Province (which is different than the Mojave Desert ecoregion) is bounded by the San Andreas Fault on the west, Colorado River on the east and the Garlock Fault to the north. This is a region where springs have been utilized for mining, livestock, and other uses. Within the proposed Chuckwalla National Monument area, the San Andreas Fault which separates Chocolate and Orocopia Valley Groundwater Basins (within the proposed national monument) from the Coachella Valley to the south.

The alluvial portion of the Chuckwalla Valley Groundwater Basin (#7-5) is the northernmost basin covered in this project area. The alluvial portion of the basin covers approximately 940 square miles including both Chuckwalla and Palen Valleys. The basin is bounded by the Chuckwalla and Little Chuckwalla Mountains in the south, the Eagle Mountains on the west, the Mule and McCoy Mountains on the east and granitic rocks of the Coxcomb and other ranges to the north. There are no perennial streams presents. Substantial groundwater pumping relative to the basin recharge has occurred in this basin and a proposed hydroelectric project that will be sustained by pumped groundwater is being considered (Eagle Crest Project). Corn and Chuckwalla Springs are within this groundwater basin watershed (California Department of Water Resources, 2003).

The alluvial portion of the Arroyo Seco Valley Groundwater Basin (#7-37) covers an area of nearly 430 square miles and is bounded by the Chuckwalla and Little Chuckwalla Mountains to the north, the Palo Verde Mountains to the east, the Chocolate Mountains to the south and west (California Department of Water Resources, 2003). Key springs in this area included Chuckwalla Well Spring and Mesquite Spring.

The alluvial portion of the Palo Verde Mesa Groundwater Basin (#7-39) covers an area of more than 350 square miles in eastern California and is bounded by the Colorado River on the east, Big Maria and Little Maria Mountains on the north, McCoy and Mule Mountains on the west and the Palo Verde Mountains to the south (California Department of Water Resources, 2003) . Clapp Spring is the only spring reconnoitered in the watershed for this basin.

The Chocolate Valley Groundwater Basin underlies a southwest-trending valley and is along the southwestern boundary of the proposed national monument. The basin is bounded by nonwater-bearing rocks of the Orocopia and Chuckwalla Mountains on the north and of the Chocolate Mountains on the south and southeast. A low-lying drainage divide that separates Chocolate Valley from Arroyo Seco Valley Groundwater Basin forms the eastern boundary (California Department of Water Resources, 2003). The key spring in this area is Canyon Spring.

The Orocopia Valley Groundwater Basin is bounded by granitic, low permeability rocks of the Cottonwood and Eagle Mountains on the north and of the Orocopia and Chocolate Mountains on the south. The basin is bounded by a section of the San Andreas fault zone and semi-permeable rocks of the Mecca Hills on the west and by a bedrock constriction on the east. The western portion of the valley drains westward toward the Salton Sea, but the eastern part drains eastward into Hayfield (dry) Lake and Chuckwalla Valley (California Department of Water Resources, 2003). Sheep Hole and Hidden Springs are within this groundwater basin.

CLIMATE IN RELATION TO WATER FEATURES

Deserts are dry places by definition, and precipitation is generally low (and sometime non-existent) over the course of a year and in any given specific location. Within the Sonoran Desert, a biseasonal rainfall pattern occurs (winter storms and summer monsoonal storms), though even during the rainy seasons most days are sunny. During the winter, frontal storms from the west (Pacific Ocean) bring widespread, gentle rain to the area. During summer, wet tropical air and frequent but localized violent thunderstorms occur and are prominent. (Desert Museum, 2018). This pattern differs from the Mojavean pattern of greater precipitation from winter storms, and thus is reflected in stable isotope results. Average annual

precipitation in this area ranges from approximately 3 to 5 inches in the Arroyo Seco Valley Groundwater Basin to 6 inches per year in the Palo Verde Mesa Groundwater Basin (California Department of Water Resources, 2003). During periods of drought, such as occurred during the past ten years corresponding decreases in groundwater recharge will also occur. This decrease in groundwater recharge may not be proportional to the percentage decrease in precipitation, as in some areas, a 50% decrease in precipitation could result in the groundwater recharge decreasing to zero based on soil, vegetation, and climate characteristics.

With that in mind, individual storm events, particularly during summer monsoonal thunderstorms, can provide intense rainfall causing flash floods that may substantially alter the landscape and drainage patterns. In canyon bottoms, springs that occur because of canyon bottom bedrock geometry and associated restrictions to flow, can expand and contract with scouring of the channel or increased sediment load, depending on the effect of the flood. Some springs of this type may disappear entirely.

Given the breadth of the study area, and the scope of this report, the user is referred to the Western Climatic Data Center or other climate data resources for current and historical climate data information for their areas of interest as they relate to springs.

WATER FEATURES - SURFACE DRAINAGES

Table 1 presents the water features described in this technical memorandum. Figure 4 presents the water features described in this and the following sections and the boundary of the proposed Chuckwalla National Monument. Surface drainages in the area are primarily ephemeral washes, that have surface runoff for short periods after substantial precipitation events. Among the most prominent are Box Canyon Wash, Salt Creek, Arroyo Seco, Milpitas Wash, and Red Cloud Wash.

Box Canyon Wash

Box Canyon Wash is an ephemeral desert wash that collects runoff from the south slope of the Eagle Mountains, the Mecca Hills and the Orocopia Mountains that drains into Shavers Valley, then southerly down Box Canyon toward the Coachella Valley. Shavers Well described below is found within Box Canyon Wash. The Box Canyon Road follows Box Canyon Wash, and the trailhead to Hidden and Sheep Hole Springs is within Box Canyon.

Salt Creek

Salt Creek is a broad, ephemeral desert wash that collects occasional runoff from the south slope of the Orocopia Mountains, the north slope of the Chocolate Mountains and the westernmost Chuckwalla Mountains. The gradient is toward the southwest through Chocolate Valley and towards Coachella Valley.

Arroyo Seco

The Arroyo Seco is a broad ephemeral wash that rises from the alluvial divide separating Arroyo Seco from Chocolate Valley to the west and bounded by the Chuckwalla Mountains on the north and the Chocolate Mountains to the south. The Arroyo Seco crosses the Arroyo Seco Valley Groundwater Basin, with a gradient toward the east, and ultimately joining Milpitas Wash (see below) immediately west of the Little Mule Mountains.

Milpitas Wash

Milpitas Wash is a continuation of ephemeral desert washes that rise in the Chocolate Mountains (primarily at Salvation Pass) and elsewhere, passing through the Little Mule Mountains with downward surface gradient to the east, eventually reaching the Cibola National Wildlife Refuge adjacent to the Colorado River. The portion of the wash below the Little Mule Mountains is termed “Milpitas Wash.”

Red Cloud Wash

Red Cloud Wash originates in the western Chuckwalla Mountains in the vicinity of the Red Cloud Mine and Well area, ultimately dissipating on the bajada (coalescing alluvial fans) that separate the Chuckwalla Mountains from the Orocopia Mountains to the west and draining into Chuckwalla Valley.

SPRINGS

Springs are places where groundwater reaches the ground surface, discharging as surface flow. By nature of their character, springs are highly sensitive to changes in groundwater level. For some springs, the reduction of less than one foot of groundwater elevation can result in the difference between surface water flow being present or absent. Some springs are small, seasonal, locally perched, features where last year's rainfall that soaked into the ground has hit a barrier to its downhill flow path, forcing that water back to the ground surface. The discharge from most of the springs in the proposed Chuckwalla National Monument is gravity driven. Roux has not inspected or evaluated through field and geochemical means some of these springs as to their sourcing and flow characteristics. Some of these other springs may be tied to more distant groundwater flow paths that may extend well beyond the boundaries of the local watershed.

Previous investigations of springs in the Mojave Desert north of the proposed Chuckwalla National Monument have statistically illustrated the unique nature of springs in the California desert when considering geology, hydrology, botany, wildlife, and other considerations (Love, Zdon, et.al., 2022). Although sufficient analysis including field-investigation has not been conducted on the springs in the proposed Chuckwalla National Monument to evaluate uniqueness in the manner like that has been proposed in that paper, or evaluated for regional versus local nature as described in another article relating to California desert springs (Zdon and Love, 2020), should the springs in the proposed national monument show similar uniqueness, the idea of mitigation compensation or mitigation offset via replacement or substitution could never truly be achieved if/when these spring areas are impacted by groundwater pumping or other hydrologic stresses. In those cases, spring ecosystems used as a replacement or substitution could not reasonably be expected to be similar in terms of the hydrologic and associated ecologic conditions to the ecosystem lost. While such offsets can represent a coarser view of replacements or substitution, the more specific conditions of biodiversity could not easily be replaced or substituted.

Water rights information are based on data in the California State Water Resources Control Board's electronic water rights information system (eWRIMS, 2023).

Canyon Spring

Canyon Spring is on the south slope of the Orocopia Mountains in the SW1/4 of Section 20, T7S, R13E. The spring is in the watershed, but not within the boundary of, the Chocolate Valley Groundwater Basin (7-32) in Riverside County, California. The spring is accessible from the Bradshaw Trail Road less than a mile to the north.

Mendenhall (1909) reported that the spring "yields a small supply of poor water." According to Ross (1992), the spring is in a canyon bottom marked by a small palm tree. Reportedly water is present at this inclusive of drought periods but is typically of poor quality. The spring is on public lands managed by the BLM and the BLM has a water right filed with the State of California for this spring (for wildlife use – Statement number F011318S).

Chuckwalla Spring

Chuckwalla Spring (Figure 4) lies high on the north slope of the Chuckwalla Mountains in the SE1/4 of Section 17, T8S, R17E. This spring is in the watershed, but not within the boundary of, the Chuckwalla Valley groundwater basin (7-05) in Riverside County, California. The spring is accessible from the

Graham Pass Road and Bradshaw Trail, the jeep road consisting of a drive up a desert wash requiring a sturdy four-wheel drive vehicle.

The spring consists of a hand-dug hole lined with rock with groundwater at about 4 feet below ground surfaces (in 2018) in granitic terrain (Partner, 2018). A gabion wall was constructed up-wash to mitigate sedimentation. It appears difficult for wildlife to reach spring in the configuration described, and there were no noticeable signs of wildlife use when the site was visited. There was sparse riparian vegetation, consisting only of mesquite, catclaw acacia and bunchgrass.

When the site was inspected, there was no odor to the water present, and discharge was through evaporation only. The water was high in dissolved solids content (greater than 2,000 parts per million) and with a pH of 7.81 when measured. The spring is on public lands managed by the U.S. Bureau of Land Management, and there are no water-right filings with the State of California for this spring.

Chuckwalla Well Spring

Chuckwalla Well Spring (Figure 5) lies at the base of the south slope of the Chuckwalla Mountains in T8S, R17E. Sections have not been defined in this area. This spring is in the watershed, but not within the boundary of, the Arroyo Seco groundwater basin (7-37) in Riverside County, California. This spring is within the Chuckwalla Bench Area of Critical Environmental Concern. The spring is accessible from the Bradshaw Trail Road (two-wheel drive accessible), while a high-clearance two-wheel drive can access the dirt road to the site.

Chuckwalla Well Spring appears to be the spring that Mendenhall (1909) refers to as Chuckwalla Well as opposed to the Chuckwalla Spring on the north slope of the range. Mendenhall described the water as being said to be of excellent quality and abundant, although that is not indicated by the current field water quality parameters which contained dissolved solids content of more than 2,000 parts per million when field checked in 2017. Based on Mendenhall's description, it appears that flow has decreased and that the change has also affected spring water quality. Brown (1920) reported the water as only being of fair quality. Brown (1923) described this site as having a well or wells "the well is an open hole 4 feet in diameter and 7-1/2 feet deep, neatly walled with round boulders. The depth of water on November 8, 1917 was 5 feet and the water was clean and drinkable, although rather salty. The well is dug in gravel in small wash that comes from a range of much dissected hills that connects the Chuckwalla and Little Chuckwalla Mountains." Brown continues, "…it is probable that the water is merely seepage in the gravels of the wash and held up by impervious clay beds." The well appears to be filled in, however was present in a spring box in an adjacent wash.

The California Department of Water Resources identified Chuckwalla Spring (either this spring or Chuckwalla Well based on location information) as flowing in 1963 (California Department of Water Resources, 1963). William Bradshaw may have used the water here or at the Mesquite/Chuckwalla Spring site as key camp in establishing the Bradshaw Trail (Robinson, 2005).

As described above in 2017, although a well may be (or was formerly) present, this feature is more of a spring with a spring box with water and seeps surfacing in channel downslope of spring box. The spring is in igneous and metamorphic-rock terrain (intrusive silicic). Although not observed at the spring, deer and/or Desert Bighorn Sheep tracks were observed nearby, and it is likely that this water source is used by them. There were many Phainopepla present at the time of the inspection. Vegetation at the spring consists of mesquite, grasses, boxthorn, and tamarisk. One palm tree is present nearby but not at the spring.

There is a federal water right claim on this feature by BLM with the State of California for this spring. Brown (1923) reported this site as a Public Water Reserve. The actual well appears to be on the border of BLM and State of California land. A further detailed survey may be needed to clarify the land status of the well and the spring feature.

Clapp Spring

Clapp Spring (Figure 6) is on the northeast slope of the Palo Verde Mountains in the NE1/4 of Section 10, T9S, R20E. This spring is in the watershed, but not within the boundary of, the Palo Verde Mesa groundwater basin (7-39) in Riverside County, California. Clapp Spring is within the Palo Verde Mountains Wilderness. The spring is accessible from the Bradshaw Trail east of the Mule Mountains, following a powerline road south to a reasonable dirt road heading west. This route becomes a four-wheel-drive accessible only dirt track and arrives at the spring from the north.

Clapp Spring is the spring noted by Mendenhall (1909) as being the unnamed spring at the north end of the Palo Verde Mountains used by stockmen. Brown (1920) referred to this spring as "Red Butte Spring" and Thumb Peak as "Red Butte." Brown did not visit the spring but noted that general knowledge had the spring flow as issuing from the rocks at the spring site, and that flow was "unfailing." The name "Clapp Spring" was referred to as an alternate name for the first time by Brown (1923).

At the time of inspection in 2017 (Partner, 2018), this spring in volcanic terrain consisted of a dry spring vent area that had been human-altered. There were signs of deer or Desert Bighorn Sheep (tracks and scat) present. A Cactus Wren was observed at the spring. Vegetation consisted primarily of mesquite, ironwood, and saltbush although approximately 10 palm trees are also present. Of note is that this spring has been noted as being perennial in the past (noted on BLM wilderness site) but is currently dry and may be affected by regional groundwater pumping. There are no water-right filings with the State of California for this spring.

Corn Spring

Corn Spring (Figure 7) lies on the north slope of the Chuckwalla Mountains in the NW1/4 of Section 28, T6S, R16E. This spring is in the watershed, but not within the boundary of, the Chuckwalla Valley groundwater basin (7-05) in Riverside County, California. Corn Spring is in the Corn Springs Area of Critical Environmental Concern. Corn Spring is reached by following the Corn Spring Road from I-10 to Corn Spring Campground (good dirt road, 2-wheel drive accessible).

Mendenhall (1909) described Corn Spring as flowing at 8 or 10 miner's inches (approximately 70 to 90 gallons per minute), rising in a local cienaga. Mendenhall described "careful development would increase flow and could irrigate a number of acres." Of note is the large flow of the spring historically and the absence of flow at present. Waring (1915) reported that "a stream of perhaps 50 gallons per minute rises in a small cienega at Corn Springs." Additionally, J. Smeaton Chase in his book California Desert Trails (1919) described Corn Springs as a reliable base for regional explorations due to the water preset. Brown (1923) describes Corn Spring as the following:

"Corn Spring, sometimes called Cohn Spring, is in the Chuckwalla Mountains in unsurveyed land of T.6S., R.16E., probably in sec. 28. The spring has been a noted watering place for many years and was an oasis inhabited by Indians long before the appearance of white men." Brown continues, "The vicinity of Corn Spring is a cienaga which constitutes an enlargement in an eastward-draining canyon. Encircling granite mountains rise 1,000 to 2,000 feet above, and the canyon outlet to the east occupies a narrow granite-walled gorge. There is a considerable area of alluvial soil and rocky outwash in the cienaga, and perhaps 5 or 10 acres is covered with a rank growth of vegetation including mesquite and arrowweed. Near the spring there is a clump of about a dozen wild palms, some of which are 2 feet in diameter. The rises in the lower end of the alluvial area and apparently represents the discharge of ground water fed by the tributary canyons into this reservoir. It has been dug out in the form of a shallow well, which yields a small flow over its lower edge. The flow varies considerably with the seasons indicating its close relation to rainfall on adjacent slopes. At the time when visited, it was only a few gallons a minute, but it is said to reach several miner's inches at times. The water is used for domestic purposes and has been successfully used in the irrigation of a garden. Its quality, as indicated by analysis, is good for both domestic use and irrigation. Indeed, it is much above the average of desert water. It is characterized by a considerable lime content."

Waring's description from 1915, and later Brown's description from 1923 suggest that increased water usage from the spring had occurred post-Mendenhall's visit. Corn Spring was noted to be dry in 1963 (California Department of Water Resources, 1963).

The spring field/cienega is in granitic terrain where there is no longer surface expression of flow. Spring discharge is through evapotranspiration only. Groundwater-dependent vegetation appears stressed and palm trees present are stressed/dying. This may be the result of up-gradient pumping near Aztec Well and water use by the existing recreational area at the spring. Birds observed during a site visit in 2017 included Phainopepla and Gilded Flicker along with un-speciated hummingbirds. Vegetation consisted of the aforementioned palm trees, along with mesquite, catclaw acacia, palo verde, creosote, arrowweed, boxthorn, brittlebush, and desert mallow. Continued decline of the riparian could lead to non-functional status in the future.

Water quality parameters were measured from the water system at the BLM campground during a site inspection in 2017. There was no odor to the water, and the water appeared to be generally of good field quality (dissolved solids content less than 500 parts per million) although laboratory analysis for general water quality was not conducted. There is a federal water right claim filed by BLM with the State of California for this spring. Brown (1923) noted Corn Spring as a Public Water Reserve.

Gucci Spring

Gucci Spring is on the south slope of the Orocopia Mountains in the SE1/4 of Section 24, T7S, R12E. The spring is in the watershed, but not within the boundary of, the Chocolate Valley Groundwater Basin (7-32) in Riverside County, California. The spring is accessible from the Bradshaw Trail Road about two miles to the north in the Orocopia Mountains Wilderness.

According to Ross (1992), the spring was named for a prospector who first developed the spring. Bighorn sheep, mountain lion and coyotes have been observed at this spring. Ross reported that as of 1992, water was usually present at this spring but of poor quality. The spring is on public lands managed by the BLM and there are no water right filings on this spring with the State of California.

Hidden Spring

Hidden Spring is within the eastern Mecca Hills in the NE1/4 of Section 11, T7S, R10E. The California Department of Water Resources has this spring mapped as being within the Orocopia Valley Groundwater Basin (7-31), however the spring is within the watershed of the Coachella Valley. The spring is a trail hike from the Box Canyon Road.

Mendenhall (1909) described this as an unnamed spring as a 'beautiful clump of palms with a spring of pure water beneath them." Brown (1920) appears to first identify this spring as "Hidden Spring." There are no water-right filings with the State of California for this spring.

Mesquite Spring

Mesquite Spring (Figure 8) is on the south slope of the Chuckwalla Mountains in the SE1/4 of Section 29, T8S, R17E. This spring is in the watershed, but not within the boundary of, the Arroyo Seco Valley groundwater basin (7-37) in Riverside County, California. Mesquite Spring is within the Chuckwalla Bench Area of Critical Environmental Concern. The spring is reached from the Bradshaw Trail (two-wheel drive). A short hike along a dirt track leads to the spring.

Mesquite Spring is the spring that Brown (1920) refers to as Chuckwalla Spring as opposed to the currently named Chuckwalla Spring on the north slope of the Chuckwalla Mountains. Brown (1923) describes this spring as, "…water stands at or near the surface of a large wash half a mile west of Chuckwalla Well. The place is known as Chuckwalla Spring. " The California Department of Water Resources identified Chuckwalla Spring (either this spring or Chuckwalla Well based on location information) as flowing in 1963 (California Department of Water Resources, 1963). William Bradshaw

may have used the water here or at the Chuckwalla Well site as key camp in establishing the Bradshaw Trail (Robinson, 2005).

At the time of inspection in 2017 (Partner, 2018), a spring-box was present but dry. Other infrastructure present appeared in disrepair and generally no longer in use. It is possible that this spring was overused in the past. There were deer and/or Desert Bighorn Sheep tracks and scat present, with plentiful Phainopepla. Vegetation consisted primarily of mesquite and grasses including bunchgrass. There are no water right filings with the State of California for this spring.

Sheep Hole Spring (Sheep Hole Oasis)

Sheep Hole Spring (also known as Sheep Hole Oasis) is within the eastern Mecca Hills in the NW1/4 of Section 11, T7S, R10E. The California Department of Water Resources has this spring mapped as being within the Orocopia Valley Groundwater Basin (7-31), however the spring is within the watershed of the Coachella Valley. The spring is a trail hike from Box Canyon Road.

Mendenhall (1909) described this spring as "water surrounded by a few burnt palms." There are no water right filings with the State of California for this spring.

HISTORIC WELLS

The following wells are features that typically were developed in the early 20th century and served as supplemental water sources for desert travelers where springs were not present or where spring water quality was unsuitable for consumption. Typically, these wells were hand-dug features and due to the site conditions, depth to water, intended use, and ingenuity of the developer, each is unique in their construction and history.

Aztec Well

Aztec Well is within the southern slope of the Chuckwalla Mountains, west of Corn Spring in T6S, R15E (sections undefined). The spring is in the watershed, but not within the boundary of, the Chuckwalla Valley Groundwater Basin (7-05) in Riverside County, California. The well is accessible from Corn Springs Road. Mendenhall (1909) reported that Aztec Well had "an abundance of good water," the current water available is unclear. Brown (1920) reported that Aztec Well was 15 feet deep and water was standing 10 feet below ground surface, with the well in good condition in 1917. While Aztec Well is mapped on lands managed by BLM (Corn Spring Area of Critical Environmental Concern), it is immediately adjacent to a private land block that appeared inhabited during a 2017 field inspection, and it is unclear if the well is used by the private land holders.

Clemens Well

The former Clemens well site is on the south slope of the Orocopia Mountains in the SE1/4 of Section 24, T7S, R12E. The former well (now backfilled) is in the watershed, but not within the boundary of, the Chocolate Valley Groundwater Basin (7-032) in Riverside County, California. The former well site is accessible from the Bradshaw Trail Road about two miles to the north in the Orocopia Mountains Wilderness.

According to Ross (1992), "Clemens Well, no dry and filled in….this well did not exist in stagecoach days but was dug later by Riverside County to serve the needs of nearby prospectors and miners. It was intended to be a replacement for Canyon Springs, the water from which was brackish and hardly fit to drink. The water from Clemens Well, on the other hand, was quite good. About 4 feet square and only 17 feet deep, by 1918 the water level in the well was 16 feet below surface. Water was drawn out by a bucket attached to a rope." Clemens well was later deemed to be a physical hazard and was destroyed (filled in) around 1961.

Gulliday Well

Gulliday Well is on the southern slope of the Chuckwalla Mountains, south of Black Butte in Section 30, T7S, R16E. The spring is in the watershed, but not within the boundary of, the Arroyo Seco Groundwater Basin (7-37) in Riverside County, California. The well is accessible from the Bradshaw Trail Road. The condition of this well is not known.

According to Ross (1992), "Hand dug and lined with rock many years ago, it had water in it in the spring of 1991. The well lies about 50 yards southeast from a piece of what appears to have been a steel air vent lying abandoned on the edge of a small wash." This feature was not inspected during 2017 field work by Partner (2018).

Hopkins Well

Hopkins Well was within the Chuckwalla Valley, on the southeast edge of Ford Dry Lake, in the SE1/4 of Section 28, T6S, R19E. The well was in the Chuckwalla Valley Groundwater Basin (7-05) in Riverside County, California. According to a groundwater monitoring report prepared by Northstar Environmental Remediation (2023) on behalf of the Genesis Solar Energy Project in Chuckwalla Valley, Hopkins Well was unused (it appears that the regional water table had lowered to depths greater than the well due to pumping), therefore the well was unused and destroyed.

Indian Well

Indian Well is within the Arroyo Seco Valley, south of Bradshaw Trail and the southern slope of the Chuckwalla Mountains, the NW1/4 of Section 3, T9S, R17E. The well is within the Arroyo Seco Valley Groundwater Basin (7-37) in Riverside County, California. The well is accessible from Bradshaw Trail and is near Rainey Well. Surrounded by a mesquite thicket, according to Ross (1992), Indian Well was "hand dug by John Young in the early 1920's. Now usually dry…"

Midway Well

Midway Well is within the Arroyo Seco Valley in a north-south tributary to Milpitas Wash in the NW1/4 of Section 15, T11S, R20E. The well is in the Arroyo Seco Valley Groundwater Basin (7-37) in Riverside County, California. The well is accessible approximately one-half mile west of Ben Hulse Highway (Highway 78) southwest of the Cibola National Wildlife Refuge and is within an inholding of private land surrounded by BLM-managed public lands.

Rainey Well

Rainey Well is south of the Chuckwalla Mountains in the NE1/4 of Section 4, T9S, R17E. The well is within the Arroyo Seco Valley Groundwater Basin (7-37) in Riverside County, California. The well is accessible from dirt side roads off of Bradshaw Trail Road. According to Ross (1992), "Water of uncertain quality is available…at the site of the abandoned J.W. Bell Ranch, where a windmill may be seen across a wash. The well, known as the J.C. Rainey Well, no provides water for an animal guzzler." This site was visited during the Partner inspection (Partner, 2018) and while the infrastructure was present as described, the hook-up with the guzzler did not appear functional.

Red Cloud Well

Red Cloud Well is within the western Chuckwalla Mountains the NW1/4 of Section 1, T7S, R15E. The well is in the watershed, but not within the boundary of, the Chuckwalla Valley Groundwater Basin (7-05) in Riverside County, California.

Shavers Well

Shavers Well is within the eastern Mecca Hills, along Box Canyon Road (paved) in the SW1/4 of Section 26, T6S, R10E. The well is in the watershed, but not within the boundary of, the Orocopia Valley

Groundwater Basin (7-31) in Riverside County, California. The well is accessible along Box Canyon Road. A historical marker is present.

Mendenhall (1909) reported that "It is about 30 feet deep, well-timbered and protected. There is a rope, bucket, and pulley so that it is easy to get the water which is of superior quality. The well is surrounded by mesquite shrubs and palo verde."

Teaque Well

Teaque Well is on the bajada north of the Chuckwalla Mountains in the SE1/4 of Section 4, T7S, R19E. The well is within the Chuckwalla Valley Groundwater Basin (7-05) in Riverside County, California. According to a groundwater monitoring report prepared by Northstar Environmental Remediation (2023) on behalf of the Genesis Solar Energy Project in Chuckwalla Valley, Teaque Well consisted of a 12-inch diameter well drilled to a depth of 242 feet that is currently unused for water-supply or monitoring. The precise location of the well is unclear as the coordinates provided appear to be off based on Google Earth imagery. The well may be associated with an abandoned agricultural field to the northwest along the powerline road.

Wiley Well

Wiley Well (Figure 9) is within the alluvial valley separating the Little Chuckwalla Mountains and the Mule Mountain and is within the Chuckwalla Valley Groundwater Basin (7-05) in Riverside County, California. The historic well is within a campground accessed by a good dirt road (Wiley Well Road) from Interstate 10. There is a handpump for the campground water system, and water from the pump was used to collect water sample that indicated the water had a high mineral content (greater than 1,000 parts per million dissolved solids). Birds observed during the site inspection included Verdin and Phainopepla. Vegetation present included palo verde, and various shrubs. The feature is used for recreation and the BLM has a water right (S006240) filed with the State of California for this source. The well was dug in 1907 by A.P. Wiley, a shopkeeper from Palo Verde, deepening a shallower well that was previously dug here in 1876 by a stage company. Water from the well was extracted by a bucket attached to a rope and it is only about 22 feet deep (Ross, 1992).

TENAJAS

Long Tank

Long Tank is at the base of the northern slope of the Chuckwalla Mountains, south of Desert Center in T6S, R15E (sections undefined). The spring is in Chuckwalla Valley Groundwater Basin (7-05) in Riverside County, California. The tenaja is accessible from jeep roads south of Desert Center.

Spring Tank

Spring Tank is along the northern slope of the Chuckwalla Mountains, south of Desert Center in T6S, R15E (sections undefined), in the first wash east of Long Tank. The spring is in the watershed, but not within the boundary of, the Chuckwalla Valley Groundwater Basin (7-05) in Riverside County, California. The well is accessible from Corn Springs Road.

Tadpole Tank

Tadpole Tank Well is along the northwestern edge of the Palo Verde Mountains in Section 7, T9S, R20E. The Tenaja is in the watershed, but not within the boundary of, the Chuckwalla Valley Groundwater Basin (7-05) in Riverside County, California.

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Table 1 – Proposed Chuckwalla National Monument Water Features

Springs				
Canyon Spring	33.54539	-115.65472	1240	Orocopia Mountains
Chuckwalla Spring	33.47682	-115.21283	1787	Chuckwalla Mountains
Chuckwalla Well Spring	33.44358	-115.21685	1995	Chuckwalla Mountains
Clapp Spring	33.41071	-114.85644	669	Palo Verde Mountains
Corn Spring	33.62566	-115.32584	1602	Chuckwalla Mountains
Gucci Spring	33.54654	-115.68073	1376	Orocopia Mountains
Hidden Spring	33.58352	-115.90632	694	Mecca Hills
Mesquite Spring	33.44317	-115.22659	2020	Chuckwalla Mountains
Sheep Hole Spring (aka Sheep Hole Oasis)	33.58406	-115.92297	576	Mecca Hills
Tenajas				
Tadpole Tank	33.40343	-114.90836	731	Palo Verde Mountains
Long Tank	33.67678	-115.39214	1194	Chuckwalla Mountains
Spring Tank	33.66803	-115.37851	1510	Chuckwalla Mountains
Wells				
Wiley Well	33.49356	-114.88976	606	Chuckwalla Valley
Aztec Well	33.63355	-115.37523	2015	Chuckwalla Mountains
Clemens Well	33.52058	-115.6661	945	Salt Creek Wash (Chocolate Mountains)
Gulliday Well	33.53979	-115.35241	2834	Chuckwalla Mountains
Hopkins Well	33.61319	-114.99555	357	Chuckwalla Valley (Ford Dry Lake)
Indian Well	33.42311	-115.18314	1700	Chuckwalla Mountains
Midway Well	33.21694	-114.86111	822	Milpitas Wash Valley
Rainey Well	33.42099	-115.18819	1729	Chuckwalla Mountains
Red Cloud Well	33.59573	-115.43754	2473	Chuckwalla Mountains
Shavers Well	33.61948	-115.91617	915	Mecca Hills
Teaque Well	33.58487	-114.99534	423	Chuckwalla Valley
Rivers/Creeks/Washes:				
Salt Creek				
Arroyo Seco				
Milpitas Wash				

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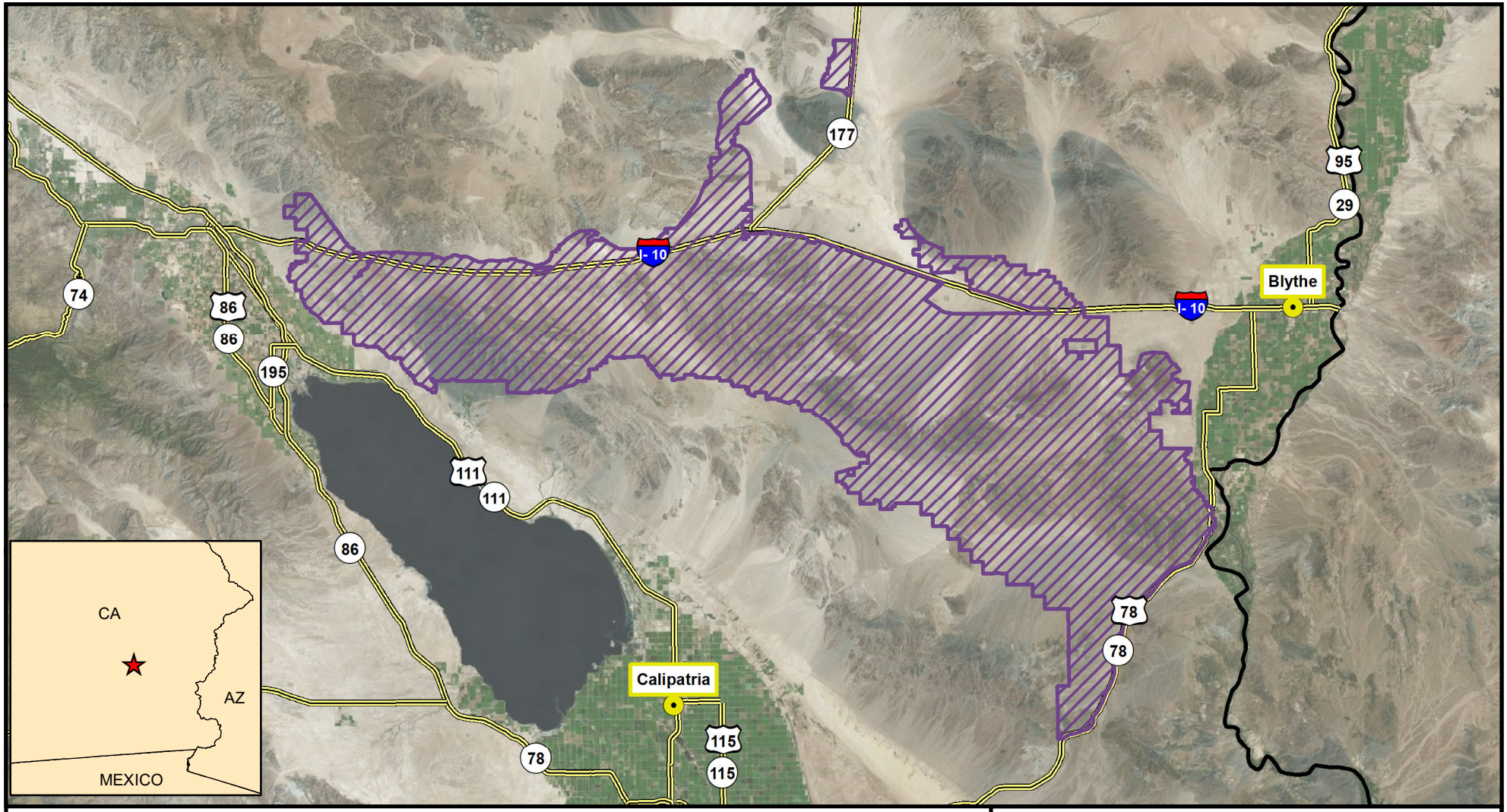

LEGEND

- PROPOSED NATIONAL MONUMENT BOUNDARY
- TOWN/CITY
- MAJOR ROAD

NOTES

1. ALL FEATURES SHOWN ARE APPROXIMATE.
2. PROPOSED NATIONAL MONUMENT BOUNDARY PROVIDED BY THE RESOURCES LEGACY FUND.
3. MAJOR ROADS OBTAINED FROM THE US CENSUS BUREAU.
4. AERIAL IMAGERY © 2023 MICROSOFT CORPORATION EARTHSTAR GEOGRAPHICS SIO

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SITE LOCATION MAP

PROPOSED CHUCKWALLA NATIONAL MONUMENT
RIVERSIDE AND IMPERIAL COUNTIES, CALIFORNIA

Prepared for: RESOURCES LEGACY FUND

ROUX

Compiled by: JNL	Date: 05/03/23	FIGURE
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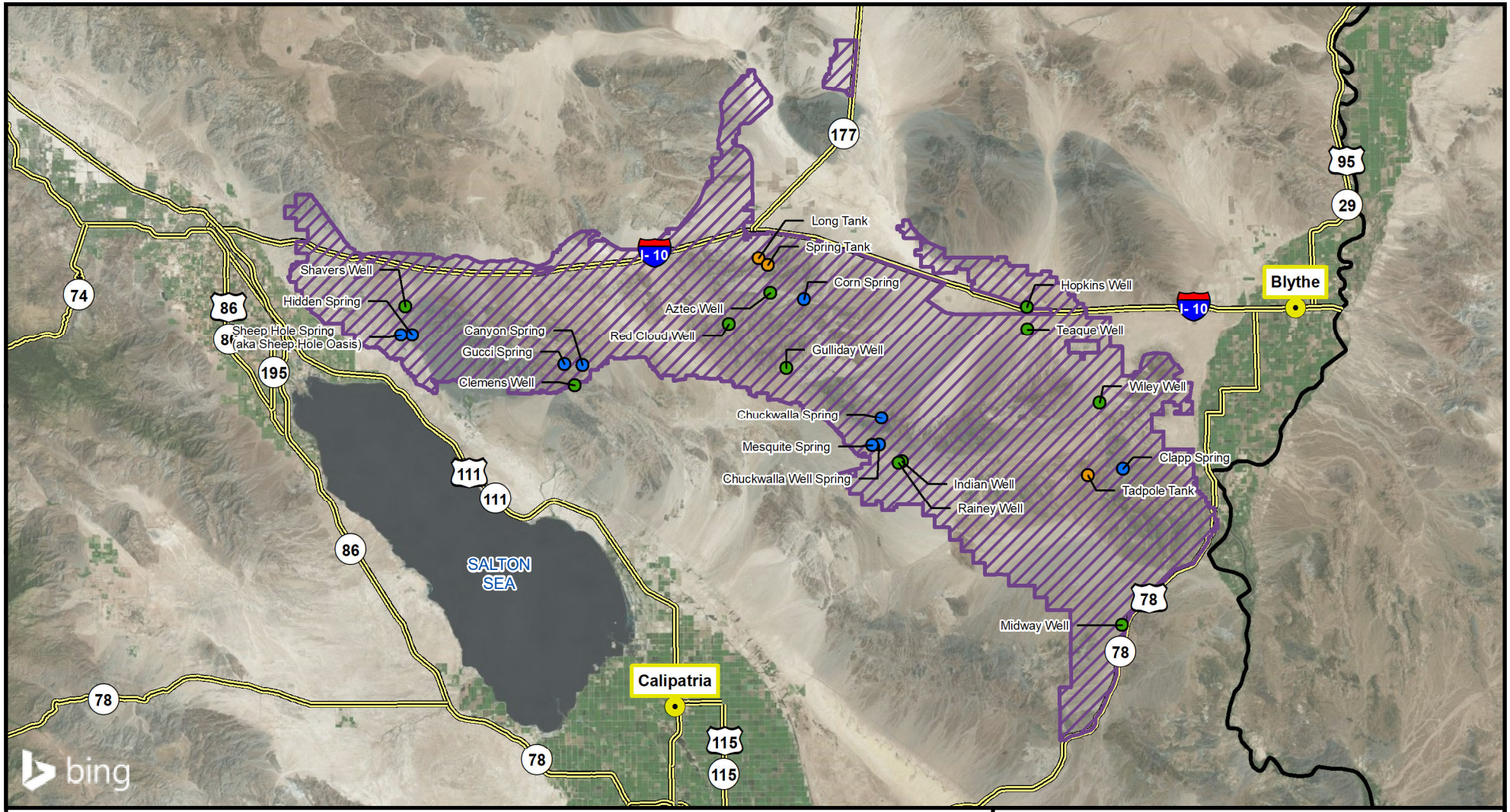

LEGEND

- SPRING
- TENAJA
- WELL
- PROPOSED NATIONAL MONUMENT BOUNDARY
- TOWN/CITY
- MAJOR ROAD

NOTES

1. ALL FEATURES SHOWN ARE APPROXIMATE.
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3. MAJOR ROADS OBTAINED FROM THE US CENSUS BUREAU.
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SITE FEATURES

PROPOSED CHUCKWALLA NATIONAL MONUMENT
RIVERSIDE AND IMPERIAL COUNTIES, CALIFORNIA

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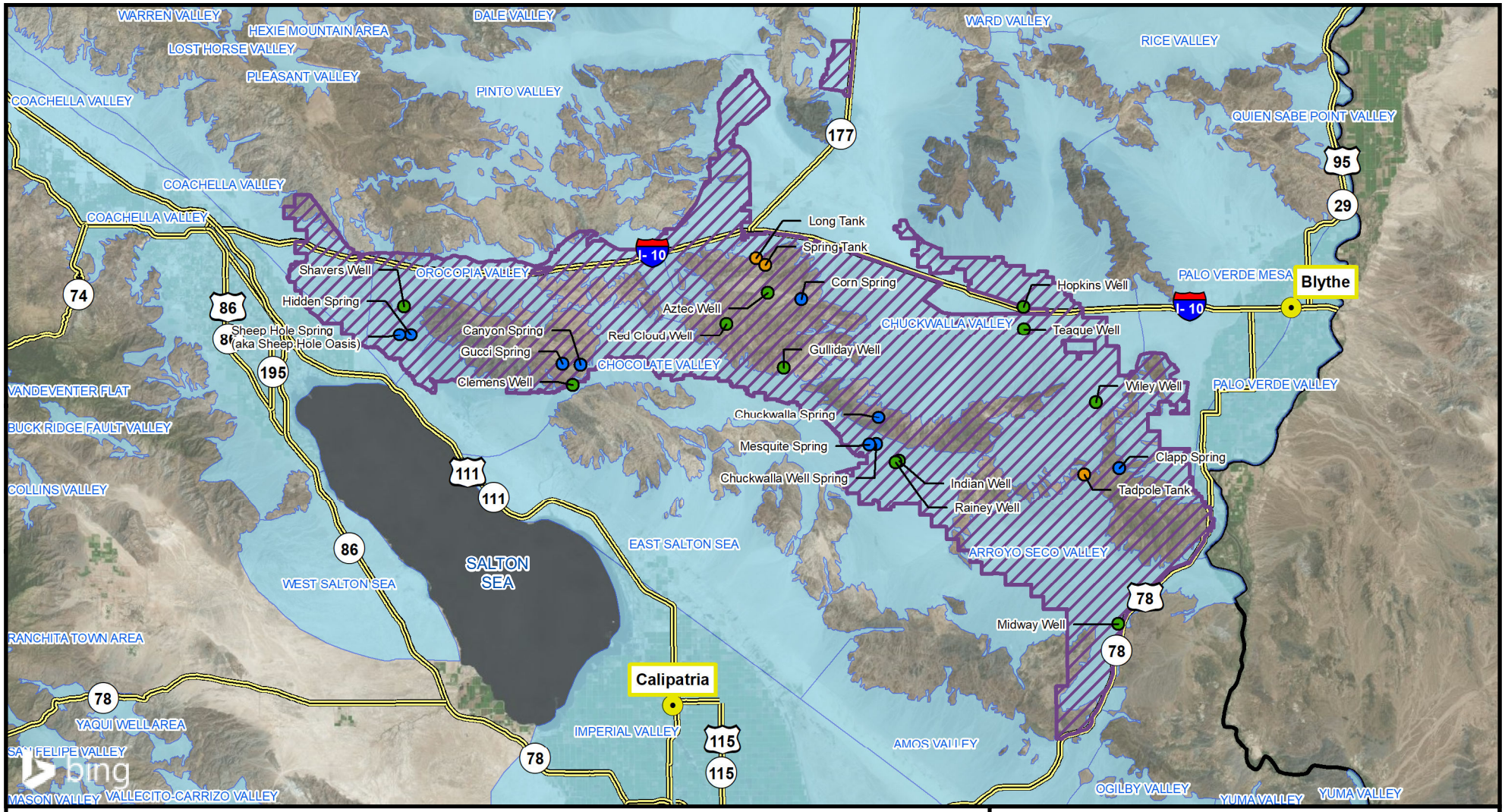

LEGEND

- SPRING
- TENAJA
- WELL
- PROPOSED NATIONAL MONUMENT BOUNDARY
- GROUNDWATER BASIN
- TOWN/CITY
- MAJOR ROAD

NOTES

1. ALL FEATURES SHOWN ARE APPROXIMATE.
2. PROPOSED NATIONAL MONUMENT BOUNDARY PROVIDED BY THE RESOURCES LEGACY FUND.
3. MAJOR ROADS OBTAINED FROM THE US CENSUS BUREAU.
4. GROUNDWATER BASIN DATA OBTAINED FROM THE CALIFORNIA DEPT. OF WATER RESOURCES.
5. AERIAL IMAGERY © 2023 MICROSOFT CORPORATION EARTHSTAR GEOGRAPHICS SIO

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GROUNDWATER BASINS

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RIVERSIDE AND IMPERIAL COUNTIES, CALIFORNIA

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CHUCKWALLA SPRING

PROPOSED CHUCKWALLA NATIONAL MONUMENT
RIVERSIDE AND IMPERIAL COUNTIES, CALIFORNIA

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CHUCKWALLA WELL SPRING

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RIVERSIDE AND IMPERIAL COUNTIES, CALIFORNIA

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FIGURE

5

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CLAPP SPRING

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Title:

CORN SPRING

PROPOSED CHUCKWALLA NATIONAL MONUMENT
RIVERSIDE AND IMPERIAL COUNTIES, CALIFORNIA

Prepared for:

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Title:

MESQUITE SPRING

PROPOSED CHUCKWALLA NATIONAL MONUMENT
RIVERSIDE AND IMPERIAL COUNTIES, CALIFORNIA

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FIGURE 8

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Title:

WILEY WELL

PROPOSED CHUCKWALLA NATIONAL MONUMENT
RIVERSIDE AND IMPERIAL COUNTIES, CALIFORNIA

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RESOURCES LEGACY FUND

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