Haley & Aldrich, Inc.
One Arizona Center
400 E. Van Buren St., Suite 545
Phoenix, AZ 85004
602.760.2450

TECHNICAL MEMORANDUM

30 April 2020
File No.: 135058-002

TO: sPower Development Company, LLC
Terrance Unrein, Senior Permitting Manager

FROM: Haley & Aldrich, Inc.
Jason Abplanalp, PhD
Eric Mears, R.G.

SUBJECT: Preliminary Uranium Exclusion Area Mapping and Existing Site Condition Assessment of the Proposed Solar Facility Near Cameron, Arizona

Introduction

sPower Development Company, LLC (sPower) contracted Haley & Aldrich, Inc. (Haley & Aldrich) to perform an evaluation and assessment of abandoned uranium mines (AUM) associated with the proposed development of a solar energy generation facility (study area) near Cameron, Arizona (Figure 1). The study area encompasses approximately 9,000 acres of largely undeveloped land on the Colorado Plateau and is within the Cameron uranium mining district, which historically was the fourth largest uranium mining district by production on the Colorado Plateau (Chenoweth, 1993; Figure 2). As such, legacy impacts of this mid-century mining activity are still found throughout the region as dispersed AUMs of varying scale (Figure 3).

This evaluation was conducted to assist sPower in completing a due diligence on the property prior to the development of a utility-scale solar energy generation facility. sPower plans to proceed with solar development on the property provided those activities do not create unreasonable risks for the company or its employees and contractors.

Naturally occurring radioactive materials (NORM), as well as AUMs found within the confines of the property, may pose a potential health risk to workers during the construction, operation, and maintenance of the solar generation facility. Appropriate exclusion areas (if warranted) and/or work practices can be calculated and/or established to limit potential worker exposure to NORM originating from the former mine workings and wastes. Additionally, disturbing these historic mining areas may possibly generate undesirable Comprehensive Environmental Response Compensation and Liability Act (CERCLA) liability for sPower.

Prior to final project planning and the initiation of construction, sPower should evaluate and establish appropriate boundaries, or buffer areas, around the AUMs, if needed, to protect workers and reduce trailing liabilities associated with disturbing these sites. Radiological and toxicological data can be evaluated to determine the impact (if any) to human health under normal, construction-related conditions. Understanding the AUM set-back requirements will allow sPower to begin the final development stage of the proposed solar generation facility and its supporting infrastructure.

The goal of this evaluation is to expand on the prior investigations and communications provided by others to sPower. Outside of these studies, this memorandum has been completed by Haley & Aldrich based on previous data provided by sPower, the U.S. Environmental Protection Agency (USEPA), the Navajo Nation Environmental Protection Agency (NNEPA), and the U.S. Department of Energy (DOE).

This memorandum represents Haley & Aldrich's completion of the scope of work for the Cameron project submitted to sPower on 24 March 2020. Project components include preliminary AUM exclusion, or setback recommendations, a discussion of current AUM reclamation statuses, a review of existing NORM data, and other development recommendations as provided by Haley & Aldrich radiological, mining, and toxicological experts. Additional field data verification, limited soil sampling and analysis, and the development of site-specific toxicology and exposure assessments are needed for refinement of the final exclusion areas. These studies would inform the development of site-specific health and safety protocols for the eventual construction, operation, and maintenance of the solar project. Such activities and scopes are recommended during the development phase of the project, prior to commencement of construction.

To better understand the geology and historic context of mining within the study area, Appendix A provides a brief timeline of uranium mine development in addition to a geologic overview of the Cameron District. At the request of sPower, Appendix B contains a review of study area reclamation history, AUM reclamation status by mine, and the responsible enforcement agency.

Radiation Hazards of the Study Area

The main constituent of concern identified from the study area is uranium. Natural uranium (e.g., as uranium ore) undergoes radioactive decay, which releases radiation. Long-term exposure to hazardous concentrations of radiation can result in an increased risk of developing cancer and presents both internal and external radiation hazards. Internal radiation hazards, which can occur through inhalation of dust or ingestion of soil containing radioactive material, is generated by alpha-emitting radionuclides including uranium (U-238), radium (Ra-226), thorium (Th-230), and radon (Rn-222). External radiation hazards, which are those characterized by the absorbance of a penetrating radioactive field, are produced by gamma-emitting radionuclides such as bismuth (Bi-214), a decay progeny of uranium.

Within the uranium decay chain, Ra-226 (and its decay progeny) are typically associated with the greatest levels of radiation exposure. If soil containing uranium is ingested, uranium can also exert adverse health effects through its properties as a heavy metal. However, levels of exposure to natural uranium that are safe for its radiogenic health effects are lower than those that are associated with its effects as a heavy metal.

According to the Navajo Nation AUM Response Trust Health and Safety Plan, the principal hazards of the study area are related to U-238 and its decay products. The primary human exposure pathway is identified as radionuclide-containing respirable particles, having similar protections required for exposure to airborne silica dust.

Preliminary Determination of AUM Exclusion Areas

METHODOLOGY

Initial exclusion areas were identified by calculating radionuclide concentrations and exposure rates (hereafter referred to as trigger levels) that correspond to a dose of radiation exposure considered to be safe for workers based on reasonable maximum exposure levels that may be associated with construction of the solar arrays. In the context of this evaluation, 'location' refers to the area of soil that a worker is standing on and contacting.

For the purposes of establishing preliminary trigger levels, the reasonable maximum exposure was defined as a solar array installation worker who was assumed to work at the same location for 10 hours a day for 30 continuous days. Exposure to radionuclides at the location was assumed to occur through external exposure to ionizing radiation, incidental ingestion of soil containing radionuclides, and inhalation of soil-derived dust containing radionuclides. A radionuclide dose of 25 millirem per year (mrem/yr) was used to define a 'safe dose'. This dose is the standard that is applied by the Nuclear Regulatory Commission (NRC) during the decommissioning of radiation sites. For comparison, NRC establishes that a radiation dose of 100 mrem/yr above background, or four times the dose that is being used to establish Site trigger levels, is safe for the general public.

The calculations indicate that the following measures of radiation would be associated with a radiation dose of 25 mrem/yr for a solar array installation worker under the exposure conditions described above:

- Average absorbed Picocuries per gram (pCi/g):
  - 70 pCi/g radium-226[1]
- Gamma radiation in counts per minute (cpm):
  - 280,000 cpm[2]
- Gamma radiation in microentogens per hour (uR/hr[3]):
  - 83 uR/hr[3]

[1] Calculated using ResRad on-site (v. 7.2) for exposure to Ra-226, 300 hours per year, assuming external, soil ingestion, dust inhalation, and radon pathways complete.
[2] Derived using sodium iodide to Ra-226 regression developed by Stantec: Gamma (cpm) = 3,635 x Surface Soil Ra-226 (pCi/g) + 14,212, and applying a Ra-226 activity of 70 pCi/g to the equation.
[3] Calculated as: Exposure rate (uR/hr) at dose of 25 mrem/yr = 25 mrem/yr x 1000 urem/mrem) / (Q factor for gamma radiation [1 urem/uR] x 10 hr/day x 30 day/yr).

The 2018 Boyd Tisi no. 2 Removal Report indicates that surface gamma survey results may be correlated with Ra-226 concentrations in soil. As ground and aerial-based gamma radiation survey data is available, this is used as a proxy for elevated concentrations of Ra-226 (Stantec, 2018).

Discussion of Preliminary AUM Exclusion Areas

The available AUM and NORM radiation measurements collected throughout the study area by the USEPA, DOE, and NNEPA are below the trigger levels identified above (see Table 1 for 2011 ground gamma radiation information). Based on this data, AUM exclusion areas are not required for the protection of workers against radiation under the exposure scenario described above. Aerial gamma survey information indicates that the study area NORM is well below the threshold (where data is available) and no NORM-related exclusion or avoidance measures are recommended at this time.

This is a preliminary assessment based on available information. Exclusion areas may be refined based on project-specific solar array installation exposure scenarios within the context of the total radiation dose a worker may receive while constructing the project. Additional information on solar-field project design and construction factors is necessary to move into the next phase of the project, where preliminary recommendations are to be evaluated based on actual worker scenarios and verified with field authentication and toxicology assessments.

Table 1 – 2011 Field Transect Gamma Radiation Data by AUM

Mine Name	2011 Background Gamma – CPM*	Max. 2011 Gamma -CPM*
Solar Field		
Evans Huskon no. 34	12,296	43,269
Charles Huskon no. 20	12,296	185,938
Harvey Begay no. 1	13,535	21,224
Elwood Canyon no. 1	13,535	27,821
Max Johnson no. 9	13,535	28,957
Alyce Tolino no. 1 & no. 2	13,535	39,957
Evans Huskon no. 2	15,819	219,808
Yazzie no. 101	15,819	83,094
Yazzie no. 312	14,187	24,415
Boyd Tisi no. 2	11,523	130,000 (appx)
Juan Horse no. 3	11,523	20,000 – 50,000 (appx range)
Juan Horse no. 4	11,781	26,792
Gen-tie Corridor		
Charles Huskon no. 14	12,567	205,128
Montezuma no. 1	11,190	30,788

Notes:
**All data from 2011 United States Environmental Protection Agency Site Assessment reports.*

DOE aerial terrestrial gamma radiation and excess bismuth-214 flyover data generated in September and October of 1997 indicates a sharp contrast in respective values between mines that were previously reclaimed (circled in black in Figures 4 and 5) compared to those that were un-reclaimed (circled in red in Figures 4 and 5). For example, the Boyd Tisi no. 2, Juan Horse no. 3, and Juan Horse no. 4 mines show no increase in gamma radiation or excess bismuth as compared to the surrounding area. Conversely, un-reclaimed mines all show notable increases in both gamma radiation and excess bismuth above background levels. Interestingly, concentration isocontours seem to follow mine features, including both the pit and waste rock pile outlines (Figures 4 and 5).

Based on this observation, it is assumed that reclamation conducted after the 1997 flyover on the Evans Huskon no. 34, Charles Huskon no. 20, Yazzie no. 312, Evans Huskon no. 2, Yazzie no. 101, Alyce Tolino nos. 1 & 3, Max Johnson no. 9, and Elwood Canyon no. 1 mines has similarly led to a major decrease in terrestrial gamma radiation, assuming similar reclamation techniques. According to DOE flyover data, these reclamation practices were highly successful at limiting surface radiation.

Aerial gamma radiation and excess bismuth survey data from the 2001 (publication date) DOE study excludes portions of the north central and southeastern study area. However, no AUMs have been reported in these areas, and it is assumed that no major deviations from background levels occur.

While available radiological data from the study area suggests that an exclusion is not necessary based on worker health parameters, a 100-foot AUM land-use buffer (see Figure 6 for examples) is recommended due to ongoing, multi-entity AUM assessment and mitigation. Site removal studies typically integrate a 100-foot AUM investigation area outside of the mine boundaries where soil sampling and gamma radiation transects occur. This allows for evaluation of hazardous conditions outside of the identified AUM and it is expected that this practice may continue as other AUMs in the study area are assessed.

A 100-foot buffer allows for the reclamation of the AUM by permitting adequate access to the impacted areas. To better understand the timing of ongoing USEPA and Navajo Trust AUM assessments and reclamation efforts, Appendix B provides an overview of the current reclamation status for each AUM in the confines or within 1,000 feet of the study area.

Initial Modeling of Recommended AUM Buffer Zones

For each of the AUMs in the study area, a 100-foot buffer zone is digitally mapped to provide a conceptual model (Figures 6 and Figure 7). This buffer zone is then merged into the original acreage of the AUM to provide an estimate of the overall area to be avoided. The acreage removed from within the solar area by 100-foot AUM buffer zones is modeled at 231.79 total acres (Figure 8), leaving a total of approximately 8,327 acres for solar array installation notwithstanding other possible exclusions for suitability, permitting, grazing, or environmental issues.

Findings and Conclusions

The radiation measurements collected throughout the study area by the USEPA, DOE, and the NNEPA are consistently below the trigger levels calculated on the worker exposure assumptions discussed above. Based on this data, AUM and NORM exclusion areas are not needed for the protection of workers against radiation exposures. Final AUM-related exclusion areas should be refined based on project-specific exposure scenarios within the context of the total radiation doses workers may receive while constructing the project.

For each of the AUMs in the study area, Haley & Aldrich recommends a 100-foot buffer zone. The 100-foot buffer allows for the reclamation of the AUM by permitting adequate access to the impacted areas and ensures that all activities needed for project development do not impact known AUM sites creating the potential for CERCLA liability. The total acreage removed from the study area by the AUMs and 100-foot AUM buffer zones is less than 250 acres, notwithstanding other possible exclusions for suitability, permitting, or environmental issues.

Additional field data verification, limited soil sampling and analysis, and site-specific toxicology and exposure assessments are recommended to support assumptions discussed in this memorandum. In addition to evaluating initial exclusion recommendations, these studies would also be used in the development of site-specific health and safety protocols for the eventual construction, operation, and maintenance of the solar project.

Closing

Haley & Aldrich appreciates the opportunity to contribute to sPower's due diligence by using existing data to preliminarily screen study area AUMs and recommend an initial land-use buffer zone. We look forward to the potential for future collaboration. Please contact Jason Abplanalp at *jabplanalp@haleyaldrich.com* or (814) 574-4121 (cell) if you wish to discuss any aspect of the project.

Enclosures:

Figure 1 – Study Area
Figure 2 – Abandoned Uranium Mines of the Study Area
Figure 3 – Existing Site Conditions
Figure 4 – Terrestrial Gamma Radiation
Figure 5 – Excess Bismuth 214
Figure 6 – Proposed AUM Buffer Examples
Figure 7 – AUM Buffer Areas
Figure 8 – AUM Buffer within Solar Area
Appendix A – Geology of the Study Area
Appendix B – Study Area Reclamation History Timeline

References

1. Austin, S.R., 1964. Mineralogy of the Cameron Area, Coconino County, Arizona. U.S. Atomic Energy Commission Raw Materials Exploration Report RME-99. 99p.

2. Chenoweth, W.L., 1993. Geology and Production History of the Uranium Ore Deposits in the Cameron Area, Coconino County, Arizona. Arizona Geological Survey Contributed Report 93-B. 32p.

3. Covid 19 Update, 2020. Navajo AUM RSE Trust Phase 2. Accessed at: www.navajoaumtrust2.org.

4. Kresan, P., 1980. Uranium Mines and Deposits, Cameron Area, Coconino County, Arizona. Arizona Geological Survey Contributed Report CR-93-B. Map.

5. Stantec, 2016. Navajo Nation AUM Environmental Response Trust -- First Phase Health and Safety Plan. Prepared for the Navajo Nation AUM Environmental Response Trust. 61p.

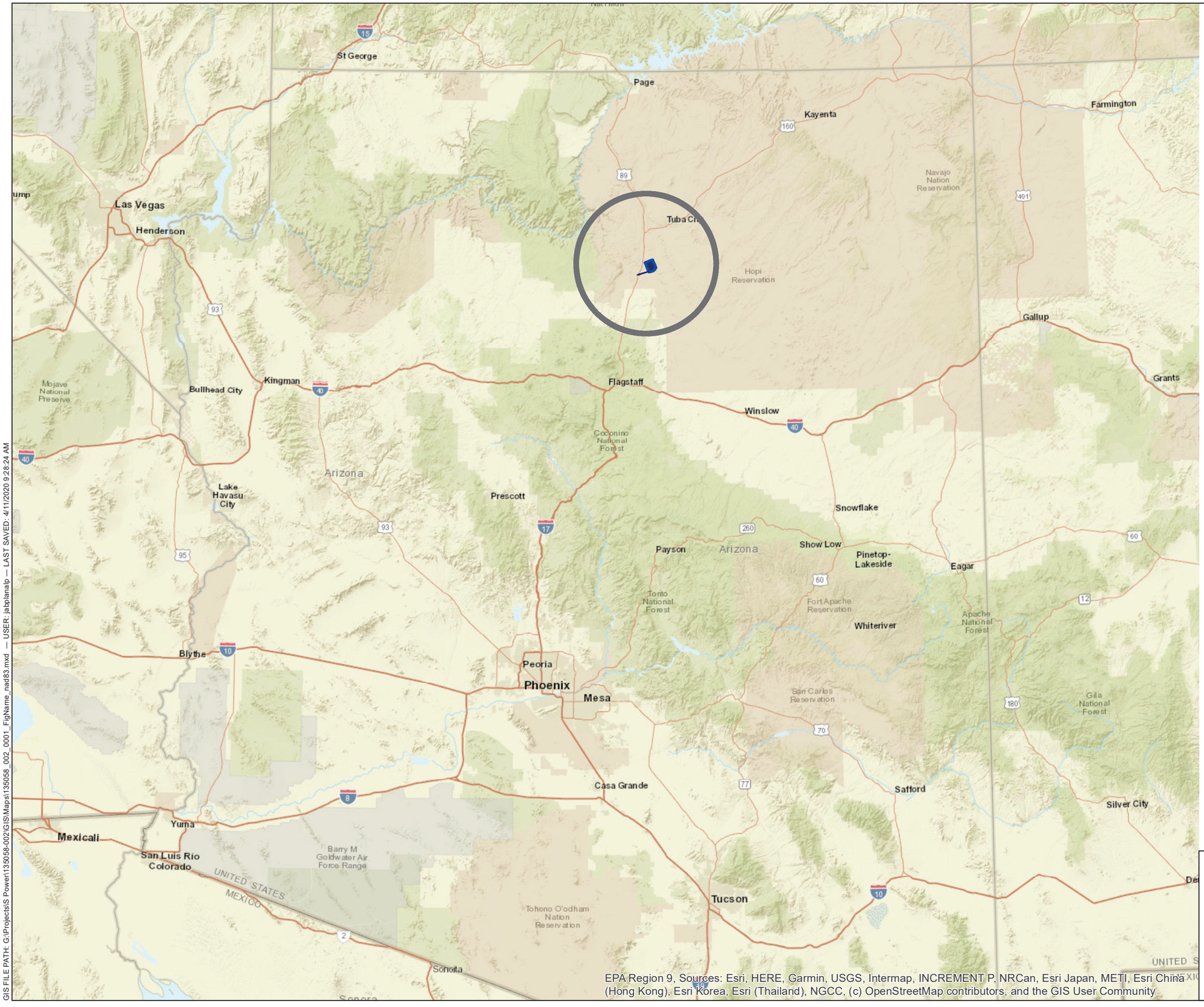
6. Stantec, 2018. Boyd Tisi no. 2 (#135) Removal Site Evaluation Report. SEMS-RM 100016416. Prepared for the EPA. 410p.

7. SWCA Environmental Consultants, 2020. DRAFT Phase I Environmental Site Assessment for the Painted Desert Power, LLC, Project, Coconino County, Arizona. Prepared for S-Power. 425p.

8. U.S. Department of Energy, 2001. An Aerial Radiological Survey of Abandoned Uranium Mines in the Navajo Nation. DOE NV 11718-602. August 2001. 31p.

9. U.S. Environmental Protection Agency, 2012. Region 9 GIS Database. Accessed at https://gispub.epa.gov/arcgis/rest/services/Region9.

FIGURES



LEGEND

- Gen-tie Corridor
- Solar Project Area

N

0 200,000 400,000

SCALE IN FEET

HALEY ALDRICH

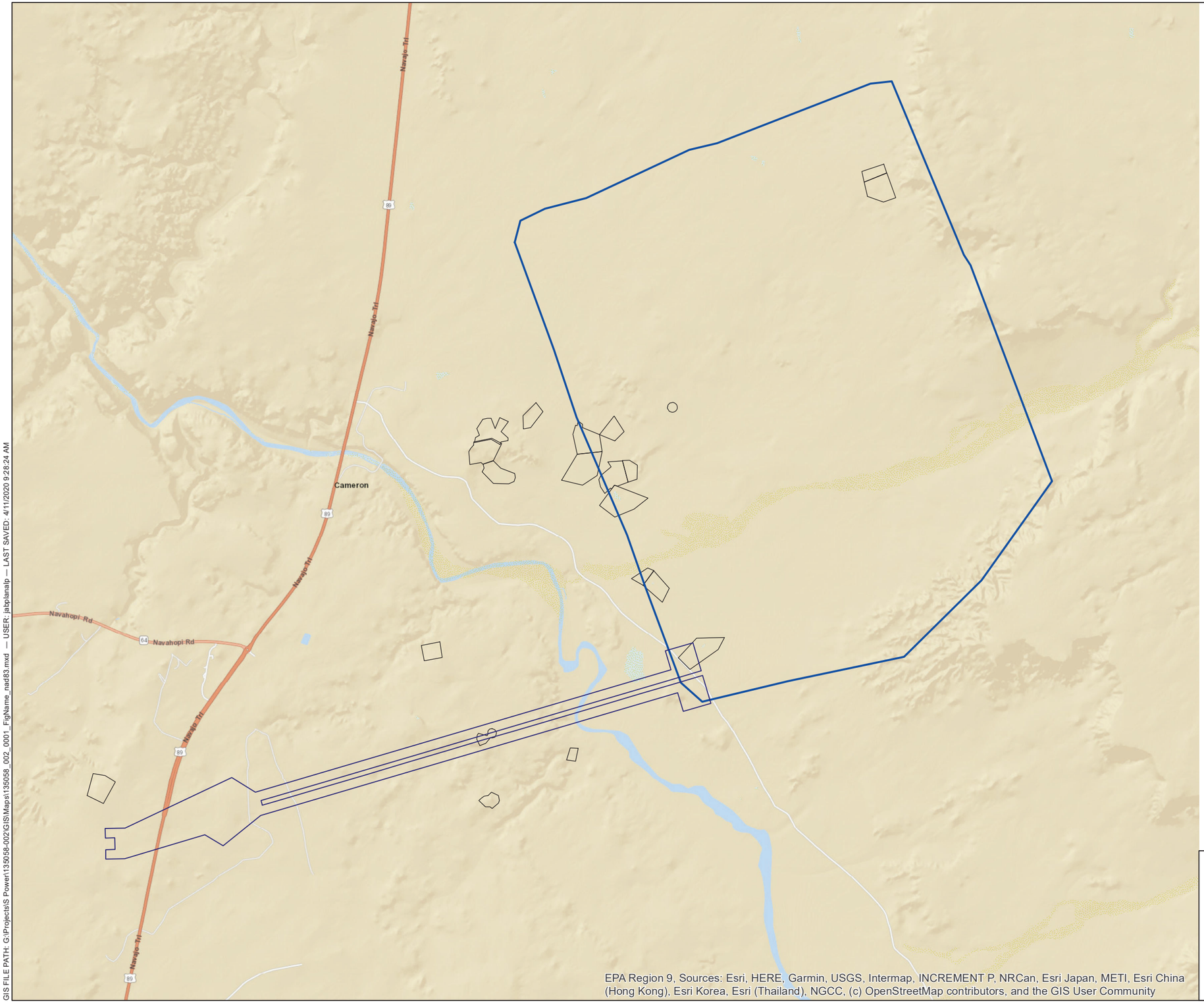
S POWER
CAMERON SOLAR PROJECT
CAMERON, AZ

STUDY AREA

APRIL 2020

FIGURE 1

GIS FILE PATH: G:\Projects\S Power\135058-002\GIS\Maps\135058_002_0001_FigName_nad83.mxd — USER: jabplanalp — LAST SAVED: 4/11/2020 9:28:24 AM



LEGEND

- Gen-tie Corridor
- Solar Project Area
- AUM Outline

N

0 4,100 8,200

SCALE IN FEET

HALEY ALDRICH

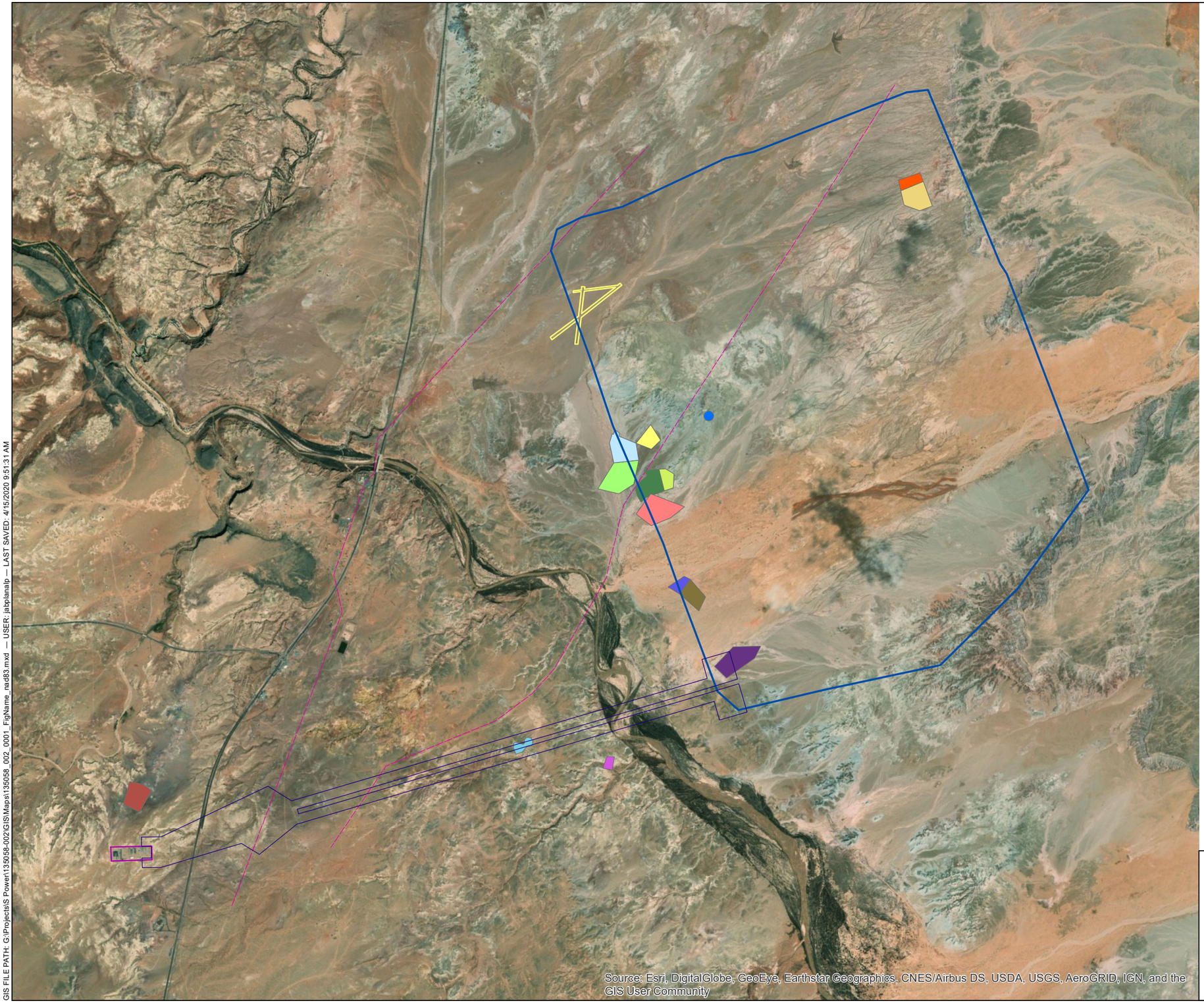
S POWER
CAMERON SOLAR PROJECT
CAMERON, AZ

ABANDONED URANIUM MINES OF THE STUDY AREA

APRIL 2020

FIGURE 2

GIS FILE PATH: G:\Projects\S Power\135058-002\GIS\Maps\135058_002_0001_FigName_nad83.mxd — USER: jatp/lanalp — LAST SAVED: 4/11/2020 9:28:24 AM



LEGEND

- Gen-tie Corridor
- Solar Project
- Pipelines
- Abandoned Runways
- Gen-tie Substation
- AZ_Major_Roads
- A & B No. 2
- Alyce Tolino 1 & 3
- Boyd Tisi 2
- Charles Huskon 14
- Charles Huskon 20
- Elwood Canyon 1
- Evans Huskon 2
- Evans Huskon 34
- Harvey Begay 1
- Juan Horse 3
- Juan Horse 4
- Max Johnson 9
- Montezuma No. 1 (rough)
- Yazzie 101
- Yazzie 312

N

0 4,100 8,200

SCALE IN FEET

HALEY ALDRICH

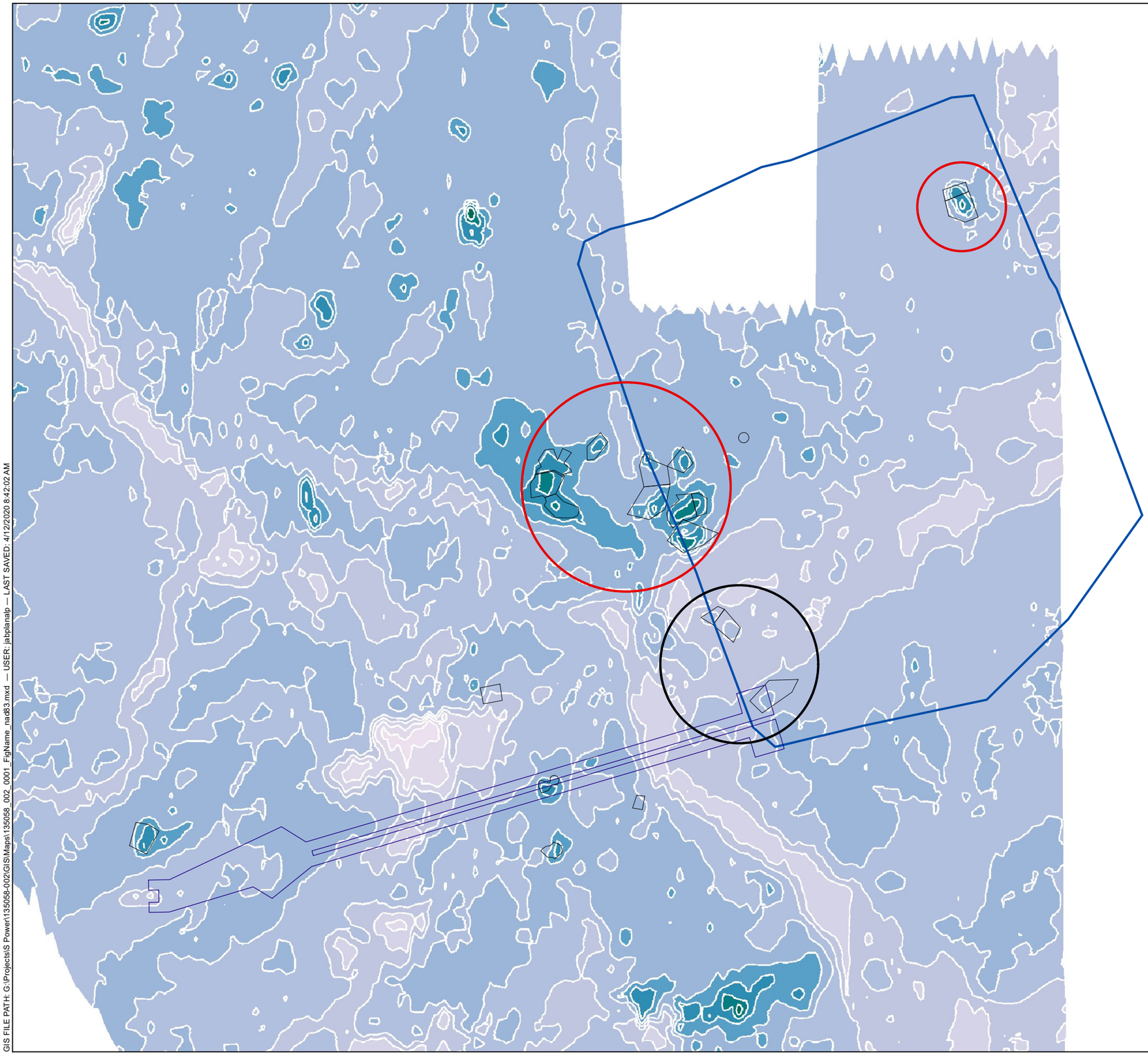
S POWER
CAMERON SOLAR PROJECT
CAMERON, AZ

EXISTING SITE CONDITIONS

APRIL 2020

FIGURE 3

GIS FILE PATH: G:\Projects\S Power\135058-002\GIS\Maps\135058_002_0001_FigName_nad83.mxd — USER: jalp\lanalp — LAST SAVED: 4/15/2020 9:51:31 AM



LEGEND

Solar Project

Gen-tie Corridor

AUM Outline

Total Terrestrial Gamma Activity Ground Surface Exposure Rate

microroentgens per hour (µR/h)

- less than 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7
- 7 - 9
- 9 - 12
- 12 - 16
- 16 - 24
- 24 - 37
- 37 - 60
- greater than 60

N

0 4,100 8,200

SCALE IN FEET

EPA Region 9

HALEY ALDRICH

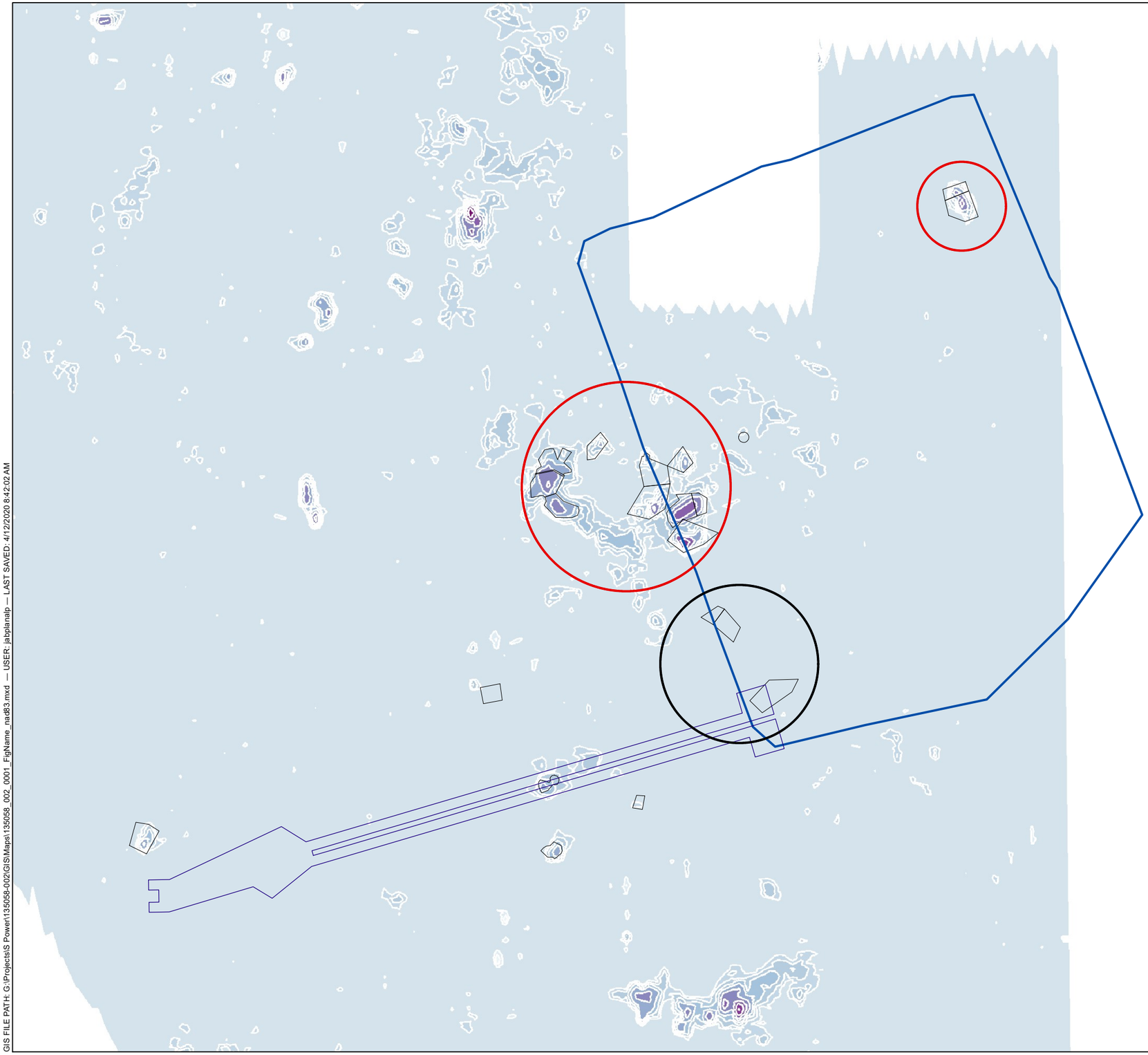
S POWER
CAMERON SOLAR PROJECT
CAMERON, AZ

TERRESTRIAL GAMMA RADIATION

APRIL 2020

FIGURE 4

GIS FILE PATH: G:\Projects\S Power\135058-002\GIS\Maps\135058_002_0001_FigName_nad83.mxd — USER: jabplanalp — LAST SAVED: 4/12/2020 8:42:02 AM



LEGEND

Solar Project

Gen-tie Corridor

AUM Outline

Excess Bismuth 214 Ground Surface Exposure Rate

microroentgens per hour (µR/h)

- less than -3.5
- -3.5 - -2.4
- -2.4 - 0
- 0 - 2.4
- 2.4 - 3.5
- 3.5 - 5.2
- 5.2 - 7.4
- 7.4 - 10.9
- 10.9 - 16.2
- 16.2 - 23.6
- 23.6 - 34.9
- 34.9 - 52.4
- greater than 52.5

N

0 4,100 8,200

SCALE IN FEET

EPA Region 9

HALEY ALDRICH

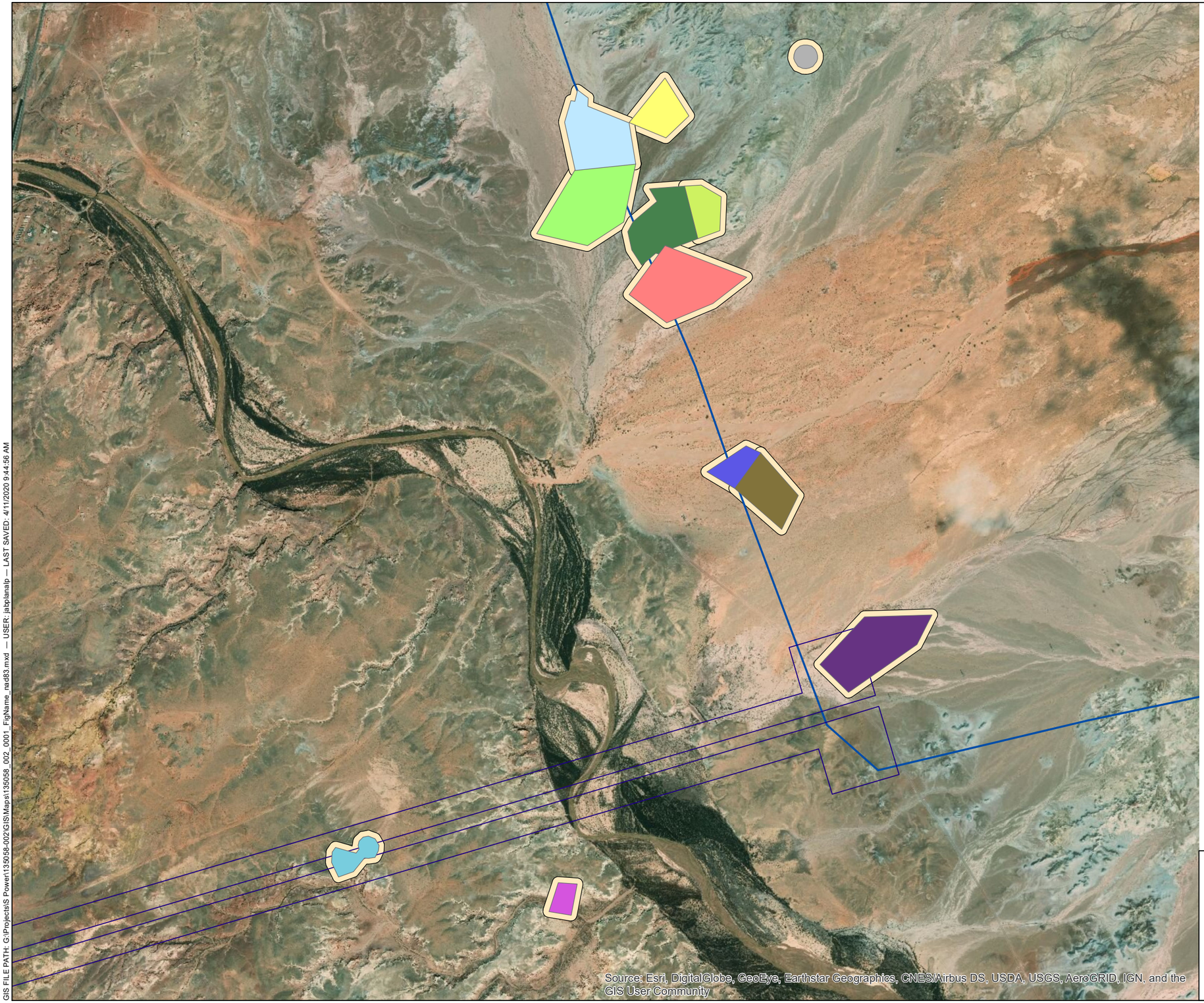
S POWER
CAMERON SOLAR PROJECT
CAMERON, AZ

EXCESS BISMUTH 214

APRIL 2020

FIGURE 5

GIS FILE PATH: G:\Projects\S Power\135058-002\GIS\Maps\135058_002_0001_FigName_na83.mxd — USER: jalopianalp — LAST SAVED: 4/12/2020 8:42:02 AM



LEGEND

- 100 ft Land Use Buffer
- Gen-tie Corridor
- Solar Project
- Alyce Tolino 1 & 3
- Boyd Tisi 2
- Charles Huskon 14
- Elwood Canyon 1
- Evans Huskon 2
- Harvey Begay 1
- Juan Horse 3
- Juan Horse 4
- Max Johnson 9
- Montezuma No. 1 (rough)
- Yazzie 101
- Yazzie 312

N

0 1,700 3,400

SCALE IN FEET

HALEY ALDRICH

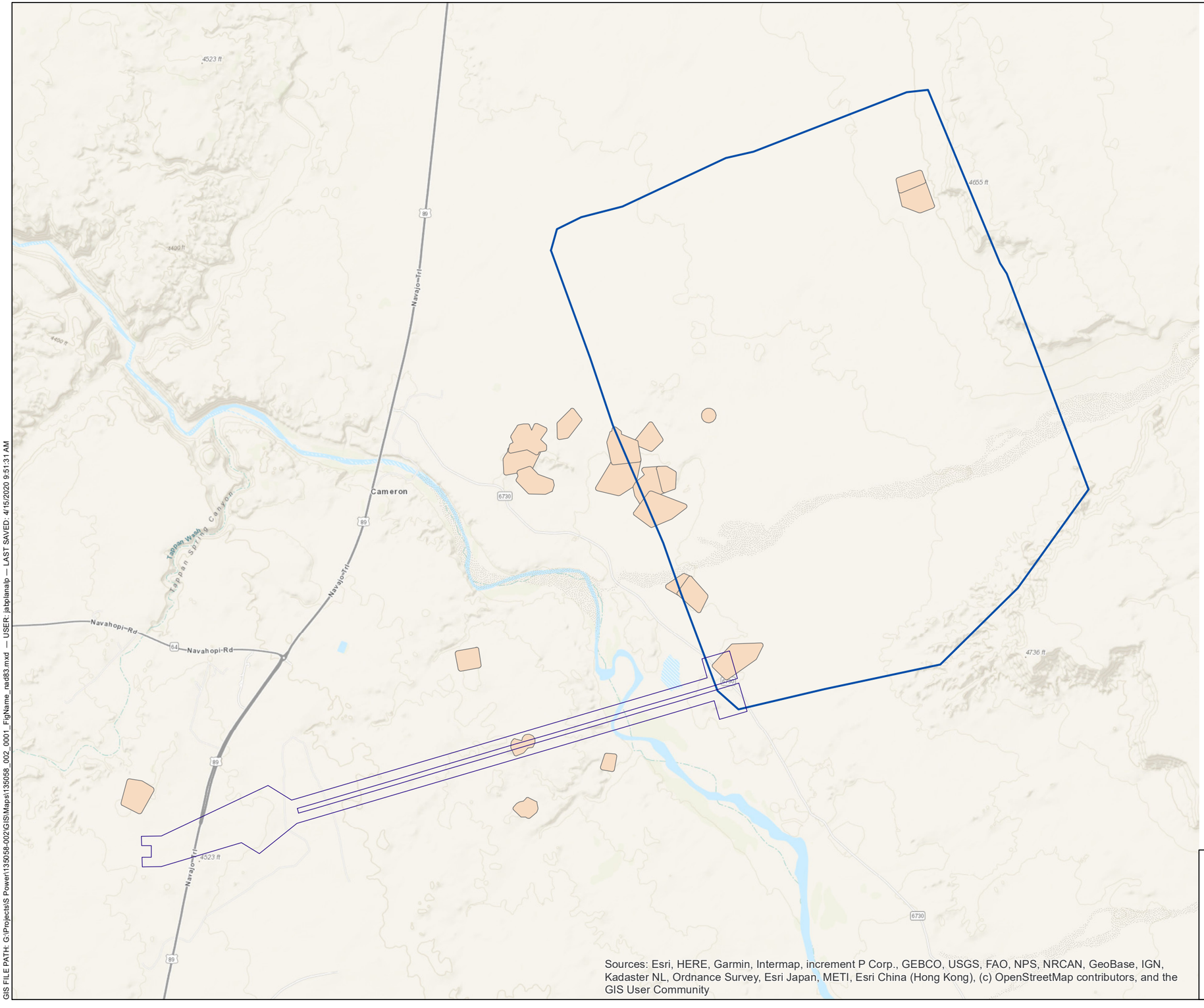
S POWER
CAMERON SOLAR PROJECT
CAMERON, AZ

PROPOSED AUM BUFFER EXAMPLES

APRIL 2020

FIGURE 6

GIS FILE PATH: G:\Projects\S Power\135058-002\GIS\Maps\135058_002_0001_FigName_nad83.mxd — USER: jalplanalp — LAST SAVED: 4/11/2020 9:44:56 AM



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

LEGEND

- Gen-tie Corridor
- Solar Project
- 100 ft Land Use AUM

N

0 4,100 8,200

SCALE IN FEET

HALEY ALDRICH

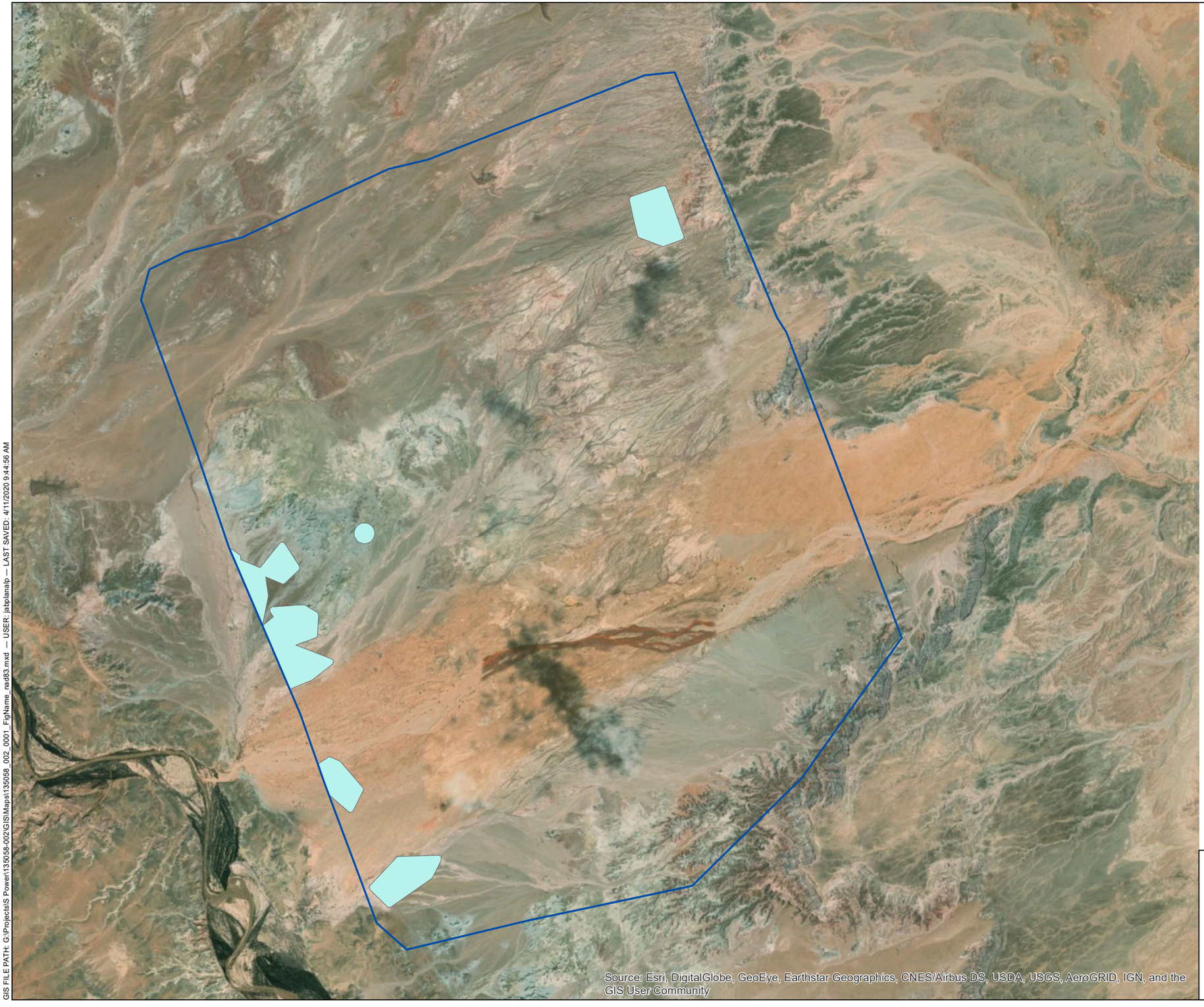
S POWER
CAMERON SOLAR PROJECT
CAMERON, AZ

AUM BUFFER AREAS

APRIL 2020

FIGURE 7

GIS FILE PATH: G:\Projects\S Power\135058-002\GIS\Maps\135058_002_0001_FigName_nad83.mxd — USER: jatplanalp — LAST SAVED: 4/15/2020 9:51:31 AM



LEGEND

- Solar Project Area
- AUM Buffer SA

N

0 2,900 5,800

SCALE IN FEET

HALEY ALDRICH

S POWER
CAMERON SOLAR PROJECT
CAMERON, AZ

AUM BUFFER WITHIN SOLAR AREA

APRIL 2020

FIGURE 8

GIS FILE PATH: G:\Projects\S Power\135058-002\GIS\Maps\135058_002_0001_FigName_nad83.mxd — USER: jalplanalp — LAST SAVED: 4/11/2020 9:44:56 AM

APPENDIX A

Geology of the Study Area

Appendix A

GEOLOGY OF THE STUDY AREA – URANIUM DEPOSITS

The study area sits within the southwestern quarter of the Colorado Plateau geologic province, which in Arizona is generally comprised of thick successions of flat-lying upper Paleozoic through mid-Mesozoic sedimentary rocks. In the Cameron area, erosional waters shed from the surrounding ridges into the Little Colorado River and have exposed beds of the lower Triassic Chinle Formation. This geologic formation is subdivided into three members, two of which comprise the study area (Chenoweth, 1993). The Petrified Forest Member, which produced a vast majority of all material mined from the region, outcrops east of the Little Colorado River, while the Shinarump Member outcrops west of the river corridor (Kresan, 1980).

Orebodies are characterized as shallow, lenticular deposits of fine to medium-grained sandstone and conglomerate that contain notable amounts of carbonaceous material. Carbonaceous fossil logs are common in the orebodies, and often contain the highest-grade ore. The sandstone lenses are thin, ranging up to 6 feet in total thickness and are laterally discontinuous. Maximum reported ore body depth from within the Cameron District is 130 feet (Chenoweth, 1993).

The ore consists primarily of secondary uranium-vanadium minerals that infill pore space between sandstone grains and in fossil logs. The mineralogy of the deposits is complex, and uraninite (UO_2) exists in both oxidized and unoxidized zones of the ore (Chenoweth, 1993). Oxidation of the sulfide ore produced a complex collection of uranium oxides, sulfates, phosphates, carbonates, silicates, vanadates, and molybdates. The weathering of the sulfides produces a yellow-tinted soil, which was used as a prospecting guide (Austin, 1964). On average, 0.21 percent of ore material was comprised of uranium minerals (Chenoweth, 1993).

Mining History of the Study Area

The first commercial discovery of ore in the Cameron area was by Charles Huskon in 1952. Additional discoveries followed in 1953 upon the release of U.S. Atomic Energy Commission radiometric flight data. Subsurface deposits were located by intensive shallow drilling programs and by the late 1950s at least 19 mines were operating within or adjacent to the study area (Chenoweth, 1993).

Mining permits were issued by the Navajo Tribal Council, receiving ultimate approval by the Bureau of Indian Affairs (BIA). These permits were to be issued to tribal members only, although once issued, the mining permits could be reassigned upon Council and BIA approval. Mining permits were generally issued on 2-year terms and were given designations after the name of the permittee. Royalties were paid to the tribe and to the permittee, with the former receiving between 10 to 20 percent and the latter 2 to 5 percent (Chenoweth, 1993).

Mining within the study area was primarily by open pit method that was limited by depth and lateral extent due to the discontinuous nature of the deposits. Miners found stripping ratios greater than 13-to-1 waste to ore were uneconomic and as such, most open pits were small and shallow. Some small pits and trenches targeted single fossil logs as the source of ore and maximum pit depth of Cameron-area mines is reportedly 130 feet (Chenoweth, 1993). Underground mining was uncommon and did not occur within the confines of the study area.

The nearest uranium mill site to the study area was located in Tuba City, approximately 21 direct miles to the northeast. This mill was constructed in 1955 and began accepting ore from the Cameron region in February of 1956. With a nearby point of sale, production from the area peaked during this year, dropping off rapidly beginning in 1959. The Tuba City mill closed in late 1962, and the last ore produced from Cameron-area mines is reported from 1963 (Chenoweth, 1993).

Total production of the mines within or nearby the study area is estimated at 264,000 pounds of U_3O_8, comprising over 20 percent of the total production from the Cameron region. It is reported that the high-density cluster of mines located to the east of the Little Colorado River bridge and partially within the study area were the most productive in the area (Chenoweth, 1993).

APPENDIX B

Study Area Reclamation History Timeline

Appendix B

STUDY AREA RECLAMATION HISTORY TIMELINE

Mid to late 1990s –The Navajo Nation Abandoned Mine Lands program reclaims AUMs across the study area using heavy machinery to address unsafe surface conditions. Waste stockpiles are commonly pushed into mine workings and native material is utilized as a cap. Boyd Tisi no. 2, Juan Horse no. 3, and Juan Horse no. 4 were reclaimed prior to 1997. Evans Huskon no. 34, Charles Huskon no. 20, Yazzie no. 312, Evans Huskon no. 2, Yazzie no. 101, Alyce Tolino nos. 1 & 3, Max Johnson no. 9, and Elwood Canyon no. 1 AUMs were reclaimed after 1997. Charles Huskon no. 14 is the only mine within the study area not reclaimed at this time. According to the United States Environmental Protection Agency (USEPA), reclamation activities conducted by the Navajo Nation in the 1990s was primarily driven by the need to eliminate physical hazards.

January through August 2011 – The USEPA conducts initial screening of AUMs within the study area by conducting gamma radiation transect surveys. Individual site screening reports are published for each AUM and these reports allow for the prioritization of seven high-priority mines, including the Boyd Tisi no. 2 AUM within the study area.

5 August 2013 – El Paso Natural Gas, LLC and Region 9 of the USEPA sign the Administrative Settlement Agreement and Order on Consent for Mine Assessments and Interim Removal Actions. This agreement is modified in 2017 by the USEPA. Under this agreement, El Paso Natural Gas is financially responsible for the assessment and initial mitigation costs associated with 19 AUMs, including the Evans Huskon no. 2 and the Charles Huskon no. 14 AUMs of the study area. A 2019 legal settlement determined that El Paso Natural Gas is financially responsible for 65 percent of the total mitigation costs associated with these AUMs.

8 April 2015 – The Navajo Nation and the United States Government enter into the Phase 1 Settlement, which calls for the assessment of 16 priority AUMs on Navajo lands. One of these, the Boyd Tisi no. 2, is within the study area. Site removal reports are to be published in 2018.

2016 – The USEPA sends a notice to former mine operator Wells Cargo indicating that they are potentially responsible for three mine claims in the western AUM region. One of these, Juan Horse no. 3, is identified as a priority mine and is located within the study area. Work is to be completed by the US EPA, with Wells Cargo potentially reimbursing the agency.

13 July 2016 – Navajo Nation and United States Government enter the Phase 2 Settlement, which calls for the assessment of 30 AUMs on Navajo lands. Of these, 5 are within the study area (Elwood Canyon no. 1, Alyce Tolino no. 1 & no. 2, Yazzie no. 101, and Yazzie no. 312). The Phase 2 Trust is to be the source of funds for the clean-up and mitigation of the Phase 1 mines (including Boyd Tisi no. 2). No completion is specified.

8 January 2018 – EnPro Holdings (successor to A & B Mining) enters agreement with the USEPA to conduct site assessments and surface screening of three AUMs in the Cameron-Tuba City region. This includes the A & B no. 2 mine.

17 September 2019 – Phase 2 Removal Site Evaluation (RSE) surface sampled and radiation scanned 13 AUM sites and 2 background locations east of Cameron, including those of the study area. This data is currently being mapped at this time. Future Phase 2 RSE work within the study area may include boring and sampling at locations with elevated levels of radioactive contamination to determine depth of impact (RSE Fieldwork, 2019).

10 March 2020 – In response to COVID-19, the Navajo Environmental Protection Agency issued a precautionary memorandum that restricted travel and promoted social distancing to prevent the spread of the virus. As a result of this memorandum, all field and contractor work associated with the Phase 2 RSE Trust has been suspended. At this time, a work-at-home directive is in effect for the Trust until 30 April, at which time conditions will be re-evaluated to resume field work for the development of removal reports on the Cameron-area Trust Phase 2 mines (Covid 19 Update, 2020).

Study Area AUM Reclamation Status

Mine Name	Management	Screening Report	Removal Report	Final Reclamation
Solar Field				
Evans Huskon no. 34	Not Assigned	Completed 1/2011	Unknown	Unknown
Charles Huskon no. 20	Not Assigned	Completed 1/2011	Unknown	Unknown
Harvey Begay no. 1	Not Assigned	Completed 8/2011	Unknown	Unknown
Elwood Canyon no. 1	Trust RSE Phase II	Completed 8/2011	Field work – 9/2019 Report in works	TBD
Max Johnson no. 9	Wells Cargo Mine	Completed 8/2011	Unknown	Unknown
Alyce Tolino no. 1 & no. 2	Trust RSE Phase II	Completed 8/2011	Field work – 9/2019 Report in works	TBD
Evans Huskon no. 2	El Paso Natural Gas (EPNG)	Completed 8/2011	Unknown	Unknown – 4/2019 US Court ruling of 65% EPNG responsibility
Yazzie no. 101	Trust RSE Phase II	Completed 8/2011	Field work – 9/2019 Report in works	TBD
Yazzie no. 312	Trust RSE Phase II	Completed 8/2011	Field work – 9/2019 Report in works	TBD
Boyd Tisi no. 2	Trust RSE Phase I	Completed 1/2011	Completed – 10/2018	2021 (est.)
Juan Horse no. 3	Wells Cargo Mine	Completed 1/2011	Unknown	Unknown
Juan Horse no. 4	Not Assigned	Completed 1/2011	Unknown	Unknown

Mine Name	Management	Screening Report	Removal Report	Final Reclamation
Gen-tie Corridor				
Charles Huskon no. 14	El Paso Natural Gas (EPNG)	Completed 1/2011	Field work 2019-2020 Report in works -2020 (est)	Unknown - 4/2019 US Court ruling of 65% EPNG responsibility
Montezuma no. 1	Not Assigned	Completed 1/2011	Unknown	Unknown
A&B no. 2	EnPro Holdings	Completed 1/2011	Unknown	Unknown

Notes:

Wells Cargo mine removal reports responsibility of USEPA, with a 2018 target completion date. As of 4/3/2020, no reports have been produced and no response to inquiries have been provided by the agency at this time.

El Paso Natural Gas mine removal reports to be provided by 2018. Ongoing litigation delayed action until April 2019 and reporting is currently ongoing.

Phase I Trust mine removal reports published in early 2019. Phase II investigations currently one year or more behind schedule.
Screening Reports managed by the USEPA. Removal reports managed by ESE Trust-engaged consultant.