

Aggregate Sources for Construction and Maintenance in Northern Arizona



Arizona Department of Transportation Research Center

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16. Abstract Constructing and maintaining Arizona's highway system requires a dependable, abundant supply of mineral aggregates, borrow, quarried rock, and other materials. Finding such sources is important in northern Arizona, where suitable materials may be limited and land jurisdictions, including sovereign American Indian nations and lands administered by the State of Arizona and federal agencies, are difficult to develop for such purposes. The Flagstaff, Globe, Holbrook, Kingman, and Prescott districts of the Arizona Department of Transportation (ADOT), encompassing Apache, Coconino, Mohave, Navajo, and Yavapai counties, may require up to 46 million tons of material for pavement preservation, safety improvements, widening, or reconstruction of traffic interchanges on the Interstate system and maintenance over the next 20 years. This study focuses on potential sources within a 10-mile-wide corridor along the existing Interstates, U.S. highways, and state routes in the five-county project area; the project team identified 285 sites that may be suitable. The team estimates that these sites may require three months to three years to develop, depending on the time needed for environmental clearance and permitting, site exploration and characterization, and site development, including building haul routes to move materials for highway projects. An implementation plan was outlined for ADOT that provides a process to determine which sites should be reviewed and cleared.			
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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
AREA				
in ²	square inches	645.2	square millimeters	mm ²
ft ²	square feet	0.093	square meters	m ²
yd ²	square yard	0.836	square meters	m ²
ac	acres	0.405	hectares	ha
mi ²	square miles	2.59	square kilometers	km ²
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft ³	cubic feet	0.028	cubic meters	m ³
yd ³	cubic yards	0.765	cubic meters	m ³
NOTE: volumes greater than 1000 L shall be shown in m ³				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
ILLUMINATION				
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m ²	cd/m ²
FORCE and PRESSURE or STRESS				
lbf	poundforce	4.45	newtons	N
lbf/in ²	poundforce per square inch	6.89	kilopascals	kPa
APPROXIMATE CONVERSIONS FROM SI UNITS				
Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
AREA				
mm ²	square millimeters	0.0016	square inches	in ²
m ²	square meters	10.764	square feet	ft ²
m ²	square meters	1.195	square yards	yd ²
ha	hectares	2.47	acres	ac
km ²	square kilometers	0.386	square miles	mi ²
VOLUME				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m ³	cubic meters	35.314	cubic feet	ft ³
m ³	cubic meters	1.307	cubic yards	yd ³
MASS				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
TEMPERATURE (exact degrees)				
°C	Celsius	1.8C+32	Fahrenheit	°F
ILLUMINATION				
lx	lux	0.0929	foot-candles	fc
cd/m ²	candela/m ²	0.2919	foot-Lamberts	fl
FORCE and PRESSURE or STRESS				
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in ²

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2003)

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LIST OF ACRONYMS

AB	aggregate base
AZSITE	Arizona Archaeological Site and Survey database
ADOT	Arizona Department of Transportation
ADMMR	Arizona Department of Mines and Mineral Resources
AZMILS	Arizona Mineral Industry Location System
ASLD	Arizona State Land Department
AC	asphalt concrete
ARFC	asphalt rubber friction course
ARAC	asphalt rubber asphalt concrete
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
FTP	file transfer protocol
GIS	geographic information system
JD	Jurisdictional Delineator
MRDS	Mineral Resource Data System (USGS)
SR	state route
SWPPP	Stormwater Pollution Prevention Plan
TAC	technical advisory committee
TRS	township, range, and section
TI	traffic interchange
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

EXECUTIVE SUMMARY

Constructing and maintaining Arizona's highway system requires a dependable and abundant supply of mineral aggregates, borrow, quarried rock, and other materials. These needs are particularly important in northern Arizona, where suitable materials may be limited and where land jurisdictions, including sovereign American Indian nations and lands administered by the State of Arizona and federal agencies, are difficult to develop for such purposes.

The Flagstaff, Globe, Holbrook, Kingman, and Prescott Districts of the Arizona Department of Transportation (ADOT), encompassing Apache, Coconino, Mohave, Navajo, and Yavapai counties, may require up to 46 million tons of materials to meet the districts' needs for pavement preservation, safety improvements, widening, or reconstruction of traffic interchanges to the Interstate system and maintenance over the next 20 years.

This study focuses on potential sources within a 10-mile-wide band along the existing Interstates, U.S. highways, and state routes within the five-county project area. A list of potential sites was developed by gaining access to federal, state, and local agencies' databases that identified potential materials sites. Study components initially included a review of all potential sources, regardless of land jurisdiction, an evaluation of the types of materials available (e.g., mineral aggregate, quarried rock), and development considerations. The technical advisory committee (TAC) later directed the research team not to consider sites on Arizona State Trust lands.

The project team identified 285 sites in the project area that may be suitable for future materials sources. These sites may require three months to three years to develop, depending on the length of time needed for environmental clearance and permitting, site exploration and characterization, and site development, including constructing haul routes to move materials for highway projects.

An implementation plan is presented for ADOT to use in prioritizing sites. It provides a process to determine which sites should be reviewed and cleared based on the type of materials available, the location of the site in relation to a highway corridor, and the amount of environmental clearance effort required. Use of this implementation plan should assist ADOT staff determine how to allocate resources and obtain quality materials economically.

Potential barriers to obtaining mineral resource sites include the proximity to existing development, land jurisdiction, and the suitability of sites in the absence of detailed exploration and site characterization.

CHAPTER 1. PROJECT GOAL

Introduction

The goal of this study was to evaluate the existing aggregate sources and identify new aggregate sources for highway construction and maintenance activities in northern Arizona (for this report, northern Arizona covers Mohave, Yavapai, Coconino, Apache, and Navajo counties).

The objectives of this project were:

- 1) Identify and evaluate the existing aggregate sources available for construction and maintenance.
- 2) Identify and evaluate the development potential of undeveloped aggregate deposits for use in construction and maintenance.
- 3) Determine the means by which these sources could be accessed and used.
- 4) Estimate the expected volumes of aggregates based on an illustrative set of construction and maintenance projects in northern Arizona anticipated over a 20-year time frame.

Background

This project was conceived to benefit both the Arizona Department of Transportation (ADOT) and the contracting industry, because it was becoming evident that readily available aggregate for construction and maintenance was becoming increasingly scarce.

Finding aggregate and borrow materials for highway construction and maintenance has become more difficult and, in many cases, more expensive. ADOT had explored and established materials sources for use by the contracting industry and, to some degree, for use by ADOT maintenance forces in the past. Because of changes in the quality and quantity requirements for materials from when sites were prospected to the time they may be designated for use, ADOT is open to the perceived risk of responsibility for the quality and quantity of the materials. Contractors are now required to be more responsible for the quality and quantity of the materials used in roadway construction. Thus, contractors are taking a greater interest in finding or establishing their own materials sources.

This approach has been reasonably effective for the construction industry to establish materials sources, but has not been as effective for ADOT maintenance forces. Because the focus was on contractors acquiring their own sources, ADOT began to reduce the number of sites in its own inventory. Initially, ADOT maintenance forces were able to bid for materials from commercial sources. Over time, with relatively few commercial materials sites in northern Arizona, the availability of affordable materials became limited. There have been examples of ADOT's northern Arizona maintenance operations needing to obtain the appropriate materials from as far away as Phoenix to complete projects. The lack of local sources creates an expensive and time-consuming alternative for ADOT maintenance forces.

It has been difficult in the past for ADOT to find available materials and to obtain quality materials. Not being able to access quality materials takes away options in how pavement sections are designed and what materials can be used in those sections. Asphaltic concrete is the product of choice for paving over portland cement concrete pavement. This pavement is not an option because of the lack of sources where the required quality standards can be maintained during production. Aggregate base has also proven to be expensive because of the lack of quality sites or lack of the ability to work a site to make the quality product. Providing a greater choice of materials sources would assist the designer in making more economical choices when designing a roadway section.

Other factors have affected the ability of ADOT or contractors to establish materials source sites, including liability and permitting issues, as well as challenges related to environmental concerns. Much of northern Arizona is either public land or American Indian trust lands. Identifying a new materials source or renewing permits for an existing source requires the applicant to consider environmental issues. On American Indian nations, these issues are difficult to address due to conflicting development and preservation goals. Public lands have extensive regulations to meet, though there is more coordination among those agencies than what is found on American Indian lands.

Methodology

Establishing new sources for aggregate can be costly and can involve lengthy studies prior to use, resulting in higher prices for aggregate materials and shortages in quality materials needed for construction and maintenance activities. These considerations produced concerns about the ability of existing materials sources in northern Arizona to meet the needs of future construction and maintenance projects. This project addresses these concerns. It undertook an effort to identify new sources of materials for use in highway maintenance and construction projects. It defined a process for ADOT to identify and prioritize those sites that may be needed in the future.

The study area included Apache, Navajo, Coconino, Mohave, and Yavapai counties, which include the ADOT districts of Flagstaff, Globe, Holbrook, Kingman, and Prescott. An illustrative set of construction and maintenance projects for a projected 20-year time frame was developed for the study area Responding to the original research request of March 6, 2007, these districts estimated the quantity of materials needed to deliver the illustrative projects over the specified period to be more than 17 million tons. As of 2007, 15 ADOT and 86 contractor materials source sites were qualified under ADOT Standard Specifications and were presumed available for immediate use. However, the existing sites likely do not have the quantity of materials needed to meet the demand. This study focuses on finding new sources of materials for ADOT's construction and maintenance program.

The project team created a master list of materials sites by contacting governmental agencies and private entities to determine whether any had located potential sites; the contact list is in Appendix A. There was also an effort to develop an online survey (Appendix B) for private-sector individuals and ADOT personnel to provide information on potential and existing

materials sites. Sample letters inviting agencies and individuals to participate in this study or in the online survey are included in this report (Appendix C). The information gathered included the location of the site and type of materials available at the site (Appendix D, available upon request). This information then was used to limit the number of sites to those that would most likely be used by ADOT for maintenance and construction activities.

The number of materials sites to be subject to further environmental review was further reduced by identifying only those sites within a 10-mile-wide corridor (a 5-mile corridor on each side) centered on a state highway and categorized based on the type of materials (Appendix E, available upon request).

An environmental review was conducted on the remaining sites, and the results are outlined for the individual sites (Appendix F).

The final steps in the study included developing an implementation process based on its findings. The methodology and recommended prioritization process should give ADOT and its partners a way to address future materials needs while meeting regulatory requirements.

CHAPTER 2. LITERATURE REVIEW

Introduction

The study involves an inventory of materials sites in northern Arizona and the search for information on these materials sites. With assistance from the technical advisory committee (TAC), the project team focused on locating materials sites and information in Yavapai, Mohave, Coconino, Navajo, and Apache counties. The team identified a set of illustrative construction and maintenance projects for the study area, and estimated the quantity of materials that would be required by ADOT to deliver those projects over a conceptual 20-year time frame. The information-gathering process included the ADOT engineering districts in Prescott, Kingman, Flagstaff, Holbrook, and Globe.

Additionally, the team conducted a survey of the identified governmental agencies and private sector individuals to initiate comments about the possibility of identifying additional materials sites. A survey participation request was forwarded to the individuals on the contact list that was developed; requests also went to the additional contacts identified during this initial phase. In general, this survey had limited responses from governmental and industry sources.

Methodology

The methodology that was developed reflects this project's unique nature. The project did not lend itself to the standard literature review, because there was limited literature available on the subject. To remedy this issue, various agencies, local governments, and private industry sources were identified that might have information regarding materials sites in northern Arizona. Then they were contacted to find out whether they had information they would share. Appendix A contains the table of these contacts.

The governmental agencies contacted included the Bureau of Indian Affairs (BIA); Indian Health Services; the Bureau of Reclamation; the U.S. Forest Service; the U.S. Army Corps of Engineers; the Bureau of Land Management (BLM); the National Park Service; the Federal Highway Administration; the Natural Resources Conservation Service; the Bureau of Mines and Mineral Technology; Housing and Urban Development; the Arizona State Land Department; Mohave County; Yavapai County; Coconino County; Navajo County; Apache County; the Cities of Flagstaff, Holbrook, Winslow, Kingman, Prescott, Sedona, Bullhead City, and Show Low; and the Towns of Page, Camp Verde, Cottonwood, Prescott Valley, and St. Johns. American Indian nations and tribes contacted included the Navajo Nation, the Hopi Tribe, the Yavapai-Apache Nation, the Yavapai-Prescott Indian Tribe, the White Mountain Apache Tribe, the Hualapai Tribe, the Kaibab Band of Paiute Indians, the Havasupai Tribe, and the Ute Mountain Ute. Also contacted were the departments of transportation in the five adjacent states—California, Utah, Nevada, Colorado, and New Mexico.

The private entities and associations contacted included Arizona Rock Products, Arizona General Contractors, Yavapai-Apache Materials, Northern Arizona Builders Association, Dyna Rock and Sand, and Rinker Materials.

The surveys (Appendixes B and C) were developed to reach out to individuals and firms that may have had additional information about materials sites. The surveys could be completed on the Internet or a paper copy could be requested.

Analysis

The literature and data availability review found that any information on existing and potential materials sites is dispersed among many agencies and entities. Once contact was made, the information requested was categorized as immediately available for use, somewhere in the entity's system, or nonexistent. In some cases, information existed, but the entity's policy prevented the release of that information.

Those entities with policy objectives that included maintaining an inventory of lands and land use, along with entities that monitored information for others, seemed to be the most responsive to the information request, and they often asked that a follow-up survey be forwarded to them. In many cases, these entities had the resources to maintain inventory of the sites and had information pertaining to the sites. Mohave County and the BLM are examples of those agencies that had policies and the resources to maintain an inventory of materials sites.

Tribal governments did not have systems in place to track materials sites and usage. The BIA deferred to the individual tribes in the tracking of materials sites and use. The research team worked with four of five tribal regional councils of the Navajo Nation government to gain a cooperative agreement to assist the team in this study.

The surveys resulted in 11 responses, of which four identified themselves. One respondent was from the private sector, one was from the Tonto National Forest, one was from Coconino County, and one was from ADOT. The e-mail received was from ADOT.

The project team has been unable to recover the actual survey data due to the change in lead researchers. Some of the information recovered was comments made about the survey. The comments offered by individuals provided insight into the issue of developing materials sites. Of the comments, the private sector respondent noted that "ADOT has a wealth of leased pits and I constantly hear that they are not keeping their leases. ADOT should be actively adding pits, not losing them."

The ADOT e-mail noted, "There is one comment to make—the cost of acquiring an ADOT environmental analysis keeps the smaller organizations from actively pursuing the analysis and opening their pit up to ADOT projects. [Large construction companies] can absorb the cost much easier than a [smaller firm or] landowner with an excellent site. With an expenditure of \$10,000 to \$15,000 and no guarantee of a return on their money, the smaller players are not willing to invest that money on such an intangible. This is a part of the puzzle that needs to be considered."

The determination of materials site acceptability for use by construction and maintenance forces is complicated by the role of ADOT, the private sector, and other governmental agencies' roles in the process of obtaining use of a materials site. To the best of the knowledge of the project team members, ADOT continues to encourage the private sector to find and develop materials sites, including any environmental clearance activities.

In determining the materials demand for this project's study area, the project team used an illustrative set of construction and maintenance projects over a projected 20 years as the basis to calculate the demand for aggregate in the future. The materials demand was calculated based on an unconstrained funding scenario and used the following assumptions:

- Milling and replacing asphaltic concrete (AC) on Interstate roadways: 5/8-inch asphalt rubber friction course (ARFC), 2-inch asphalt rubber asphaltic concrete (ARAC), 5-inch AC, and 3-inch depth for shoulder build-up.
- Interstate reconstruction: 5/8-inch ARFC, 4-inch ARAC, 8-inch AC, and 14-inch aggregate base (AB)
- Primary, secondary roadway widening: 5/8-inch ARFC, 4-inch ARAC, 8-inch AC, and 14-inch AB
- Pavement preservation used the pavement values represented by milling and replacing AC on Interstate roadways multiplied by 36 lane miles per year.

The total aggregate demand, excluding maintenance requirements, for 20 years is approximately 46 million tons.

Literature Review Conclusion

Information on existing and potential materials sources in northern Arizona is dispersed among numerous governmental, tribal, and private entities. The information available to the study team depends on an entity's resources and mission, especially for those entities that have a need to monitor materials sites and their use as a part of their overall mission. The least information is available from those entities not required to dedicate resources to maintaining materials source information.

The contacts from the first steps in the literature review were used to conduct the surveys in the latter phase of the review and resulted in limited responses and no additional sites being identified. The survey confirmed that there is limited knowledge of the availability of sites and the steps necessary to incorporate them into the construction and maintenance operations within ADOT or any other agency.

The aggregate demand for road construction during the next 20 years in northern Arizona is 46 million tons.

CHAPTER 3. DATA COMPILATION

Introduction

The project team, the project manager, and the TAC identified potential issues affecting sites, such as the status of mining claims and development, the status of geotechnical studies, environmental analysis issues (including owner/operators who may be unwilling to complete the process), known biological, cultural, or hazardous materials issues associated with each area, permit limitations/complications, land use, tribal concerns, site access issues, and sites that otherwise may not meet the standard specification requirements.

Materials Characteristics

The materials characteristics were developed from the data received from the various sources of materials site information. The sites were located based on geographic, coordinate, or public lands information, depending on how the information was provided by the source. The sites were then mapped based on the location data.

The team conducted a thorough literature and agency search for data relating to materials sources in northern Arizona. Data were obtained from numerous sources listed in Table 1.

Table 1. Information Sources for Northern Arizona Materials Sources.

Name of Database or List	Source
1. ADOT Material Source Inventory for Storm Water Compliance Purposes	ADOT Materials Section
2. ADOT Materials Site Inventory, June 2, 2004	ADOT Materials Section
3. Arizona Mineral Industry Location System (AZMILS) Apache County	Arizona Department of Mines and Mineral Resources (ADMMR 2007a)
4. AZMILS Coconino County	Arizona Department of Mines and Mineral Resources (ADMMR 2007b)
5. AZMILS Navajo County	Arizona Department of Mines and Mineral Resources (ADMMR 2007d)
6. AZMILS Mohave County	Arizona Department of Mines and Mineral Resources (ADMMR 2007c)
7. AZMILS Yavapai County	Arizona Department of Mines and Mineral Resources (ADMMR 2007e)
8. ADOT Cleared Commercial Sources, Arizona	ADOT Environmental Planning
9. ADOT Cleared Commercial Sources, California	ADOT Environmental Planning
10. ADOT Cleared Commercial Sources, Colorado	ADOT Environmental Planning
11. ADOT Cleared Commercial Sources, New Mexico	ADOT Environmental Planning
12. ADOT Cleared Commercial Sources, Nevada	ADOT Environmental Planning
13. ADOT Cleared Commercial Sources, Utah	ADOT Environmental Planning
14. U.S. Geological Survey Mineral Resource Data System (MRDS)	U.S. Geological Survey (USGS 2007)
15. Arizona State Land Department (ASLD) Pit Data	ASLD

Table 1. Information Sources for Northern Arizona Materials Sources.

Name of Database or List	Source
16. Navajo-Hopi Materials Deposit Data	<i>Mineral Resources of Navajo-Hopi Indian Reservations, Arizona-Utah, Vol. II and III, (Kiersch 1955a, 1955b)</i>
17. New Mexico Data	New Mexico Energy, Minerals, and Natural Resources Division
18. Survey Data BLM Data, Arizona	Response to survey request for data
19. Survey Data BLM Data, California	Response to survey request for data
20. Survey Data BLM Data, Nevada	Response to survey request for data
21. Survey Data Latitude/Longitude	Response to survey request for data
22. Survey Data Nevada Mine Directory	Response to survey request for data
23. Survey Data (Township, Range, and Section [TRS])	Response to survey request for data
24. Utah Data	Utah Division of Oil, Gas, and Mining
25. Various Arizona Area Pit Data (TRS)	<i>An evaluation of sand and gravel resources in and near the Verde Valley of the Coconino National Forest, Arizona (Cox 1995); An evaluation of sand and gravel resources in and near the Prescott National Forest in the Verde Valley, Arizona (Cox et al. 1999)</i>
26. Various Arizona Area Pit Data (Latitude/Longitude)	
27. ADMMR Active Mines Pit Data	Directory of Active Mines in Arizona 2007, ADMMR spreadsheet
28. California Pit Data Imperial County	California Department of Conservation, Division of Mines and Geology
29. California Pit Data Inyo County	
30. California Pit Data Riverside County	
31. California Pit Data San Bernardino County	
32. ADOT County Material Inventory Data	Information compiled from the ADOT County Material Inventory data maps (ADOT 1980, 1978, 1975; Arizona Highway Department 1973, 1972)
33. Colorado Data	Colorado Division of Reclamation, Mining, and Safety
34. National Atlas Crushed Stone Operations, Arizona	US Geological Survey Minerals Information Team; crushed stone operations considered active in 2002 with a production of greater than 50,000 tons and that are nongovernmental and nonportable
35. National Atlas Crushed Stone Operations, California	
36. National Atlas Crushed Stone Operations, Utah	
37. National Atlas Sand and Gravel Operations, Arizona	
38. National Atlas Sand and Gravel Operations, Colorado	
39. National Atlas Sand and Gravel Operations, New Mexico	
40. National Atlas Sand and Gravel Operations, Utah	
41. National Atlas Sand and Gravel Operations, California	

The data obtained from the sources in Table 1 were first compiled into spreadsheets. These data were then combined to form a single large summary spreadsheet. The summary spreadsheet was used as input for geographic information system (GIS) software, which was

used to sort and map the data, to further identify potential materials sites worth exploring by ADOT. The project team stratified the number of sites by establishing a 5-mile corridor on each side of the existing state highway centerlines. This corridor focused on sites that are within a reasonable proximity to existing state highways. Appendix H provides the general layout of all identified sites within the 10-mile-wide corridor.

The team used the materials classifications summarized from the data to identify the types of materials each site could provide (Appendix I). The TAC's guidance then focused the team on mineral aggregate, riprap, and rock quarry sites. This resulted in 285 sites to be further examined. The materials sites have not been classified as either maintenance- or construction-specific. Individual site materials characteristics that directly relate to ADOT materials specifications are not available.

Decision Rules/Assumptions

Before doing environmental overviews of the potential sites, the team decided, with TAC input, to make several rules regarding the study methodology. First, it was assumed that any site would be approximately 80 acres. Second, the study would focus on two types of materials: mineral aggregate and rock quarry. Third, potential materials sources would be restricted to within 5 miles of an existing state highway. The TAC also determined that no materials source sites would be located on Arizona State Land Department (ASLD) land because of the auction requirement for land sales; that the environmental clearance would not differentiate between pits used for maintenance and those used for construction; and that a haul route was a critical element for a viable materials source and would be included in the clearance.

Environmental Review

The team examined 128 potential mineral aggregate sites and 157 potential rock quarry sites (materials source sites) for issues associated with Section 404 of the Clean Water Act, conflicts with existing land use, presence of cultural resources, and potential biological compliance issues related to federally listed species. Environmental clearance processes do not differentiate between construction and maintenance materials sources. Haul routes were not specifically identified for each site. The assumption is that haul routes are available to the sites and that any environmental clearance process will need to include the routes.

Section 404

The presence of Waters of the United States (Waters) was determined by checking for "blue line" washes on U.S. Geological Survey 7.5-minute topographic series maps for each materials source site. Blue line washes generally exhibit characteristics of an ordinary high water mark and are, therefore, assumed to be Waters. If the 80-acre area contained one or more blue line washes, the site would likely require a Clean Water Act Section 404 permit through the U.S. Army Corps of Engineers as part of the environmental clearance process.

Land Use

Land use at each potential materials source site was determined through a review of aerial photography. Land-use conflicts were identified as an overlap between a materials source site and existing development. For example, if an 80-acre area was surrounded by development, it was identified as a conflict, while sites that had development on only one side were not scored as a conflict as long as site access appeared unimpeded. Only obvious conflicts were counted and, in this respect, the evaluation was a conservative estimate of land-use conflicts.

Biological Resources

At each materials source site, the study used aerial photography and existing databases to examine the potential for biological compliance issues related to federally listed endangered, threatened, proposed, or candidate species.

The U.S. Fish and Wildlife Service (USFWS) lists of endangered, threatened, proposed, and candidate species for Apache, Coconino, Mohave, Navajo, and Yavapai counties were reviewed to determine which species or federally designated critical habitats may occur at or near each materials source site. Species-specific data, such as known range and occurrence records provided by the USFWS or the Arizona Game and Fish Department, were cross-referenced for proximity to, or overlap of, the mineral aggregate sources or rock quarries.

Cultural Resources

The status of cultural resources at each materials source site was determined by reviewing previous cultural resource survey records. The majority of the materials source sites had not been previously surveyed and, therefore, most sites will require additional survey. Absence of a cultural site does not necessarily mean absence of a potential conflict.

Two resources, the AZSITE database maintained by the Arizona State Museum and the ADOT Portal, were the source of background data on the materials source locations. The AZSITE database contains locational information pertaining to previous cultural resource surveys and previously documented cultural resources. Scanned versions of the original archaeological site cards and some National Register of Historic Places eligibility information also are available. The ADOT Portal is a database that contains scanned versions of cultural resources reports carried out along the Arizona's highways for ADOT. This information can be accessed by entering the road name and milepost.

Results

Table 2 and Table 3 summarize the percentage of sites that have potential environmental issues.

Table 2. Mineral Aggregate Sites* with Potential Environmental Issues.

Issues	Apache County (%)	Coconino County (%)	Mohave County (%)	Navajo County (%)	Yavapai County (%)	Total (%)
Biology	18	31	49	0	30	33.1
Cultural	9	38	17	20	25	22.8
404	82	62	80	0	73	71.7
Land Use	0	0	20	0	21	15.7
None	9	8	9	80	16	15.0

*Sites may be listed in multiple categories.

Table 3. Rock Quarry Sites* with Potential Environmental Issues.

Issues	Apache County (%)	Coconino County (%)	Mohave County (%)	Navajo County (%)	Yavapai County (%)	Total (%)
Biology	0	6	13	0	18	11.5
Cultural	0	26	52	33	16	26.1
404	50	57	57	50	70	61.8
Land Use	0	6	9	0	18	10.8
None	50	26	9	50	13	20.4

*Sites may be listed in multiple categories.

The data developed for the sites, along with a summary of discussion regarding the sites, are outlined in Appendix F, and the maps outlining the sites are in Appendix J and are by county.

Additional Site Considerations

The sites represented on the maps in Appendix J are those that have been identified by this study and the various agencies as possible materials sources for use by ADOT. The maps represent both active and potential sites. The data provided did not differentiate between active and potential sites.

It was determined during TAC meetings and subsequent communications with ASLD that any potential materials sites on lands administered by ASLD are subject to the same rules as those applicable to any other sale of mineral materials on state land. These rules require that ASLD sell mineral materials via a process that includes an auction to obtain the highest possible revenue for the materials. Consequently, as directed by the TAC, sites on lands administered by ASLD were dropped from further consideration. The information concerning state trust land sites is included in the original master database compiled by the project team and is available upon request to the ADOT Research Center as Appendix D for ADOT's use in the future.

Geographic Information Systems Data Compilation

The raw locational data originated from the ADOT Materials Group and was composed of two spreadsheets, one containing latitude/longitude data and the other containing township, range, and section (TRS) data. Both sets of data were then plotted utilizing ArcGIS software. The TRS data required an additional step prior to plotting by way of a geocode process. The TRS data was geocoded with supplemental Public Land Survey System data for Arizona, California, Utah, Colorado, and New Mexico. Each TRS location was then plotted within the center of its closest square-mile section based on its TRS description. The corridors were buffer zones generated from ADOT's Interstate, primary, and secondary highway system, queried by request for this particular study. Once the aggregate locations and corridors were created, a selection by location within ArcGIS was used to query out only the focus aggregates for this study. The selected aggregates were then exported to a Personal Geodatabase. The supporting data are found in Appendix E (available upon request).

CHAPTER 4. IMPLEMENTATION PLAN

Introduction

The goal of the implementation plan was to rank aggregate source sites based on their relative ease of development. Therefore, the implementation plan, proposed by the project team, assumed that ADOT will further develop a program of individually identifying, clearing, and testing existing and future aggregate sites for use in the construction program and for use by maintenance forces. This plan is a recommendation to ADOT on how to prioritize resources to identify and establish individual aggregate sites for future use.

Assumptions Based on Project Work Program

The following assumptions were made to determine the aggregate sites that would be selected by ADOT for an illustrative future capital improvement program. The illustrative projects along the corridors listed before would range from major improvements, such as widening and traffic interchange (TI) construction, to pavement preservation projects. In some cases, sites identified along the major or primary corridors may provide aggregate to corridors with intermittent aggregate needs for pavement preservation or maintenance.

a. Locations of most aggregate needs (TI construction, roadway widening, pavement preservation)

i. Interstate corridors include Interstate 40, Interstate 17, and Interstate 15.

These corridors are the most heavily traveled in traffic and truck volumes. Most of the state's widening and major improvement projects focus on these routes. Pavement preservation projects on Interstate corridors tend to be tens of miles long and require large amounts of aggregate. They therefore cost more than those on other routes.

ii. Other routes include U.S. 93 and U.S. 89.

These routes are major connectors between northern Arizona communities and other communities in and out of Arizona. These routes are heavily traveled and have a diverse mix of traffic that includes commercial vehicles, tourists, and local commuters. Major improvement projects are not as common and pavement preservation projects tend to be extended in terms of design life expectancies and usually are shorter in length than Interstate projects.

b. Locations of intermittent aggregate needs (pavement preservation, minor widening)

i. Routes include U.S. 160, U.S. 191.

These routes are major connectors between northern Arizona communities but are not as heavily traveled as the major routes. Commercial vehicles are fewer in terms of the total traffic volume, and the more heavily trafficked areas are near commercial developments. Widening projects are limited to intersections or to the construction of

passing lanes. Pavement preservation projects are not as extensive in terms of length of project or design life as with the major roadways.

ii. Other routes include State Route (SR) 64, SR 260, and SR 264.

These routes are similar to the previous routes in that they are not as heavily traveled and the higher traffic volumes are in areas with commercial development. Most traffic is either from tourists or commuters with limited commercial traffic. Some major widening has occurred in the past; in the future, with limited funds, there may be minor widening in localized areas.

c. Locations of intermittent aggregate needs (pavement preservation)

i. Routes include Business I-40, SR 67, SR 69, SR 77, SR 87, SR 89A, SR 95, SR 98, SR 99, SR 169, SR 180A, SR 261, SR 273, SR 277, SR 377, SR 373, SR 389, SR 473, SR 564, U.S. 60, U.S. 64, U.S. 163, and U.S. 180.

These routes connect northern Arizona communities, but most work may be limited to pavement preservation to preserve the existing investment in the pavement structure. Traffic is mixed with some tourist and commuter traffic. Some minor improvements may be necessary due to localized growth. Many of the projects along these routes could access aggregate sites used for the Interstates.

d. Corridor width (distance from the existing paved roadway)

i. 354 sites are within a 20-mile corridor width (10 miles from each side of centerline).

Setting the 20-mile-wide corridor is the initial step to identifying sites that may be accessible for upcoming projects. Caution should be exercised in using this corridor width because some sites may not be economically accessible. In addition, some sites may be challenging in terms of obtaining clearances for haul roads and access.

ii. 285 sites are within a 10-mile corridor width (5 miles from each side of centerline).

Just over 80 percent of the available sites within the 20-mile-wide corridors are within the 10-mile-wide corridor. The project team recommends giving highest priority to the sites in this corridor. Project economics also dictate staying within the 10-mile-wide corridor. The additional haul distance could cost a contractor or site owner an additional \$30,000 per mile for the life of one project.

e. Environmental and regulatory considerations

Sites should be prioritized based on the effort required to obtain environmental clearance so that proper focus is directed to those sites that stand a reasonable chance of getting environmental clearance. Sites that may require an extended environmental clearance time should be carefully considered in the prioritization process to ensure that all economically viable sites are considered.

i. All sites and their access roads will require a cultural resources survey.

The project study team has found that almost none of the sites considered have cultural resources surveys. The access roads also must be surveyed. As a result, the project team has not used this parameter for eliminating sites from future consideration. This is the first step in any investigation of a particular location. Once adequate information is obtained upon completion of a Class III cultural resources survey (a 100 percent survey), an informed decision can be made. Should cultural resources be present, the site would be modified to protect those resources or would be eliminated from future consideration. Mitigation of cultural resources impacts at a location should not be pursued unless the type of aggregate obtained is not available elsewhere.

ii. The sites would then be ranked according to:

- 1) Surrounding land use. Consideration of land use on adjacent properties is a valuable parameter for evaluating potential sites. This may help to avoid the potential for locating aggregate sources adjacent to sensitive land uses (e.g., residential developments and schools).
- 2) The presence of threatened or endangered species or their habitat. The presence or absence of threatened or endangered species (or their habitat) is useful for evaluating potential sites. Although it is possible to environmentally clear a site that is occupied, or potentially occupied, by a threatened or endangered species, the project team recommends that such sites be eliminated from consideration unless the type of aggregate obtained is not available at another location.
- 3) U.S. Army Corps of Engineers (Corps) requirements (i.e., Clean Water Act Sections 401 and 404). Many aggregate sites, especially those providing sand and gravel, are traversed by ephemeral or perennial drainages that could be Waters of the United States (Waters) under jurisdiction of the Corps. Sites traversed by perennial drainages should be eliminated from consideration unless the type of aggregate obtained is not available at another location. Though it is possible to permit sites within Waters under Sections 401 and 404 of the Clean Water Act, those sites where impacts to Waters would exceed one-half acre should be avoided. This approach could accommodate use of Pre-Certified and Nationwide permits. Individual Section 401 Water Quality Certification and an individual Section 404 permit may require up to two years to obtain and would likely incur additional costs for mitigation.
- 4) Land ownership. Potential aggregate sites on lands within some jurisdictions (e.g., American Indian trust lands and the Arizona State Land Department) should be eliminated from consideration unless the type of aggregate obtained is not available at another location.

Ranking Based on Program

a. Current five-year construction program

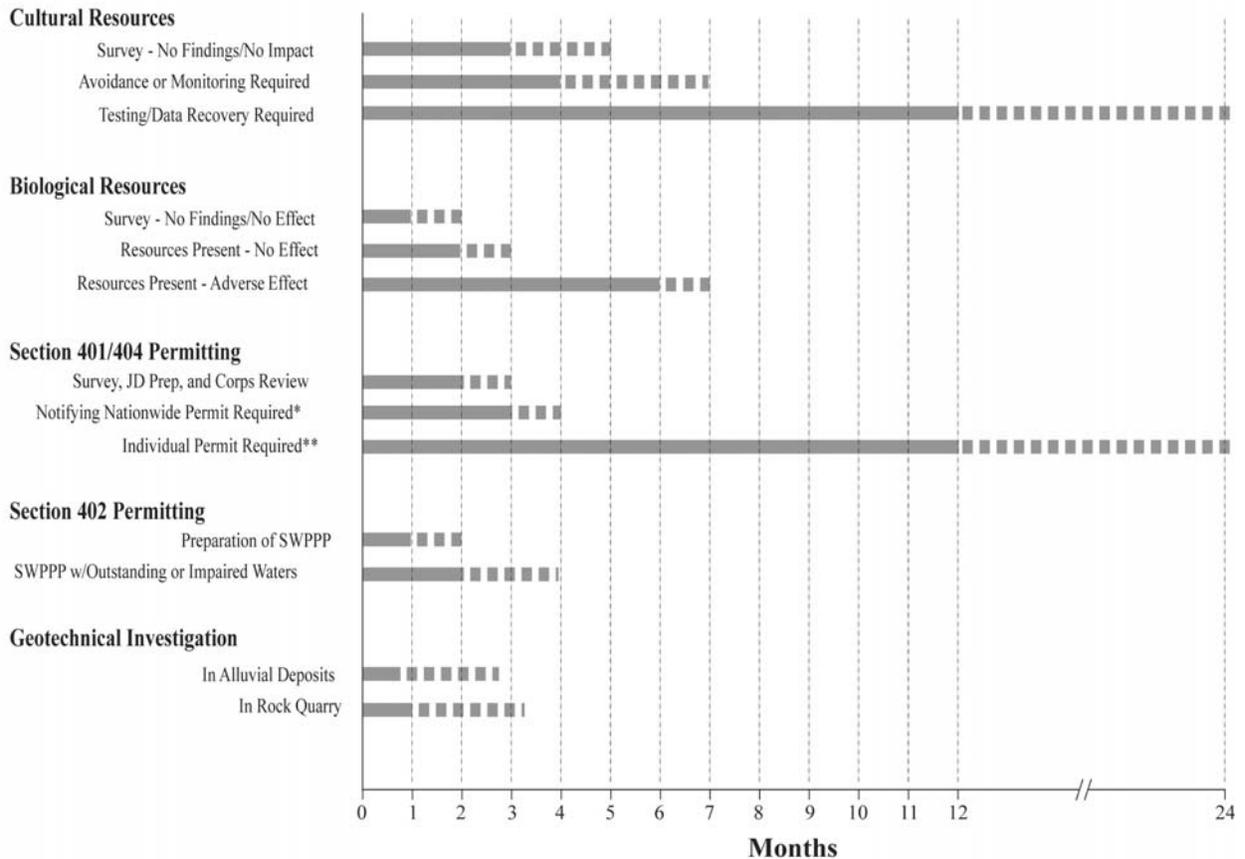
It is recommended that ADOT initially identify those projects in the current program that will need major quantities of aggregate and then identify the aggregate sites nearest the project that the project could possibly use. To accomplish the clearance processes, the lead time is normally two years (see Appendix G) and can increase to five years depending on the site location, outside agency review, and participation in clearing the site.

b. Development projects in program (Design Concept Reports, Project Assessments)

ADOT should coordinate upcoming projects with the development of aggregate needs and potential aggregate sources identified in this study. Incorporating aggregate needs into the project-development process would open more aggregate sites for ADOT's use.

General Schedules for Aggregate Site Availability

The general schedules for determining site availability are based on previous experience in identifying sites, determining the aggregate characteristics, and obtaining environmental clearances for an individual site. Figure 1 shows the approximate time needed for environmental clearances and a geotechnical investigation. See Appendix G for a more-detailed discussion of environmental and geotechnical clearance time frames. See Appendix J for detailed maps of environmental concerns at mineral aggregate and rock quarry sites.



All timelines shown are subject to additional 2 months of review if federal lands are involved

*Most likely if the impact is small (less than 0.5 acres but greater than 0.1 acre). If 0.1 acre or less, a non-notifying Nationwide Permit is required.

**Generally required if the impacts exceed 0.5 acre.

Figure 1. Environmental Clearance and Geotechnical Investigation Timelines (Approximate).

Of the 285 sites evaluated, all lacked complete cultural resource surveys. A site file review and Class III cultural resources survey and report will be required for each site and the associated access roads.

a. Sites with only cultural resource issues

Almost all locations will require a Class III cultural resources survey. If the results are negative and there are no concerns, these sites should receive first priority for environmental clearance.

b. Sites with Section 401/404 issues

Sites with cultural resource issues (no survey) and Section 401/404 considerations should receive second priority for environmental clearance.

c. Sites with land use issues

Sites with land use conflicts should not be considered for environmental clearance unless the type of aggregate obtained is not available at another location. Adjacent conflicting land uses introduce additional time and costs to obtain clearances, and the conflicts tend to persist throughout the life of the aggregate source.

Implementation Plan Summary

Implementation of a systematic program to develop new aggregate sources for highway construction and maintenance in northern Arizona focuses on sites within a 10-mile-wide corridor around a particular roadway. Interstate routes should receive first priority, as future requirements for aggregate sources are greatest.

CHAPTER 5. CONCLUSIONS AND RECOMMENDATIONS

The research effort to evaluate the existing aggregate sources and to identify new aggregate sources for highway construction and maintenance activities in northern Arizona produced a listing of potential materials sites and an implementation plan for ADOT to use in developing these potential sites.

The project canvassed both the private and public sectors to identify the programs and materials sites that could possibly be used for maintenance and construction materials. This effort identified 285 sites. This project also conducted surveys of private- and public-sector individuals involved in materials production in northern Arizona and adjacent states to determine whether there were any other sites available for use. Also an effort was made to reach the American Indian communities to develop a list of available sites.

The response to these efforts essentially was limited to governmental entities that had developed systems in gathering and recording information on materials sites, including mining claims, mining, sand and gravel operations, and rock quarries. Response from the American Indian communities included discussion about providing information on materials sites; this information was not always available. The interview responses were limited and reflected the different expectations of how sites were to be identified and developed by both private and public sectors. The private sector would prefer that the public sector do the preliminary work in developing and reserving a materials site, while the public sector would prefer the opposite.

The research team also developed some project materials needs based on a 20-year time frame. The basis of the aggregate needs was an illustrative set of construction and maintenance projects in northern Arizona. The construction materials needs were estimated at 25 million tons for new construction and 19 million tons for pavement preservation. Maintenance needs would be approximately 2 million tons over the 20-year time frame.

The project, with guidance from the TAC, limited the identified sites by first identifying those sites classified as rock quarry and mineral aggregate sites. The second data sort identified sites within a 10-mile-wide corridor of an Interstate or state highway. This corridor was 5 miles from each side of the highway. These data sorts produced a listing of 285 materials sites. The final data sort generally rated the sites based on environmental impacts and the amount of effort to environmentally clear the sites. The results appear in Table 2 and Table 3.

The implementation process outlined in Chapter 4 is a result of identifying materials sites and generally prioritizing them in terms of further investigation. The scope of the project limited the project team's ability to delve deeper into each materials site's characteristics, though the end result identifies sites that warrant further investigation by ADOT.

The project team recommends that ADOT take the following steps in partnership with the various private and public entities that impact the Department's maintenance and construction operations:

- Adopt the implementation process and identify areas of critical materials needs for the five-year capital improvement program in northern Arizona.
- In partnership with the contracting industry, develop an agreement and assign responsibilities to execute the proposed implementation process.
- Initiate a concentrated outreach effort to the American Indian community to identify possible materials sources and develop a working agreement so that produced materials can be shared among the entities.

In examining the objectives of this study, the following responses are provided:

- 1) **Objective:** Identify and evaluate existing aggregate sources available for construction and maintenance.

Response: The project team identified and evaluated existing sources based on the information provided by the individual agencies.

- 2) **Objective:** Identify and evaluate the development potential of undeveloped aggregate deposits for use in construction and maintenance.

Response: The project team determined that with the environmental clearance steps that are required to use a materials source, the development potential was limited by the need for environmental clearances or "administrative" processes. Those sites, within the 10-mile-wide corridor, have been generally ranked by the environmental clearance effort and probability that clearance could be done in a reasonable time.

- 3) **Objective:** To determine the means by which these sources could be used.

Response: This study determined that the sources identified for further study would be limited to those that could be classified as sources of mineral aggregate and, in some cases, aggregate base materials.

- 4) **Objective:** To estimate quantity of potential volumes and general locations of need for aggregates for ADOT's use in northern Arizona over at least a 20-year time frame.

Response: The project team provided an estimate of project aggregate needs over a 20-year time frame based on an illustrative set of construction and maintenance projects in northern Arizona.

The project team recommends that the implementation plan and process be adopted and a project developed to further examine the process and how it can be applied to individual materials sites in the areas of the highest materials demand.

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- Arizona Department of Mines and Mineral Resources (ADMMR). 2007c. Arizona Mineral Industry Location System database: Mohave County. Phoenix: Arizona Department of Mines and Mineral Resources (now Arizona Geological Survey)
- Arizona Department of Mines and Mineral Resources (ADMMR). 2007d. Arizona Mineral Industry Location System database: Navajo County. Phoenix: Arizona Department of Mines and Mineral Resources (now Arizona Geological Survey)
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APPENDIX A: GOVERNMENT AND INDUSTRY CONTACTS

Agency	Contact Name	Mailing Address	Phone Number	E-mail	Information	Information Obtained	County	State	Web Site	Comments
Associations										
Arizona Contractors Association	Amanda McGinnis	3030 N. 3rd St. Phoenix, AZ 85012-3039	(602) 246-8627 (928) 205-5424	amcgennis@azagc.org	Provided list of members with addresses in five northern counties	Yes	Multiple	AZ	www.azca.com	
Arizona Rock Products Association	Steve Trussel	916 W. Adams St. Phoenix, AZ 85007	(602) 271-0346	steve@azrockproducts.org	ARPA will mail or e-mail survey/info to members.	Yes	Multiple	AZ	www.azrockrproducts.org	
Northern Arizona Building Association	Denise Fisher	1500 Cedar Ave. Suite 86 Flagstaff, AZ 86004	(928) 779-3071 T (928) 7790-4211 F	denise@nazba.org	Provided membership directory	Yes	Multiple	AZ	www.nazba.org	
Federal Agencies										
Bureau of Land Management (BLM)	Dave Eddy, Geologist	Phoenix District Hassayampa Field Office 21605 N. 7th Ave. Phoenix AZ 85027-2929	(623) 580-5500	david_eddy@blm.gov	List of active and closed sites in Arizona; Web based application; can develop reports	Yes	All	AZ		
BLM	Linda Mullenix	Phoenix District Hassayampa Field Office 21605 N. 7th Ave. Phoenix AZ 85027-2929	(623) 580-5540	linda_mullenix@blm.gov	LR2000 Resident Expert		All	AZ	www.blm.gov/lr2000	
Bureau of Reclamation	Carol Irwin	Lower Colorado Region Phoenix Region 6150 W. Thunderbird Road Glendale, AZ 85306-4001	(623) 773-6210 T (602) 284-5107 M	cerwin@lc.usbr.gov	His office does not track this information; no big projects	No	Maricopa and Lower Colorado Region	AZ		
Bureau of Reclamation	Joe Liebhouser	Lower Colorado Region Office P.O. Box 61470 Boulder City, NV 89006	(702) 293-8414	jliebhouser@lc.usbr.gov	No active work in this area; referred to Yuma Office; suggest BLM or FS as better references	No		AZ/NV/CA		
Bureau of Reclamation	Mike Igoe	7301 Calle Agua Salada Yuma, AZ 85364-0973	(928) 343-8272 T	migoe@lc.usbr.gov	Approximate location of local sources	Yes	Multiple	AZ/CA/NV	www.lc.usbr.gov	Several quarries are permitted through BLM; some are located in CA; mainly use gravel, hardrock, and riprap for levee and bankline roads
Federal Highway Administration (FHWA)	Scott Anderson, Geotech Department	Central Federal Lands Highway Division 12300 W. Dakota Ave. Lakewood, CO 80228	(720) 963-3519	scott.anderson@fhwa.dot.gov	No database or info is maintained by aggregate sources; Info may be found in individual project files	No	All	HI, AZ, CA, CO, NM, NV and other central states	www.fhwa.dot.gov	Their Western Area Division is considering a similar project, but this area does not include AZ

Agency	Contact Name	Mailing Address	Phone Number	E-mail	Information	Information Obtained	County	State	Web Site	Comments
FHWA	Mike Peabody, Materials Engineer	Central Federal Lands Highway Division 12300 W. Dakota Ave. Lakewood, CO 80228	(720) 963-3541	michael.peabody@fhwa.dot.gov	Send survey to request information	No	All			
FHWA	Division Administrator: Robert Hollis	FHWA 400 E. Van Buren St. Suite 410 Phoenix, AZ 84004	(602) 379-3646	robert.hollis@fhwa.dot.gov	Send survey to request information	No	All			
Housing and Urban Development (HUD)	Field Office Director: Rebecca Flanagan	One N. Central Ave. Suite 600 Phoenix, AZ 85004	(602) 379-7100		HUD is not a land owner, but a property owner; it does not track of this type of info	No	All	AZ	www.hud.gov	
HUD	SW Office of Native American Programs, Acting Administrator: Kevin Fitzgibbons	One N. Central Ave. Suite 600 Phoenix, AZ 85004	(602) 379-7235		Send survey to request information	No	All	AZ		
National Park Service (NPS)	Public Information Officer (PIO)	Intermountain Region National Park Service 12795 Alameda Parkway Denver, CO 80225	(303) 969-2500		Aggregate and material resources are not available for non-park use; it does inventory certain materials	No	NA	NA	www.nps.gov	
NPS	Park Superintendent: Scott Travis	Canyon de Chelly National Monument P.O. Box 588 Chinle, AZ 86503-0588	(928) 674-5500		Send survey to request information		Apache	AZ	http://www.nps.gov/cach/	83,840 acres, all non-federal
NPS	Deputy Park Superintendent: Nancie Ames	Glen Canyon National Recreation Area P.O. Box 1507 Page, AZ 86040	(928) 608-6200	nancie_e_ames@nps.gov	Send survey to request information	No	Coconino	AZ/UT	www.nps.gov/glca	
NPS	Park Superintendent: Steve Martin	Grand Canyon National Park P.O. Box 129 Grand Canyon, AZ 86023	(928) 638-7888, ext. 7945	steve_martin@nps.gov	Send survey to request information	No	Coconino, Mohave	AZ	http://www.nps.gov/grca/	1,180,862.78 federal acres, 36,540.54 non- federal acres
NPS	Engineering Manager: John Reese	Grand Canyon National Park P.O. Box 129 Grand Canyon, AZ 86023	(928) 638-7905	john_reese@nps.gov	Send survey to request information	No		AZ		
NPS	Park Superintendent: Ann Worthington	Hubbell Trading Post National Historic Site P.O. Box 150 Ganado, AZ 86505	(928) 755-3475	ann_worthington@nps.gov	Send survey to request information	No	Apache	AZ	http://www.nps.gov/hutr/	160.09 federal acres
NPS	Park Superintendent: William Dickinson	Lake Mead National Recreational Area 601 Nevada Way Boulder City, NV 89005	(702) 293-8906	william_k_dickinson@nps.gov	Send survey to request information	No	Mohave	AZ/NV	http://www.nps.gov/lame/	

Agency	Contact Name	Mailing Address	Phone Number	E-mail	Information	Information Obtained	County	State	Web Site	Comments
NPS	Park Superintendent: Kathleen Davis	Montezuma Castle National Monument P.O. Box 219 Camp Verde, AZ 86322	(928) 567-5276, ext. 223	kathy_m_davis@nps.gov	Send survey to request information	No	Yavapai	AZ	http://www.nps.gov/moca/	840.86 federal acres, 16.83 non-federal acres
NPS		Tuzigoot National Monument P.O. Box 219 Camp Verde, AZ 86322	(928) 567.5276		Send survey to request information	No	Yavapai	AZ	http://www.nps.gov/tuzi/	57.78 federal acres, 754.11 non-federal acres
NPS	Park Superintendent: Nancy Skinnner	Superintendent Navajo National Monument HC 71 Box 3 Tonal, AZ 86044	(928) 672.2700	nancy_skinner@nps.gov	Send survey to request information	No	Navajo, Coconino	AZ	http://www.nps.gov/nava/	360 federal acres
NPS	Park Superintendent: Brad Travor	Petrified Forest National Park P.O. Box 2217 Holbrook, AZ 86025	928.524.6228, ext. 225	brad_travor@nps.gov	Referred to Dennis Steele, Facility Director	No	Apache, Navajo	AZ	http://www.nps.gov/pefo/	93,532.57 federal acres
NPS	Park Facility Manager: Dennis Steele	Petrified Forest National Park P.O. Box 2217 Holbrook, AZ 86025	(928) 524-6228, ext. 247	dennis_steele@nps.gov	Send survey to request information	No	Apache, Navajo	AZ	http://www.nps.gov/pefo/	93,532.57 federal acres
NPS	Park Superintendent: John Hiscock	Pipe Spring National Monument HC 65 Box 5 Fredonia, AZ 86022	(928) 643-7105	john_hiscock@nps.gov	Send survey to request information	No	Mohave	AZ	http://www.nps.gov/pisp/	40 federal acres
NPS	Acting Park Superintendent: Nancy Schultz	Superintendent Flagstaff Area National Monuments 6400 N. Highway 89 Flagstaff, AZ 86004 Attn: Sunset Crater Volcano National Monument Visitor Center	(928) 526-0502 (928) 526-1157, ext. 224	nancy_schultz@nps.gov	Send survey to request information	No	Coconino	AZ	http://www.nps.gov/sucr/	3,040 federal acres
NPS		Superintendent Flagstaff Area National Monuments 6400 N. Highway 89 Flagstaff, AZ 86004 Attn: Walnut Canyon National Monument Visitors Center	(928) 526-0502 (928) 526-1157, ext. 224	nancy_schultz@nps.gov	Send survey to request information	No	Coconino	AZ	http://www.nps.gov/waca/	3288.62 federal acres, 290.84 non-federal acres
NPS		Superintendent Flagstaff Area National Monuments 6400 N. Highway 89 Flagstaff, AZ 86004 Attn: Wupatki National Monument Visitor Centers	(928) 526-0502 (928) 526-1157, ext. 224	nancy_schultz@nps.gov	Send survey to request information	No	Coconino	AZ	http://www.nps.gov/wupa/	35,422.13 federal acres
US Army Corps of Engineers (USACE)	Jay Field	Los Angeles District	(213) 452-3908	PublicAffairs.SPL@usace.army.mil	No response	No	Multiple	AZ/NV/CA	www.usace.army.mil	

Agency	Contact Name	Mailing Address	Phone Number	E-mail	Information	Information Obtained	County	State	Web Site	Comments
USACE	Ruth Fowler, Construction Support Branch	AZ-NV Area Office 3636 N. Central Ave. Phoenix, AZ 85012	(602) 640-2003 (602) 640-2018, ext. 235	Ruth.T.Fowler@usace.army.mil	Awaiting response	No	Multiple	AZ/NV/ CA		Add to survey mailing list
U.S. Department of Mines					Agency eliminated in 1995; functions transferred to DOE, USGS and BLM	No	NA	NA		
USDA Forest Service (FS)	Sarah Leche	AZ Zone Office for Minerals 2324 E. McDowell Road, Phoenix, AZ 85006	(602) 225-5200	sleche@fs.fed.us	Only handle soils, not material content; suggested I speak to someone in Engineering	No	Maricopa	AZ	http://www.fs.fed.us/r3/tonto/home.shtml	
FS	Terry Brennan	Engineering Department 2324 E. McDowell Road Phoenix, AZ 85006	(602) 225-5375	tbrennan@fs.fed.us	Awaiting response	No	Maricopa	AZ	http://www.fs.fed.us/r3/tonto/home.shtml	Add to survey mailing list
FS	Forest Supervisor: Elaine Zieroth	USDA Forest Service Apache-Sitgreaves National Forests P.O. Box 640 Springerville, AZ 85938	(928) 333-4301	ezieroth@fs.fed.us	Send survey to request information	No	Coconino, Navajo, Apache, Greenlee	AZ	http://www.fs.fed.us/r3/asnf/	
FS	Forest Supervisor: Joe Stringer	USDA Forest Service Coconino National Forest 1824 S. Thompson St. Flagstaff, AZ 86001	(928) 527-3600	jstringer@fs.fed.us	Send survey to request information	No	Coconino, Yavapai, Gila	AZ	http://www.fs.fed.us/r3/coconino/	
FS	Forest Supervisor: Mike Williams	USDA Forest Service Kaibab National Forest Supervisor's Office 800 S. Sixth St. Williams, AZ 86046	(928) 635-8200	mrwilliams01@fs.fed.us	Send survey to request information	No	Coconino	AZ	http://www.fs.fed.us/r3/kai/	
FS	Forest Supervisor: Alan Quan	USDA Forest Service Prescott National Forest 344 S. Cortez St., Prescott, AZ 86303	(928) 443-8000	aquan@fs.fed.us	Send survey to request information	No	Yavapai	AZ	http://www.fs.fed.us/r3/prescott/	
FS	Forest Supervisor: Gene Blankenbaker	USDA Forest Service Tonto National Forest 2324 E. McDowell Road Phoenix, AZ 85006	(602) 225-5200	gblankenbaker@fs.fed.us	Send survey to request information	No	Yavapai, Maricopa, Gila, Pinal	AZ	http://www.fs.fed.us/r3/tonto/	
U.S. Geological Survey (USGS)	Jim Bliss	U.S. Geological Survey Water Resources Division 520 N. Park Ave. Suite 221 Tucson, AZ 85719	(520) 670-5502	jbliss@usgs.gov	Has ADOT county atlas data in digital format (not the maps, just the tables)	Yes	Pima	AZ	www.usgs.gov	
USGS in Tucson	Jim Bliss	USGS DeConcini Building 520 N. Park Ave. Room 355 Tucson, AZ 85719	(520) 670-5502	jbliss@usgs.gov	Has ADOT county atlas data in digital format (not the maps, just the tables)	No	Pima	AZ		

Agency	Contact Name	Mailing Address	Phone Number	E-mail	Information	Information Obtained	County	State	Web Site	Comments
USDA Natural Resource and Conservation Service (NRCS)	Bill Johnson	230 N. 1st Ave. Suite 509 Phoenix, AZ 85003	(602) 280-8836	bill.johnson@az.usda.gov	Characterizing soil content for Arizona; not yet completed inventories in Navajo and Apache counties	Yes	All	AZ	www.soildataviewer.nrcs.usda.gov	
NRCS	Eric Wolfbrandt, GIS Specialist for agency	230 N. 1st Ave. Suite 509 Phoenix, AZ 85003	(602) 280-8822	eric.wolfbrandt@az.usda.gov	Soil interpretations and soil properties are provided on one map for each state; Soil Data Viewer software provides users access to soil interpretations and soil properties while shielding them from the complexity of the soil database	Yes	All	AZ	www.soildataviewer.nrcs.usda.gov	Soil Data Viewer is a tool built as an extension to ArcMap that allows a user to create soil-based thematic maps
State Agencies										
Arizona Department of Mines and Mineral Resources	Nyal Niemuth	1502 W. Washington St. Phoenix, AZ 85007	(602) 771-1604	njn22r@hotmail.com	Google Earth map with SAG locations; Directory of Active Mines; library; USGS crushed stone and SAG maps shapefiles; ASLD limestone potential map	Yes				
Arizona Geological Survey	Phil Pearthree	416 W. Congress, #100 Tucson, AZ 85701	(520) 770-3500	phil.pearthree@azgs.az.gov	AZ Geobib resource; search for literature about SAG; Joe Crow with Rinker Materials	No, just a bibliography	Pima	AZ		
Arizona State Mine Inspector's Office	Cassandra Dawa	1700 W. Washington St. 4th Floor Phoenix, AZ 85007	(602) 542-5971		Reclamation plans on file for few aggregate pits in Coconino	No	Maricopa	AZ		
Arizona State Land Department	Rebecca Price	1616 W. Adams St. Phoenix, AZ 85007	(602) 542-2686	rprice@land.az.gov	CD of SAG leases on State Trust Land	Yes	Maricopa	AZ		
CALTRANS	Joe Peterson		(530) 741-5378		CA pits/multiple districts	No				
CDOT	Mike Coggins		(970) 385-1625		Durango District					
CDOT	Weeminuche		(970) 565-0111		Four Corners					
CDOT	Sky Mt. Ute		(970) 382-0609		Durango					
Nevada DOT	Mel Rodela		(775) 888-7787	mrodela@dot.state.nv.us	NV pits					
NMDOT	Joan Bowser		(505) 827-5541		100% contractor furnished	No				
NMDOT	Sky Mt. Ute		(505) 566-9900		Farmington					
UDOT	Tim Biel		(801) 965-4859		Statewide					

Agency	Contact Name	Mailing Address	Phone Number	E-mail	Information	Information Obtained	County	State	Web Site	Comments
County Agencies										
Apache County	Steve Rogers	P.O. Box 238 St. Johns, AZ 85936	(928) 337-7536	srogers@co.apache.az.us	Minimal records are maintained	No	Apache	AZ		
Coconino County	Tim Wolff	5600 E. Commerce Ave. Flagstaff, AZ 86004	(928) 526-2735	twolff@coconino.az.gov	Sheep Hill is the only site maintained by the county	No	Coconino	AZ		
Mohave County	Cullin Patillo	3675 E. Andy Devine Ave. P.O. Box 7000 Kingman, AZ 86402-7000	(928) 757-0910	Cullin.Patillo@co.mohave.az.us	Information concerning material sites is part of a .zip file	Yes	Mohave	AZ		
Navajo County	Clyde Holyoak	100 E. Carter Drive P.O. Box 668 Holbrook, AZ 86025	(928) 205-5424	clyde.holyoak@co.navajo.az.us	Currently use a cinder pit for maintenance otherwise use commercial sources	No	Navajo	AZ		
Yavapai County	Doug Federico	1100 Commerce Drive Prescott, AZ 86035	(928) 777-7561	doug.federico@co.yavapai.az.us	County mainly uses commercial sources	No	Yavapai	AZ		
City Agencies										
Bullhead City Engineering Department	Bill Avery	1255 Marina Blvd. Bullhead City, AZ 86442	(928) 763-0128	bavery@bullheadcity.com	Approximate location of local sources	Yes	Mohave	AZ		
Bullhead City Roads/Public Works	Don Carley	1255 Marina Blvd. Bullhead City, AZ 86442	(928) 763-0184	dcarley@bullheadcity.com	Approximate location of local sources	Yes	Mohave	AZ		
Bullhead City Street Maintenance	Randy Williams	1255 Marina Blvd. Bullhead City, AZ 86442	(928) 763-0184	rwilliams@bullheadcity.com	Supervisor of Don Carley	Yes	Mohave	AZ		
City of Cottonwood Public Works	David Enright	1490 W. Mingus Ave. Cottonwood, AZ 86326	(928) 634-8033	denright@ci.cottonwood.az.us	Approximate locations of local sources	Yes	Yavapai	AZ		
City of Flagstaff Public Works-Streets	Dan Holmes	211 W. Aspen Ave. Flagstaff, AZ 86001	(928) 779-7600, ext. 7235	dholmes@ci.flagstaff.az.us	Approximate location of local sources	Yes	Coconino	AZ		
City of Holbrook Streets Department	Brent Holmes	P.O. Box 970 Holbrook, AZ 86025	(928) 524-6654	No e-mail available	Approximate location of local sources	Yes	Navajo	AZ		
City of Page Utility Department	Fred Ladman	P.O. Box 1180 Page, AZ 86040	(928) 645-4310	ladman@cityofpage.org	Approximate location of local sources	Yes	Coconino	AZ		
City of Sedona Public Works-Engineering	Cullen Hollister	102 Roadrunner Drive Sedona, AZ 86336	(928) 204-7116	chollister@sedonaaz.gov	Approximate locations of local sources (no local sources)	Yes	Yavapai	AZ		

Agency	Contact Name	Mailing Address	Phone Number	E-mail	Information	Information Obtained	County	State	Web Site	Comments
City of Show Low Maintenance Facility & Roads Operation	Mark Cobal	1281 Thornton Show Low, AZ 85901	(928) 532-4102	mcobal@ci.show-low.az.us	Approximate location of local sources	Yes	Navajo	AZ		
City of St. Johns Public Works	Paul Ramsey	405 W. 4 North St. Johns, AZ 85936	(928) 337-2031	pramsey@siaz.us	No contact yet	No	Apache	AZ		
Kingman Engineering Department	Mike Prior	310 N. Fourth St. Kingman, AZ 86401	(928) 753-8122	mprior@cityofkingman.gov	Approximate location of local sources	Yes	Mohave	AZ		Blake Chapman, 928-692-3135
Lake Havasu Water Resource Manager	Doyle Wilson	900 London Bridge Road Lake Havasu City, AZ 86403	(928) 453-6660	wilsond@lhcaz.gov	Approximate location of local sources	Yes	Mohave	AZ		
Prescott Streets Division	Chad McDowell	1505 Sundog Ranch Road Prescott, AZ 86301	(928) 777-1662	chad.mcdowell@cityofprescott.net	Approximate location of local sources	Yes	Yavapai	AZ		Dale Wachs, 928-777-1140
Town of Prescott Valley Public Works	Ken Stanton	7501 E. Civic Circle Prescott Valley, AZ 86314	(928) 759-3070	kstanton@pvaz.net	Approximate location of local sources	Yes	Yavapai	AZ		
Town of Camp Verde Public Works	Jessie Jones	473 S. Main St. Camp Verde, AZ 86322	(928) 567-0534	jjones@cvaz.org	Approximate location of local sources	Yes	Yavapai	AZ		
Tuba City					Navajo Reservation		Coconino	Navajo		
Tribal										
BIA, Navajo Region	Irwin Bekis	Navajo Regional Office Bureau of Indian Affairs P.O. Box 1060 Gallup, NM 87305	(505) 863-8282	No e-mail available	Send survey to request information	No	Coconino, Apache, Navajo	AZ		
BIA, Western Region	Bob Maxwell	Bureau of Indian Affairs P.O. Box 10 Phoenix, AZ 85001	(602) 379-6782	No e-mail available	Send survey to request information	No	Statewide	AZ		
Fort Mohave	John Algotts	500 Merriman Ave. Needles, CA 92363	(928) 346-1606		Phone calls not returned	No	Mohave	AZ		
Havasupai Tribe	Not contacted	P.O. Box 10 Supai, AZ 86435	(928) 448-2731		Send survey to request information	No	Mohave	AZ		
Hopi Tribe	Clay Hamilton	P.O. Box 123 Kykotsmovi, AZ 86039	(928) 734-2328	CHamilton@hopi.nsn.us	Interested in what sites were being used by ADOT	No	Coconino, Navajo	AZ		
Hualapai Tribe	Erin Forest	P.O. Box 179 Peach Springs, AZ 86434	(928) 769-2216 ext. 112		Phone calls were not returned	No	Mohave	AZ		
Inter Tribal Council of Arizona (ITCA)	Esther Corbett	2214 N. Central Ave. Suite 100 Phoenix, AZ 85004	(602) 258-4822	esther.corbett@itcaonline.com	This group provided contact information only	No	Statewide	AZ		

Agency	Contact Name	Mailing Address	Phone Number	E-mail	Information	Information Obtained	County	State	Web Site	Comments
Kaibab-Paiute		HC 65 Box 2 Fredonia, AZ 86022	(928) 643-7245		Blind e-mail was sent and returned; phone calls not returned	No	Mohave	AZ		
Navajo BIA Chinle Agency	Not contacted				Send survey to request information					
Navajo BIA Fort Defiance Agency	Not contacted				Send survey to request information					
Navajo BIA Western Agency	Not contacted				Send survey to request information					
Navajo Nation Abandoned Mines	Madelynn Roanhorse, Program Director		(928) 871-6982		Send survey to request information	No				
Navajo Nation Minerals	Brad Niesemeir	P.O. Box 1910 Window Rock, AZ 86515	(928) 871-6587		Claimed he provided information to the Navajo/ADOT task team	No	Northeast AZ	AZ		
White Mountain Apache	Richard Palmer	P.O. Box 700 Whiteriver, AZ 85941	(928) 338-2530		The tribe did a study a few years ago; steps are being taken to release some of the information	No	Gila, Navajo, Apache	AZ		
Yavapai-Camp Verde	Jerry Piper (Yavapai-Apache Sand and Rock)	P.O. Box 249 Camp Verde, AZ 86322	(928) 567-3109	jerry.yasr@commspeed.net	Does have technical information available	No	Yavapai	AZ		
Yavapai- Prescott	Mark Galeano, Real Estate Manager	530 E. Merritt St. Prescott, AZ 86301	(928) 777-9468		No sites being operated by the tribe; it has a site being operated by Fann Construction	No	Yavapai	AZ		
Private										
Dyna Rock & Sand (in Winslow)	Tom McCauley	206 W. 1st St. Winslow, AZ 86047	(928) 289-9349		Dyna Rock acts as local source for most city projects	No (local contractor)	Navajo	AZ		
Rinker Materials	Joe Crow	701 N. 44th St. Phoenix, AZ 85008	(602) 220-5236		1997 prepared Corridor Study for Coconino National Forest	No	Maricopa	AZ		

APPENDIX B: ADOT ONLINE SURVEY

[Add Survey and Exit](#)

ADOT Survey

1. Introduction & Welcome

Welcome to the ADOT Preliminary Survey of Aggregate Sources for Construction and Maintenance in Northern Arizona. The purpose of this web-based survey is to gather information from ADOT employees, businesses, local governments and non-government agencies about their knowledge of aggregate material resources in the five northern Arizona counties of Apache, Coconino, Mohave, Navajo, and Yavapai.

Research objectives for this project include identifying and evaluating existing and potential aggregate sources for construction and maintenance, determining how these resources can be used, and estimating the quantity of the expected volumes and general locations of need for aggregates for use over a 20-year planning horizon based on the Arizona Long-Range Transportation Plan.

We appreciate your time and response in providing this information.

[Next >>](#)

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ADOT Survey

2. Survey Overview & Instructions

If you have used, studied, considered, or have an opinion on aggregate material resources, please respond to this survey. Answer as many of the following questions as possible.

If you would like a colleague or other interested party to be included in the survey, please contact Vi Brown of Prophecy Consulting Group at vi.brown@att.net or 480.205.2616 and she will provide the necessary information to this individual.

If you have questions about the survey or have problems using this web-based survey tool, contact Vi Brown, 480.205.2616 or vi.brown@att.net, or Nelson Moore, 602.980.1247 or nelmoo@att.net. Please respond to this survey on or before March 17, 2008.

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ADOT Survey

3. Aggregate Material Resources and Locations - Site One

Please share with us your knowledge of past, existing, and/or future potential aggregate resource sites that you are aware of in northern Arizona. Provide information for each site that you are aware of. (You may input data for up to five sites).

1. Site Name (Site No. 1)

2. Site Location (postal address, nearest cross streets, highway & milepost, or distance & direction from a known point)

Physical Mailing

Address

City

County

State

ZIP Code

Nearest Cross

Streets

Nearest Highway Mile

Post

3. Latitude (Enter Degrees as Positive Number; Enter Seconds as a Decimal)

Degrees

Minutes

Seconds

4. Longitude (Enter Degrees as Positive Number; Enter Seconds as a Decimal)

Degrees

Minutes

Seconds

5. Additional Site Location Data

Township

Range

Section

Quarter/Half

6. Site Status (Check Only One)

Past Site Existing Site Future Site Don't Know

7. Is this site permitted?

Yes

No

Don't Know

8. Who owns the permit for this site?

9. List applicable permits

Permit (1)

Permit (2)

Permit (3)

Permit (4)

Permit (5)

10. Has an environmental assessment/clearance been issued?

Yes No Pending Don't Know

11. Primary Material Type: (Check All That Apply)

River Rock	Granite - Fresh/Decomposed	Metamorphic
Alluvial Fan	Limestone/Marble	Other
Cinders	Volcanic/Igneous	unknown

12. Material Quality:(Check Only One)

Poor Fair Good Very Good Excellent Unknown

13. Estimated quantity of materials at this site(cubic yards):

14. Site Use

Not a mining site

No activity for 10+ years

Expired permit or license

Possible activity during last 10 years

Never used

Other

15. Are materials stockpiled on site?

Yes

No

16. Number of Known Site Users

Zero

One

Two

Three

Four

Five

Six or more

17. Site Owner

ADOT

Private

Arizona State Land Department (ASLD)

County

Bureau of Land Management (BLM)

National Park Service (NPS)

Tribal

Bureau of Indian Affairs (BIA)

Bureau of Reclamation (Reclamation)

Other

18. Site Contact Information

Contact

Phone

Email

19. Is information regarding this site available electronically?

Yes

No

Unknown

20. If yes, in what form is the electronic information?

***21. Do you have information on additional Aggregate Sources?**

Yes

No

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ADOT Survey

4. ADOT Employees

The following questions are reserved only for ADOT employees and relates to your job function and your knowledge and use of ADOT's Central Materials Testing Program (CMTP)/Material Information Data Acquisition System (MIDAS).

1. Are you an ADOT employee?

Yes

No

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ADOT Survey

5. Job Information

1. What is your job title?

2. What is your primary job function or duty?

3. Have you used ADOT's Central Material Testing Program (CMTP)/Material Information Data Acquisition System (MIDAS) software program?

Yes

No

4. What do you like best about the CMTP/MIDAS program?

5. What are your suggestions for improving the CMTP/MIDAS program?

6. What other database software programs do you use to perform your job function(s)?
(Check all that apply)

Excel

Access

dBase

Crystal
Reports

SAS

SPSS

Other

7. In your opinion, who should supply aggregate and other material resources to work sites?

ADOT

Contractor

Both

Other

8. Please provide additional comments that you may have regarding aggregate and material resources in northern Arizona:

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ADOT Survey

6. Contact Information:

Please provide your contact information below:

1. Name

First Name

Last Name

2. ADOT Organization (if applicable)

District or Group

Section/Service

Other

3. Contact Information

Name of Organization or Company

Mailing Address

City

County

State

ZIP Code

Work Phone

Cell Phone

Fax Number

Email Address

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Add Survey and Exit

ADOT Survey

7. Comments to Questionnaire

1. Rate the Following Questions from "Poor" to "Excellent"

	Poor	Fair	Good	Very Good	Excellent
Ease in accessing survey					
Format of survey					
Number of questions					
Type of questions					
Clarity of Questions					
Amount of time to complete survey					

2. Do you have additional comments concerning this survey?

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Add Survey and Exit

ADOT Survey

8. Exit Survey

Exit Survey Here

TO Submit Survey, Select "Done" button below and exit survey

<< Prev

Done >>

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APPENDIX C: SAMPLE LETTERS



**ARIZONA DEPARTMENT OF TRANSPORTATION
Transportation Planning Division**

Janet Napolitano
Governor

Victor M. Mendez
Director

**Arizona Transportation Research Center
206 S. 17th Avenue, MD 075R
Phoenix, AZ 85007**

Dale Buskirk
Division Director

DATE

SUB: SPR 500 - Aggregate Sources for Construction and Maintenance in Northern Arizona

Dear ADOT Employee,

The Arizona Transportation Research Center (ATRC) is conducting research for ADOT to evaluate existing aggregate material sources and identify new sources for highway construction and maintenance activities in Mohave, Yavapai, Coconino, Apache, and Navajo counties. The material sources to be identified include aggregate, sand and rock, borrow and fill material, cinder, and rock quarry sites. A consulting firm, Prophecy Consulting Group, LLC*, is under contract to perform this work.

Research objectives for this project include identifying and evaluating existing and potential aggregate sources for construction and maintenance, determining how these resources can be used, and estimating the quantity of the expected volumes and general locations of need for aggregates for use over a 20-year planning horizon based on the Arizona Long-Range Transportation Plan.

One of the tasks identified for this study project is to conduct a survey of ADOT employees regarding their knowledge and use of aggregate material resources in northern Arizona. If you have used, studied, considered, or have an opinion on aggregate material resources, please respond to this survey. Your input is very important to us.

To access the survey on the web, please click on the following link:
<http://www.surveymonkey.com/s.aspx?sm=xxxxxxxxxxxxxxxxxxx>. This link is uniquely tied to this survey and your email address. Please do not forward this message. If you would like a colleague or other interested party to be included in the survey, please contact Vi Brown of Prophecy Consulting Group at vi.brown@att.net or 480.205.2616 and she will provide the necessary information to this individual.

If you do not have internet access, or have difficulty accessing the above link on-line, you may obtain a hard copy of the survey by contacting Vi Brown. The survey must be completed by Day of Week, Date in 2008 (three weeks after mailing). If you are completing a hard copy of the survey, it must be postmarked no later than Day of Week, Date in 2008 (three weeks after mailing) and addressed with correct postage to:

Prophecy Consulting Group, LLC
ATTN: Vi Brown
2005 S. Henkel Circle
Mesa, AZ 85202-6564

Should you have questions or comments, please contact me at 602-712-6927 or jharris@azdot.gov, Vi Brown at 480.205.2616 or vi.brown@att.net, or Jeff Swan at 928-853-2794 or jswan@npgcable.com.

On behalf of the research team, thank you in advance for your cooperation.

Sincerely,



Jason Harris, Project Manager

- * ATRC has contracted with the study team led by Prophecy Consulting, LLC, Swan Consulting, Ninyo and Moore, and EcoPlan and Associates. Individuals from these firms may contact you to gather additional information on existing and/or potential material sites within your jurisdiction.



**Arizona Department of Transportation
Transportation Planning Division**

206 South Seventeenth Avenue Phoenix, Arizona 85007-3213

Janet Napolitano
Governor

Victor M. Mendez
Director

Dale Buskirk
Division Director

DATE

Council Member
Navajo Agency Council
All Arizona Chapters
«Address1»
«City», «State» «PostalCode»

RE: ADOT Research Project: SPR 500, Aggregate Sources for Northern Arizona

Dear Council Member,

The Arizona Transportation Research Center (ATRC) is conducting research for the Arizona Department of Transportation (ADOT) to evaluate existing aggregate sources and identify new aggregate sources for highway construction and maintenance activities covering Mohave, Yavapai, Coconino, Apache, and Navajo counties.

The research objectives include:

- 1) identify and evaluate existing aggregate sources available for construction and maintenance.
- 2) identify and evaluate the development potential of undeveloped aggregate deposits for use in construction and maintenance.
- 3) to determine the means by which these sources could be used.
- 4) to estimate quantity of the expected volumes and general locations of need for aggregates for use over at least a 20-year planning horizon based on the Arizona Long-Range Transportation Plan.

Since the research began a few months ago, ATRC has learned of similar initiatives and objectives are currently underway in the form of multi-agency committees and partnerships. This research project (SPR 500) plans to coordinate efforts with those involved on other committees to achieve the said objectives. Once the research is complete, it will be published and made available to the agencies that participated in this survey.

In an effort to efficiently disseminate information (and responses) from each of the Navajo Chapters regarding the attached questionnaire, I respectfully request this letter and questionnaire be placed in all Navajo Agency Council meeting agenda packets for October.

The intent of the questionnaire is to determine the location of any existing and/or potential aggregate sources along with the names/agencies responsible for the permit oversight of these sources. Upon locating these aggregate sources, ADOT will apply for a permit (if applicable) through the Navajo Nations Mineral Department for further investigation.

Should you have any questions or comments, please feel free to contact me at 602-712-6927 or email jharris@azdot.gov. Thank you in advance for your cooperation.

Sincerely,

Jason Harris, Project Manager
Arizona Transportation Research Center | 206 S 17th Ave, MD 075R | Phoenix, AZ 85007 | 602-712-6927

ADOT Research Project: SPR 500, Aggregate Sources for Northern Arizona Questionnaire

The Arizona Department of Transportation (ADOT) is conducting a research project to evaluate existing aggregate sources and identify new aggregate sources for highway construction and maintenance activities covering Mohave, Yavapai, Coconino, Apache, and Navajo counties. The material sources to be identified include aggregate, sand and rock, borrow, cinder, and rock quarry sites.

This questionnaire serves as a request for information on existing and/or potential material sites within your jurisdiction.

1. Please provide your contact information below:

Name:
Agency:
Address:
Address 2:
City/Town:
State:
Zip:
Phone:
Email:

2. Material Sources: Existing or Planned

- a. Do you have any existing or planned material sites within your jurisdiction?
- b. If so, do you have any records pertaining to these material sites?
- c. Are the records available for use in this study if permission is granted by owner(s)?

If answered 'yes' to the above questions, please proceed with remaining questions. If answered 'no' to any question above, skip the remaining questions and return questionnaire to address below.

3. Material Sources: Record Locations

- a. Where are the records located?
- b. Do the records show site location?
- c. Is there a legal description of site boundaries?
- d. If known, how is the material site being used at present?
- e. Do the records contain technical information regarding soil or aggregate type, gradation, etc.?
- f. What is the environmental and other permit status?

4. If applicable, please provide names of other agencies/organizations that the research team can contact regarding above questions?

5. Would you like to be notified when the research report becomes available?

If so, please provide information in question #1 above.

*All questionnaires must be completed by Friday, November 2, 2007 (postmarked by November 2nd) for consideration in this ATRC research project. Please return one-page questionnaire to:

ATRC
Attn: Jason Harris
206 S 17th Ave, MD 075R
Phoenix, AZ 85007

Should you have any questions or comments, please feel free to contact me at 602-712-6927 or email jharris@azdot.gov. Thank you in advance for your participation in this survey.

Sincerely,



Jason Harris, Project Manager
Arizona Transportation Research Center (ATRC)

Cc: Stan Robbins, Apache County District One
Ken Poocha, Arizona Commission of Indian Affairs
Don Sneed, ADOT Tribal Coordinator
Vi Brown, Prophecy Consulting Group, LLC
Jeff Swan, Swan Consulting, LLC
Bruce Kay, Ninyo and Moore
George Ruffner, EcoPlan and Associates

*Note: ATRC has contracted the consultant team led by Prophecy Consulting and includes Swan Consulting, Ninyo and Moore, and EcoPlan and Associates. Individuals from these firms may contact you regarding more information on existing and/or potential material sites within your jurisdiction.

APPENDIX D: MASTER DATABASES

The master databases are Excel spreadsheets on file with the ADOT Research Center and available to the public upon request. Table 4 explains the files relating to the master databases.

Table 4. Files Available through the ADOT Research Center.

File or Folder Name	Description
File: Master in-state source data.xls	Master in-state spreadsheet summary of data collected from numerous smaller-source spreadsheets compiled from various sources.
File: In-state data spreadsheet col heading definitions.doc	Column heading definitions for the spreadsheet "Master In-state source data.xls"
File: Master Out-of-state source data.xls	Master out-of-state spreadsheet summary of data collected from numerous smaller-source spreadsheets compiled from various sources
File: Out-of-state data spreadsheet col heading definitions.doc	Column heading definitions for the spreadsheet "Master Out-of-state source data.xls"
Folder: "spreadsheets used to compile master spreadsheets"	Contains the 64 source spreadsheets used to compile the master spreadsheet (these spreadsheets were primarily compiled in 2008)
Folder: "GIS data"	Contains the geographic information systems (GIS) database files generated during analyses and sorting of the data (the GIS data is based upon a corridor width of 10 miles, or 5 miles on either side of state highways)

Table 5 explains the column headings found in the databases (Microsoft Excel files) on file with the ADOT Research Center. The table also provides a key for codes used in the different columns.

Table 5. Master Databases Column Heading Definitions and Key.

Spreadsheet Column	Heading	Definition
B	County	County name
C	ADOT_Dist	ADOT District name
D	T	Township number
E	R	Range number
F	S	Section number
G	Y	Latitude (degrees)
H	X	Longitude (degrees)
I	Hwy	Nearest state or federal highway number
J	MP	Nearest highway milepost location
K	Mat_Type	Reported material type being extracted from designated location
L	Sel_Cat	Material type selection category, as defined by the team (all materials types reported were classified as one of these categories: Aggregate Base/SAG; Cementitious Products; Fill; Metals/Minerals; Mineral Aggregate; Miscellaneous; Rock/Quarry; Volcanics)
M	Clrd_Cmcl	Whether site is cleared commercial site (Y for yes, N for no)
N	Op_Own	Name of site's operator or owner

Table 5. Master Databases Column Heading Definitions and Key.

Spreadsheet Column	Heading	Definition
O	Source	Name of agency or publication supplying the data
P	ADOT_SWPP_	<p>ADOT Stormwater Pollution Prevention Plan (SWPPP) group number</p> <p>Group A: Currently Active and Inactive Sites for Study Area —Includes a place where work or other activities related to extraction processing, removal, or recovery of minerals is being conducted. May include a site or portion of a site where mining has occurred but is not currently underway and the facility may be covered by an active mining permit issued by the landowner(s), applicable state or federal government agency.</p> <p>Group B: Currently Inactive Site for Study Area—Include a site or part of a site where mining occurred in the past but is not an active facility. A site that is no longer being used will remain in this group until it can be reclaimed, at which time it would be moved to Group C.</p> <p>Group C: Reclamation Phase—Includes activities intended to return the land to a premining state. Once a site is reclaimed, it will be removed from this group.</p> <p>Group I: Non-mining Sites within Study Area—Includes sites on original ADOT inventory that are not mining sites and so not Sector J of stormwater regulations.</p> <p>Group II: Never Used Sites within Study Area—Includes sites where permits were acquired but the sites were never used by ADOT.</p> <p>Group III: Reclaimed Sites within Study Area—Includes sites that may be in use by others, but ADOT has no active permit or legal access.</p>
Q	Notes	Miscellaneous information regarding the site
R	Loc_Desc	Detailed description regarding the pit location
S	Sprdsht	Source spreadsheet number used to provide the date on a given row (folder with the 64 spreadsheets used to compile the master spreadsheet on file at the ADOT Research Center)
T	Site_Mtrl_	Pit or location number as reported on the original source data
U	Tot_Acres	Approximate reported surface area of the pit
V	SIC_Code	Four-digit code number, typically 1429, 1442, 1429 (meaning not defined on original source spreadsheet)

Table 5. Master Databases Column Heading Definitions and Key.

Spreadsheet Column	Heading	Definition
W	Site_Use	Site use per Code Number 0 through 17 0-Not a mining site 1-Expired permit or license 2-Never used 3-No activity for 10-plus years or since 1993 4-Reclaimed 5-Possible activity since 1993 6-May need revegetation 7-Residual stockpiles may exist at former mining site 8-District Construction/Contractors 9-District Maintenance and/or Construction 10-Probable no SWPPP required 11-Probabe SWPPP required 12-Site visited/no outfall/no SWPPP for current conditions 13-Site visited/SWPPP or best management practices needed for current conditions 14-Site visited/confirmed no mining activity (not Sector J) 15-SWPPP preparation completed 16-Postpone SWPPP preparation because site is a community source 17-Postpone SWPPP preparation because ADOT has no legal access
X	Joint_Use	Indicates use by more than one agency
Y	EA_Effecti	Indicates whether Environmental Assessment is pending or not available
Z	Pot_NonSW_	Potential Non-Stormwater Discharge Code: AA-Total suspended solids BB-Total dissolved solids CC-pH, acids DD-Fuel (diesel, gasoline, oil, polynuclear aromatic hydrocarbons, solvents) EE-Heavy metals FF-Fertilizers GG-Discharges not regulated under Sector J
AA	Stckpl_Mat	Indicates the presence of stockpiled material at the site
AB	US_Water	Indicates whether site is in or near Waters of the United States
AC	Water_Dist	Distance to water in miles
AD	U_I_Wat	U/I Waters—typically “No” or blank (not defined on original source spreadsheet)

Table 5. Master Databases Column Heading Definitions and Key.

Spreadsheet Column	Heading	Definition
AE	Owner_Code	Owner code: 1-ADOT 2-Arizona State Land 3-US Department of Agriculture Forest Service 4-Bureau of Land Management 5-Tribal 6-Bureau of Reclamation 7-Private 8-Maricopa County Flood Control District 9-Department of the Army
AF	Status	*column not used*
AG	Lic_Exp	Expiration date of license and/or permit: Perp = perpetual; Deed or Grant = type of license or permit
AH	F32	Miscellaneous information regarding source of data
AI	F33	Miscellaneous information regarding source of data

In-State Data Master Spreadsheet – Column-Heading Definitions

Spreadsheet Column	Column Heading	Heading Definition
A	County	County Name
B	ADOT District	ADOT District Name
C	Township	Township Number
D	Range	Range Number
E	Section	Section Number
F	Latitude	Latitude (degrees)
G	Longitude	Longitude (degrees)
H	Highway	nearest State or Federal Highway Number
I	Milepost	nearest highway milepost location
J	Material Type	reported Material Type being extracted from designated location
K	Cleared Commercial Source (Y/N)	Indicates whether the site is a cleared commercial site
L	Operator/Owner	Name of operator/owner of the site
M	Source	Name of agency or publication supplying the data

In-State Data Master Spreadsheet – Column-Heading Definitions

Spreadsheet Column	Column Heading	Heading Definition
N	ADOT SWPP Group	<p>Indicates ADOT SWPPP Group Number:</p> <p>Group A: Currently Active and Inactive Sites for Study Area - A materials source in this group will include a place where work or other activities related to the extraction, processing, removal or recovery of minerals is being conducted. Group A may also include a site or portion of a site where mining has occurred in the past, yet currently mining is not being actively undertaken and the facility may or may not be covered by an active mining permit issued by the landowner(s), applicable State or Federal government agency.</p> <p>Group B: Currently Inactive Site for Study Area - a material source in this group will include a site or portion of a site where mining occurred in the past but is not an active facility. A site that is no longer being used will remain in this group until it can be reclaimed, at which time it would be moved to Group C.</p> <p>Group C: "Reclamation Phase": Includes activities intended to return the land to its pre-mining state. (Once a site is reclaimed, it will be removed from this Group)</p> <p>Group I: NON-MINING SITES Within Study Area: Includes sites on original ADOT inventory that are not mining sites and therefore not Sector J of the storm water regulations.</p> <p>Group II: NEVER USED Sites within Study Area: Includes sites where permits were acquired, but the sites were never used by ADOT.</p> <p>Group III: RECLAIMED Sites Within Study Area: Includes sites that may be in use by others, but ADOT has no active permit or legal access.</p>
O	Site Notes	Miscellaneous information regarding the site
P	Location Description	Detailed description regarding the pit location
Q	Spreadsheet Number	Source spreadsheet number used to provide the data on a given row. A listing of the 64 spreadsheets used to compile the master spreadsheet is provided separately.
R	Site/Material Source No.	Pit or location number as reported on the original source data
S	Acres	Approximate reported surface area of the pit
T	SIC Code	<p>Standard Industrial Classification Codes:</p> <p>1429 crushed and broken stone (basalt and volcanic rock)</p> <p>1442 sand and gravel</p> <p>1499 borrow or fill dirt</p> <p>Not 14xx non-mining sites; material storage areas only</p>

In-State Data Master Spreadsheet – Column-Heading Definitions

Spreadsheet Column	Column Heading	Heading Definition
U	Site Use	<p>Site use per code number 1 thru 17.</p> <ul style="list-style-type: none"> 0 Not a mining site 1 Expired permit or license 2 Never used 3 No activity for 10+ years or since 1993 4 Reclaimed 5 Possible activity since 1993 6 May need revegetation 7 Residual stockpiles may exist at former mining site 8 District Construction/Contractors 9 District Maintenance and/or Construction 10 Probable no SWPPP required 11 Probable SWPPP required 12 Site visited/No outfall/No SWPPP for current conditions 13 Site visited/SWPPP or BMPs needed for current conditions 14 Site visited/Confirmed no mining activity (not Sector J) 15 SWPPP preparation completed 16 Postpone SWPPP preparation because site is a community source 17 Postpone SWPPP preparation because ADOT has no legal access
V	Joint Use	Indicates use by more than one agency
W	EA Effective	Indicates whether Environmental Assessment is pending or not available
X	Potential Non-SW Discharge	<p>Potential Non - Stormwater Discharge Code:</p> <ul style="list-style-type: none"> AA Total Suspended Solids BB Total Dissolved Solids CC pH, Acids DD Fuel (diesel, gasoline, oil, PAH, solvents) EE Heavy Metals FF Fertilizers GG Discharges not regulated under Sector J
Y	Stockpiled Material	Stockpiled Material - indicates the presence of stockpiled material at the site
Z	Water of US	Water of US - Indicates whether site is in or near waters of the US.
AA	Distance to Waters (miles)	Distance to Water in miles
AB	U / I Waters	U/I Waters – Indicates whether site is considered as including Unique or Impaired Waters

In-State Data Master Spreadsheet – Column-Heading Definitions

Spreadsheet Column	Column Heading	Heading Definition
AC	Owner Code	Owner Code: 1 ADOT 2 Arizona State Land 3 USDA Forest Service 4 Bureau of Land Management 5 Tribal 6 Bureau of Reclamation 7 Private 8 Maricopa County Flood Control District 9 Department of the Army
AD	Status	Status of License
AE	License Expired	Expiration date of license and/or permit: Perp = perpetual, Deed or Grant = type of license or permit
AF	Misc Information regarding Source of Data	Miscellaneous information regarding source of data
AG	Misc Information regarding Source of Data	Miscellaneous information regarding source of data

Out-of-State Data Master Spreadsheet - Column Heading Definitions

Spreadsheet Column	Column Heading	Heading Definition
A	State	State Name
B	ADOT District	*column not used*
C	Township	Township Number
D	Range	Range Number
E	Section	Section Number
F	Latitude	Latitude (degrees)
G	Longitude	Longitude (degrees)
H	Highway	nearest State or Federal Highway Number
I	Milepost	nearest highway milepost location
J	Material Type	reported Material Type being extracted from designated location
K	Cleared Commercial Source (Y/N)	Indicates whether the site is a cleared commercial site
L	Operator/Owner	Name of operator/owner of the site
M	Source	Name of agency or publication supplying the data
N	Site Notes	*column not used*
O	Location Description	Detailed description regarding the pit location
P	Spreadsheet Number	Source spreadsheet number used to provide the data on a given row. A listing of the 64 spreadsheets used to compile the master spreadsheet is provided separately.
Q	Site/Material Source No.	Pit or location number as reported on the original source data
R	Acres	Approximate reported surface area of the pit
S	EA Effective	Indicates whether Environmental Assessment is pending or not available
T	Status	Status of License

APPENDIX E: MASTER DATABASES SORTED BY 10-MILE CORRIDOR

The master databases are Excel spreadsheets on file with the ADOT Research Center and available to the public upon request. Table 6 explains the column headings found in the databases.

Table 6. Master Databases (Sorted by 10-mile Corridor) Column Heading Definitions.

Spreadsheet Column	Heading	Definition
B	County	County name
C	ADOT_Dist	ADOT District name
D	T	Township number
E	R	Range number
F	S	Section number
G	Y	Latitude (degrees)
H	X	Longitude (degrees)
I	Hwy	Nearest state or federal highway number
J	MP	Nearest highway milepost location
K	Mat_Type	Reported material type being extracted from designated location
L	Sel_Cat	Material type selection category, as defined by the team (all materials types reported were classified as one of these categories: Aggregate Base/SAG; Cementitious Products; Fill; Metals/Minerals; Mineral Aggregate; Miscellaneous; Rock/Quarry; Volcanics)
M	Clrd_Cmcl_	Indicates whether site is cleared commercial site (“Y” for “yes”; “N” for “no”)
N	Op_Own	Name of operator/owner of the site
O	Source	Name of agency or publication supplying the data

Table 6. Master Databases (Sorted by 10-mile Corridor) Column Heading Definitions.

Spreadsheet Column	Heading	Definition
P	ADOT_SWPP –	<p>Indicates Arizona Department of Transportation (ADOT) Stormwater Pollution Prevention Plan (SWPPP) Group Number:</p> <p>Group A: Currently Active and Inactive Sites for Study Area— Includes a place where work or other activities related to the extraction, processing, removal, or recovery of minerals is being conducted. Group A may include a site or portion of a site where mining has occurred but is not being actively undertaken and the facility may be covered by an active mining permit issued by the landowner(s), applicable state or federal government agency.</p> <p>Group B: Currently Inactive Site for Study Area—Include a site or portion of a site where mining occurred in the past but is not an active facility. A site that is no longer being used will remain in this group until it can be reclaimed, at which time it would be moved to Group C.</p> <p>Group C: “Reclamation Phase”—Includes activities intended to return the land to a premining state. Once a site is reclaimed, it will be removed from this group.</p> <p>Group I: Non-mining Sites within Study Area—Includes sites on original ADOT inventory that are not mining sites and, therefore, not Sector J of stormwater regulations.</p> <p>Group II: Never Used Sites within Study Area—Includes sites where permits were acquired but the sites were never used by ADOT.</p> <p>Group III: Reclaimed Sites within Study Area: Includes sites that may be in use by others, but ADOT has no active permit or legal access.</p>
Q	Notes	Miscellaneous information regarding the site
R	Loc_Desc	Detailed description regarding the pit location
S	Sprdsht	Source spreadsheet number used to provide the data on a given row (a listing of the 64 spreadsheets used to compile the master spreadsheet is provided separately)
T	Site_Mtrl_	Pit or location number as reported on the original source data
U	Tot_Acres	Approximate reported surface area of the pit
V	SIC_Code	Four-digit code number, typically 1429, 1442, 1429 (meaning not defined on original source spreadsheet)

Table 6. Master Databases (Sorted by 10-mile Corridor) Column Heading Definitions.

Spreadsheet Column	Heading	Definition
W	Site_Use	Site use per Code Number 0 through 17. 0–Not a mining site 1–Expired permit or license 2–Never used 3–No activity for 10-plus years or since 1993 4–Reclaimed 5–Possible activity since 1993 6–May need revegetation 7–Residual stockpiles may exist at former mining site 8–District Construction/Contractors 9–District Maintenance and/or Construction 10–Probable no SWPPP required 11–Probable SWPPP required 12–Site visited/no outfall/no SWPPP for current conditions 13–Site visited/SWPPP or best management practices needed for current conditions 14–Site visited/confirmed no mining activity (not Sector J) 15–SWPPP preparation completed 16–Postpone SWPPP preparation because site is a community source 17–Postpone SWPPP preparation because ADOT has no legal access
X	Joint_Use	Indicates use by more than one agency
Y	EA_Effecti	Indicates whether Environmental Assessment is pending or not available
Z	Pot_NonSW –	Potential Non-Stormwater Discharge Code: AA–Total Suspended Solids BB–Total Dissolved Solids CC–pH, Acids DD–Fuel (diesel, gasoline, oil, polynuclear aromatic hydrocarbons, solvents) EE–Heavy Metals FF–Fertilizers GG–Discharges not regulated under Sector J
AA	Stckpl_Mat	Indicates the presence of stockpiled material at the site
AB	US_Water	Indicates whether site is in or near Waters of the United States
AC	Water_Dist	Distance to water in miles

Table 6. Master Databases (Sorted by 10-mile Corridor) Column Heading Definitions.

Spreadsheet Column	Heading	Definition
AD	U_I_Wat	Unique or impaired waters—typically “No” or blank (not defined on original source spreadsheet)
AE	Owner_Code	Owner code: 1–ADOT 2–Arizona State Land 3–US Department of Agriculture Forest Service 4–Bureau of Land Management 5–Tribal 6–Bureau of Reclamation 7–Privates 8–Maricopa County Flood Control District 9–Department of the Army
AF	Status	*column not used*
AG	Lic_Exp	Expiration date of license and/or permit: Perp = perpetual; Deed or Grant = type of license or permit
AH	F32	Miscellaneous information regarding source of data
AI	F33	Miscellaneous information regarding source of data
AI	F33	Miscellaneous information regarding source of data

APPENDIX F: SITES CATEGORIZED BY ENVIRONMENTAL ISSUES

At the request of ADOT, EcoPlan Associates, Inc. (EcoPlan) examined 128 potential mineral aggregate sources and 157 potential rock quarries for potential biological compliance issues related to federally listed endangered, threatened, proposed, or candidate species.

The US Fish and Wildlife Service (USFWS) lists of endangered, threatened, proposed, and candidate species for Apache, Coconino, Mohave, Navajo, and Yavapai counties were reviewed by a qualified biologist (Patrick E.T. Dockens, EcoPlan) to determine which species or federally designated critical habitat may occur at or near the mineral aggregate sources or rock quarries. Species specific data, such as known range and occurrence records provided by the USFWS and/or the Arizona Game and Fish Department, were cross-referenced for proximity to or overlap of the mineral aggregate sources or rock quarries.

Forty-three mineral aggregate sites were determined to have biology-related issues that may require compliance with state and federal laws should they be utilized (Table 7).

Table 7. Mineral Aggregate Sites with Biology-related Issues.

Site No.	Issue
8	Within Sonoran Desert tortoise range
9	Within Critical Habitat for Mexican spotted owl
17	Within Sonoran Desert tortoise range
18	Within Sonoran Desert tortoise range
22	Within Sonoran Desert tortoise range
23	1,200 feet from woundfin Critical Habitat, 400 feet from Virgin River chub and Southwestern willow flycatcher Critical Habitat, within Mohave Desert tortoise range, near known Relict leopard frog populations
24	Within Mohave Desert tortoise range, near known Relict leopard frog populations
25	Within range of Siler pincushion cactus
26	Near localities for Gierisch globemallow (Black Rock Gulch), 900 feet from Virgin River chub, Woundfin, and Southwestern willow flycatcher Critical Habitat, within Mohave Desert tortoise range, nearby Holmgren’s milk-vetch occurrences
27	Within Mohave Desert tortoise range, near known Relict leopard frog populations
28	Approximately 1 mile from Southwestern willow flycatcher and Virgin River chub Critical Habitat
34	Nearby yellow-billed cuckoo, Northern Mexican garter snake habitat along river, Gila Chub in river, approximately 350 feet distant
38	Within Sonoran Desert tortoise range
39	Within Sonoran Desert tortoise range
42	Within Sonoran Desert tortoise range
43	Within Sonoran Desert tortoise range
44	Within Sonoran Desert tortoise range

Table 7. Mineral Aggregate Sites with Biology-related Issues.

Site No.	Issue
45	Within Sonoran Desert tortoise range
46	Within Sonoran Desert tortoise range
52	Nearby yellow-billed cuckoo, Northern Mexican garter snake habitat along river, Gila Chub in river, approximately 350 feet distant
55	Within known range of the Peeble's Navajo cactus
59	Within Sonoran Desert tortoise range
74	Within Sonoran Desert tortoise range
85	Potential occurrence of Arizona cliffrose, 0.5 mile from Razorback sucker and Southwestern willow flycatcher Critical Habitat
86	Potential occurrence of Arizona cliffrose, 600 feet from razorback sucker, Southwestern willow flycatcher Critical Habitat, nearby yellow-billed cuckoo occurrences
87	Potential occurrence of Arizona cliffrose
88	Potential occurrence of Arizona cliffrose, 300 feet from known roundtail chub occurrences, nearby yellow-billed cuckoo occurrences
89	Potential occurrence of Arizona cliffrose, 300 feet from razorback sucker Critical Habitat Overlaps Southwestern willow flycatcher Critical Habitat, 250 feet from known roundtail chub occurrences, nearby yellow-billed cuckoo occurrences
90	Potential occurrence of Arizona cliffrose
91	Potential occurrence of Arizona cliffrose
92	Potential occurrence of Arizona cliffrose
93	Potential occurrence of Arizona cliffrose
94	Potential occurrence of Arizona cliffrose, 1 mile from razorback sucker, Southwestern willow flycatcher Critical Habitat
96	Potential occurrence of Arizona cliffrose
97	Potential occurrence of Arizona cliffrose
201	Within range of Chiricahua leopard frog, ~1.5 miles from a known occurrence, ~0.7 mile from occupied Little Colorado spinedace habitat, within the Mexican Wolf 10(j) population boundaries, ~3 miles south of known breeding range for Mountain plover
202	Within the Mexican Wolf 10(j) population boundaries, within Mexican spotted owl Critical Habitat, ~3 miles south of known breeding range for Mountain plover, <2 miles from known occurrences of New Mexico meadow jumping mouse
206	Within Fickeisen Plains cactus range
208	~0.25 mile outside Mexican spotted owl Critical Habitat
210	Within Fickeisen Plains cactus range
214	Within Sonoran Desert tortoise range
215	Within Sonoran Desert tortoise range
223	~1 mile from known yellow-billed cuckoo occurrences

Forty-one rock quarry sites were determined to have biology-related issues that may require compliance with state and federal laws should they be utilized (Table 8).

Table 8. Rock Quarry Sites with Biology-related Issues.

Site No.	Issue
7	Within Mexican spotted owl Critical Habitat
8	Within Mexican spotted owl Critical Habitat
9	Within USFWS Chiricahua leopard frog distribution range, but more than 2.5 miles of known occurrence, within Mexican spotted owl Critical Habitat
11	Within USFWS Chiricahua leopard frog distribution range, but more than 2.5 miles of known occurrence, within Mexican spotted owl Critical Habitat
12	Within USFWS Chiricahua leopard frog distribution range, but more than 2.5 miles of known occurrence, within Mexican spotted owl Critical Habitat
22	Within range of Fickeisen Plains cactus
23	On edge of Brady pincushion cactus range, within range for Welsh's milkweed
24	Within USFWS Chiricahua leopard frog distribution range, but more than 2.5 miles of known occurrence, ~1.4 miles from Critical Habitat for Little Colorado spinedace, within Mexican spotted owl Critical Habitat, ~0.6 mile from a Mexican spotted owl protected activity center (PAC)
25	Within USFWS Chiricahua leopard frog distribution range, but more than 2.5 miles of known occurrence
38	Within Mexican spotted owl Critical Habitat, within a Mexican spotted owl PAC
46	Within Mexican spotted owl Critical Habitat, ~0.5 mile from a Mexican spotted owl PAC
52	Within Mexican spotted owl Critical Habitat, ~0.5 mile from a Mexican spotted owl PAC
54	Within range for Welsh's milkweed
55	Within Arizona cliffrose range near Bagdad, within Sonoran Desert tortoise range
56	Within Sonoran Desert tortoise range, within USFWS range for Hualapai Mexican vole
57	Within Sonoran Desert tortoise range
62	Within Sonoran Desert tortoise range
63	Within Sonoran Desert tortoise range
64	Within Sonoran Desert tortoise range
66	Within Sonoran Desert tortoise range
67	Within Sonoran Desert tortoise range
68	Within Sonoran Desert tortoise range
69	Within Sonoran Desert tortoise range
70	Within range of Siler pincushion cactus
77	Within Sonoran Desert tortoise range
78	~1.5 miles from Critical Habitat for Holmgren's milk-vetch, within 7 miles of known Mohave Desert tortoise occurrences, <1 mile from known occurrences of Gierisch mallow

Table 8. Rocky Quarry Sites with Biology-related Issues.

Site No.	Issue
79	Within USFWS Chiricahua leopard frog distribution range, but more than 2.5 miles of known occurrence, within Mexican spotted owl Critical Habitat
80	Within USFWS Chiricahua leopard frog distribution range, but more than 2.5 miles of known occurrence
81	Within USFWS Chiricahua leopard frog distribution range, but more than 2.5 miles of known occurrence
82	Within USFWS Chiricahua leopard frog distribution range, but more than 2.5 miles of known occurrence
94	Within Sonoran Desert tortoise range
96	Within Sonoran Desert tortoise range
106	Within Mexican spotted owl Critical Habitat
114	Within Arizona cliffrose range near Bagdad, within Sonoran Desert tortoise range
119	Within 0.3 mile of black-footed ferret 10(j) population boundaries
120	Within 0.3 mile of black-footed ferret 10(j) population boundaries
122	Within 0.3 mile of black-footed ferret 10(j) population boundaries
123	Within 0.3 mile of black-footed ferret 10(j) population boundaries
129	Potential occurrence of Arizona cliffrose, yellow-billed cuckoo occurrences along river
131	Potential occurrence of Arizona cliffrose, <0.1 mile from razorback sucker Critical Habitat, Northern Mexican garter snake habitat along river, 400 feet from known roundtail chub occurrences, yellow-billed cuckoo occurrences along river
149	Within Sonoran Desert tortoise range

**Aggregate Sources for Construction and Maintenance in Northern Arizona
Mineral Aggregate Classification**

No_	X	Y	T	R	S	MAT_TYPE	NEPA_VB1	NUM	F12	LAND_USE	CULTURAL	Notes	IMPACT	BIO_VB	NEPA_VB2	Exclude	Conty	Total
1	-109.61975972500	34.35738495820	11N	26E	17	Mineral Aggregate	1	1.000000	0.5	OK	0.000000		Y	0	0	0	Apache	1
2	-109.37410728100	34.48119892980	12N	28E	3	Mineral Aggregate	1	2.000000	0.5	OK	0.000000		N	0	0	0	Apache	1
3	-109.59410478000	34.49079976750	13N	26E	33	Mineral Aggregate	1	3.000000	1	OK	0.000000		N	0	0	0	Apache	1
4	-109.41916538300	35.24420522000	21N	28E	6	Mineral Aggregate	1	4.000000	0.5	OK	0.000000		N	0	0	0	Apache	1
5	-109.36649169800	35.20434639240	21N	28E	22	Mineral Aggregate	1	5.000000	0.5	OK--in median?	1.000000		N	0	0	0	Apache	2
6	-109.27811533400	35.28138596710	22N	29E	28	Mineral Aggregate	1	6.000000	0.5	OK	0.000000		N	0	0	0	Apache	1
7	-109.11813359600	36.93592440940	41N	30E	27	Mineral Aggregate	1	7.000000	0.5	OK--near highway	0.000000		N	0	0	0	Apache	1
8	-113.52705839600	34.61709165860	15N	12W	28	Mineral Aggregate	0	8.000000	N	OK--freeway	1.000000		N	1	0	0	Mohave	2
9	-111.55799229300	35.38734489500	23N	08E	9	Mineral Aggregate	1	9.000000	0.5	OK--near road, freeway	1.000000		N	1	0	0	Coconino	3
10	-112.17356758300	35.48518024590	24N	02E	3	Mineral Aggregate	1	10.000000	0.5	OK--near highway	0.000000		N	0	0	0	Coconino	1
11	-113.32276609800	35.57163061900	25N	10W	11	Mineral Aggregate	1	11.000000	1	OK	0.000000		N	0	0	0	Mohave	1
12	-112.01633998600	36.74218351280	39N	04E	31	Mineral Aggregate	1	12.000000	1	OK	0.000000		N	0	0	0	Coconino	1
13	-110.94085334000	34.86267589040	17N	13E	23	Mineral Aggregate	0	13.000000	N	OK	0.000000		N	0	0	100	Coconino	0
14	-111.31321662700	35.15191188880	20N	10E	2	Mineral Aggregate	1	14.000000	0.5	OK--near freeway	1.000000		Y	0	0	0	Coconino	2
15	-111.18779168500	35.13631986090	20N	11E	12	Mineral Aggregate	0	15.000000	N	OK--near freeway	0.000000		N	0	0	100	Yavapai	0
16	-112.05197386700	35.27823509860	22N	03E	23	Mineral Aggregate	1	16.000000	0.5	OK--near road, freeway	0.000000		N	0	0	0	Coconino	1
17	-114.09453913600	34.34875096680	12N	18W	25	Mineral Aggregate	0	17.000000	N	OK	0.000000		N	1	0	0	Mohave	1
18	-114.34937412500	34.57358475030	14N	20W	10	Mineral Aggregate	0	18.000000	N	airport	0.000000		N	1	0	0	Mohave	1
19	-113.65004854600	34.86095768830	17N	13W	15	Mineral Aggregate	0	19.000000	N	OK	0.000000		N	0	0	100	Mohave	0
20	-114.15498536400	34.89692947420	18N	18W	36	Mineral Aggregate	1	20.000000	0.5	N--developed, in median	1.000000		N	0	1	0	Mohave	3
21	-114.59579178700	34.98061081770	18N	22W	2	Mineral Aggregate	0	21.000000	N	N--developed	0.000000		N	0	1	0	Mohave	1
22	-114.57816448200	35.05695081890	19N	22W	1	Mineral Aggregate	1	22.000000	1	N--developed	1.000000		N	1	1	0	Mohave	4
23	-113.92654831400	36.87591077580	40N	15W	9	Mineral Aggregate	1	23.000000	0.5	OK	0.000000		N	1	0	0	Mohave	2
24	-114.03437198900	36.85785513090	40N	16W	21	Mineral Aggregate	1	24.000000	1	OK	0.000000		N	1	0	0	Mohave	2
25	-112.59238496500	36.97404662510	41N	03W	11	Mineral Aggregate	1	25.000000	0.5	OK--dirt road	0.000000		N	1	0	0	Yavapai	2
26	-113.71676196500	36.97371429460	41N	13W	9	Mineral Aggregate	1	26.000000	0.5	OK--freeway	0.000000		N	1	0	0	Mohave	2
27	-113.93342574300	36.91583832860	41N	15W	33	Mineral Aggregate	1	27.000000	1	N--developed	0.000000		N	1	1	0	Mohave	3
28	-112.17993533200	34.35424663180	11N	02E	8	Mineral Aggregate	1	28.000000	0.5	OK	0.000000	Pipeline	N	1	0	0	Yavapai	2
29	-112.12912390000	34.33400909170	11N	02E	14	Mineral Aggregate	1	29.000000	1		0.000000		N	0	0	0	Yavapai	1
30	-112.16242890100	34.33942539650	11N	02E	16	Mineral Aggregate	1	30.000000	0.5	N--development	1.000000		N	0	1	0	Yavapai	3
31	-112.12706999400	34.31269226600	11N	02E	23	Mineral Aggregate	0	31.000000	N	OK--near highway	0.000000		N	0	0	100	Yavapai	0
32	-112.12706999400	34.31269226600	11N	02E	23	Mineral Aggregate	0	32.000000	N	OK--near highway	0.000000		N	0	0	100	Yavapai	0
33	-112.10955864900	34.30905760760	11N	02E	25	Mineral Aggregate	0	33.000000	N	N--development	0.000000		N	0	1	0	Yavapai	1
34	-112.07508876800	34.32723236630	11N	03E	17	Mineral Aggregate	1	34.000000	1	agriculture	0.000000		N	1	0	0	Yavapai	2
35	-114.10691494400	35.14740382690	20N	17W	5	Mineral Aggregate	1	35.000000	0.5	development close by	0.000000		N	0	0	0	Mohave	1
36	-114.19856759900	35.22704769620	21N	18W	10	Mineral Aggregate	1	36.000000	1	N--developed	0.000000		N	0	1	0	Mohave	2
37	-114.28689174000	35.22701278350	21N	19W	11	Mineral Aggregate	1	37.000000	1	N--developed	0.000000		N	0	1	0	Mohave	2
38	-114.37399958700	35.22780198590	21N	20W	1	Mineral Aggregate	1	38.000000	1	OK--adjacent to freeway	1.000000		N	1	0	0	Mohave	3
39	-114.46243616800	35.19517748900	21N	20W	19	Mineral Aggregate	1	39.000000	1	development close by	0.000000		Y	1	0	0	Mohave	2
40	-113.38399881500	35.18129038750	21N	10W	30	Mineral Aggregate	0	40.000000	N	OK--freeway	0.000000	2 pipelines	N	0	0	100	Mohave	0
41	-113.67355504200	35.16506068990	21N	13W	33	Mineral Aggregate	1	41.000000	1	OK--dirt road, freeway	0.000000	Pipeline	N	0	0	0	Mohave	1
42	-113.90329742900	35.19407854670	21N	15W	20	Mineral Aggregate	1	42.000000	0.5	OK--dirt road	1.000000	3 pipelines	N	1	0	0	Mohave	3
43	-114.07511646900	35.17668169500	21N	17W	26	Mineral Aggregate	1	43.000000	0.5		0.000000		N	1	0	0	Mohave	2
44	-114.07410510200	35.15853011360	21N	17W	35	Mineral Aggregate	1	44.000000	1	development close by	0.000000	2 RR lines-Atchison, Topeka and Santa Fe	N	1	0	0	Mohave	2
45	-114.51543895600	35.19513832220	21N	21W	22	Mineral Aggregate	1	45.000000	0.5	development close by	0.000000	Power line	N	1	0	0	Mohave	2
46	-113.64583526100	35.41337529800	23N	13W	2	Mineral Aggregate	1	46.000000	1	RR very close	0.000000	Fe	N	1	0	0	Mohave	2
47	-114.36035342700	35.55896612110	25N	19W	18	Mineral Aggregate	1	47.000000	1	OK-RR	0.000000		N	0	0	0	Mohave	1
48	-114.36034117800	35.52994144320	25N	19W	30	Mineral Aggregate	1	48.000000	1	OK-RR--developed other side	0.000000		N	0	0	0	Mohave	1
49	-112.12429106300	34.23665151630	10N	02E	23	Mineral Aggregate	0	49.000000	N	OK--near highway	0.000000		N	0	0	100	Yavapai	0
50	-112.07206420200	34.27994682160	10N	03E	5	Mineral Aggregate	0	50.000000	N	OK	0.000000		N	0	0	100	Yavapai	0
51	-112.18009955800	34.36887012660	11N	02E	5	Mineral Aggregate	1	51.000000	1	in median?	1.000000		N	0	0	0	Yavapai	2
52	-112.07508876800	34.32723236630	11N	03E	17	Mineral Aggregate	1	52.000000	1	agriculture	0.000000		N	1	0	0	Yavapai	2
53	-112.77492256200	34.27604767770	11N	05W	22	Mineral Aggregate	1	53.000000	1	OK--near development	0.000000		N	0	0	0	Yavapai	1
54	-110.65960016800	34.97864265260	18N	16E	9	Mineral Aggregate	0	54.000000	N	OK--near highway	0.000000		N	0	0	100	Navajo	0
55	-110.25050405700	34.92170265430	18N	20E	32	Mineral Aggregate	0	55.000000	N	OK--near freeway	0.000000		N	1	0	0	Navajo	1
56	-113.10497557900	34.01728559980	08N	08W	21	Mineral Aggregate	1	56.000000	0.5	OK	0.000000		N	0	0	0	Yavapai	1
57	-112.16637608700	34.11203029920	09N	02E	21	Mineral Aggregate	0	57.000000	N	OK	0.000000		N	0	0	100	Yavapai	0
58	-112.16820812200	34.08011505750	09N	02E	33	Mineral Aggregate	0	58.000000	N	OK	0.000000		N	0	0	100	Yavapai	0
59	-112.15109211200	34.08473511870	09N	02E	34	Mineral Aggregate	1	59.000000	1	N--development	0.000000		N	1	1	0	Yavapai	3
60	-112.75194877800	34.14184227250	09N	05W	11	Mineral Aggregate	0	60.000000	0.5	OK	0.000000		N	0	0	0	Yavapai	1
61	-112.21626783300	34.45114388810	12N	01E	1	Mineral Aggregate	1	61.000000	1	OK	0.000000		N	0	0	0	Yavapai	1
62	-112.28684856400	34.45428830220	12N	01E	5	Mineral Aggregate	1	62.000000	1	OK--dirt road	0.000000		N	0	0	0	Yavapai	1
63	-112.26733641500	34.42696216970	12N	01E	16	Mineral Aggregate	1	63.000000	0.5	OK--dirt road	0.000000		N	0	0	0	Yavapai	1

**Aggregate Sources for Construction and Maintenance in Northern Arizona
Mineral Aggregate Classification**

No.	X	Y	T	R	S	MAT_TYPE	NEPA_VB1	NUM	F12	LAND_USE	CULTURAL	Notes	IMPACT	BIO_VB	NEPA_VB2	Exclude	Conty	Total
64	-112.21595831300	34.38708962640	12N	01E	25	Mineral Aggregate	1	64.000000	0.5	near development	1.000000		N	0	0	0	Yavapai	2
65	-112.54697032900	34.38833966130	12N	03W	14	Mineral Aggregate	1	65.000000	0.5	OK	0.000000		N	0	0	0	Yavapai	1
66	-112.25494183000	34.53041611350	13N	01E	3	Mineral Aggregate	1	66.000000	1	near development	0.000000		N	0	0	0	Yavapai	1
67	-112.25559783600	34.52441106080	13N	01E	10	Mineral Aggregate	1	67.000000	0.5	near development	0.000000		N	0	0	0	Yavapai	1
68	-112.25559783600	34.52441106080	13N	01E	10	Mineral Aggregate	1	68.000000	0.5	near development	0.000000		N	0	0	0	Yavapai	1
69	-112.23568470500	34.52619967500	13N	01E	11	Mineral Aggregate	1	69.000000	1	agriculture, development	0.000000		N	0	0	0	Yavapai	1
70	-112.23568470500	34.52619967500	13N	01E	11	Mineral Aggregate	1	70.000000	1	agriculture, development	0.000000		N	0	0	0	Yavapai	1
71	-112.39477785700	34.54214141650	13N	01W	5	Mineral Aggregate	0	71.000000	N	OK--near development	1.000000		N	0	0	0	Yavapai	1
72	-112.10583568200	34.50272435140	13N	02E	14	Mineral Aggregate	1	72.000000	0.5	OK	0.000000		N	0	0	0	Yavapai	1
74	-113.24789213600	34.42855553700	13N	09W	31	Mineral Aggregate	1	74.000000	0.5	OK--in median?	0.000000		N	1	0	0	Yavapai	2
75	-112.28825350500	34.57353714880	14N	01E	20	Mineral Aggregate	1	75.000000	1	OK--near development	0.000000		N	0	0	0	Yavapai	1
76	-112.27104214500	34.55907171450	14N	01E	28	Mineral Aggregate	1	76.000000	1	N--development	0.000000			0	1	0	Yavapai	2
77	-112.27104214500	34.55907171450	14N	01E	28	Mineral Aggregate	1	77.000000	1	N--development	0.000000			0	1	0	Yavapai	2
78	-112.35812908800	34.57376862860	14N	01W	22	Mineral Aggregate	0	78.000000	N	OK--near development	0.000000		N	0	0	100	Yavapai	0
79	-112.32367314300	34.58440379080	14N	01W	24	Mineral Aggregate	1	79.000000	0.5	N--development	0.000000			0	1	0	Yavapai	2
80	-112.37596249500	34.54504811630	14N	01W	33	Mineral Aggregate	1	80.000000	1	N--development	1.000000			0	1	0	Yavapai	3
81	-112.42744408800	34.62728586500	14N	02W	1	Mineral Aggregate	0	81.000000	N	OK--highway	1.000000		N	0	0	0	Yavapai	1
82	-112.44491824600	34.58358745040	14N	02W	23	Mineral Aggregate	0	82.000000	N	N--development	1.000000			0	1	0	Yavapai	2
83	-112.42791958900	34.57130611180	14N	02W	24	Mineral Aggregate	1	83.000000	1	N--development	1.000000			0	1	0	Yavapai	3
84	-112.46384516700	34.55995751350	14N	02W	27	Mineral Aggregate	1	84.000000	0.5	OK--near development	0.000000	Cemetery	N	0	0	0	Yavapai	1
85	-111.93728581800	34.63173136280	14N	04E	4	Mineral Aggregate	1	85.000000	1	OK--near development	0.000000		N	1	0	0	Yavapai	2
86	-111.88613296100	34.58576208430	14N	04E	24	Mineral Aggregate	0	86.000000	N	OK--near development	1.000000		N	1	0	0	Yavapai	2
87	-111.90341722700	34.55657208470	14N	04E	35	Mineral Aggregate	1	87.000000	0.5	OK--near highway	0.000000		N	1	0	0	Yavapai	2
88	-111.83209746200	34.62963938970	14N	05E	4	Mineral Aggregate	1	88.000000	1	OK--near development	1.000000		Y	1	0	0	Yavapai	3
89	-111.87103007700	34.57671214810	14N	05E	30	Mineral Aggregate	1	89.000000	1	OK--near development	0.000000		N	1	0	0	Yavapai	2
90	-112.02523420800	34.73070540950	15N	03E	3	Mineral Aggregate	0	90.000000	N	N--development	1.000000			1	1	0	Yavapai	3
91	-112.00737579100	34.70144433760	15N	03E	14	Mineral Aggregate	1	91.000000	1	OK--nearby development	0.000000		N	1	0	0	Yavapai	2
92	-111.98966039800	34.68705723690	15N	03E	24	Mineral Aggregate	1	92.000000	0.5	OK--nearby development	0.000000		N	1	0	0	Yavapai	2
93	-111.91925078300	34.70475414680	15N	04E	10	Mineral Aggregate	1	93.000000	0.5	N--development	0.000000			1	1	0	Yavapai	3
94	-111.97215345400	34.67620460390	15N	04E	19	Mineral Aggregate	1	94.000000	0.5	OK	0.000000		N	1	0	0	Yavapai	2
95	-111.81339952700	34.68380815810	15N	05E	22	Mineral Aggregate	1	95.000000	0.5	OK	0.000000		N	0	0	0	Yavapai	1
96	-111.81402340800	34.64464010260	15N	05E	34	Mineral Aggregate	1	96.000000	1	N--development	0.000000			1	1	0	Yavapai	3
97	-112.04251180000	34.74891471420	16N	03E	28	Mineral Aggregate	1	97.000000	0.5	N--development	1.000000			1	1	0	Yavapai	4
98	-111.83113648400	34.79193277180	16N	05E	9	Mineral Aggregate	1	98.000000	1		0.000000		N	0	0	0	Yavapai	1
99	-111.83113648400	34.79193277180	16N	05E	9	Mineral Aggregate	0	99.000000	N	OK	0.000000		N	0	0	100	Yavapai	0
100	-112.46373463500	34.81764837390	17N	02W	34	Mineral Aggregate	1	100.000000	0.5	agriculture, nearby development	0.000000		N	0	0	0	Yavapai	1
101	-111.88092862600	34.83794840480	17N	05E	19	Mineral Aggregate	1	101.000000	1	OK--highway	1.000000		N	0	0	0	Yavapai	2
102	-112.74209203600	35.28306038170	22N	04W	17	Mineral Aggregate	0	102.000000	N	OK--nearby development	0.000000	2 pipelines	N	0	0	100	Yavapai	0
103	-113.02599167700	35.28632537650	22N	07W	16	Mineral Aggregate	1	103.000000	0.5	OK--dirt road	1.000000	2 pipelines	N	0	0	0	Yavapai	2
200	-109.82019200000	34.67081900000	15N	24E	29		1	0.000000	0		0.000000			0	0	0	Apache	1
201	-109.19813100000	34.02590300000	07N	30E	5		0	0.000000	0		0.000000			1	0	0	Apache	1
202	-109.37551700000	34.00229400000	07N	28E	15		1	0.000000	0		0.000000			1	0	0	Apache	2
203	-109.26281900000	34.73855600000	15N	29E	4		0	0.000000	0		0.000000			0	0	100	Apache	0
204	-111.93799200000	35.18116700000	21N	04E	23		0	0.000000	0		1.000000			0	0	0	Coconino	1
205	-112.17939400000	35.31689200000	22N	02E	4		1	0.000000	0		0.000000			0	0	0	Coconino	1
206	-111.46303100000	35.69690800000	27N	09E	29		0	0.000000	0		0.000000			1	0	0	Coconino	1
207	-111.44816100000	34.99543300000	19N	09E	28		1	0.000000	0		0.000000			0	0	0	Coconino	1
208	-111.76050800000	35.18992500000	21N	06E	21		1	0.000000	0		1.000000			1	0	0	Coconino	3
209	-111.74293600000	35.93176100000	29N	06E	3		0	0.000000	0		1.000000			0	0	0	Coconino	1
210	-111.46453900000	35.69514400000	27N	09E	29		0	0.000000	0		0.000000			1	0	0	Coconino	1
211	-114.40143300000	35.60049400000	26N	20W	34		1	0.000000	0		0.000000			0	0	0	Mohave	1
212	-114.28177800000	35.22709200000	21N	19W	11		1	0.000000	0		0.000000			0	1	0	Mohave	2
213	-114.50537500000	35.79729200000	28N	21W	26		0	0.000000	0		0.000000			0	0	100	Mohave	0
214	-114.43400000000	34.71015800000	16N	20SW	23		1	0.000000	0		0.000000			1	0	0	Mohave	2
215	-114.31641100000	34.67967500000	16N	20W	35		1	0.000000	0		1.000000			1	0	0	Mohave	3
216	-113.56447200000	35.13760300000	20N	12W	4		1	0.000000	0		0.000000			0	0	0	Mohave	1
217	-114.39861100000	35.68627500000	27N	20W	34		1	0.000000	0		0.000000			0	0	0	Mohave	1
218	-114.12258900000	34.91708300000	18N	17W	30		1	0.000000	0		0.000000			0	0	0	Mohave	1
219	-114.11726700000	34.91784400000	18N	17W	30		1	0.000000	0		0.000000			0	0	0	Mohave	1
220	-110.01312200000	35.07950800000	19N	22E	4		0	0.000000	0		0.000000			0	0	100	Navajo	0
221	-110.10509700000	34.80937500000	16N	21E	3		0	0.000000	0		0.000000			0	0	100	Navajo	0
222	-110.10509700000	35.80937500000	16N	21E	3		0	0.000000	0		0.000000			0	0	100	Navajo	0
223	-112.04072500000	34.39144400000	12N	03E	27		1	0.000000	0		1.000000			1	0	0	Yavapai	3
224	-113.18682200000	34.58601900000	14N	09W	3		0	0.000000	0		1.000000			0	0	0	Yavapai	1

**Aggregate Sources for Construction and Maintenance in Northern Arizona
Rock Quarry Classification**

No_	OBJECTID	County	T	R	S	Y	X	LINK	Total	No1	LINK_1	County_1	BIO	404_binary	LAND_USE_b	Cultural_b	BIO_binary	
1	26	Apache	16	N	30	E	8	34.67083300000	-109.71916700000	1	1	1.000000	1.000000 Apache	1.000000	0.000000	0.000000	0.000000	
2	40	Apache	15N	29E	4		34.73419939030	-109.27611027600	2	100	2.000000	2.000000 Apache	0.000000	0.000000	0.000000	0.000000	0.000000	
3	240	Coconino	24	N	2	E	4	35.48444400000	-112.17833300000	3	1	3.000000	3.000000 Coconino	1.000000	0.000000	0.000000	0.000000	
4	329	Coconino	20	N	1	E	31	35.071111100000	-112.321111100000	4	1	4.000000	4.000000 Coconino	1.000000	0.000000	0.000000	0.000000	
5	333	Coconino	20	N	9	E	26	35.08527800000	-111.40194400000	5	2	5.000000	5.000000 Coconino	1.000000	0.000000	1.000000	0.000000	
6	339	Coconino	20	N	13	E	29	35.10444400000	-110.98527800000	6	2	6.000000	6.000000 Coconino	1.000000	0.000000	1.000000	0.000000	
7	346	Coconino					35.14444400000	-111.63190000000	7	1	7.000000	7.000000 Coconino	Within Mexican Spotted Owl Crit. Hab.	0.000000	0.000000	0.000000	1.000000	
8	347	Coconino	20	N	7	E	3	35.15000000000	-111.63333300000	8	1	8.000000	8.000000 Coconino	Within Mexican Spotted Owl Crit. Hab.	0.000000	0.000000	0.000000	1.000000
9	504	Coconino	11	N	14	E	3	34.36722200000	-110.82861100000	9	1	9.000000	9.000000 Coconino	Within USFWS current Chiricahua Leopard Frog distribution range, but more than 2.5 miles of known occurrence, within Mexican Spotted Owl Crit. Hab.	0.000000	0.000000	0.000000	1.000000
10	505	Coconino	11	N	14	E	3	34.36944400000	-110.83611100000	10	1	10.000000	10.000000 Coconino	Within USFWS current Chiricahua Leopard Frog distribution range, but more than 2.5 miles of known occurrence, within Mexican Spotted Owl Crit. Hab.	1.000000	0.000000	0.000000	0.000000
11	506	Coconino	11	N	14	E	3	34.36944400000	-110.83611100000	11	2	11.000000	11.000000 Coconino	Within USFWS current Chiricahua Leopard Frog distribution range, but more than 2.5 miles of known occurrence, within Mexican Spotted Owl Crit. Hab.	1.000000	0.000000	0.000000	1.000000
12	508	Coconino	12	N	8	E	16	34.42222200000	-111.50972200000	12	2	12.000000	12.000000 Coconino	Within USFWS current Chiricahua Leopard Frog distribution range, but more than 2.5 miles of known occurrence, within Mexican Spotted Owl Crit. Hab.	1.000000	0.000000	0.000000	1.000000
13	704	Coconino					35.06000000000	-111.55000000000	13	100	13.000000	13.000000 Coconino		0.000000	0.000000	0.000000	0.000000	
14	777	Coconino	21	N	8	E	25	35.17444400000	-111.48611100000	14	100	14.000000	14.000000 Coconino		0.000000	0.000000	0.000000	
15	799	Coconino	21	N	7	E	14	35.19694400000	-111.63000000000	15	1	15.000000	15.000000 Coconino		0.000000	1.000000	0.000000	
16	839	Coconino	21	N	7	E	1	35.23611100000	-111.60361100000	16	1	16.000000	16.000000 Coconino		1.000000	0.000000	0.000000	
17	877	Coconino	22	N	8	E	29	35.25833300000	-111.56861100000	17	1	17.000000	17.000000 Coconino		1.000000	0.000000	0.000000	
18	896	Coconino	22	N	1	W	21	35.27000000000	-112.40194400000	18	100	18.000000	18.000000 Coconino		0.000000	0.000000	0.000000	
19	909	Coconino	22	N	2	W	24	35.27861100000	-112.44638900000	19	1	19.000000	19.000000 Coconino		1.000000	0.000000	0.000000	
20	914	Coconino	22	N	1	W	17	35.28750000000	-112.40888900000	20	100	20.000000	20.000000 Coconino		0.000000	0.000000	0.000000	
21	935	Coconino	23	N	2	E	36	35.32083300000	-112.12722200000	21	1	21.000000	21.000000 Coconino		1.000000	0.000000	0.000000	
22	1010	Coconino	27	N	9	E	29	35.69222200000	-111.46444400000	22	2	22.000000	22.000000 Coconino	Within range of Fickeisen Plains Cactus	0.000000	1.000000	0.000000	1.000000
23	1091	Coconino	40	N	7	E	16	36.86666700000	-111.65111100000	23	1	23.000000	23.000000 Coconino	On edge of Brady pincushion cactus range, within range for Welsh's milkweed	0.000000	0.000000	0.000000	1.000000
24	79	Coconino	14N	10E	34		34.56172573760	-111.28624827600	24	1	24.000000	24.000000 Coconino	Within USFWS current Chiricahua Leopard Frog distribution range, but more than 2.5 miles of known occurrence, ~1.4 miles from Crit. Hab. for Little Colorado spinedace, within Mexican Spotted Owl Crit. Hab., ~0.6 miles from an Mexican Spotted Owl PAC	0.000000	0.000000	0.000000	1.000000	
25	80	Coconino	15N	12E	4		34.71241087680	-111.08809195300	25	2	25.000000	25.000000 Coconino	Within USFWS current Chiricahua Leopard Frog distribution range, but more than 2.5 miles of known occurrence	1.000000	0.000000	0.000000	1.000000	
26	105	Coconino	24N	02E	10		35.47069764870	-112.17358349900	26	1	26.000000	26.000000 Coconino		1.000000	0.000000	0.000000	0.000000	
27	106	Coconino	24N	02E	9		35.47069097420	-112.19130402700	27	100	27.000000	27.000000 Coconino		0.000000	0.000000	0.000000	0.000000	
28	107	Coconino	24N	02E	10		35.47069764870	-112.17358349900	28	1	28.000000	28.000000 Coconino		1.000000	0.000000	0.000000	0.000000	
29	125	Coconino	26N	09E	3		35.65735310690	-111.42824228700	29	100	29.000000	29.000000 Coconino		0.000000	0.000000	0.000000	0.000000	

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No_	OBJECTID	County	T	R	S	Y	X	LINK	Total	No1	LINK_1	County_1	BIO	404_binary	LAND_USE_b	Cultural_b	BIO_binary
30	126	Coconino	27N	02E	12		35.74308417630	-112.13515521100	30	100	30.000000	Coconino		0.000000	0.000000	0.000000	0.000000
31	127	Coconino	27N	09E	31		35.67199259100	-111.48145895200	31	1	31.000000	Coconino		1.000000	0.000000	0.000000	0.000000
32	132	Coconino	28N	02E	1		35.84474121770	-112.13539695900	32	1	32.000000	Coconino		1.000000	0.000000	0.000000	0.000000
33	133	Coconino	28N	02E	2		35.84471818710	-112.15316384100	33	100	33.000000	Coconino		0.000000	0.000000	0.000000	0.000000
34	140	Coconino	16N	13E	5		34.81056968330	-110.99727382900	34	1	34.000000	Coconino		1.000000	0.000000	0.000000	0.000000
35	141	Coconino	17N	07E	35		34.815668130900	-111.62854925900	35	100	35.000000	Coconino		0.000000	0.000000	0.000000	0.000000
36	146	Coconino	18N	07E	28		34.92081458160	-111.66428413800	36	100	36.000000	Coconino		0.000000	0.000000	0.000000	0.000000
37	147	Coconino	18N	14E	36		34.90979435310	-110.81765151300	37	1	37.000000	Coconino		1.000000	0.000000	0.000000	0.000000
													Within Mexican Spotted Owl Crit. Hab., within an Mexican Spotted Owl PAC				
38	148	Coconino	19N	07E	6		35.06362742700	-111.70128086000	38	2	38.000000	Coconino		1.000000	0.000000	0.000000	1.000000
39	153	Coconino	20N	09E	26		35.09251084060	-111.41906524200	39	1	39.000000	Coconino		1.000000	0.000000	0.000000	0.000000
40	156	Coconino	20N	12E	5		35.15393594350	-111.15274992500	40	1	40.000000	Coconino		1.000000	0.000000	0.000000	0.000000
41	157	Coconino	20N	13E	32		35.09675449040	-110.99365420600	41	1	41.000000	Coconino		1.000000	0.000000	0.000000	0.000000
42	158	Coconino	21N	01W	1		35.22311642680	-112.35242915400	42	1	42.000000	Coconino		1.000000	0.000000	0.000000	0.000000
43	159	Coconino	21N	01W	5		35.22357806620	-112.42633605100	43	100	43.000000	Coconino		0.000000	0.000000	0.000000	0.000000
44	162	Coconino	21N	06E	21		35.19330115300	-111.77003109600	44	2	44.000000	Coconino		1.000000	0.000000	1.000000	0.000000
45	163	Coconino	21N	06E	8		35.22212332270	-111.78764109100	45	100	45.000000	Coconino		0.000000	0.000000	0.000000	0.000000
													Within Mexican Spotted Owl Crit. Hab., ~0.5 miles from an Mexican Spotted Owl PAC				
46	164	Coconino	21N	07E	31		35.16414694610	-111.69935611600	46	2	46.000000	Coconino		1.000000	0.000000	0.000000	1.000000
47	181	Coconino	21N	09E	15		35.20821077020	-111.43420215800	47	100	47.000000	Coconino		0.000000	0.000000	0.000000	0.000000
48	182	Coconino	21N	09E	23		35.18285705700	-111.41652541900	48	1	48.000000	Coconino		1.000000	0.000000	0.000000	0.000000
49	187	Coconino	22N	02E	29		35.26339046590	-112.21051575000	49	1	49.000000	Coconino		1.000000	0.000000	0.000000	0.000000
50	192	Coconino	22N	03E	21		35.27739895480	-112.08664134200	50	1	50.000000	Coconino		1.000000	0.000000	0.000000	0.000000
51	194	Coconino	22N	05E	32		35.24005721340	-111.89414644600	51	1	51.000000	Coconino		1.000000	0.000000	0.000000	0.000000
													Within Mexican Spotted Owl Crit. Hab., ~0.5 miles from an Mexican Spotted Owl PAC				
52	205	Coconino	23N	07E	13		35.38246247540	-111.61152969900	52	2	52.000000	Coconino		1.000000	0.000000	0.000000	1.000000
53	211	Coconino	41N	08E	11		36.96320536080	-111.50907186700	53	100	53.000000	Coconino		0.000000	0.000000	0.000000	0.000000
54	212	Coconino	41N	08E	11		36.96320536080	-111.50907186700	54	1	54.000000	Coconino		0.000000	0.000000	0.000000	1.000000
													Within range for Welsh's milkweed Within AZ Cliffrose range near Bagdad, within Sonoran Desert tortoise range				
55	647	Mohave	14 N	11 W	20		34.53444400000	-113.42027800000	55	1	55.000000	Mohave		0.000000	0.000000	0.000000	1.000000
													Within Sonoran Desert tortoise range, within USFWS range for Hualapai Mexican vole				
56	1205	Mohave	21 N	15 W	32		35.15694400000	-113.89222200000	56	2	56.000000	Mohave		1.000000	0.000000	0.000000	1.000000
57	1246	Mohave	16 N	13 W	25		34.70305600000	-113.56472200000	57	2	57.000000	Mohave		1.000000	0.000000	0.000000	1.000000
58	1336	Mohave	23 N	17 W	30		35.35055600000	-114.14555600000	58	2	58.000000	Mohave		1.000000	0.000000	1.000000	0.000000
59	1345	Mohave	23 N	13 W	20		35.35888900000	-113.67972200000	59	1	59.000000	Mohave		1.000000	0.000000	0.000000	0.000000
60	1356	Mohave	24 N	18 W	34		35.42555600000	-114.19972200000	60	2	60.000000	Mohave		1.000000	0.000000	1.000000	0.000000
61	1358	Mohave	24 N	19 W	36		35.42638900000	-114.25527800000	61	1	61.000000	Mohave		1.000000	0.000000	0.000000	0.000000
62	1443	Mohave	21 N	14 W	20		35.18750000000	-113.79027800000	62	1	62.000000	Mohave		0.000000	0.000000	0.000000	1.000000
63	1487	Mohave	21 N	17 W	6		35.23055600000	-114.13111100000	63	2	63.000000	Mohave		1.000000	0.000000	0.000000	1.000000
64	1497	Mohave					35.24470000000	-114.04890000000	64	2	64.000000	Mohave		0.000000	1.000000	0.000000	1.000000
65	1498	Mohave	22 N	17 W	36		35.24472200000	-114.04888900000	65	1	65.000000	Mohave		0.000000	1.000000	0.000000	0.000000
66	1507	Mohave	22 N	17 W	27		35.26194400000	-114.07944400000	66	1	66.000000	Mohave		0.000000	0.000000	0.000000	1.000000
67	1509	Mohave	22 N	17 W	26		35.26777800000	-114.06222200000	67	1	67.000000	Mohave		0.000000	0.000000	0.000000	1.000000
68	1510	Mohave	22 N	17 W	23		35.27361100000	-114.05861100000	68	2	68.000000	Mohave		1.000000	0.000000	0.000000	1.000000

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69	1512	Mohave	22	N	17	W	22	35.277222000000	-114.076111000000	69	2	69.000000	69.000000	Mohave	Within Sonoran Desert tortoise range Within range of Siler Pincushion Cactus	1.000000	0.000000	0.000000	1.000000
70	1651	Coconino	42	N	2	W	32	36.992778000000	-112.531944000000	70	2	70.000000	70.000000	Coconino		0.000000	1.000000	0.000000	1.000000
71	1694	Mohave						35.344700000000	-113.770000000000	71	100	71.000000	71.000000	Mohave		0.000000	0.000000	0.000000	0.000000
72	1695	Mohave						35.344710000000	-113.770050000000	72	100	72.000000	72.000000	Mohave		0.000000	0.000000	0.000000	0.000000
73	1700	Mohave	23	N	13	W	26	35.345556000000	-113.643056000000	73	1	73.000000	73.000000	Mohave		1.000000	0.000000	0.000000	0.000000
74	1705	Mohave						35.364300000000	-114.158300000000	74	1	74.000000	74.000000	Mohave		1.000000	0.000000	0.000000	0.000000
75	1717	Mohave						35.371700000000	-113.822100000000	75	1	75.000000	75.000000	Mohave		1.000000	0.000000	0.000000	0.000000
76	1728	Mohave	23	N	18	W	13	35.377500000000	-114.157222000000	76	1	76.000000	76.000000	Mohave		0.000000	0.000000	1.000000	0.000000
77	206	Mohave	14N		20W		14	34.55183070930	-114.33180168300	77	2	77.000000	77.000000	Mohave	Within Sonoran Desert tortoise range	1.000000	0.000000	0.000000	1.000000
78	291	Mohave	41N		13W		1	36.97732716920	-113.66256202400	78	1	78.000000	78.000000	Mohave	~1.5 miles from Crit. Hab. for Holmgren's Milk Vetch, within 7 miles of known Mohave Desert tortoise occurrences, <1 mile from known occurrences of Gierisch mallow Within USFWS current Chiricahua Leopard Frog distribution range, but more than 2.5 miles of known occurrence, within Mexican Spotted Owl Crit. Hab.	0.000000	0.000000	0.000000	1.000000
79	1793	Navajo	11	N	15	E	2	34.367778000000	-110.710278000000	79	2	79.000000	79.000000	Navajo	Within USFWS current Chiricahua Leopard Frog distribution range, but more than 2.5 miles of known occurrence	1.000000	0.000000	0.000000	1.000000
80	1799	Navajo	12	N	20	E	20	34.417222000000	-110.247500000000	80	2	80.000000	80.000000	Navajo	Within USFWS current Chiricahua Leopard Frog distribution range, but more than 2.5 miles of known occurrence	1.000000	0.000000	0.000000	1.000000
81	1929	Navajo	14	N	21	E	25	34.577778000000	-110.073611000000	81	2	81.000000	81.000000	Navajo	Within USFWS current Chiricahua Leopard Frog distribution range, but more than 2.5 miles of known occurrence	1.000000	0.000000	0.000000	1.000000
82	1933	Navajo	15	N	19	E	31	34.653889000000	-110.373056000000	82	2	82.000000	82.000000	Navajo	occurrence	1.000000	0.000000	0.000000	1.000000
83	1945	Navajo	16	N	16	E	14	34.790278000000	-110.618333000000	83	1	83.000000	83.000000	Navajo		1.000000	0.000000	0.000000	0.000000
84	1953	Navajo	16	N	23	E	3	34.819722000000	-109.899722000000	84	100	84.000000	84.000000	Navajo		0.000000	0.000000	0.000000	0.000000
85	1956	Navajo	17	N	21	E	30	34.836944000000	-110.147500000000	85	1	85.000000	85.000000	Navajo		1.000000	0.000000	0.000000	0.000000
86	534	Navajo	18N		15E		2	34.98228985310	-110.72941568000	86	100	86.000000	86.000000	Navajo		0.000000	0.000000	0.000000	0.000000
87	535	Navajo	18N		15E		2	34.98228985310	-110.72941568000	87	100	87.000000	87.000000	Navajo		0.000000	0.000000	0.000000	0.000000
88	536	Navajo	18N		15E		2	34.98228985310	-110.72941568000	88	100	88.000000	88.000000	Navajo		0.000000	0.000000	0.000000	0.000000
89	537	Navajo	18N		15E		2	34.98228985310	-110.72941568000	89	100	89.000000	89.000000	Navajo		0.000000	0.000000	0.000000	0.000000
90	558	Navajo	19N		22E		4	35.07134342050	-110.01930003200	90	100	90.000000	90.000000	Navajo		0.000000	0.000000	0.000000	0.000000
91	1855	Yavapai	10	N	6	W	4	34.237500000000	-112.884167000000	91	1	91.000000	91.000000	Yavapai		1.000000	0.000000	0.000000	0.000000
92	2170	Yavapai	12	N	1	E	22	34.406667000000	-112.241667000000	92	1	92.000000	92.000000	Yavapai		0.000000	0.000000	1.000000	0.000000
93	2171	Yavapai						34.406940000000	-112.258300000000	93	1	93.000000	93.000000	Yavapai		1.000000	0.000000	0.000000	0.000000
94	2223	Yavapai	8	N	5	W	21	34.024444000000	-112.780556000000	94	2	94.000000	94.000000	Yavapai	Within Sonoran Desert tortoise range	1.000000	0.000000	0.000000	1.000000
95	2277	Yavapai	10	N	5	W	36	34.173611000000	-112.723333000000	95	100	95.000000	95.000000	Yavapai		0.000000	0.000000	0.000000	0.000000
96	2385	Yavapai	12	N	5	W	34	34.335000000000	-112.766667000000	96	1	96.000000	96.000000	Yavapai	Within Sonoran Desert tortoise range	0.000000	0.000000	0.000000	1.000000
97	2434	Yavapai						34.391670000000	-112.225000000000	97	3	97.000000	97.000000	Yavapai		1.000000	1.000000	1.000000	0.000000
98	2445	Yavapai	12	N	1	E	23	34.401667000000	-112.219167000000	98	2	98.000000	98.000000	Yavapai		1.000000	0.000000	1.000000	0.000000
99	2446	Yavapai	12	N	2	E	19	34.402500000000	-112.191389000000	99	1	99.000000	99.000000	Yavapai		1.000000	0.000000	0.000000	0.000000
100	2453	Yavapai	12	N	2	E	18	34.415833000000	-112.187778000000	100	1	100.000000	100.000000	Yavapai		1.000000	0.000000	0.000000	0.000000
101	2466	Yavapai	13	N	4	W	31	34.420278000000	-112.693889000000	101	1	101.000000	101.000000	Yavapai		1.000000	0.000000	0.000000	0.000000

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102	2470	Yavapai	12	N	2	E	18	34.42333300000	-112.19666700000	102	1	102.000000	102.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
103	2473	Yavapai	12	N	2	E	18	34.42555600000	-112.19694400000	103	1	103.000000	103.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
104	2483	Yavapai	12	N	2	E	18	34.42833300000	-112.19722200000	104	1	104.000000	104.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
105	2527	Yavapai	12	N	1	E	6	34.44583300000	-112.28888900000	105	1	105.000000	105.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
106	2693	Yavapai	13	N	1	W	17	34.50666700000	-112.39083300000	106	2	106.000000	106.000000	Yavapai	1.000000	0.000000	0.000000	1.000000
107	2712	Yavapai	13	N	1	W	17	34.51500000000	-112.39750000000	107	2	107.000000	107.000000	Yavapai	1.000000	0.000000	1.000000	0.000000
108	2778	Yavapai	14	N	2	E	33	34.54833300000	-112.16472200000	108	1	108.000000	108.000000	Yavapai	0.000000	1.000000	0.000000	0.000000
109	2787	Yavapai	14	N	2	W	34	34.55166700000	-112.45972200000	109	3	109.000000	109.000000	Yavapai	1.000000	1.000000	1.000000	0.000000
110	2808	Yavapai	14	N	2	E	31	34.56111100000	-112.18805600000	110	2	110.000000	110.000000	Yavapai	1.000000	0.000000	1.000000	0.000000
111	2852	Yavapai	14	N	2	W	20	34.58055600000	-112.49166700000	111	1	111.000000	111.000000	Yavapai	0.000000	1.000000	0.000000	0.000000
112	2875	Yavapai						34.58600000000	-113.20600000000	112	1	112.000000	112.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
113	2883	Yavapai	14	N	2	W	16	34.58888900000	-112.46527800000	113	1	113.000000	113.000000	Yavapai	0.000000	1.000000	0.000000	0.000000
Within Mexican Spotted Owl Crit. Hab.																		
114	2930	Yavapai	15	N	9	W	27	34.61111100000	-113.18472200000	114	1	114.000000	114.000000	Yavapai	0.000000	0.000000	0.000000	1.000000
115	2941	Yavapai						34.61944000000	-112.34300000000	115	3	115.000000	115.000000	Yavapai	1.000000	1.000000	1.000000	0.000000
116	2973	Yavapai	15	N	6	E	31	34.65555600000	-111.75583300000	116	2	116.000000	116.000000	Yavapai	1.000000	0.000000	1.000000	0.000000
117	2974	Yavapai	15	N	6	E	30	34.65861100000	-111.75222200000	117	1	117.000000	117.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
118	3040	Yavapai	22	N	4	W	11	35.30833300000	-112.69361100000	118	1	118.000000	118.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
Within 0.3 miles of Black-footed Ferret 10(j) population boundaries																		
119	3049	Yavapai						35.51670000000	-113.31580000000	119	2	119.000000	119.000000	Yavapai	1.000000	0.000000	0.000000	1.000000
Within 0.3 miles of Black-footed Ferret 10(j) population boundaries																		
120	3050	Yavapai						35.51720000000	-113.31390000000	120	2	120.000000	120.000000	Yavapai	1.000000	0.000000	0.000000	1.000000
121	3053	Yavapai						35.52077000000	-113.31233000000	121	1	121.000000	121.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
Within 0.3 miles of Black-footed Ferret 10(j) population boundaries																		
122	3054	Yavapai						35.52077000000	-113.31233000000	122	2	122.000000	122.000000	Yavapai	1.000000	0.000000	0.000000	1.000000
123	3055	Yavapai						35.52080000000	-113.31200000000	123	2	123.000000	123.000000	Yavapai	1.000000	0.000000	0.000000	1.000000
124	3083	Yavapai						34.73722000000	-111.78800000000	124	1	124.000000	124.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
125	3097	Yavapai						34.74900000000	-112.12200000000	125	100	125.000000	125.000000	Yavapai	0.000000	0.000000	0.000000	0.000000
126	3098	Yavapai						34.74902000000	-112.12285000000	126	100	126.000000	126.000000	Yavapai	0.000000	0.000000	0.000000	0.000000
127	3129	Yavapai						34.77722000000	-112.10830000000	127	1	127.000000	127.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
128	3132	Yavapai						34.77780000000	-112.10890000000	128	1	128.000000	128.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
Potential occurrence of AZ Cliffrose, Yellow-billed Cuckoo occurrences along river																		
129	3135	Yavapai						34.78110000000	-112.05690000000	129	3	129.000000	129.000000	Yavapai	0.000000	1.000000	1.000000	1.000000
130	3137	Yavapai						34.78140000000	-112.10390000000	130	100	130.000000	130.000000	Yavapai	0.000000	0.000000	0.000000	0.000000
Potential occurrence of AZ Cliffrose, <0.1 miles from Razorback Sucker Crit. Hab., Northern Mexican Garter Snake habitat along river, 400 feet from known Roundtail Chub occurrences, Yellow-billed Cuckoo occurrences along river																		
131	3140	Yavapai	16	N	3	E	17	34.78638900000	-112.05472200000	131	3	131.000000	131.000000	Yavapai	1.000000	1.000000	0.000000	1.000000
132	3145	Yavapai						34.79560000000	-112.12470000000	132	1	132.000000	132.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
133	3147	Yavapai						34.79670000000	-112.07640000000	133	1	133.000000	133.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
134	3160	Yavapai	17	N	2	W	25	34.82888900000	-112.42333300000	134	2	134.000000	134.000000	Yavapai	1.000000	0.000000	1.000000	0.000000
135	3162	Yavapai	17	N	5	E	20	34.83722200000	-111.85805600000	135	1	135.000000	135.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
136	3200	Yavapai						34.90690000000	-112.46250000000	136	1	136.000000	136.000000	Yavapai	0.000000	1.000000	0.000000	0.000000
137	3201	Yavapai	18	N	2	W	34	34.90694400000	-112.46250000000	137	1	137.000000	137.000000	Yavapai	0.000000	1.000000	0.000000	0.000000
138	3205	Yavapai						34.91720000000	-112.43580000000	138	1	138.000000	138.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
139	3206	Yavapai	18	N	2	W	26	34.91722200000	-112.43583300000	139	1	139.000000	139.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
140	3215	Yavapai	18	N	1	W	9	34.95750000000	-112.36916700000	140	1	140.000000	140.000000	Yavapai	1.000000	0.000000	0.000000	0.000000
141	3216	Yavapai						34.95750000000	-112.36920000000	141	1	141.000000	141.000000	Yavapai	1.000000	0.000000	0.000000	0.000000

**Aggregate Sources for Construction and Maintenance in Northern Arizona
Rock Quarry Classification**

No_	OBJECTID	County	T	R	S	Y	X	LINK	Total	No1	LINK_1	County_1	BIO	404_binary	LAND_USE_b	Cultural_b	BIO_binary	
142	3218	Yavapai	18	N	2	W	1	34.975000000000	-112.433333000000	142	100	142.000000	142.000000	Yavapai				
143	3219	Yavapai						34.975000000000	-112.433300000000	143	100	143.000000	143.000000	Yavapai				
144	3220	Yavapai						34.979700000000	-112.386900000000	144	1	144.000000	144.000000	Yavapai				
145	3221	Yavapai	19	N	1	W	32	34.979722000000	-112.386944000000	145	1	145.000000	145.000000	Yavapai				
146	3223	Yavapai						34.986100000000	-112.436100000000	146	100	146.000000	146.000000	Yavapai				
147	3224	Yavapai	19	N	2	W	34	34.986111000000	-112.436111000000	147	100	147.000000	147.000000	Yavapai				
148	3236	Yavapai	21	N	9	W	31	35.160278000000	-113.266667000000	148	100	148.000000	148.000000	Yavapai				
149	583	Yavapai	09N	07W	21			34.11264031740	-112.99625730400	149	2	149.000000	149.000000	Yavapai	Within Sonoran Desert tortoise range			
150	602	Yavapai	13N	02W	10			34.52501044390	-112.46265674300	150	2	150.000000	150.000000	Yavapai				
151	603	Yavapai	13N	02W	10			34.52501044390	-112.46265674300	151	2	151.000000	151.000000	Yavapai				
152	645	Yavapai	15N	01E	22			34.67042692370	-112.25220140500	152	1	152.000000	152.000000	Yavapai				
153	646	Yavapai	15N	01E	26			34.65587310760	-112.23464121200	153	1	153.000000	153.000000	Yavapai				
154	647	Yavapai	15N	01E	22			34.67042692370	-112.25220140500	154	1	154.000000	154.000000	Yavapai				
155	648	Yavapai	15N	01E	22			34.67042692370	-112.25220140500	155	1	155.000000	155.000000	Yavapai				
156	649	Yavapai	15N	01E	26			34.65587310760	-112.23464121200	156	1	156.000000	156.000000	Yavapai				
157	650	Yavapai	15N	01E	26			34.65587310760	-112.23464121200	157	1	157.000000	157.000000	Yavapai				
	0							0.000000000000	0.000000000000	0	99	0.000000	0.000000					

APPENDIX G: ENVIRONMENTAL TIME FRAMES

The different environmental resources—land use, cultural resources, biological resources, and Section 401/404 permitting—considered for each aggregate source require varying amounts of time for environmental clearance. This appendix quantifies the approximate timelines required to clear each resource. Where possible, it presents an average length of time, a best-case scenario, and a worst-case scenario.

a. Land use

A conflict between a potential aggregate source and established land use, such as residential development, cannot be resolved and would rule out the ability to environmentally clear that aggregate source. There is no timeline associated with the environmental clearance because the clearance is not possible. When such a case was identified, the potential source was deleted from the spreadsheet, because its use was not feasible, in spite of its scores on other environmental resources.

b. Cultural resources

All of the aggregate sources in this study will require at least some cultural survey. This survey would cover the 80 acres including the proposed pit and the access road connecting the pit to the adjacent state highway.

The time frame to obtain cultural resource clearance varies, but generally is measured in months. A best-case scenario for the time to complete the cultural survey, write the reports, and complete the cultural consultation is three months. More realistically, this process takes approximately six months. The worst-case scenario is when impacts to cultural resources cannot be avoided and data recovery is necessary; here, a time frame of one to two years (and sometimes longer) is not unrealistic.

Based on experience with Woodruff Butte, a site of pilgrimage shrines of the Hopi Tribe, site development should not consider areas that are identified as traditional cultural properties (TCPs). These TCPs are typically areas of religious significance or areas where religiously significant resources are obtained. As with land use conflicts, it is recommended that potential aggregate sources with TCPs be dropped from consideration.

Cultural resource clearance can be complicated by landownership. Federal landowners, such as the U.S. Forest Service and the Bureau of Land Management, may require survey permits and must lead the Section 106 process when property under their jurisdiction is affected. On average, the presence of federal landowners can add two to four months to the cultural clearance process.

c. Biological resources

The time needed for biological clearance varies depending on the presence of sensitive biological resources and the potential impacts. If there are no resources present, or no impacts from the project, only a report needs to be prepared—in this case, the report would need to be reviewed only by the Arizona Department of Transportation (ADOT) and the Federal Highway Administration (FHWA). That process could be completed in one to two months. If the project is determined to affect federally listed threatened or endangered species, a minimum of 30 days would be added to the clearance while the impacts are reviewed by the U.S. Fish and Wildlife Service (USFWS). The total biological clearance time would be approximately three months. If ADOT and FHWA determine the impacts adversely affect the threatened or endangered species, the consultation with the USFWS lasts 135 days (4.5 months), increasing the total biological clearance time to six to seven months.

Biological resource clearance can also be complicated by landownership. Federal landowners, such as the U.S. Forest Service and the Bureau of Land Management, must concur with the findings of the biology report before they initiate Section 7 consultation with the USFWS. On average, the presence of federal landowners can add one to two months to the biological clearance process.

d. Section 401/404 permitting

Aggregate sources, especially mineral aggregate, are commonly found near rivers, streams, or ephemeral washes, all of which can be jurisdictional Waters of the United States (Waters); thus, obtaining a Clean Water Act Section 404 permit is often a component of the environmental clearance process. Before the permit can be issued, a Jurisdictional Delineation (JD) must be conducted. The field work, preparation of the JD, and review by the U.S. Army Corps of Engineers (Corps) takes a minimum of two months.

The type of permit is determined by the extent of the impact to the jurisdictional Waters: if the area of impact is small (for example, less than 0.5 acre), the permit is likely to be a notifying Nationwide Permit. In this case, the permit would require one to two months to prepare and approximately two months for the Corps to review and approve, for a total of four months. If impacts exceed 0.5 acre, an Individual Permit is generally required. Preparation of the Individual Permit and its review by the Corps are extensive, with total time to obtain clearance being about one to two years.

e. Schedules

In the absence of insurmountable issues (e.g., adjacent land use or TCPs), the recommended sequence for pursuing environmental clearance would be cultural resources, biological resources, and Jurisdictional Delineation and Section 401/404 permitting. The Corps require cultural and biological reports as part of the documentation for the permit. Given the time commitment, cultural resources work should be started first. If a survey indicates that no fatal flaws (such as TCPs) are present, the biological resource review process can be conducted. Likewise, absent any fatal flaws, such as the presence of federally protected endangered species, the biological clearance can be conducted simultaneously with other resource studies.

Finally, the Section 401/404 permitting process should be started while the cultural and biological clearances are being completed (Table 10).

Table 9. Calendar Days to Environmental Clearance under Various Scenarios

	Best Case	Average	Worst Case
Cultural only	90	210	540
Cultural, Section 401/404	120	300	720
Cultural, Biology, Section 401/404	120	300	720

f. Section 402

If the amount of disturbed ground associated with developing an aggregate source exceeds 1 acre, an Arizona Pollutant Discharge Elimination System Permit will be required and a Storm Water Pollution Prevention Plan (SWPPP) must be prepared and reviewed by the Arizona Department of Environmental Quality (ADEQ). Preparing and reviewing the SWPPP is relatively straightforward and generally takes the time listed in Table 10. The exception is if the aggregate source is in a watershed that contains outstanding or impaired Waters. Then approximately 60 days should be added to the overall clearance schedule to account for preparation of a more complex SWPPP that includes water quality monitoring and ADEQ review times.

g. Geotechnical investigation

The schedule for an environmental clearance for geotechnical investigation would be similar to the schedule for overall environmental clearance described in Table 10. A geotechnical investigation generally has a smaller footprint than a clearance for an aggregate source, so the timeline for a geotechnical clearance would likely follow the best-case scenario or the average scenario, with the extended timeline of a worst-case scenario unlikely. This schedule assumes that geotechnical analysis is conducted at the beginning of the project clearance, when the schedule may be even more compressed based on the smaller footprint; if a geotechnical investigation is to be conducted after the overall project clearance, the time frame might be longer. Another important assumption is that geotechnical plans are available from the beginning of this clearance period.

The schedule for a geotechnical investigation is affected by a number of administrative requirements in addition to environmental clearances. Temporary rights-of-entry, utility clearances, and haul road easements may be required before any field exploration begins.

SWPPPs may be required if disturbance exceeds a threshold acreage. The site's physical and geological conditions also affect the schedule. The exploration and sampling needs in potential rock quarries differ from those in alluvial deposits. Access into and around the site may require road construction, track-mounted equipment, or difficult access rock-coring rigs with water trucks. Extensive disturbance is generally avoided unless it is known that development is feasible. Factors include the thickness of overburden and the deposit's vertical and lateral limits. An on-ground survey likely will be needed to lay out the exploration plan following environmental clearances. A development or mining plan may be required before determining the suitability and useable volume of the aggregate.

Table 11 shows the approximate number of workdays needed to perform a geotechnical investigation for an alluvial site and for a quarry. All cases assume that all clearances have been received. The exploration plan includes up to 80 test pits or borings over a 40-acre site. Test pits are limited to 15 feet deep, and rock cores are limited to 20 feet deep.

Best Case assumes that the site is accessible with normal four-wheel-drive equipment, access roads are not required, and a SWPPP is not needed.

Average Case assumes that the site is accessible with normal four-wheel-drive equipment, that access roads need some grading, and that a SWPPP is required.

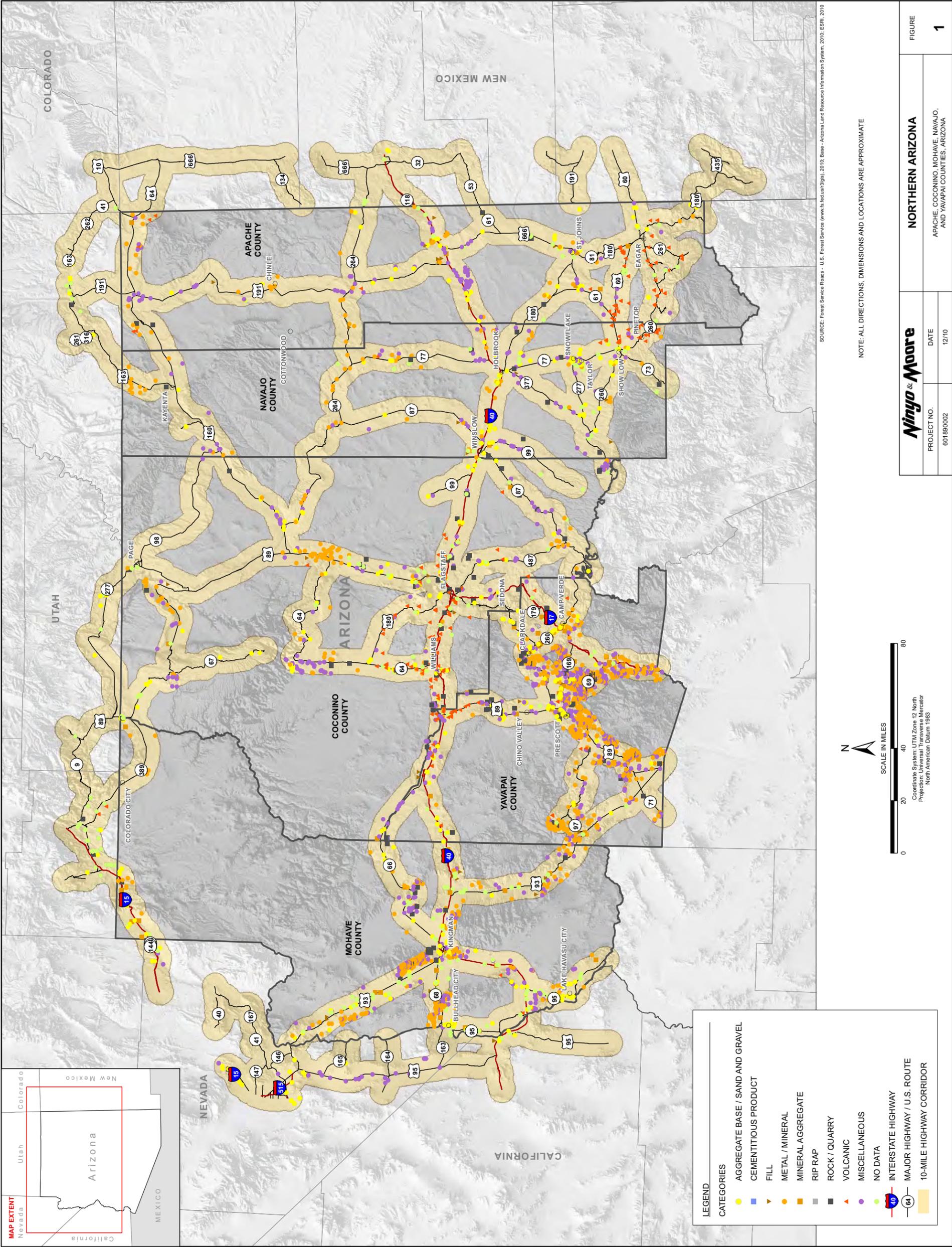
Worst Case assumes that tracked equipment will be required for access around the site, a pioneer road to the site is required, and a SWPPP is needed.

Table 10. Calendar Days Needed for Geotechnical Investigation

	Best Case	Average	Worst Case
Alluvial deposit	25	50	80
Rock quarry	30	60	100

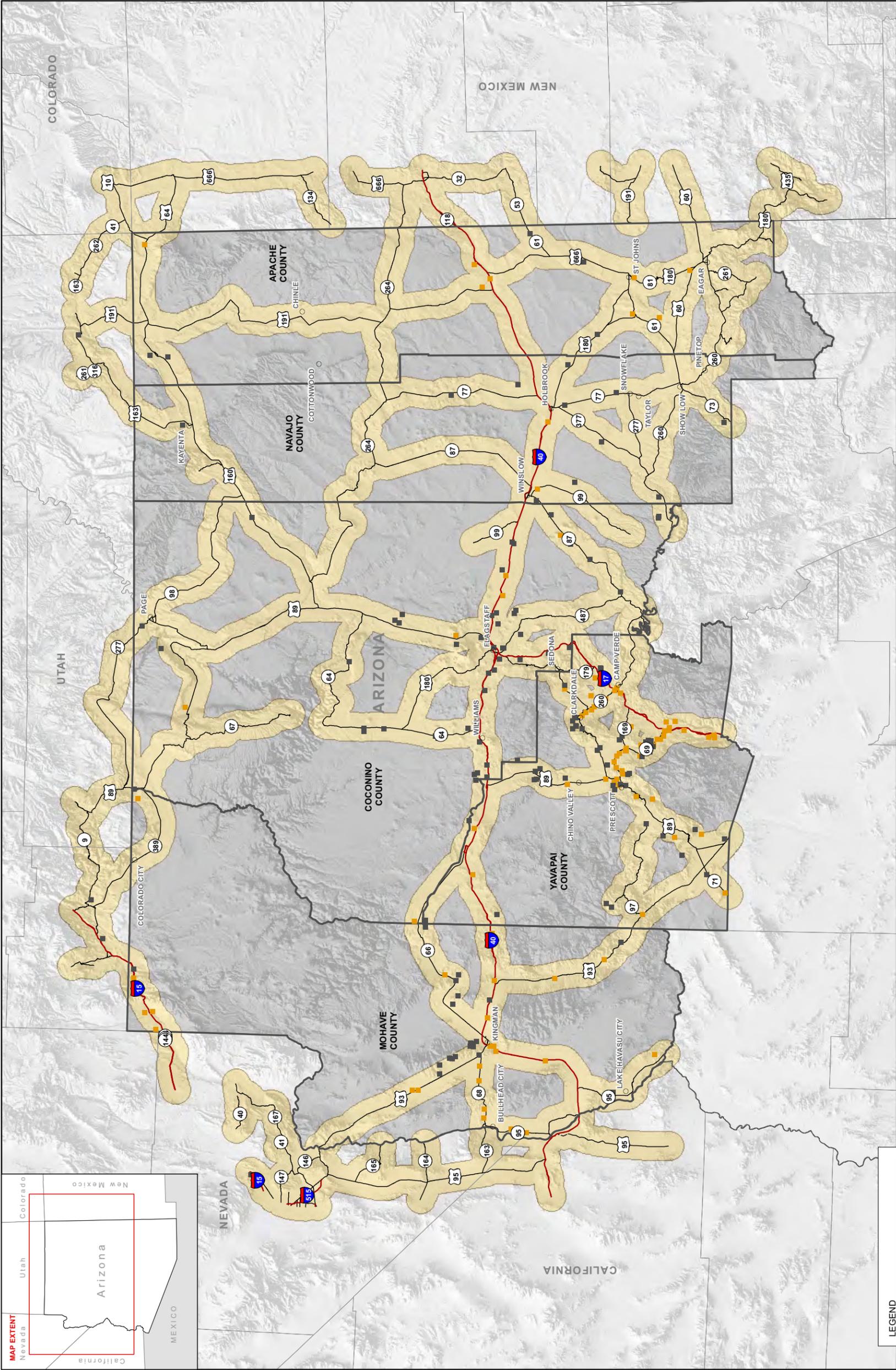
Subsequent work elements include laboratory testing and reporting, which may take up to 30 days to complete. Other work elements could include a mining plan, license application, and haul road layout and license.

APPENDIX H: MAP OF SITES WITHIN 10-MILE CORRIDOR



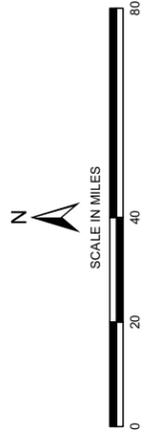
Ningo & Moore		NORTHERN ARIZONA		FIGURE 1
		PROJECT NO. 601890002	DATE 12/10	

APACHE, COCONINO, MOHAVE, NAVAJO, AND YAVAPAI COUNTIES, ARIZONA



SOURCE: Forest Service Roads - U.S. Forest Service (www.fs.fed.us/d39g), 2010; Base - Arizona Land Resource Information System, 2010; ESRI, 2010

NOTE: ALL DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE

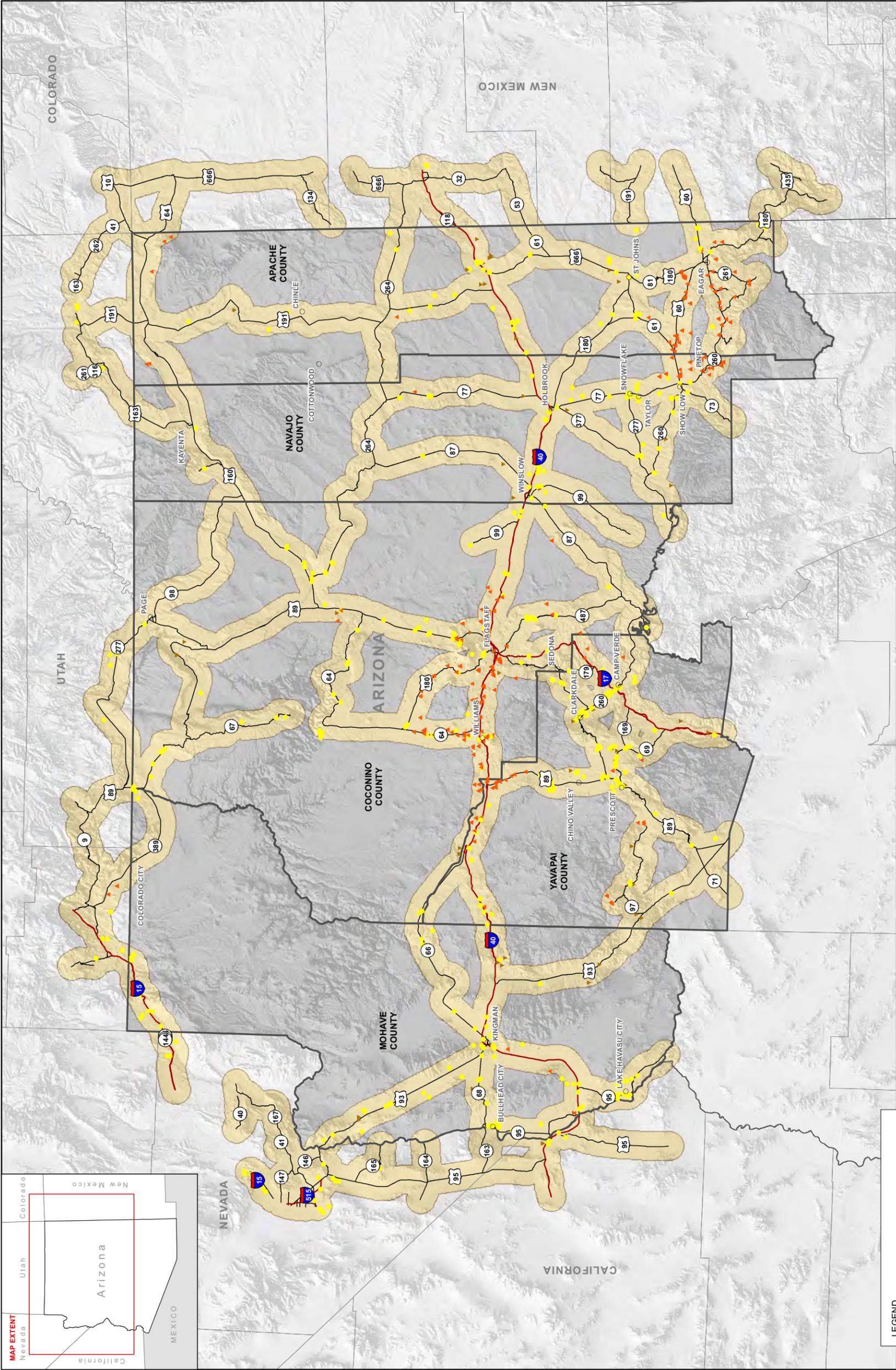


LEGEND

CATEGORIES

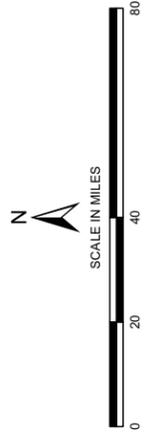
- MINERAL AGGREGATE
- RIP RAP
- ROCK / QUARRY
- INTERSTATE HIGHWAY
- MAJOR HIGHWAY / U.S. ROUTE
- 10-MILE HIGHWAY CORRIDOR

Ninyo & Moore		NORTHERN ARIZONA		FIGURE
PROJECT NO.	DATE			
601890002	12/10			1
		APACHE, COCONINO, MOHAVE, NAVAJO, AND YAVAPAI COUNTIES, ARIZONA		



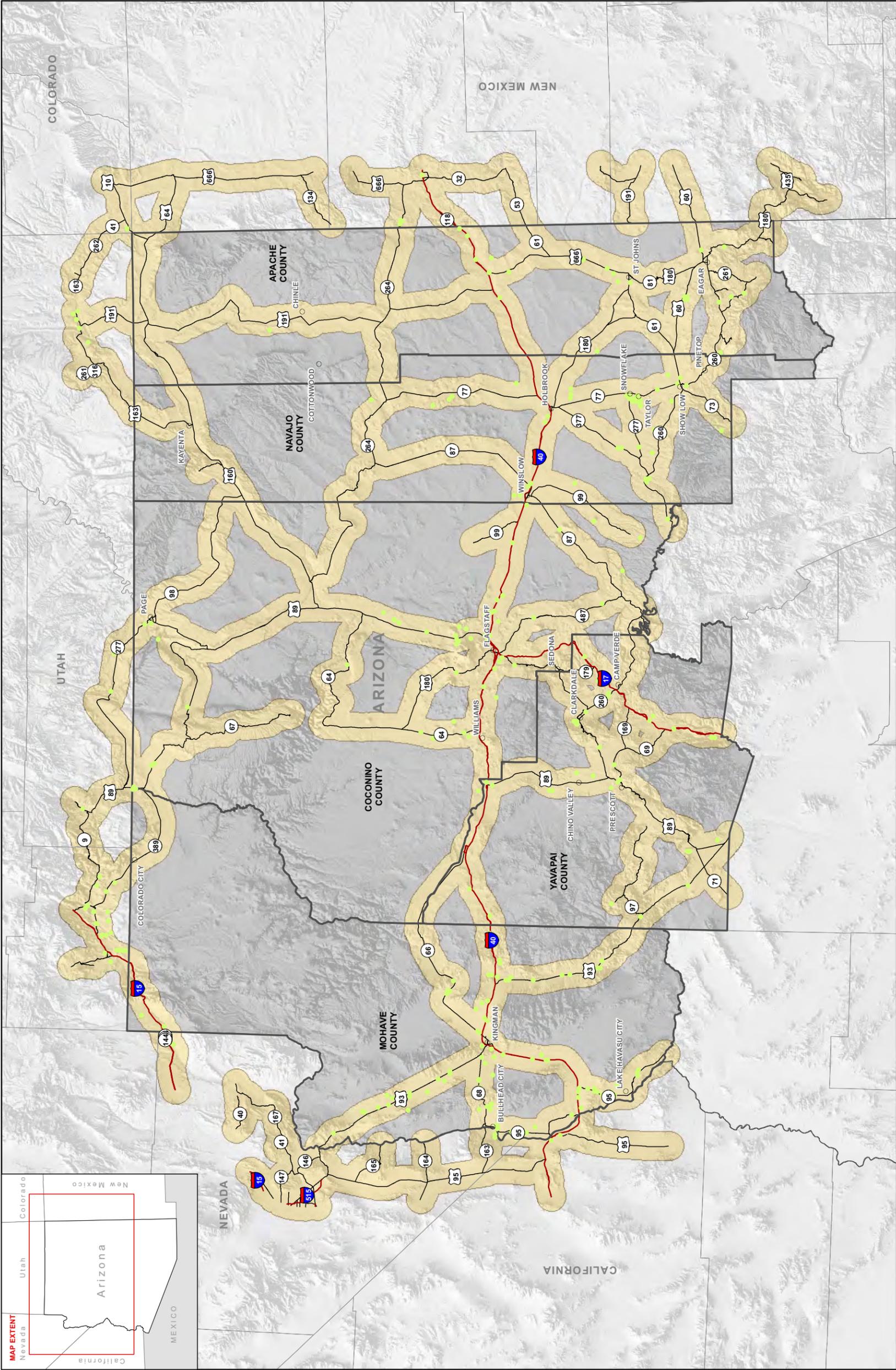
SOURCE: Forest Service Roads - U.S. Forest Service (www.fs.fed.us/d39g), 2010; Base - Arizona Land Resource Information System, 2010; ESR, 2010

NOTE: ALL DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE



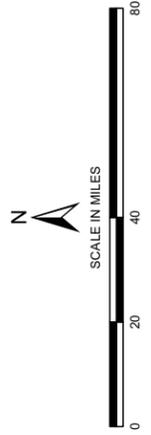
LEGEND	
CATEGORIES	
	AGGREGATE BASE / SAND AND GRAVEL
	FILL
	VOLCANIC
	INTERSTATE HIGHWAY
	MAJOR HIGHWAY / U.S. ROUTE
	10-MILE HIGHWAY CORRIDOR

Ninyo & Moore		NORTHERN ARIZONA		FIGURE 1
		PROJECT NO. 601890002	DATE 12/10	
APACHE, COCONINO, MOHAVE, NAVAJO, AND YAVAPAI COUNTIES, ARIZONA				



SOURCE: Forest Service Roads - U.S. Forest Service (www.fs.fed.us/d39g), 2010; Base - Arizona Land Resource Information System, 2010; ESR, 2010

NOTE: ALL DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE



LEGEND

CATEGORY	NO DATA	INTERSTATE HIGHWAY	MAJOR HIGHWAY / U.S. ROUTE	10-MILE HIGHWAY CORRIDOR

Ninyo & Moore		NORTHERN ARIZONA		FIGURE 1
		PROJECT NO. 601890002	DATE 12/10	

APACHE, COCONINO, MOHAVE, NAVAJO, AND YAVAPAI COUNTIES, ARIZONA

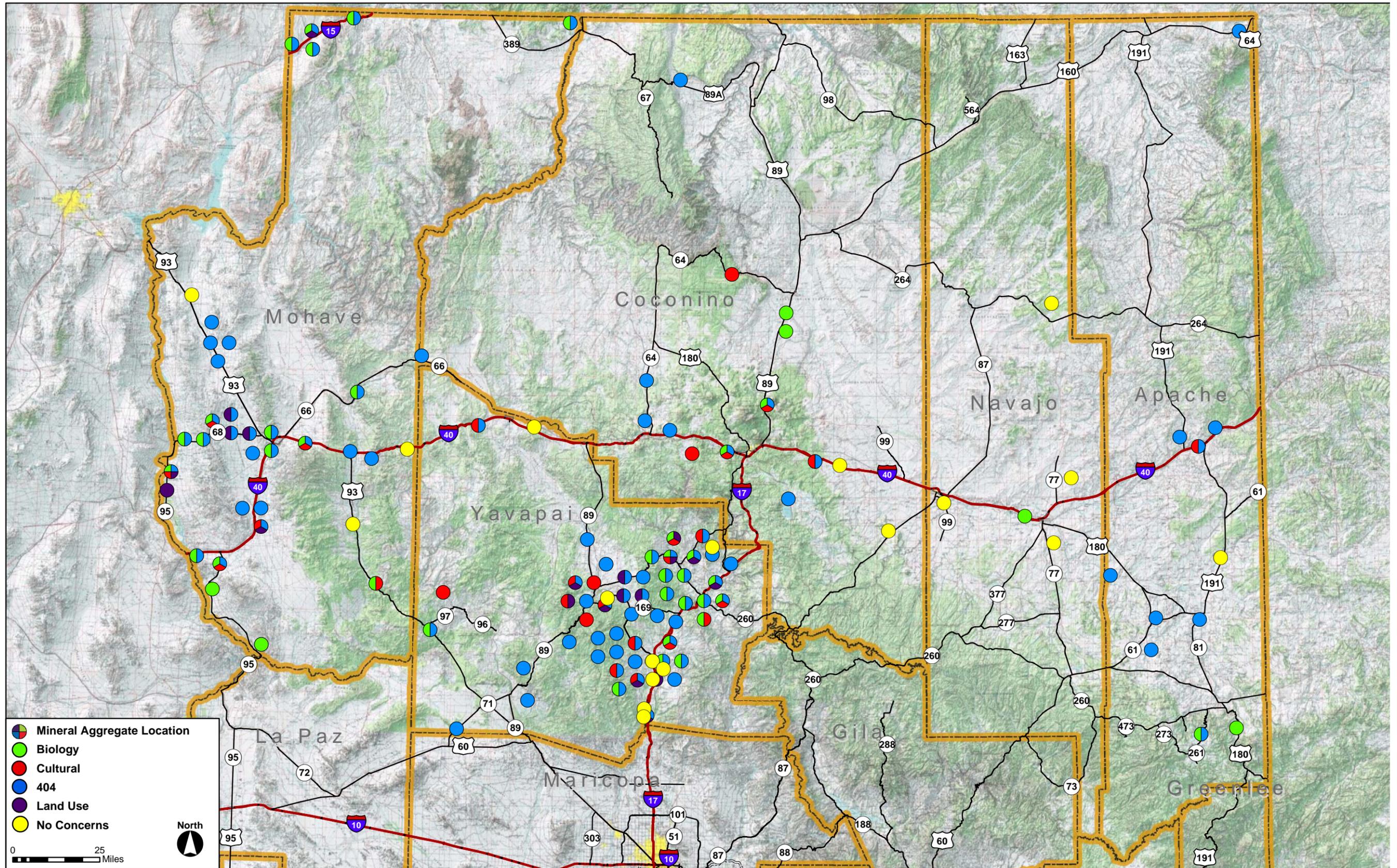
APPENDIX I: TYPES OF MATERIALS EACH SITE CAN PROVIDE

Table 11. Materials Available from Potential Sites.

Materials	Category
Mineral aggregate	Mineral aggregate
Aggregate base	Aggregate base/sand and gravel
Sand and gravel	
Riprap	Riprap
Cinders	Volcanics
Pumice	
Volcanics	
Borrow	Fill
Clay	
Fill	
Soil and other fill	
Soil	
Basalt	Rock/quarry
Boulders	
Crushed rock	
Crushed stone	
Dimension stone/aggregate	
Dimension stone	
Flagstone	
Granite	
Hard rock	
Hard rock materials	
Limestone-general	
Marble-dimension	
Rock quarry	
Stone	
Stone-dimension	
Abrasive	Metals/minerals
Aluminum	
Arsenic	
Asbestos	
Barium	
Bentonite	
Beryllium	
Calcium	
Coal	
Copper	
Diatomite	
Feldspar	
Feldspars/silver	
Gemstone	

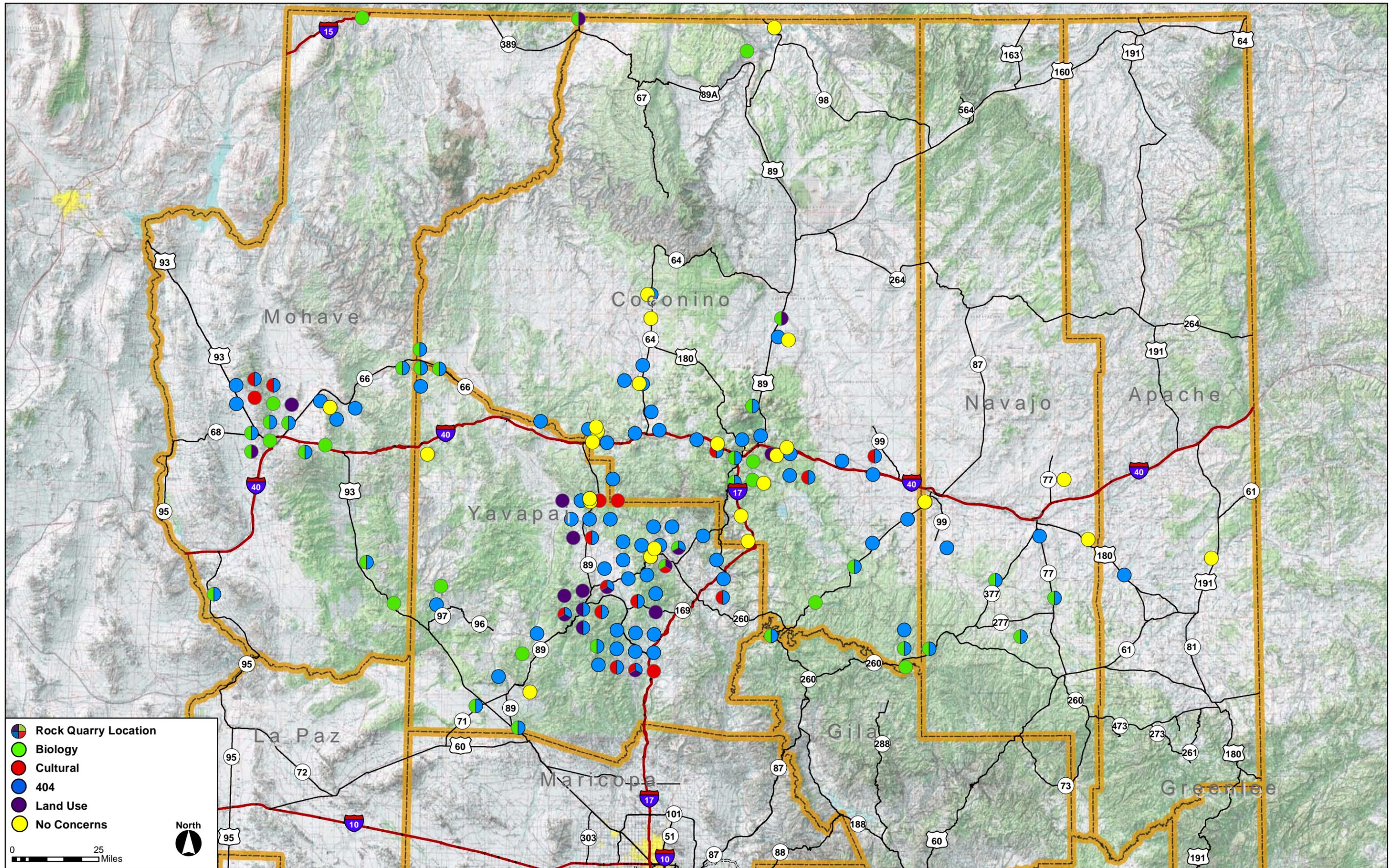
Materials	Category
Gold	Metals/minerals (cont'd)
Graphite	
Gypsum	
Iron	
Kyanite	
Lead	
Lithium	
Magnesium	
Magnesium compounds	
Manganese	
Mercury	
Mica	
Molybdenum	
Perlite	
Phosphate	
Plutonium	
Potassium	
Rare earths	
Rhenium	
Silica	
Silicon	
Silver	
Sodium	
Tungsten	
Vanadium	
Vermiculite	
Uranium	
Zeolites	
Zinc	
Cement	Cementitious products
Lime	
Fluorine	Miscellaneous
Geothermal	
Helium	
Manufactured products	
Mill	
Petrified wood	
Specimens	
Unknown	
Various	

APPENDIX J: MAPS OF ACTIVE, POTENTIAL SITES



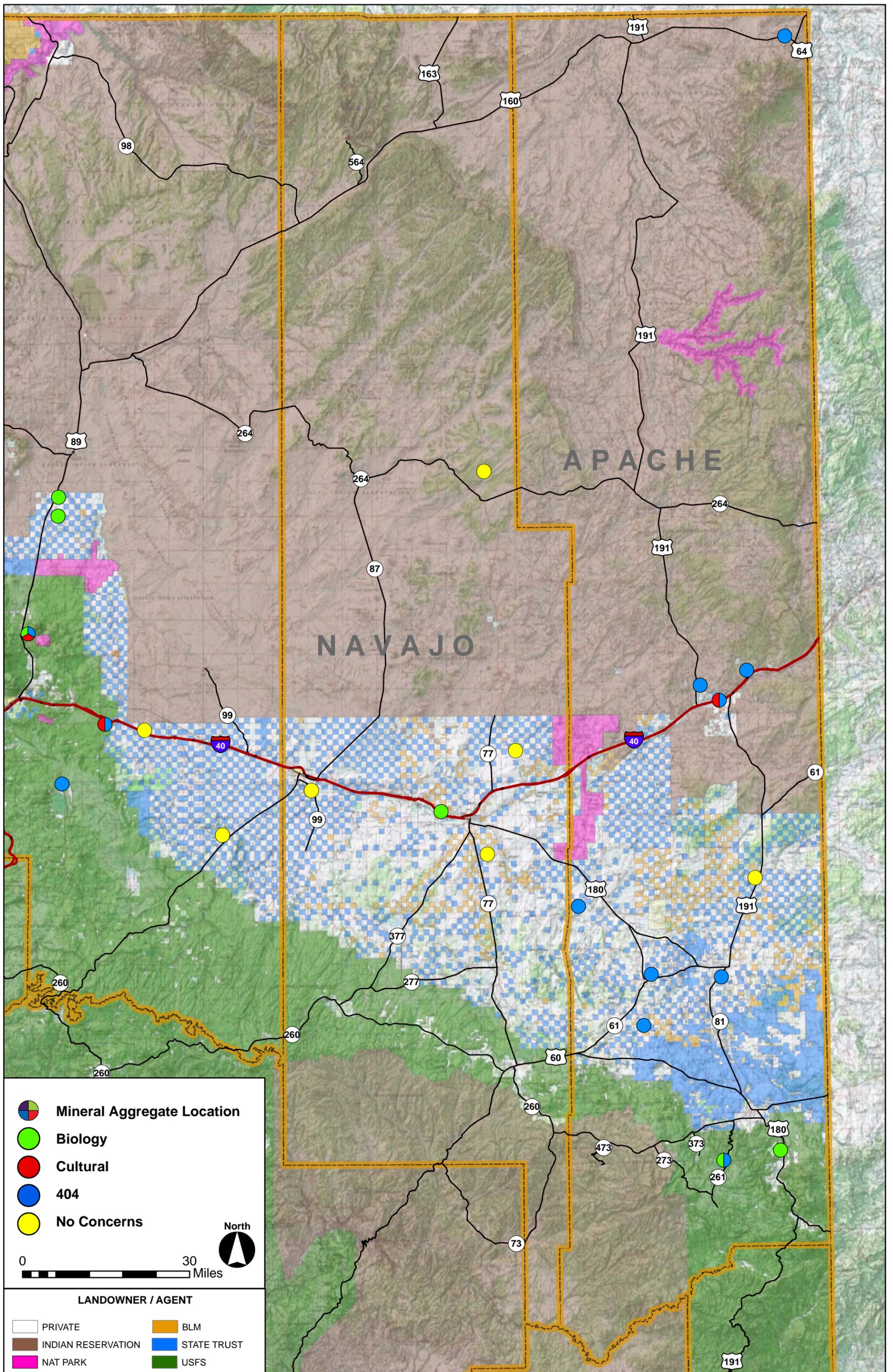
Mineral Aggregate Concerns - Northern Arizona Region

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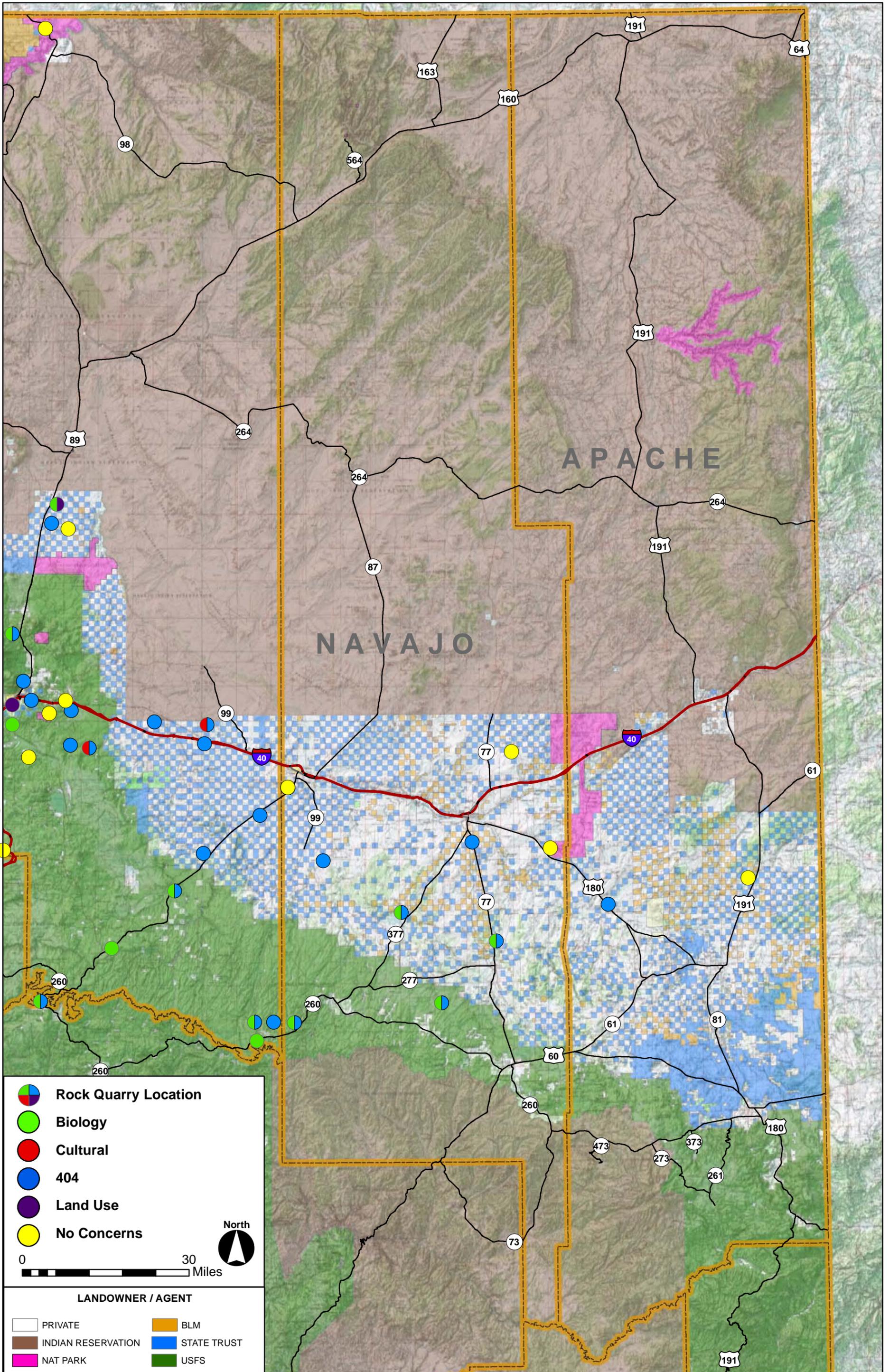


Rock Quarry Concerns - Northern Arizona Region

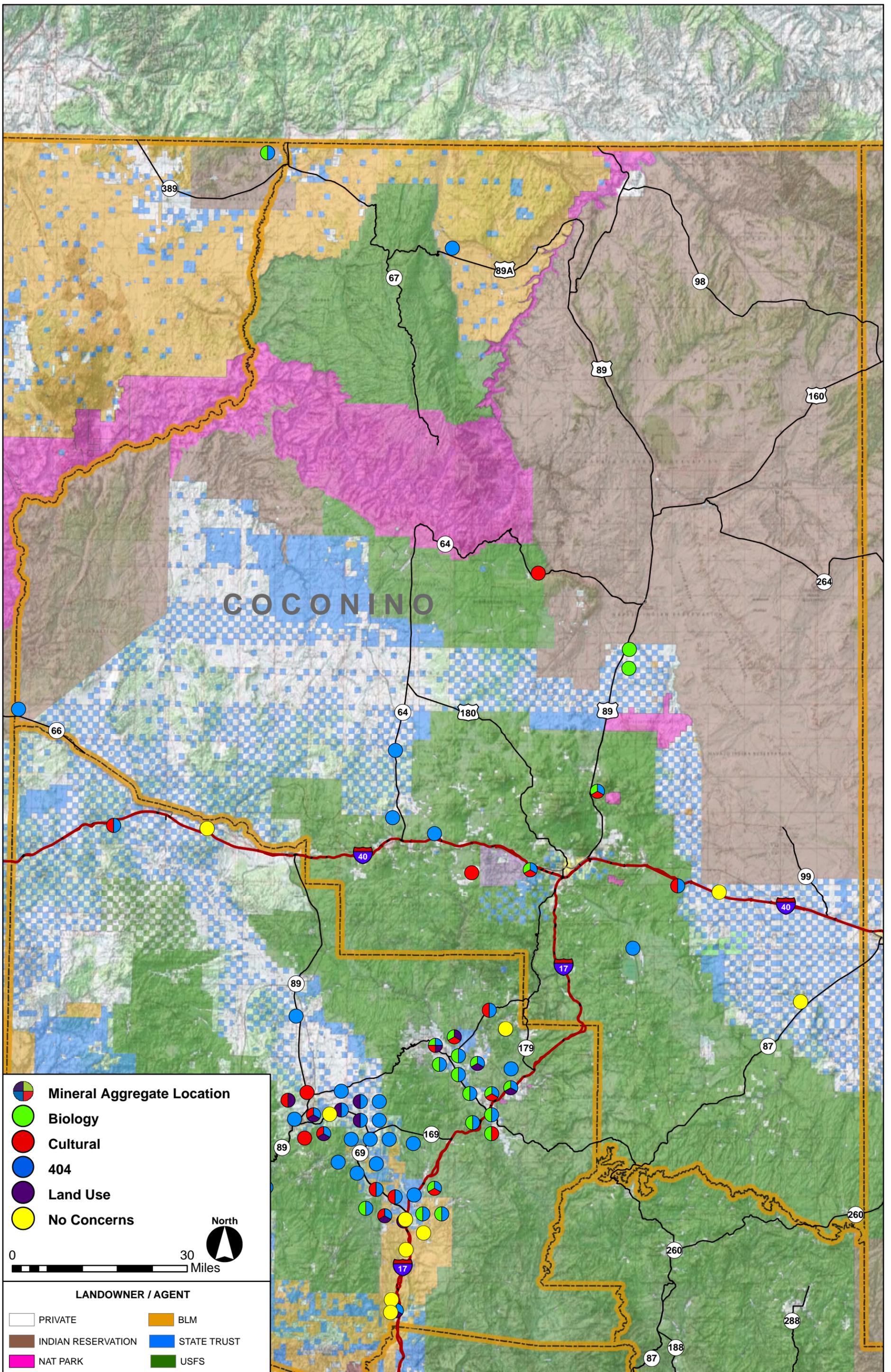
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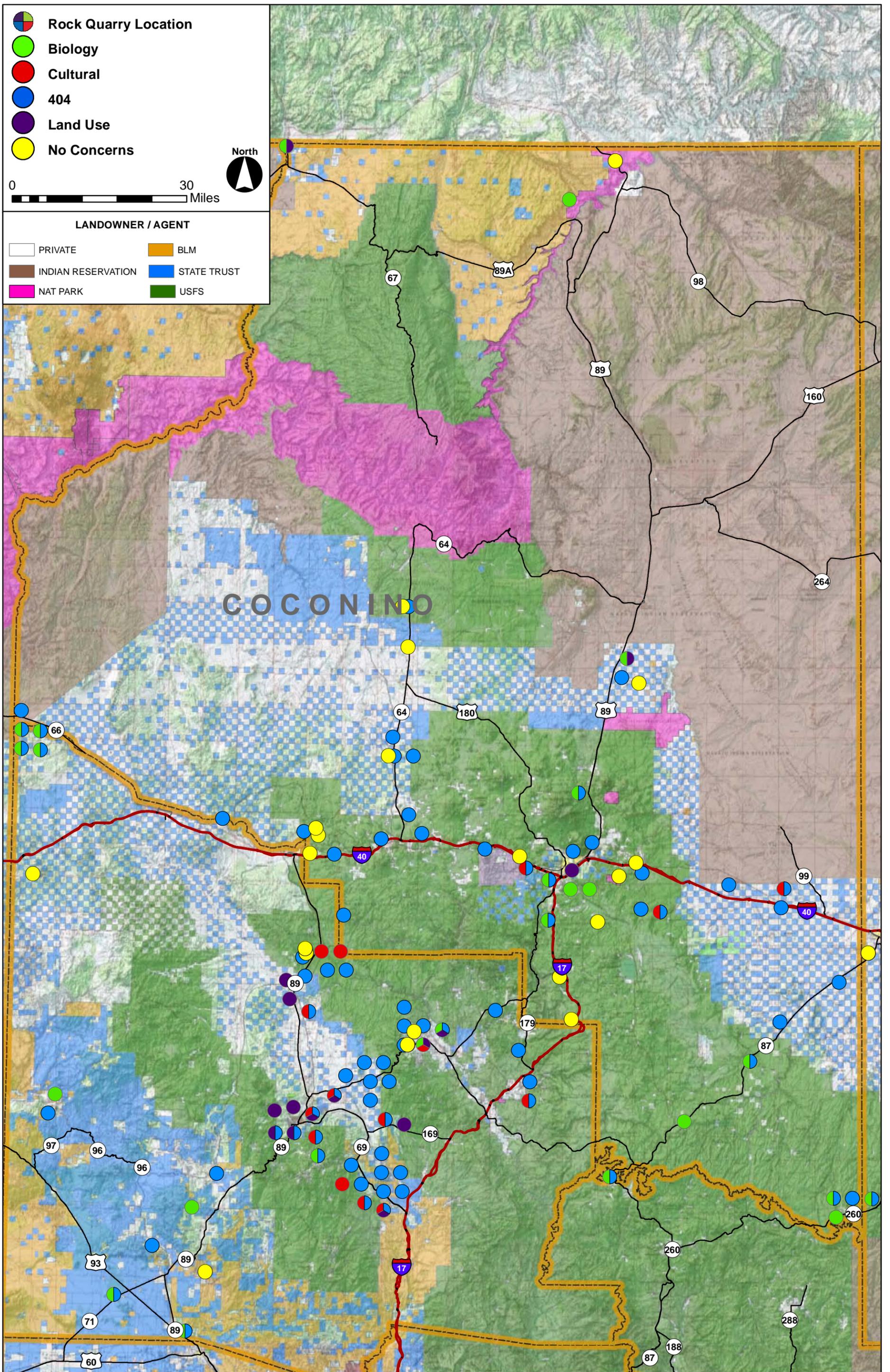
Mineral Aggregate Concerns - Apache and Navajo Counties

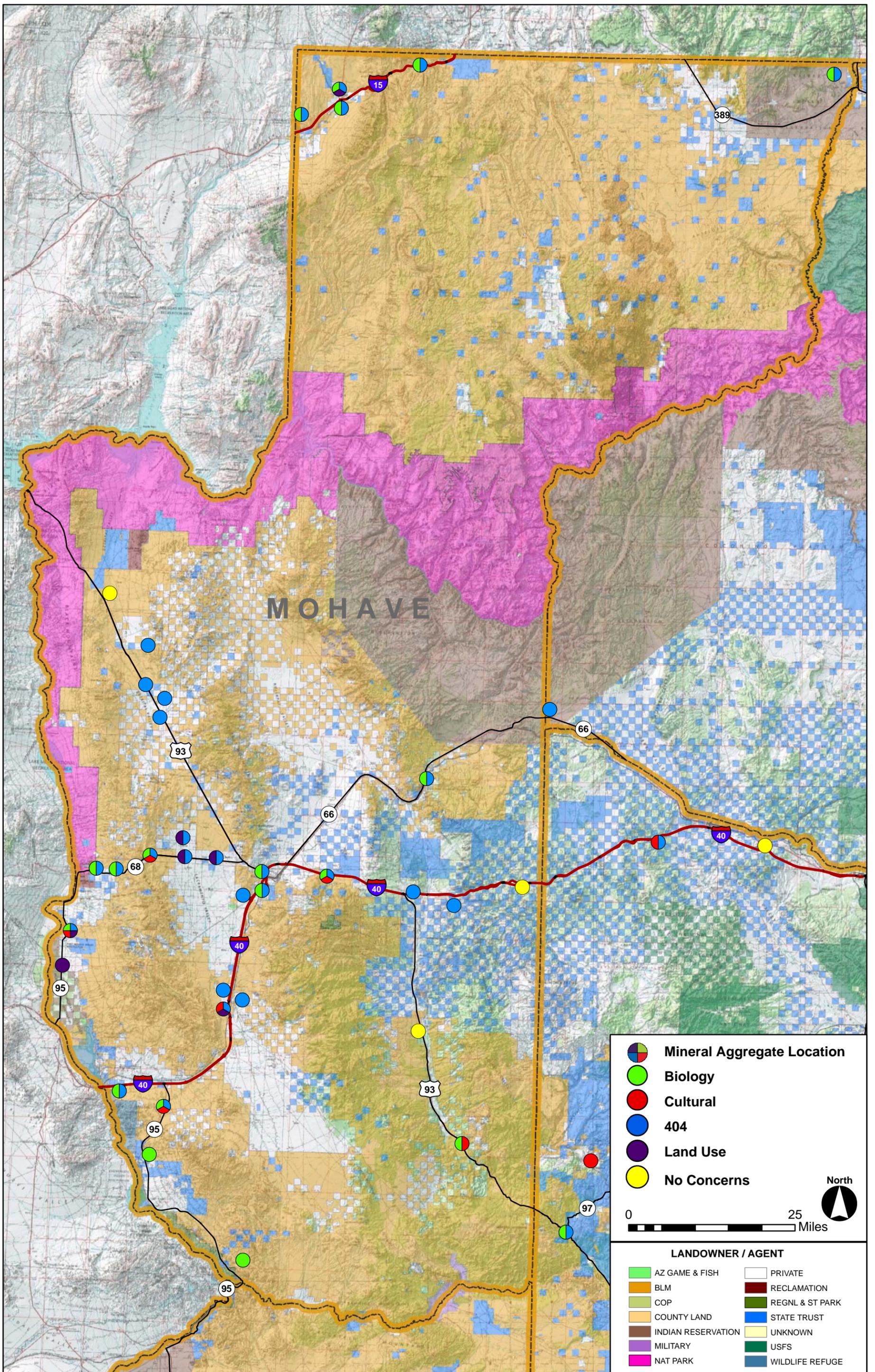


Rock Quarry Concerns - Apache and Navajo Counties

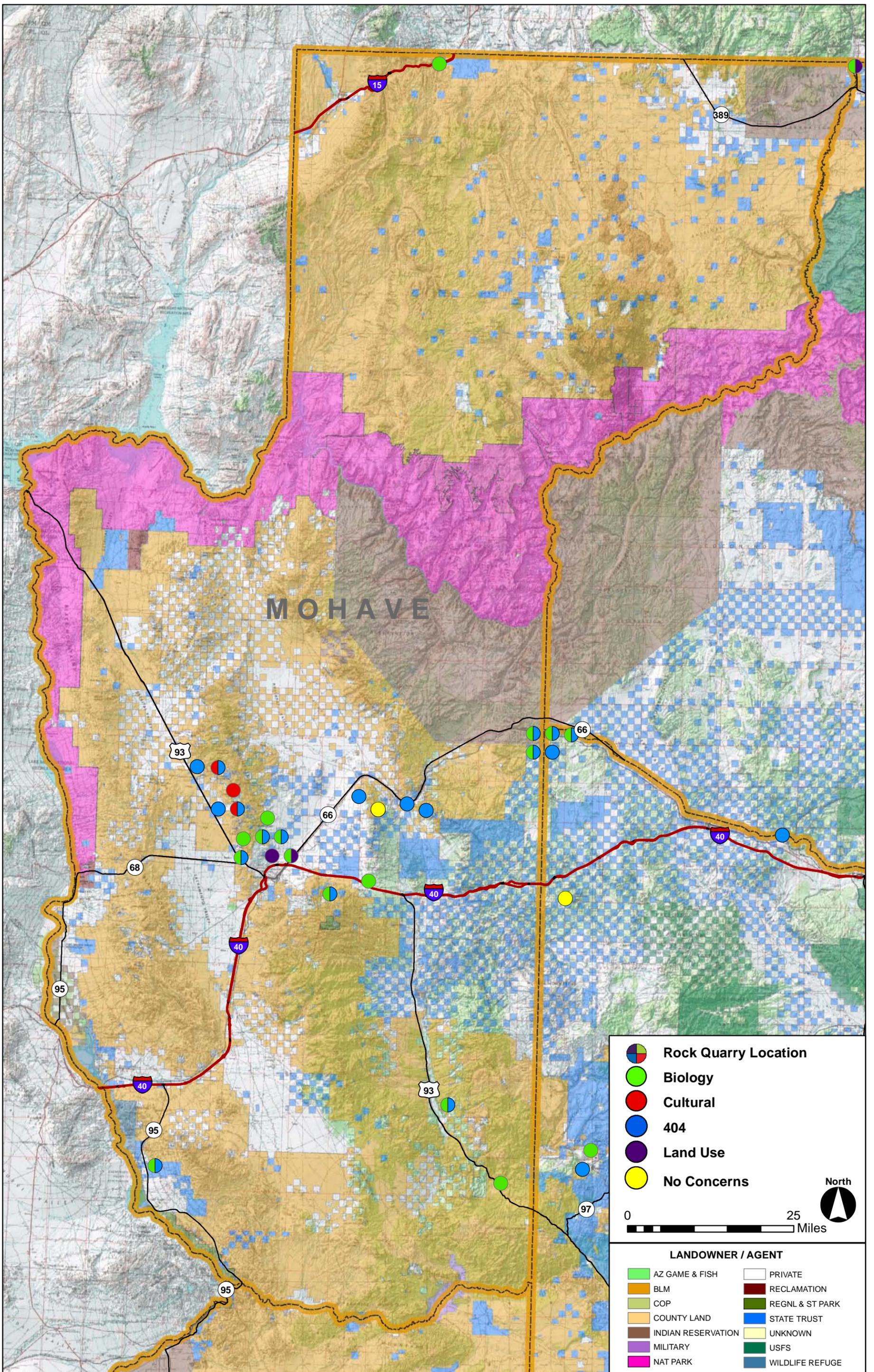


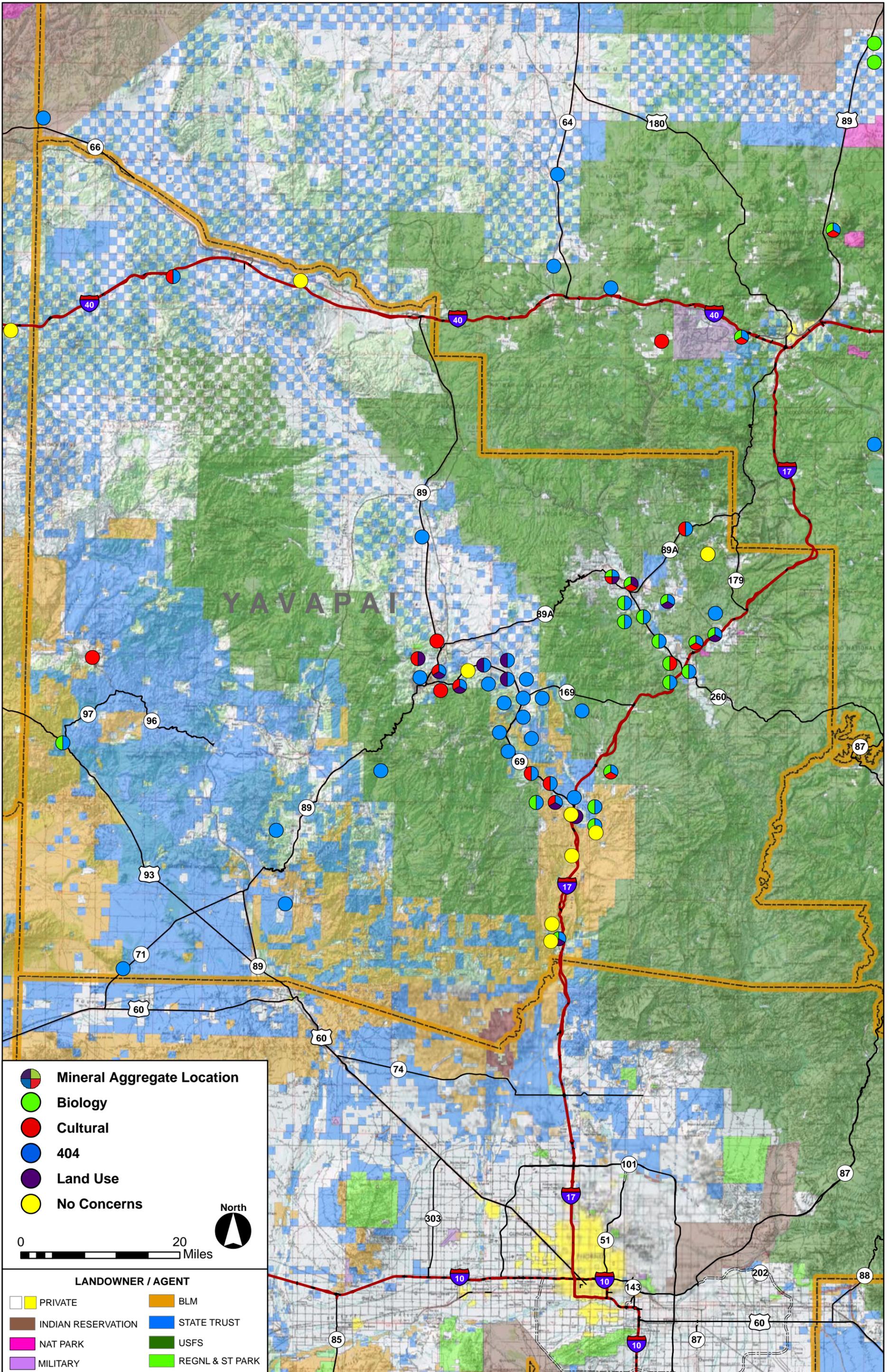
Mineral Aggregate Concerns - Coconino County



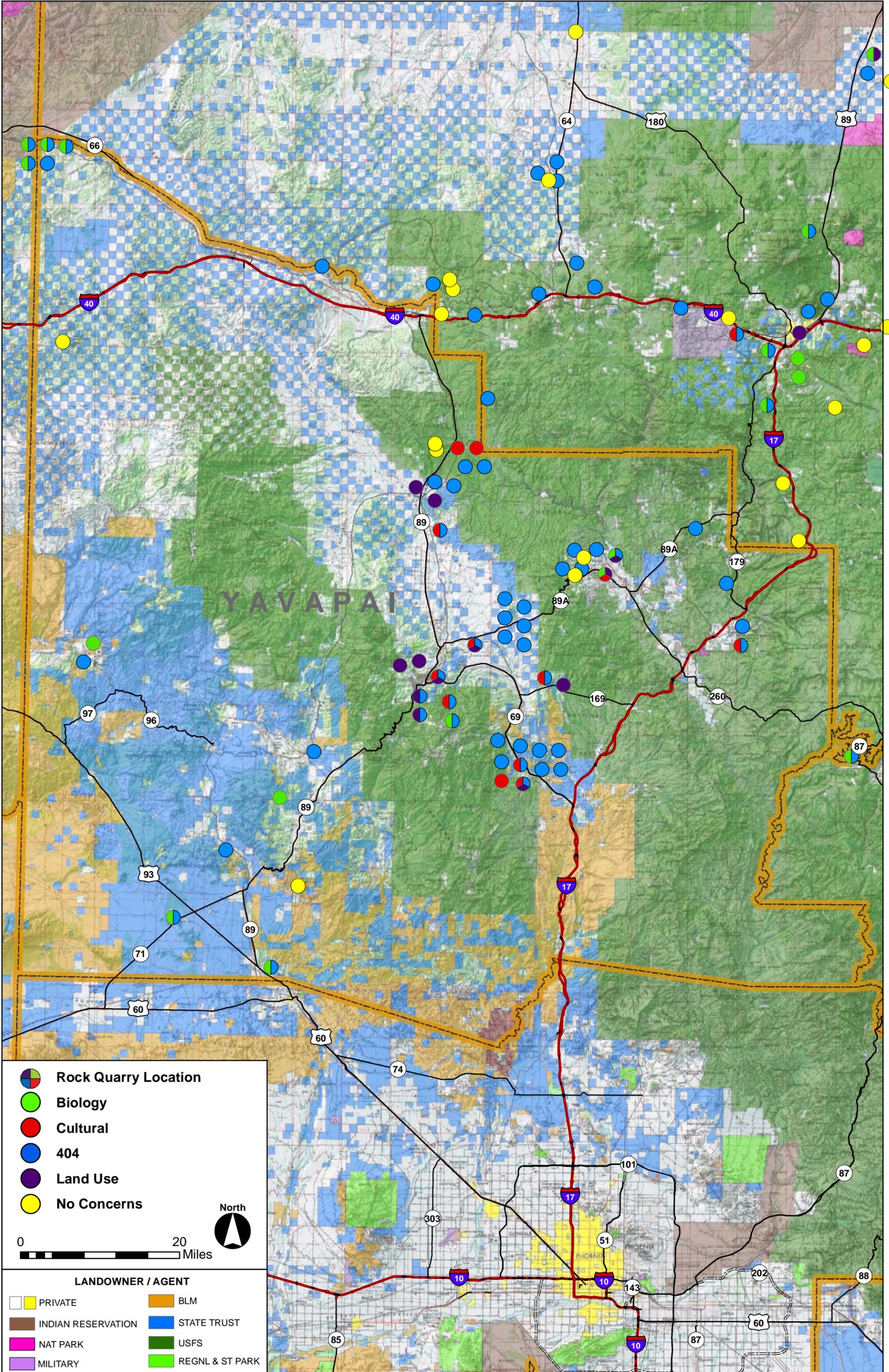


Mineral Aggregate Concerns - Mohave County





Mineral Aggregate Concerns - Yavapai County



Rock Quarry Concerns - Yavapai County

