

2022 Biennial Adaptive Management Report - Final



Prepared for:
Desert Conservation Program, Clark County, Nevada

December 14, 2021

Prepared by:
Alta Science and Engineering, Inc.
1220 Big Creek Road, Suite A
Kellogg, Idaho 83837
alta-se.com



Contributors:



[sennabiological](http://sennabiological.com) 



Contents

Section 1	Introduction and background.....	1
1.1	Purpose	3
1.2	Previous Biennial AMR	3
1.2.1	Summary of 2020 Biennial AMR recommendations	3
1.3	Significant updates since the 2018 Biennial AMR	3
1.3.1	Adaptive management and monitoring plan	4
Section 2	Land use trends in Clark County – analysis and discussion	4
2.1	Assessment of general habitat loss.....	5
2.2	Conclusions and recommendations for land use trend analysis	8
Section 3	Habitat loss by ecosystem – analysis and discussion	9
3.2	Developed acres indexed to account for prevalence on the landscape	11
3.2.2	Developed acres indexed to prevalence of all habitat within Clark County. ..	11
3.2.3	Developed acres indexed to prevalence of habitat within the MSHCP Available Development Area	13
3.1	Conclusions and recommendations for habitat loss by ecosystem analysis	15
Section 4	Effectiveness of management actions – analysis and discussion.....	17
4.1	Conclusions and recommendations for management action effectiveness.....	19
Section 5	Species status and population trends.....	20
5.1	Methods.....	20
5.1.1	Reptiles.....	20
5.1.2	Avian.....	21
5.1.3	Bats.....	21
5.1.4	Plants.....	21
5.2	Results.....	21
5.2.1	Reptiles.....	21
5.2.2	Avian.....	24
5.3	Conclusions and recommendations for species status and trends	25
Section 6	Summary of conclusions and recommendations	26
Section 7	References	28

Appendices

Appendix A Summary of Recommendations from previous biennial AMR.....	A
Appendix B Ecosystem Disturbance Mapping Procedure.....	B
Appendix C Current Projects Linked to BGOs.....	C

Tables

Table 1. Total area, development area (habitat loss), and percent habitat loss prior to 2001, 2001-2019, and 2019-2021 in Clark County, Nevada	6
Table 2. Habitat loss by ecosystem during 2019-2021 and since 2001. These percentages are based on the total area of each ecosystem in Clark County, Nevada	10
Table 3. Description of data used to calculate indexes in prevalence Figures 4-7.	11
Table 4. Categories of projects tallied by which biological goals they support	19
Table 5. Summary of conclusions for all assessments performed by the Science Advisor Panel for the 2020 Biennial AMR	26
Table 6. Summary of recommendations for all assessments performed by the Science Advisor Panel for the 2022 Biennial AMR	27

Figures

Figure 1. MSHCP permit area and plan area (inset)	2
Figure 2. Map of ecosystems, habitat loss, and federal disposal boundaries within the MSHCP permit area	7
Figure 3. Percent habitat loss as a function of total habitat, time period, and development pace of permitting acreage	8
Figure 4. Index of habitat loss since the Permit began (2001-2021), proportional to its occurrence in Clark County, Nevada.....	12
Figure 5. Index of habitat loss during the 2019-2021 biennium proportional to its occurrence in Clark County, Nevada.....	13
Figure 6. Long term (2001-2021), habitat loss by ecosystem, proportional to its occurrence in the MSHCP available development area	14
Figure 7. Recent biennium (2019-2021) habitat loss by ecosystem, proportional to its occurrence in the MSHCP available development area	15
Figure 8. Estimated annual occupancy rates of desert tortoises	22
Figure 9. Estimated annual occupancy rates of desert iguanas	23
Figure 10. Estimated annual occupancy rates of leopard lizards	23
Figure 11. Number of individual southwestern willow flycatchers and yellow-billed cuckoos detected per hour of survey effort.	24

Acronyms and Abbreviations

AMMP	Adaptive Management and Monitoring Plan
AMP	Adaptive Management Program
AMR	Adaptive Management Report
Alta	Alta Science & Engineering, Inc.
BCCE	Boulder City Conservation Easement
BGO	Biological Goal and Objective
DCP	Desert Conservation Program
ECO	Enduring Conservation Outcomes
ESA	Endangered Species Act
MOA	Memorandum of Agreement
MSHCP	Multiple Species Habitat Conservation Plan
OHV	Off Highway Vehicle
Permit	Incidental Take Permit #TE34927-0
Permittees	Clark County; cities of Boulder City, Henderson, Las Vegas, Mesquite, and North Las Vegas; and Nevada Department of Transportation
PIE	Public information, education, and outreach
USFWS	United States Fish and Wildlife Service

Section 1 Introduction and background

This Biennial Adaptive Management Report (AMR) describes the analysis and subsequent recommendations from the Science Advisor Panel's review in accordance with the Clark County Multiple Species Habitat Conservation Plan (MSHCP) and associated Biological Opinion (USFWS 2000).

Clark County coordinates compliance with Incidental Take Permit #TE34927-0 (Permit) issued by the United States Fish and Wildlife Service (USFWS) in 2001, in accordance with Section 10(a)(1)(B) of the Endangered Species Act (ESA). The current Permit expires in February 2031. Permittees include Clark County; the cities of Boulder City, Henderson, Las Vegas, Mesquite, and North Las Vegas; and the Nevada Department of Transportation (Permittees). Clark County serves as the Plan Administrator for the MSHCP on behalf of the other Permittees, with the Desert Conservation Program (DCP) representing Clark County in this role. Compliance with the Permit requires implementation of the MSHCP and Implementing Agreement (Clark County 2000, USFWS et al. 2000).

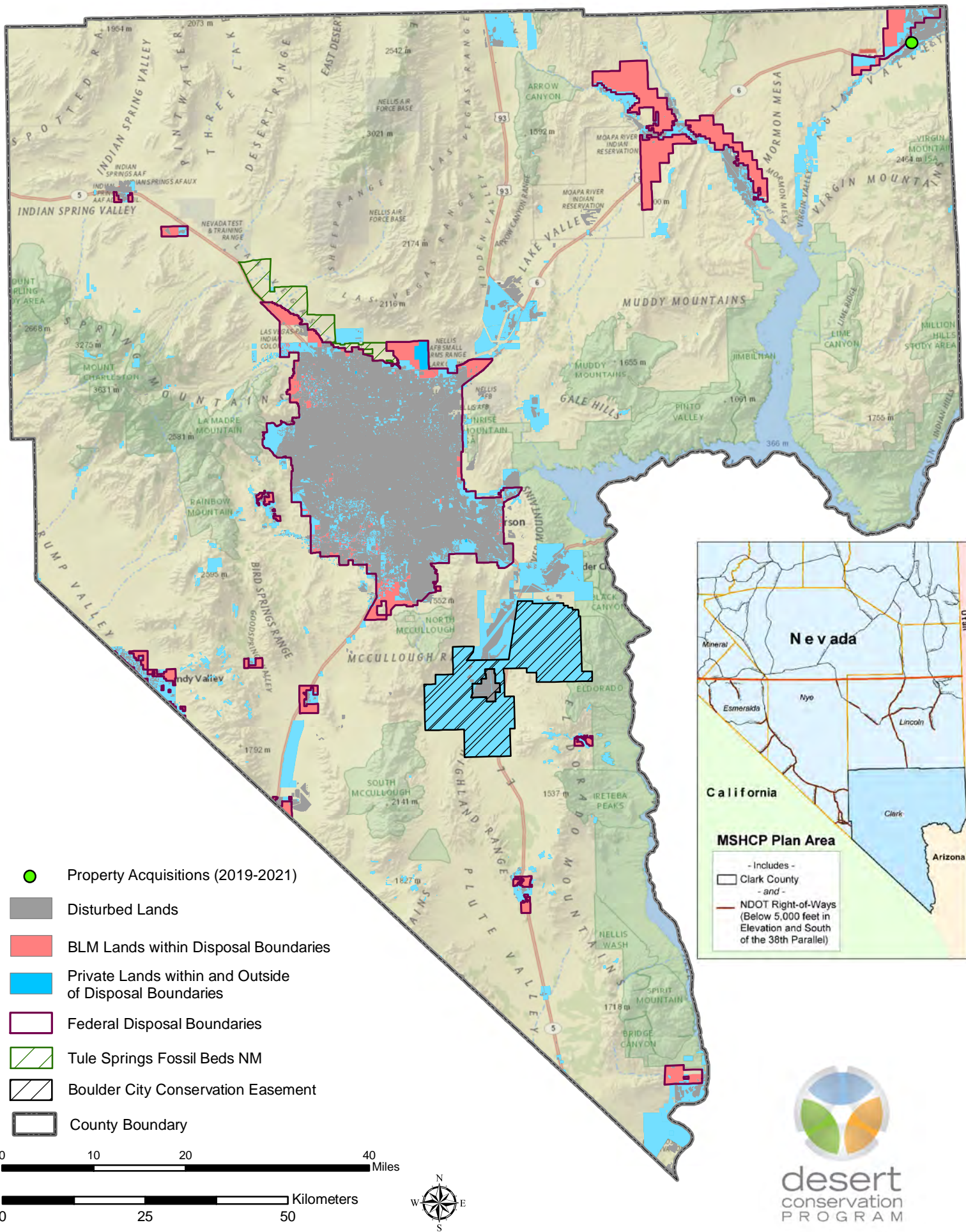
The MSHCP and Permit consists of 78 species categorized as "covered" species, which includes 15 reptiles and amphibians, 8 birds, 4 mammals, 10 invertebrates, and 41 plants (USFWS 2001). Covered species include both listed and non-listed species under the ESA and are those species for which sufficient information was known and where management prescriptions could be implemented and supported by the Permit. At the time the MSHCP was finalized in 2000, the desert tortoise (*Gopherus agassizii*) and the southwestern willow flycatcher (*Empidonax traillii extimus*) were the only species listed under the ESA as threatened and endangered, respectively. Since 2000, after the MSHCP was finalized, the Mount Charleston blue butterfly (*Icaricia shasta charlestonensis*) and the western population of the yellow-billed cuckoo (*Coccyzus americanus*) have been listed as endangered and threatened, respectively.

The MSHCP plan area includes Clark County, as well as lands in Nye, Lincoln, Mineral, and Esmeralda counties that lie below the 38th parallel, are less than 5,000 feet in elevation, and are in association with Nevada Department of Transportation activities (Figure 1). The Permit originally allowed for the incidental take of MSHCP-covered species from 145,000 acres within the plan area, which has since increased by 22,650 acres (due to the credit provided by the creation of the Tule Springs Fossil Beds National Monument) for a total of 167,650 acres. The area in which the MSHCP allows incidental take is a portion of the plan area, referred to as the "available development area", and includes (Figure 1):

- Non-federal lands in Clark County; and
- Any federal lands within Clark County that may be designated by a federal agency for disposal and eventual transfer to non-federal ownership (i.e., Federal Disposal Boundaries).

Additional introductory information, such as the history (including the background of the Adaptive Management Program [AMP]), function, and the proposed future amendment of the MSHCP and Permit is detailed in the 2016 Biennial AMR (Enduring Conservation Outcomes [ECO] 2016).

Figure 1 MSHCP Permit Area



1.1 Purpose

The MSHCP and Permit required the development of a science-based adaptive management process, the AMP. Consequently, a Memorandum of Agreement (MOA) was prepared to describe the AMP, including specific goals and guiding principles to the AMP (Clark County 2000, USFWS 2001 and 2002). The AMP is designed to provide an objective, quantitative evaluation of the effectiveness of management actions in attaining program goals through the interpretation of inventory, monitoring, and research goals (USFWS 2000). The AMP thus provides objective data and analysis upon which to base management decisions, and a framework to evaluate those management decisions (USFWS 2000). The AMP is required to have an objective, science-based adaptive management contractor (i.e., Science Advisor Panel) to provide an independent assessment of MSHCP implementation. The Biennial AMR is the product of that independent assessment. The independent review is accomplished by obtaining information on recent projects, reports, and datasets, and performing the following four assessments (USFWS 2000):

1. Analyze all land-use trends in Clark County to ensure that take and habitat disturbance are balanced with conservation (Section 2).
2. Track habitat loss by ecosystem (Section 3).
3. Evaluate the effectiveness of management actions at meeting MSHCP goals of conservation and recovery (Section 4).
4. Monitor population trends and ecosystem health (Section 5).

The purpose of this Biennial AMR is to document the Science Advisor Panel's analyses, findings, and subsequent recommendations of the above four items to improve the DCP's AMP and the MSHCP implementation.

1.2 Previous Biennial AMR

Prior to this Biennial AMR, the most recent report was completed in 2020 and included data from 2001 through 2019 (Alta 2020). This Biennial AMR summarizes recommendations from the 2020 report and narrative from the DCP to evaluate how recommendations have been implemented (Appendix A). This Biennial AMR also summarizes new recommendations to assist the DCP in the upcoming biennium.

1.2.1 Summary of 2020 Biennial AMR recommendations

The 2020 Biennial AMR included 7 recommendations that were intended for DCP implementation, and DCP staff comments for each are located in Appendix A. It is the Science Advisor Panel's opinion that (based on the responses from the DCP), all recommendations have been or are being implemented successfully.

1.3 Significant updates since the 2018 Biennial AMR

Since the Biennial AMR in 2020 the following significant updates to the DCP workflow and details of the MSHCP have been implemented:

- The DCP is continuing to initiate monitoring and other elements described in the Adaptive Management and Monitoring Plan (AMMP), including developing monitoring plans for all species and habitats previously not monitored.

- Three new riparian parcels (approximately 59 acres total) have been acquired as described in the most recent update to the Riparian Reserve Unit Management Plan; DCP is currently looking at acquiring additional new riparian properties.

1.3.1 Adaptive management and monitoring plan

An AMMP was developed based on the 2016 Biological Goals and Objectives (BGOs). It provides the technical direction for collecting and assessing monitoring data, determining the success of the conservation actions in achieving the BGOs, and maintaining or enhancing populations of MSHCP-covered species and their habitats through an adaptive management process. The incorporation of relevant and quantitative data and information obtained through systematic and consistent monitoring is a fundamental component of the AMMP. This information is used to periodically evaluate conservation success, with an emphasis on learning from past actions and making necessary changes. The AMMP applies to the entire suite of conservation actions conducted under the MSHCP to formalize adaptive management of the entire conservation program. Adaptive management of individual projects can also be important, but is not directly described in the main body of the AMMP; guidance is provided in Appendix B of the AMMP. Understanding the process and timing of adaptive management tasks will serve to streamline DCP workflow and maximize effectiveness toward permit requirements and biological goals.

A portion of the AMMP describes the evaluation timeline for both analyzing monitoring data and the adaptive management process (TerraGraphics 2017):

- The adaptive management evaluation process is a regular, systematic, recurring process to be performed every four years. This 2022 AMR does not include an adaptive management evaluation.
- The adaptive management action process occurs when necessary, beginning at the four-year evaluation interval and continuing until the actions have met their stated goals.
- Analysis of monitoring data for reporting purposes can occur at any time as individual projects dictate, but at a minimum should be conducted every two years as part of the Biennial AMR to serve as a benchmark for conservation progress (See Section 5) (see first bullet).
- Quantification and reporting of project-level progress that leads to the achievement of BGOs should be part of the adaptive management evaluation (see first bullet).

Integration of concepts and analyses from the AMMP into DCP workflow should occur at an intentional pace. The 2020 Biennial AMR included the first iteration of the adaptive management evaluation process and partially based on that analysis, the first revision of the AMMP is scheduled for 2022 and will be implemented in the 2024 Adaptive Management Evaluation.

Section 2 Land use trends in Clark County – analysis and discussion

The first assessment tool of the AMR states “*Analyze all land-use trends in Clark County to ensure that take and habitat disturbance is balanced with conservation*” (USFWS 2000). Land use trends measure the change from a current land use to a different one. The Science Advisor Panel is particularly interested in the change from a natural habitat to a human land use, which represents a habitat loss for a covered species. In the MSHCP, permitted acres (i.e., the

number of acres which are permitted to undergo land use change) and habitat loss are the primary measures of “take” for 78 covered species (Clark County 2000).

The original MSHCP allowed for 145,000 acres to be developed between 2001 and 2031. The establishment of the Tule Springs Fossil Beds National Monument provided an amendment to the MSHCP, which allowed for an additional 22,650 acres of development within the original MSHCP timeframe. As acres are permitted for development, each of the Permittees provide monthly updates on expended permitted acres which are summarized in Quarterly Administrator Update reports. The Science Advisor Panel’s assessment used data through July 2021, provided by DCP staff (DCP 2019). The Science Advisor Panel assumes the data from the Permittees are accurate, complete, and current. Because mitigation fees are required to be paid prior to disturbing any habitat, the acres of actual habitat loss are expected to be less than expended permitted acres. Expended permitted acres are used to track the remaining permitted acres available for development under the MSHCP.

Habitat loss is determined from the total number of acres developed and acts as a surrogate for assessing impacts on covered species, with the assumption that any disturbed habitat results in habitat loss for covered species. Habitat loss is measured at the extent of non-federal lands and federal disposal areas within the county. Non-federal lands include lands in private, municipal (city and county), and state ownership.

This section summarizes the number of acres permitted and habitat loss that have occurred since the last assessment from 2020 (Alta 2020) and cumulatively since the initiation of the MSHCP in 2001. Overall, the assessment is structured by two questions regarding habitat loss (ECO 2010). These assessment questions are discussed in the sub-section below and are:

- How many acres have been permitted for habitat loss?
- How many total acres of habitat loss have occurred?

2.1 Assessment of general habitat loss

The reported number of expended permitted acres was compared to county-wide aerial imagery collected in early July 2021 to determine actual habitat loss to date versus permitted disturbance acres to date (see ECO 2016 for a detailed description of the aerial imagery and spatial analysis). The results presented in this sub-section pertain to actual habitat loss, assuming that all development equates to habitat loss. Habitat loss discussed in this sub-section is irrespective of ecosystem. Habitat loss from currently undeveloped permitted acreage, if developed in the future, will be captured in the 2024 Biennial AMR.

As of July 2021, a total of 115,520 acres have been permitted under the MSHCP, including 15,000 municipal acres that were exempted from the original MSHCP. This is 68.9% of the total permitted acres under the amended MSHCP (including the Tule Springs Fossil Beds National Monument; 167,650 acres total). Also, as of July 2021, a total of 114,626 acres of habitat have been developed (i.e., actual habitat loss; Table 1; Figure 2). This is 68.4% of the amended allowed acreage. From March 2019 to July 2021, 11,154 acres of development occurred, which is a habitat loss of 0.2% of all land in Clark County (Table 1, Figure 3a). This is in contrast to the 6,336 acres of habitat lost to development in the previous biennium (Alta 2020). Habitat loss from 2019-2021 was 3.0% less than the average habitat loss across all previous bienniums (11,154 acres versus 11,497 acres, on average; based on the overall total acreage developed between 2001 and 2019). Habitat loss from 2019-2021 was 3.8% of the total amount of developed land in Clark County (Figure 3b). Habitat loss was 6.7% of the total amended permitted acres (Figure 3c).

Current and historic rates of habitat loss can be used to project potential future rates of loss. From 2001 to 2021 the average amount of development per biennium was 11,463 acres (average of 5,731.5 acres per year). At this rate, the remaining 53,024 acres permissible for development under the current MSHCP would be developed in 9.3 years from July 2021, or approximately year 2030. However, several recent bienniums have not experienced such high rates of development. With the average 6,093 acres of development per biennium (average 3,046.5 acres per year) from 2015 to 2019 (excluding the 2019-2021 development because of its relatively high rate of development), the remaining acres permissible for development would be developed in 17.4 years from July 2021, or approximately year 2038. For reference the current Permit is valid until February 2031. It must be noted that these calculations are for informational purposes only and do not represent projections of actual future rates of development. Actual development has been highly variable over time and is expected to continue as such in the future.

Table 1. Total area, development area (habitat loss), and percent habitat loss prior to 2001, 2001-2019, and 2019-2021 in Clark County, Nevada

Total acres in Clark County	Acres developed (habitat loss) within each time period ¹ (% total acres ² / % permitted acres ³)			Cumulative developed acres (% total acres / % permitted acres)
	Prior 2001	2001-2019	2019-2021	
5,159,738	180,754 (3.5% / NA ⁴)	103,472 (2.0% / 61.8%)	11,154 (0.2% / 6.7%)	295,380 (5.7% / 68.4% ⁵)

¹ Based on aerial imagery. The total developed acres are fewer than the number of acres permitted for development.

² Percent of total acres in Clark County developed within time period.

³ Percent of MSHCP-permitted acres developed within time period.

⁴ Not Applicable, as MSHCP began in 2001.

⁵ Cumulative percent of expended permitted acres developed is based on acres developed since the permit began in 2001 (114,626 acres).

Figure 2

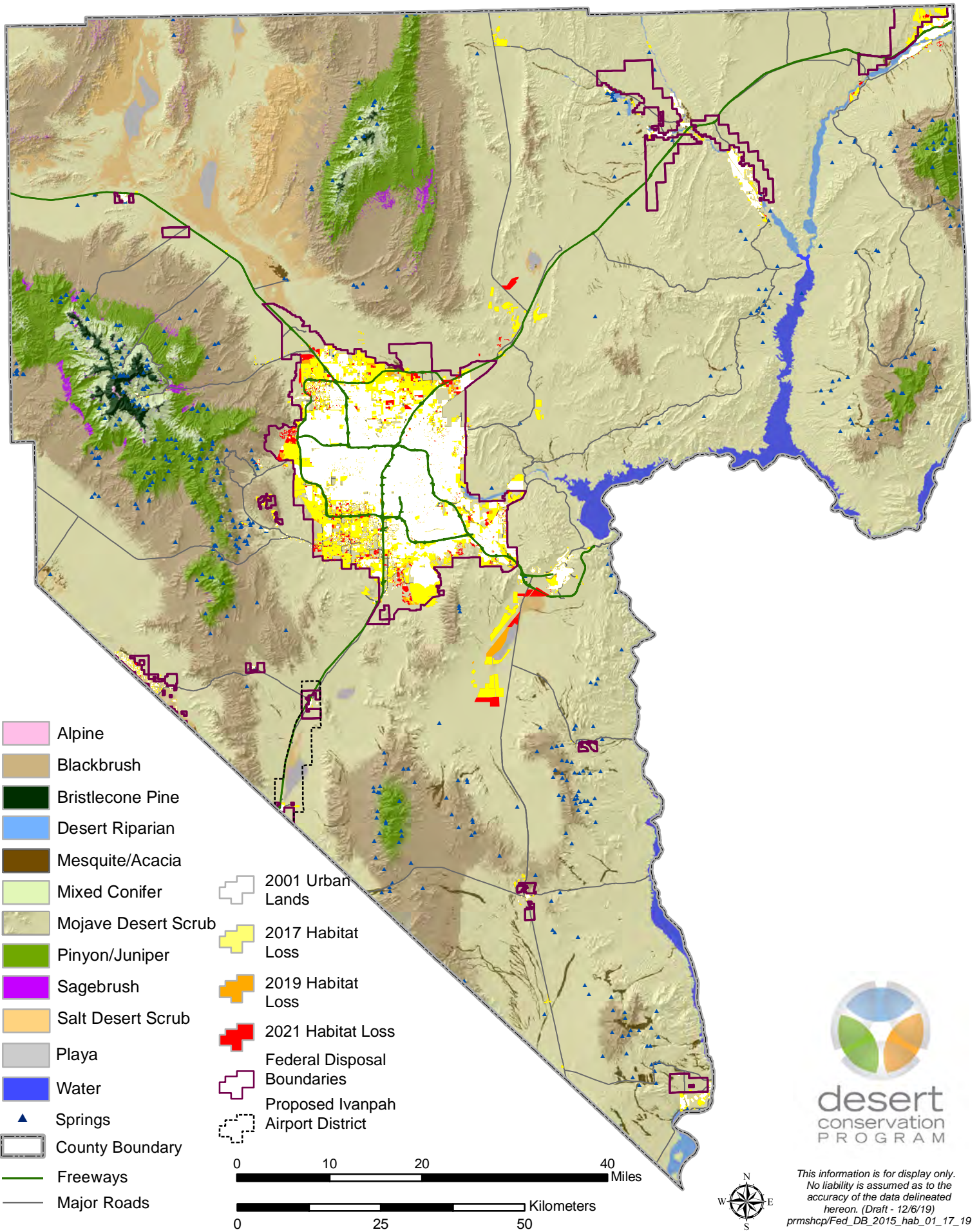
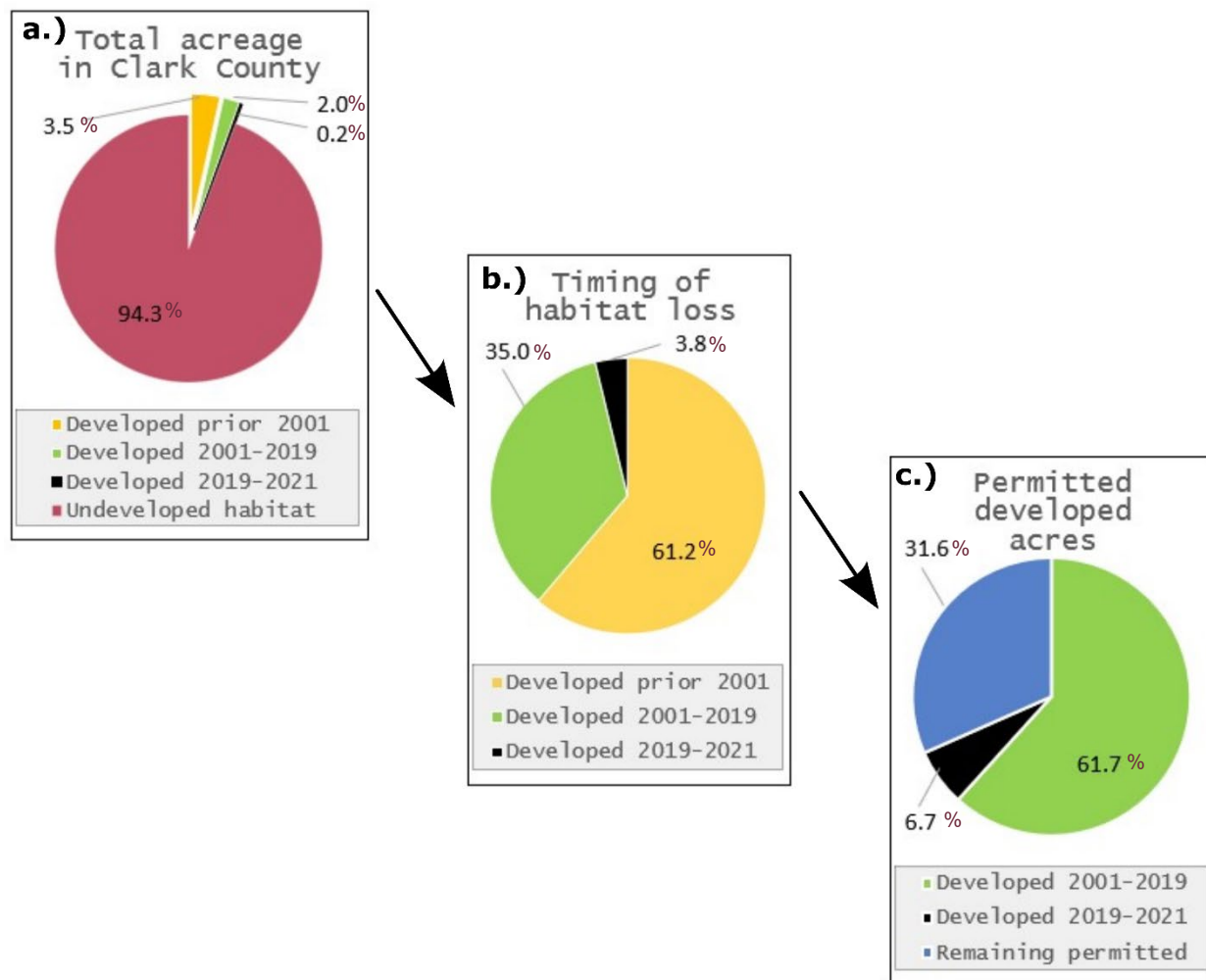


Figure 3. Percent habitat loss as a function of total habitat, time period, and development pace of permitting acreage



(a) Habitat loss, by time period, compared to total habitat (i.e., total acreage) within Clark County.

(b) Distribution of habitat loss by time period.

(c) Proportion of total amended permitted acres developed per time period.

Note: Each color among pie charts represents the same calculated acreage and time period (e.g., orange slices are the amount of habitat developed prior to 2001 [180,754 ac] in both [a] and [b]).

2.2 Conclusions and recommendations for land use trend analysis

Based on the Science Advisor Panel’s assessment of land use trends (i.e., general habitat loss), conclusions are:

- General habitat loss is commensurate with what is expected given the percent of habitat loss at this point in the timeline of the MSHCP. However, annual rates of habitat take have varied tremendously over the duration of the MSHCP and may increase or decrease with changing economic conditions in the region.
- In a general sense, current conservation actions are balancing habitat take (USFWS 2000) because the Permit conditions are being met.

These conclusions are consistent with the 2020 AMR conclusions.

The Science Advisor Panel does not have any specific recommendations for the DCP to implement in this section.

Section 3 Habitat loss by ecosystem – analysis and discussion

The second assessment tool of the AMR states “*Track habitat loss by ecosystem*” (USFWS 2000). In addition to tracking total habitat loss, the DCP tracks habitat loss by ecosystems (i.e., habitat types) as an assessment of development impacts (i.e., “take”) on 78 covered species. There are 12 ecosystems described for Clark County, although not all ecosystems are impacted by development due to land ownership and land use patterns (Figure 2). Information describing each ecosystem was detailed in the 2016 Biennial AMR (ECO 2016). Table 2 summarizes acres of habitat that have been developed (i.e., habitat loss) in the most recent biennium (i.e., 2019-2021) and over the life of the Permit (i.e., since 2001). Table 2 also categorizes acres by ecosystem relative to that ecosystem’s prevalence throughout Clark County.

DCP re-calculated the development layers since the last AMR to leverage access to better aerial imagery and applied standardized GIS methods. The numbers presented here are considered more accurate than those in previous AMRs. For this reason (combined with several ecosystems making up very small proportion of land in Clark County), some percentages in tables and figures presented in this section are notably different from past AMR calculations. Sources and methods used to calculate habitat loss are included in Appendix B.

Table 2. Habitat loss by ecosystem during 2019-2021 and since 2001. These percentages are based on the total area of each ecosystem in Clark County, Nevada

Ecosystem ¹	Total acres (% of Clark County ²)	Developed acres (i.e., Habitat Loss)			
		Prior 2001 ³	2001 - 2019	2019 - 2021	Cumulative since Permit began (2001- 2021) (% of ecosystem type ⁴)
Blackbrush	1,027,144 (19.91%)	1	627	70	697 (0.07%)
Desert Riparian	27,717 (0.54%)	3,005	560	13	573 (2.07%)
Mesquite/Acacia	50,008 (0.97%)	5,546	2,185	22	2,207 (4.41%)
Mixed Conifer	67,556 (1.31%)	31	7	1	8 (0.01%)
Mojave Desert Scrub	3,377,939 (65.47%)	165,412	92,037	10,475	102,512 (3.03%)
Pinyon/Juniper	286,400 (5.55%)	36	6	0	6 (<0.01%)
Sagebrush	11,632 (0.23%)	0	3	0	3 (0.03%)
Salt Desert Scrub	204,329 (3.96%)	6,723	7,978	505	8,483 (3.90%)
Playa	19,180 (0.37%)	0	69	68	137 (0.71%)
Total	5,159,738	180,754	103,472	11,154	114,626 (2.00%)

¹Excludes 'Alpine', 'Bristlecone Pine', and 'Water', as these ecosystems total 1.7% of Clark County. 'Alpine' and 'Bristlecone Pine' have had 0 acres developed, and, based on the more accurate re-calculation of developed areas, 110 acres of 'Water' were developed prior to 2015. 'Water' can be developed due to the resolution and classification errors in the Heaton et al. (2011) ecosystem model, and in specific instances such as a man-made reservoir.

²Percent of Clark County comprised of each ecosystem. Calculation is for the entirety of Clark County, including federal land, and therefore reflects ecosystem acreages for the larger county-encompassed landscape.

³Existing development before Permit began.

⁴Cumulative percent development rounded to nearest 0.01%.

In the most recent biennium (2019-2021), a total of 11,154 acres of classified ecosystem types were developed. The majority of development was in Mojave Desert Scrub (10,475 acres; 93.9% of development this biennium). Considerably more Blackbrush and Playa were developed in this biennium than in the previous biennium (70 vs. 6 acres, and 68 vs. 21 acres, respectively).

The acreages presented in Table 2 are used in subsequent subsections to visualize the relative proportion of each ecosystem that has been developed.

3.2 Developed acres indexed to account for prevalence on the landscape

In addition to quantifying the absolute area of habitat loss for each ecosystem (Section 3, above), the Science Advisor Panel calculated an index of the acreage loss proportional to the total existing area of each ecosystem (i.e., prevalence). This prevalence calculation determines if specific ecosystems are being lost at a disproportionately higher rate than they occur, which could lead to recommendations for conservation actions. For example, a disproportionately high rate of loss of the Mesquite/Acacia ecosystem would indicate a need for conservation actions targeted at protecting or enhancing remaining Mesquite/Acacia habitats.

The indexed prevalence calculations are done four ways to visualize habitat lost across different development periods and different scopes of reference. Table 3 illustrates the calculations behind each prevalence figure (Figures 4-7), and they are bulleted below:

Development Periods—

- The life of the permit (2001-present), and
- The recent biennium (2019-2021)

Scale of Reference—

- All habitat in Clark County
- Habitat within the available development area (See Section 1)

Table 3. Description of data used to calculate indexes in prevalence Figures 4-7.

		Development Period	
		2001-2021 (Life of Permit)	2019-2021 (Recent Biennium)
Scope of Reference	All of Clark County	Figure 4	Figure 5
	Available Development Area	Figure 6	Figure 7

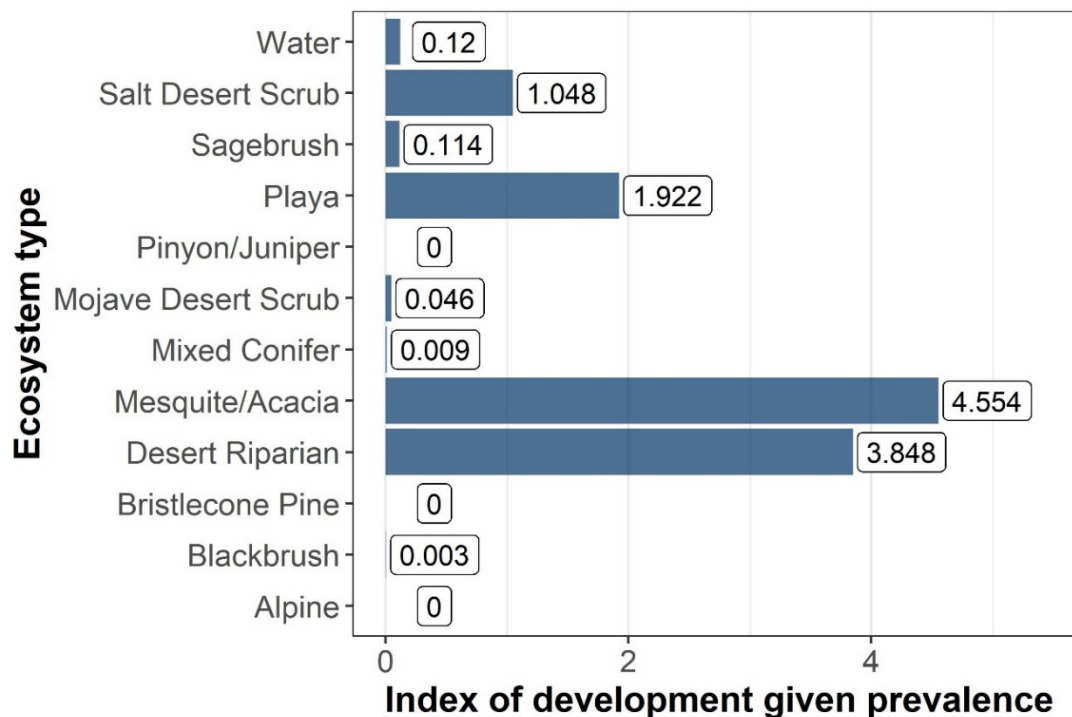
3.2.2 Developed acres indexed to prevalence of all habitat within Clark County.

The first two prevalence calculations (Figure 4 and Figure 5) consider all habitat within Clark County, much of which is outside the MSHCP available development area, and therefore not eligible for development at this time.

To illustrate the calculations performed to create Figure 4, the amount of all Desert Riparian that has been developed since the Permit began (2001 – 2021) is 2.07% whereas the acreage of all of Clark County that is Desert Riparian ecosystem is 0.54%. Therefore, Desert Riparian has been developed at a rate disproportionately higher than expected. Loss of Desert Riparian by an index factor is 3.85 (i.e., $0.0202 / 0.0054 \approx 3.848$). This index does not have a naturally

interpretable unit of measurement, but can be compared across ecosystem types to identify relatively high rates of development of relatively rare ecosystem types.

Figure 4. Index of habitat loss since the Permit began (2001-2021), proportional to its occurrence in Clark County, Nevada



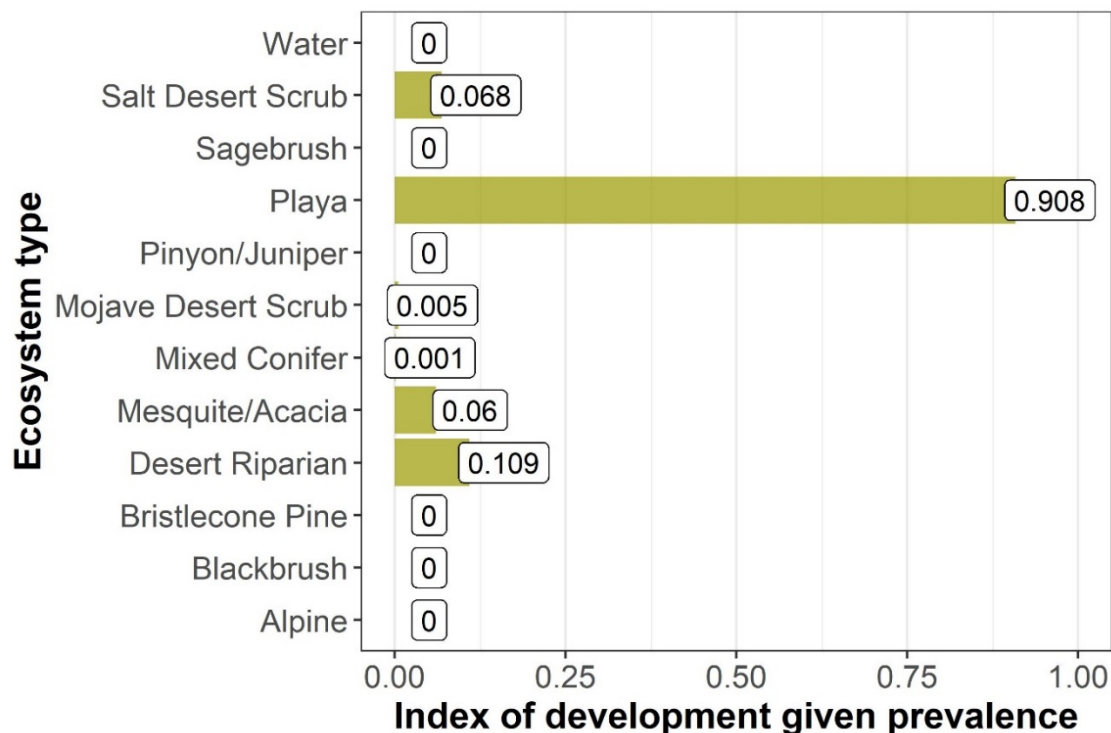
Note: Values indicate the rate at which an ecosystem is being developed relative to its occurrence to visualize disproportionate disturbance in ecosystem types with low prevalence. Values calculated as proportion of ecosystem lost to development divided by proportion of Clark County comprised by that ecosystem type.

Desert Riparian and Mesquite/Acacia habitats have been developed at considerably higher rates given their general low prevalence within Clark County (index calculations in Figure 4 of 3.848 and 4.554, respectively), because of their relative rarity in Clark County (0.5% and 1.0% of land area, respectively; Table 2).

Playa and Salt Desert Scrub have also been developed at disproportionately high rates index calculations in Figure 4 of 1.922 and 1.048, respectively) given their prevalence within Clark County (0.37% and 3.96% of land area, respectively; Table 2).

The habitat loss analysis of recent development only (2019-2021) when compared to ecosystem prevalence across Clark County is illustrated in Figure 5.

Figure 5. Index of habitat loss during the 2019-2021 biennium proportional to its occurrence in Clark County, Nevada



Note: Values calculated as proportion of ecosystem lost to development divided by proportion of Clark County comprised by that ecosystem type.

Consistent with development over the life of the permit to-date (2001-2021, Figure 4), there was a recent disproportionate loss of Playa (0.908), and lesser disproportionate losses of Desert Riparian, Mesquite/Acacia, and Salt Desert Scrub (Figure 5).

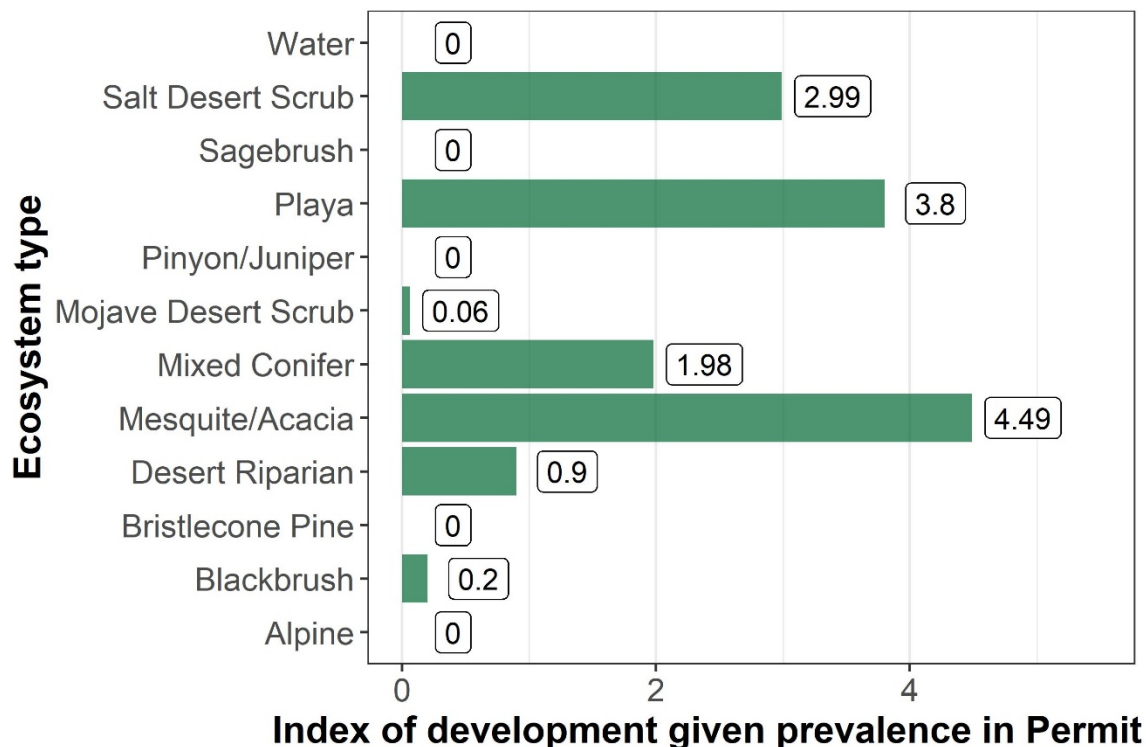
Interpretation of Table 2 combined with Figures 4 and 5 highlight that there are multiple factors to balance when assessing whether the rate of disturbance to an ecosystem warrants additional conservation action. Using a scale of reference of Clark County in its entirety, and timescale of both the life of the Permit to-date (2001-2021), as well as development only in the recent biennium (2019-2021), the Desert Riparian, Mesquite/Acacia, Playa, and Salt Desert Scrub ecosystems warrant conservation attention because of their proportionally high historic rate of development, whereas Mojave Desert Scrub warrants conservation attention because of its high overall amount of development (Table 2).

3.2.3 *Developed acres indexed to prevalence of habitat within the MSHCP Available Development Area*

The MSHCP permit area does not cover the entirety of Clark County (see Section 1). While it is valuable to consider habitat loss with respect to available habitat across the landscape (the entirety of Clark County), it may not accurately describe habitat loss in context with the habitats available to be developed. Figure 6 and Figure 7 show the same calculations as Figure 4 and Figure 5, respectively, with the exception that the denominator is the total acreage in the MSHCP available development area for each ecosystem type, rather than across all of Clark County. This calculation assumes that all development reported in Table 2 occurred within the MSHCP available development area.

Acreage and condition of land within the MSHCP available development area is determined by using aerial imagery of existing disturbed acreage, property ownership GIS layers, and current federal designation of disposal boundaries. As of July 2021, DCP staff calculated a total of 569,712 acres have been developed, or are potentially available to be developed under the MSHCP (i.e., private land or federal disposal lands not covered under conservation agreements; Figure 1). These are lands that, if developed, would fall under the administration of the MSHCP, although the total acreage of these lands that can ultimately be developed is limited by the Permit to 167,650 acres.

Figure 6. Long term (2001-2021), habitat loss by ecosystem, proportional to its occurrence in the MSHCP available development area

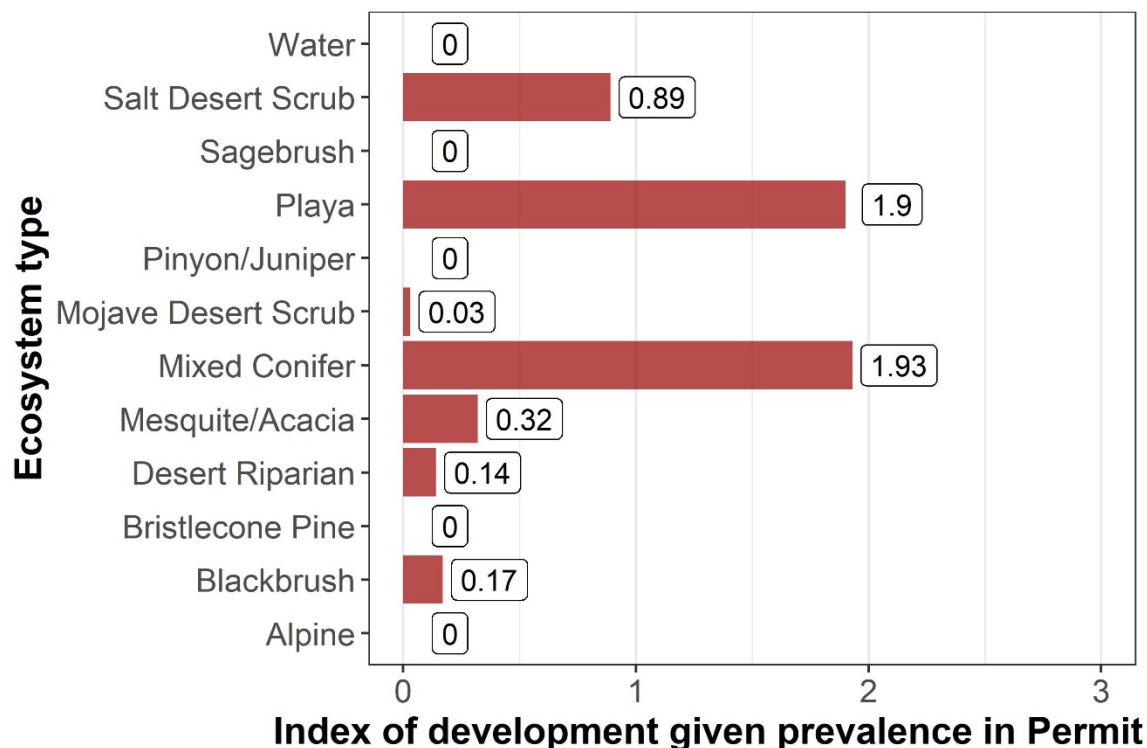


Note: Values calculated as proportion of ecosystem lost to development divided by proportion of the MSHCP available development area comprised by that ecosystem type.

Over the life of the Permit to-date (2001-2021), Mesquite/Acacia and Playa habitats have the highest index of development, given their prevalence within MSHCP available development area (4.49 and 3.8, respectively, Figure 6). Salt Desert Scrub, Mixed Conifer, and Desert Riparian habitats also have disproportionately high rates of development (2.99, 1.98, and 0.9, respectively, Figure 6).

The habitat loss analysis of recent development only (2019-2021) when compared to ecosystem prevalence within the MSHCP available development area is illustrated in Figure 7.

Figure 7. Recent biennium (2019-2021) habitat loss by ecosystem, proportional to its occurrence in the MSHCP available development area



Note: Values calculated as proportion of ecosystem lost to development divided by proportion of the MSHCP available development area comprised by that ecosystem type.

Habitat loss during the most recent biennium (2019-2021, Figure 7) when compared to the available habitat in the MSHCP available development area show the highest index of development for Mixed Conifer, Playa, and Salt Desert Scrub ecosystems (index of 1.93, 1.9, and 0.89 respectively). This is generally consistent with development over the life of the Permit to-date (Figure 6), but notable changes in development include an increase in rate of development for Mixed Conifer (but see conclusions in Section 3.1, below) and a decrease in rate of development for Mesquite/Acacia in the recent biennium.

3.1 Conclusions and recommendations for habitat loss by ecosystem analysis

Based on the Science Advisor Panel's assessment of habitat loss categorized by ecosystem, conclusions are:

- Mesquite/Acacia, Salt Desert Scrub, Playa, and Desert Riparian ecosystem types are rare both within the entire county and within the MSHCP available development area, yet these ecosystem types were disproportionately highly developed both since 2001 and since 2019. We recommend conservation projects that focus on these ecosystem types to best counteract their relatively high rates of development.
- Mixed Conifer habitat is disproportionately highly developed when compared to available acres within the MSHCP available development area. Its development is not as notable when compared to acres across all of Clark County. This ecosystem type and associated development was a discussion point for the Science Advisor Panel and DCP

staff during the preparation of this document. The Science Advisor Panel is not recommending specific conservation focus in Mixed Conifer habitat for three reasons: 1) Mapping uncertainty (described in bullets below), 2) Its overall relevance to MSHCP implementation, and 3) Prior conservation projects included \$5.3 million at the Spring Mountains National Recreation Area, which includes Mixed Conifer habitat and is considered adequate mitigation for the 8-acres that have been developed. The Science Advisor Panel will likely revise the development analyses in future AMRs to better reflect the prevalence of each ecosystem in the available development area versus across the entire county. This is relevant to the Mixed Conifer ecosystem type because although it appears relatively rare within the available development area, it is more prevalent across the entire county, specifically at higher elevations. It is a habitat type that typically occurs above elevations that are developed under the MSHCP and therefore should generally not be a conservation focus for DCP.

- Aside from disproportionate development of rare ecosystem types, the majority of habitat loss was Mojave Desert Scrub. We recommend continued conservation projects that address the larger loss of this common ecosystem type.
- We recognize challenges associated with identifying and conserving Mesquite/Acacia ecosystems and land ownership challenges associated with conserving Salt Desert Scrub and Desert Riparian ecosystems. Nonetheless, these ecosystems are rapidly being developed in Clark County.
- We recognize that the ecosystem type and associated acreage is derived from remotely sensed data, and that accuracy and precision of habitat classification may improve when a new ecosystem layer is completed. This may impact both the total acreages of each available ecosystem type, as well as classification of which habitats are being developed.
- DCP does not have control over which ecosystems are developed, or at what rate they are developed; therefore, a reasonable assessment of their attention to development trends lies in combining the assessments here in Section 3 with the evaluation of ongoing project effectiveness in Section 4. Often project descriptions and information available to the Science Advisor Panel for use in evaluating project effectiveness (Section 4) do not explicitly connect ecosystem type to each project implemented, but Appendix A includes DCP responses to how they have addressed previous recommendations to place conservation attention on ecosystem types that are being developed at both high overall rates, as well as those being disproportionately developed.

The following are recommendations from the Science Advisor Panel that are intended for DCP implementation:

- Develop conservation actions for those ecosystems undergoing the highest total loss and the highest proportional loss since both metrics could be important to the conservation and management of covered species.
 - Target future conservation actions specific to Mesquite/Acacia, Salt Desert Scrub, Playa, and Desert Riparian ecosystems due to their low prevalence and high historic and recent relative rate of development.
 - Target future conservation actions to Mojave Desert Scrub ecosystems due to the total high rate of habitat loss.

These recommendations are similar to those made in the 2020 AMR and are still relevant.

Section 4 Effectiveness of management actions – analysis and discussion

The third assessment tool in the AMR states “*Evaluate the effectiveness of management actions at meeting MSHCP goals of conservation and recovery*” (USFWS 2000). Herein, the management actions are the various projects the DCP implements and manages (see Biennium Progress Reports for project descriptions, budgets, and timelines; Clark County 2021a). To evaluate the effectiveness of project-based management actions, the Science Advisor Panel reviewed the project list and noted which BGO’s were being addressed by each project. Tabulating the BGOs across multiple projects provided a simple metric to quantify outcomes to help assess the entire program and identify where gaps may exist. This analysis is anticipated to differ for each Biennial AMR, as it is dependent on the administered projects at that time and the adaptive management tools utilized by the DCP. Furthermore, this analysis will become increasingly quantitative with each AMR as concepts from the 2016 BGOs and 2017 AMMP report are further integrated into the DCP workflow.

The 2018 AMR indicated the AMMP B1 worksheets were to be implemented at the start of each project to document project expectations and outcomes with respect to the BGOs, and act as an evaluation tool at the conclusion of the project. The DCP continues to transition to this new process, and furthermore, the B1 worksheets were reformatted in 2020 and 2021 to better guide the tracking of BGOs at the project-level. The updated worksheet is anticipated to more directly link and quantify the project objectives with the BGOs, and the 2024 Biennium AMR will reflect this update. Information learned during the current (2022) Biennial AMR analyses will further inform revisions to the B1 worksheets.

The biological goals are summarized below (see TerraGraphics 2017 for complete description and corresponding biological objectives):

Riparian Goals:

- Goal R1.** Maintain or expand habitat on riparian reserve lands;
- Goal R2.** Maintain stable or increasing populations of T&E listed species on riparian reserve lands;
- Goal R3.** Foster community engagement;
- Goal R4.** Promote ecological resilience;

Desert Goals:

- Goal D1.** Maintain or expand habitat on desert upland reserve system lands;
- Goal D2.** Maintain stable or increasing populations of T&E listed species on desert reserve lands;
- Goal D3.** Foster community engagement; and
- Goal D4.** Promote ecological resilience.

To facilitate this assessment, the DCP provided the Science Advisor Panel with a list of master projects which included narratives describing each project, sub-project, and accomplishments (Clark County 2021a). All sub-projects were assigned by the DCP to one of seven categories, summarized below and in Table 4. Master Projects all have the Desert Conservation Program as the lead agency. These projects include both desert and riparian contracts, and includes acquisition, restoration, education, land management, research, and survey efforts. Consistent

with previous AMR analysis the Master Projects were not explicitly tallied in this assessment, as there was overlap between Master Projects and the sub-projects.

1. **AMP.** Components include contracting an independent Science Advisor Panel and design and implementation of research projects. Specific projects in this category include those for desert upland areas (range-wide desert tortoise monitoring, reptile occupancy sampling, predation studies, desert tortoise connectivity study, forage study, invasive species reduction, rare plant propagation and pollinator study, and the Eastern Mojave Conservation Collaborative, and species and habitat monitoring in desert upland areas for birds, bats, and small mammals), and riparian reserve units (projects include surveys for birds, bats, small mammals, and surveys for federally listed birds). There were 26 projects in this category that were assessed for addressing the biological goals; all 8 biological goals were addressed with the great majority of projects addressing goals R2, D1, and D2.
2. **BCCE projects** include property management, maintenance, and restoration. Specific projects in this category include kiosk and signage maintenance, cultural resource surveys, and law enforcement. A total of seven projects were assessed in meeting the biological goals; all projects addressed biological goals D1, D3 and/or D4.
3. **Conservation projects** include general funding of conservation actions to provide for conservation and recovery of covered species which include research, habitat protection, or species inventory. Specific projects for this biennium include fencing installation and maintenance at the Tule Spring Fossil Beds National Monument, relict leopard frog conservation efforts, gila monster threat assessment and modeling efforts, and rare plant surveys. Seven projects in this category addressed goals D1, D2, and D3.
4. **Public information, education, and outreach (PIE) projects** aim to inform the public about the MSHCP and include programs to encourage people to respect and protect the desert. Specific projects include the Mojave Max education program and Off Highway Vehicle (OHV) outreach and education. There were three projects assessed in this category which addressed goals R3, and D3.
5. **Program administration and permit compliance** encompasses all aspects of implementing the MSHCP and complying with the incidental take permit. Specific projects include surveys for the desert pocket mouse, avian surveys in support of the MSHCP permit amendment, acquisition of supplies, data analysis, legal services, and contracting consultants. The seven assessed projects in this category addressed all eight biological goals.
6. **Riparian reserves projects** focus on acquiring private lands in desert riparian habitats to conserve habitat for riparian birds covered by the MSHCP. Specific project names include avian nest monitoring, the Muddy River grading plan and habitat restoration, Virgin River restoration, Mormon Mesa restoration, fence and gate maintenance, weed management and removal, archeological resource evaluations, water rights consulting, and property acquisition. There were 14 assessed riparian projects that addressed biological goals R1, R2, and R3.
7. **Wild desert tortoise assistance projects** include maintenance of tortoise exclusion fencing, tortoise telemetry and health assessments, a restoration workshop, a transportation ecology workshop, the Road Warrior mortality survey, and desert tortoise research projects on nesting and mating. Specific projects that were assessed here include two workshops, telemetry and desert tortoise health assessments on the BCCE, and research studies on nesting and mating opportunities. There were 10 assessed projects that addressed goals D1, D2, and D3.

Projects vary in magnitude (both in effort and in monetary scale), duration, and overall potential impact in achieving BGOs. There were 55 master projects and 161 sub-projects, of which 74 were classified based on the Biological Goal to which they contributed (e.g. many sub-projects were for supply acquisition, land acquisition, projects that had split funding that were only assessed once, or services that were administrative in nature, and were thereby excluded from analysis; Table 4 and Appendix C).

Table 4. Categories of projects tallied by which biological goals they support

Project Category	Number of projects and sub-projects assessed	R1	R2	R3	R4	D1	D2	D3	D4
AMP	26	4	9	2	4	15	17	2	7
BCCE	7	-	-	-	-	2	-	5	1
Conservation	7	-	-	-	-	5	5	1	-
PIE	3	-	-	1	-	-	-	3	-
Administration	7	4	3	1	1	3	5	1	1
Riparian	14	12	2	2	-	-	-	-	-
Wild desert tortoise	10	-	-	-	-	6	5	3	-

Note: Each project may address more than one biological goal.

4.1 Conclusions and recommendations for management action effectiveness

Based on the Science Advisor Panel's assessment of management action effectiveness, conclusions are:

- Overall, the assessment of the effectiveness of the DCP's management actions is positive because all biological goals have projects that are either recently completed and/or are in progress.
- Classification of projects was conducted post-hoc and was based on information provided by the DCP (as it was for the 2018 and 2020 AMRs). For future implementation of concepts from the AMMP, each project should be cross-referenced with its applicable BGOs during project inception and should be validated during project close-out (TerraGraphics 2017). This will provide more consistent (and quantitative) data on which BGOs are applicable to each project and will be based on DCP staff's knowledge of each project.

The following are recommendations from the Science Advisor Panel that are intended for DCP implementation:

- Implement all effectiveness worksheets after the updates they are currently undergoing are finalized (anticipated to be finalized with the AMMP revision, planned for 2022). By doing so, and collating in a spreadsheet, direct quantitative assessment within the next Biennial AMR will be possible.

Section 5 Species status and population trends

The final assessment tool in the AMR states “*Monitor population trends and ecosystem health*” (USFWS 2000). The MSHCP directs the DCP to monitor the status and trends of covered species and their habitats to prevent loss or fragmentation of habitat for the benefit of stabilizing or increasing population numbers within Clark County (Clark County 2000, USFWS 2002). No quantitative goals were established at the initiation of the MSHCP; however, goals were to be developed over time through surveys, monitoring, and adaptive management.

Monitoring the status of populations and the habitats of MSHCP-covered species provides information on the benefits of conservation actions conducted by the DCP as part the MSHCP implementation. Additionally, monitoring can serve as a safeguard against failing to detect MSHCP-covered species population declines in spite of successful implementation of the MSHCP.

The AMMP outlines the rationale and general methodology for monitoring species’ status and population trends for all MSHCP-covered species (TerraGraphics 2017). Monitoring will be used to record and evaluate species’ population and habitat trends, and potentially to demonstrate the impact of conservation actions on the populations of MSHCP- covered species. Furthermore, the AMMP outlines how monitoring data will be used to conduct the new program-level adaptive management process. The adaptive management evaluation for populations and habitats of MSHCP-covered species is to be completed every 4 years and is separate from the Biennial AMR (see Section 1.3.1). The AMMP also requires all monitoring data to be synthesized and disseminated in the Biennial AMR. This 2022 Biennial AMR is an off-year for the AMMP’s adaptive management evaluation, so species’ population status, where possible, are presented for informational purposes only, without statistical analysis of trends.

5.1 Methods

5.1.1 Reptiles

Occupancy monitoring surveys for desert tortoises were conducted from 2013 through 2021 (except no surveys in 2019), providing eight years of data over a nine year period. Other reptile species were incidentally observed and recorded during the desert tortoise surveys from 2015 through 2021 (excluding 2019), yielding six years of data over a seven year period. All survey data are in the Boulder City Conservation Easement, Nevada.

Dynamic occupancy models were used to analyze the desert tortoise occupancy data (MacKenzie et al. 2003). Dynamic occupancy models allow for modeling trends in the proportion of sampling sites where a species is present and explicitly incorporates imperfect detection and non-independence in occupancy status within a plot among years. Imperfect detection is where, when a species is truly present at a site, it may not be observed during any given single visit. A fully-parameterized dynamic occupancy model (i.e., all estimated parameters were independent among years) was fit to each species’ occupancy data using the ‘unmarked’ (v1.1.0) package in Program R (v4.0.5). This allowed for the most independence in estimated yearly occupancy rates by allowing colonization (the rate at which unoccupied sites become occupied), extinction (the rate at which occupied sites become unoccupied), and detection probability (the probability of detecting the species given true presence) to vary independently from year to year. These rates were then used to derive estimated annual occupancy rates. We note that desert tortoise apparent annual occupancy rates are known to vary dramatically over time due to interannual variations in aboveground activity rates and therefore are often unavailable for

detection even when truly present (Harju and Cambrin 2019). Thus we present annual occupancy rates with the caveat that fluctuations in apparent occupancy rates may be an unobservable combination of variation in true occupancy and availability for detection.

Dynamic occupancy models were also fit to two reptile species that had a sufficient number of detections to allow for dynamic occupancy modeling: desert iguanas (*Dipsosaurus dorsalis*) and leopard lizards (*Gambelia wislizenii*). Occupancy models for both species were also fully parameterized, in that colonization, extinction, and detection probability rates were estimated separately for each year, allowing for the most year-independent derived occupancy rates conditional on non-independence of occupancy state within a plot among years.

5.1.2 Avian

Surveys for yellow-billed cuckoo and southwestern willow flycatcher were conducted following established federal survey protocols specific to each species. Protocol surveys included 4-5 visits within a breeding season to conduct callback surveys and visual point count surveys. Because new reserve unit properties were acquired within this window, not all survey units were surveyed in each year. To standardize for unequal survey areas and unequal time spent in each unit (due to survey effort or unit size), detections of individuals were standardized as the number of individual birds of each species detected per hour of survey effort.

Point count surveys for all other avian species were conducted at riparian reserve units in 2017 through 2020 and at the Boulder City Conservation Easement in 2018 through 2020. Surveys were also conducted at both sites in 2021, but data was not finalized at the time of analysis. Surveys were 10 minutes in duration and survey stations were visited three times each year. Each avian species observed was recorded along with estimated distance from the survey point. However, trends in non-listed avian species were not calculated due both data limitations and complexity. Because data was not available for 2021, only a single additional year of data were provided beyond that already summarized in the 2020 Biennial AMR and there are no existing models to fit the point count survey design of multiple surveys within a year and distance to observed birds. Analysis of these data are therefore deferred to the 2024 Biennial AMR and AMMP evaluation.

5.1.3 Bats

Acoustic surveys for bats on upland and riparian reserve units were conducted from 2018 through 2021. The data from those surveys have not yet been analyzed to species level, and thus will not be presented here.

5.1.4 Plants

Surveys for MSHCP-covered plants were conducted in 2020 to identify populations of covered plants so that monitoring can begin. Because only a single year of surveys have been conducted, it is not currently possible to establish or present information on status and trends. We refer readers to Ironwood Consulting (2021) for full survey methodology and results.

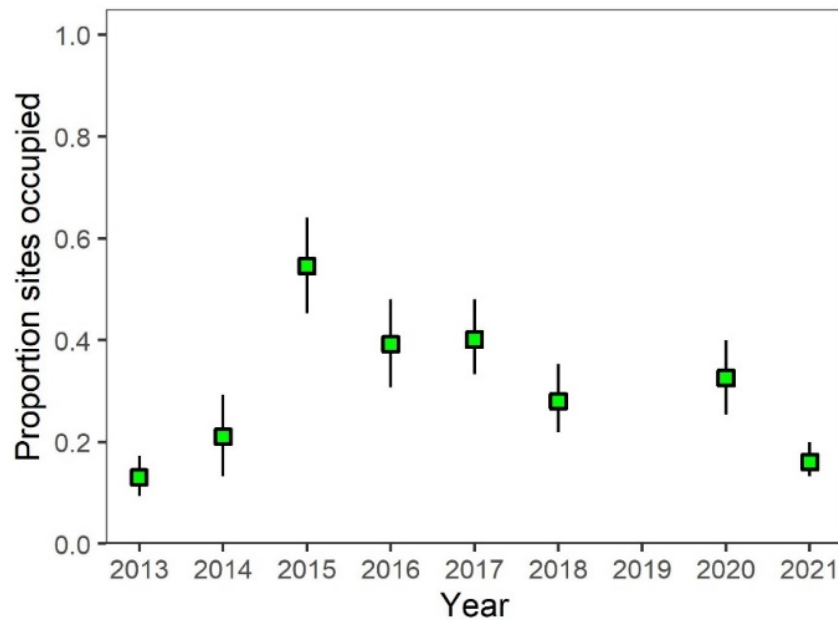
5.2 Results

5.2.1 Reptiles

Estimated occupancy rates of desert tortoises varied over time, ranging from a low of 0.13 (95% CI 0.09-0.17) in 2013 to a high of 0.54 (0.44-0.64) in 2015. (Figure 1). Of the other

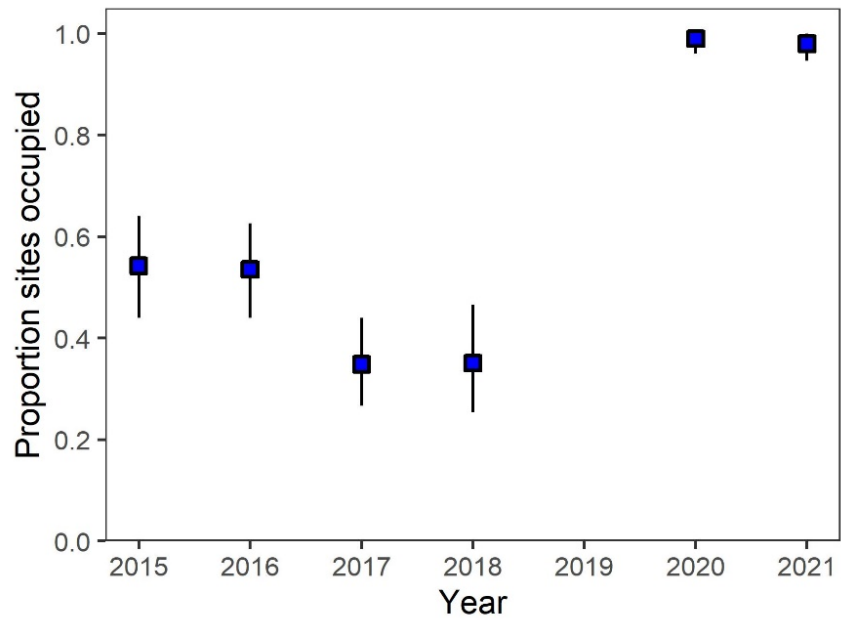
MSHCP-listed reptiles incidentally observed, only desert iguanas and leopard lizards had a sufficient number of observations in all years to allow for occupancy estimation. Occupancy rates of desert iguanas were higher than those of desert tortoises, ranging from 0.35 (0.26-0.44) in 2017 to 0.99 (0.96-1.00) in 2020 (Figure 9). The years of highest estimated desert iguana occupancy were 2020 and 2021. Occupancy rates for leopard lizards were roughly the inverse of those for desert iguanas, with the lowest occupancy years being 2020 and 2021, and ranging from 0.23 (0.15-0.31) in 2020 to 1.0 (1.0-1.0) in 2017 (Figure 10). The notably high estimated occupancy rates for desert iguanas in 2020 and 2021 was partially an artefact of the field data and modeling process, whereby a low frequency of re-detections resulted in low estimated detection probabilities and consequently high estimated true occupancy, even for sites with zero detections. Oppositely, for leopard lizards in 2020 and 2021, re-detections at occupied sites was high, resulting in high estimated detection probability and thus a low probability that sites with zero initial detections were potentially occupied.

Figure 8. Estimated annual occupancy rates of desert tortoises



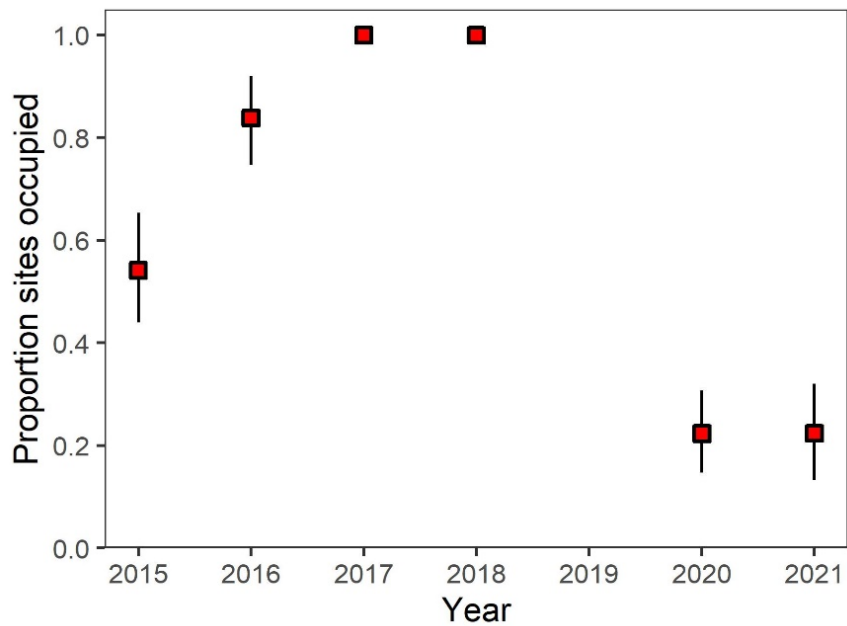
Note: Green squares are year-specific area-wide occupancy rate estimates and error bars are 95% confidence intervals.

Figure 9. Estimated annual occupancy rates of desert iguanas



Note: Blue squares are year-specific area-wide occupancy rate estimates and error bars are 95% confidence intervals.

Figure 10. Estimated annual occupancy rates of leopard lizards

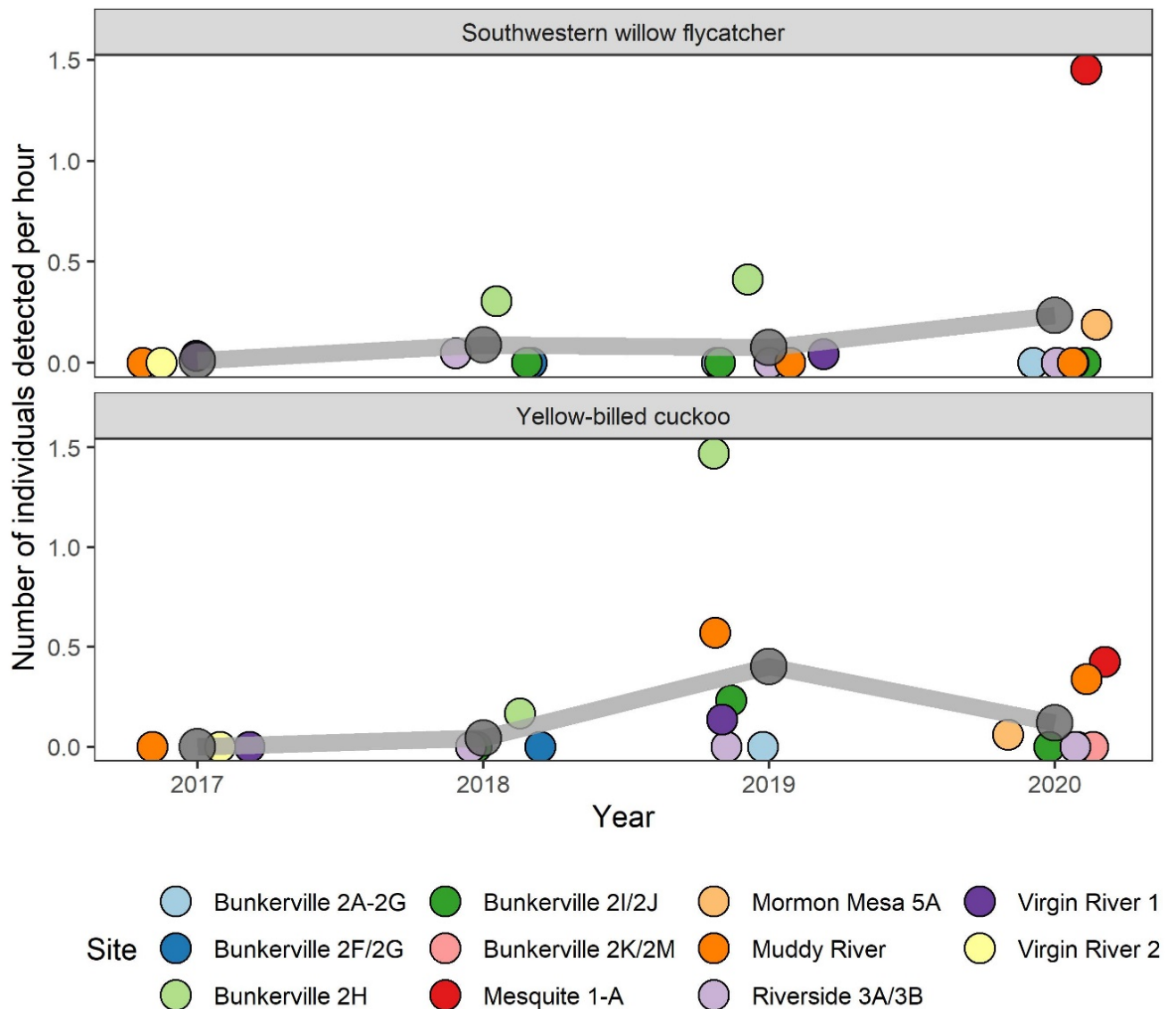


Note: Red squares are year-specific area-wide occupancy rate estimates and error bars are 95% confidence intervals.

5.2.2 Avian

Protocol surveys for yellow-billed cuckoos and southwestern willow flycatchers took place at multiple riparian reserve units each year from 2017-2020. Locations and descriptions of each riparian reserve unit is included in the Riparian Reserves Management Plan (Clark County 2021b). Individual birds detected per hour of survey effort slightly increased from 2017 to 2019 for both yellow-billed cuckoos and southwestern willow flycatchers (Figure 11).

Figure 11. Number of individual southwestern willow flycatchers and yellow-billed cuckoos detected per hour of survey effort.



Note: Color circles are individual reserve units and grey circles are within-year averages across units.

5.3 Conclusions and recommendations for species status and trends

Status and trends of many of the MSHCP-listed species were presented here, and it is expected that the next Biennial AMR / AMMP will have statistical analysis of trends of these and additional species.

Based on the Science Advisor Panel's assessment of species status and trends, conclusions are:

- This assessment is informative in nature without trend or other in-depth interpretation because this year's AMR does not coincide with the adaptive management evaluation. The next adaptive management evaluation process will be performed in conjunction with the 2024 AMR and will include statistical analysis where possible, including additional interpretation.
- Continued monitoring of MSHCP-covered plant populations is expected to facilitate future trend analyses on presence, areal coverage, and/or plant species abundances.

The following are recommendations from the Science Advisor Panel that are intended for DCP implementation:

- Processing of the bat acoustic detection data is expected to yield several years of species presence and abundance records, supporting future trend analyses for bat populations.
- Monitoring ecosystem health is included in the language for this assessment (USFWS 2000), however no specific effort from DCP has resulted in ecosystem health data for the Science Advisor to evaluate. DCP is currently working with the Science Advisor Panel to develop habitat monitoring plans and they are expected to be included in the planned AMMP revision in 2022. When the habitat monitoring plans are finalized, they should be implemented.
- The Science Advisor Panel should determine if new methods are available to analyze the full avian point count dataset incorporating multiple within-year surveys and distance to detection data. Alternatively, the DCP may consider reducing the amount of survey information collected (e.g., single-visit surveys per year with distances-to-detection recorded or multiple surveys per year without recording distances).

Section 6 Summary of conclusions and recommendations

This Biennial AMR describes the independent analysis and subsequent conclusions and recommendations from the Science Advisor Panel’s assessment of land use trends, habitat loss by ecosystem, the effectiveness of management actions at meeting MSHCP goals, and population trends and ecosystem health (Table 5).

Table 5. Summary of conclusions for all assessments performed by the Science Advisor Panel for the 2020 Biennial AMR

Assessment section	Summary of conclusions
Section 2—Analyze all land-use trends in Clark County to ensure that take and habitat disturbance are balanced with conservation.	General habitat loss is commensurate with what is expected given the timeline of the Permit and generally, current conservation actions reflect a focus that is appropriate given the rates and patterns of habitat take.
Section 3—Track habitat loss by ecosystem.	<p>Mojave Desert Scrub, Mesquite/Acacia, Salt Desert Scrub, Playa, and Desert Riparian, ecosystems warrant conservation attention because of either their total habitat loss and/or proportionally high historic rate of development.</p> <p>The Science Advisor Panel will reconsider restructuring future analyses to incorporate prevalence of ecosystem types within the available development area compared to overall prevalence in Clark County.</p>
Section 4—Evaluate the effectiveness of management actions at meeting MSHCP goals of conservation and recovery	All biological goals have projects that are either recently completed and/or are in progress.
Section 5—Monitor population trends and ecosystem health.	<p>Continued monitoring of plant populations is expected to facilitate future trend analyses on presence, areal coverage, and/or plant species abundances.</p> <p>This year’s assessment is informative and does not include trend or other in-depth interpretation. The next adaptive management evaluation will be in the 2024 AMR.</p>

Recommendations for each assessment are described in their corresponding sections and are summarized in Table 6, below.

Table 6. Summary of recommendations for all assessments performed by the Science Advisor Panel for the 2022 Biennial AMR

Assessment section	Summary of recommendations
Section 2—Analyze all land-use trends in Clark County to ensure that take and habitat disturbance are balanced with conservation.	The Science Advisor Panel does not have any specific recommendations for the DCP to implement in this section.
Section 3—Track habitat loss by ecosystem.	<p>Develop conservation actions for ecosystems undergoing the highest total habitat loss and the highest proportional habitat loss. These include:</p> <ul style="list-style-type: none"> ○ Desert Riparian, Mesquite/Acacia, Salt Desert Scrub, and Playa, due to their low prevalence and high historic and recent relative rate of development. ○ Mojave Desert Scrub ecosystem due to the total high rate of habitat loss.
Section 4—Evaluate the effectiveness of management actions at meeting MSHCP goals of conservation and recovery	Implement all effectiveness worksheets after the updates they are currently undergoing are finalized (planned for 2022). By doing so, and collating in a spreadsheet, direct quantitative assessment within the next Biennial AMR will be possible.
Section 5—Monitor population trends and ecosystem health.	<p>Processing bat acoustic data is required before analysis or assessment of population status can occur</p> <p>Monitoring plans for ecosystem health should be finalized and implemented.</p> <p>Avian survey methods should be revisited in conjunction with the Science Advisor Panel to ensure cost and effort efficiency.</p>

The Science Advisor Panel’s overall appraisal, based on the above four primary assessments (summarized in Table 5 and Table 6), is that the DCP is successfully implementing the current MSHCP. General recommendations include improving project and program-level tracking and reporting to allow for more quantitative rigor in future assessments, and the completion of several monitoring and planning efforts that are already underway.

Section 7 References

- Alta Science and Engineering, Inc. 2020. 2020 Biennial Adaptive Management Report. February 7, 2020.
- Clark County. 2000. Final Clark County Multiple Species Habitat Conservation Plan and Environmental Impact Statement for Issuance of a Permit to Allow Incidental Take of 79 Species in Clark County, Nevada. Prepared by RECON for the Desert Conservation Program. September 2000.
- Clark County 2021a. 2019-2021 Project Data for the Biennium Progress Report. Personal Communication with K. Jenkins, September 2021.
- Clark County 2021b. Clark County Multiple Species Habitat Conservation Plan, Riparian Reserves Management Plan, Version 1.3. July 2021.
- Desert Conservation Program (DCP). 2019. Data from GIS Calculations in Support of the Quarterly Administer Updates, Personal Communication with S. Cambrin and J. Ellis, October 2021.
- Enduring Conservation Outcomes (ECO). 2010. Final Adaptive Management Report, Clark County Multiple Species Habitat Conservation Plan. June 15, 2010.
- ECO. 2016. 2016 Adaptive Management Report, Clark County Multiple Species Habitat Conservation Plan. December 18, 2015.
- Harju, S.M., and S.M. Cambrin. 2019. Identifying habitat correlates of latent occupancy when apparent annual occupancy is confounded with availability for detection. *Biological Conservation* 238:108246.
- Heaton, J. S., X. Miao, K. Von Seckendorff Hoff, D. Charlet, P. Cashman, J. Trexler, A. Grimmer, R. Patil. 2011. Final Report 2005-UNR-578. Report to Clark County MSHCP 2005-UNR-578:D27
- Ironwood Consulting. 2021. Clark County Rare Plant 2020 Survey Report. 2020 Annual Survey Report and Data Deliverable submitted to Clark County, Nevada.
- MacKenzie, D.I., J.D. Nichols, J.E. Hines, M.G. Knutson, and A.B. Franklin. 2003. Estimating site occupancy, colonization, and local extinction when a species is detected imperfectly. *Ecology* 84:2200-2207.
- TerraGraphics Environmental Engineering, Inc. 2017. Adaptive Management and Monitoring Plan. Prepared for Clark County DCP. January 9, 2017.
- U.S. Fish and Wildlife Service (USFWS). 2000. Intra-Service Biological Opinion and Conference Opinion on Issuance of an Incidental Take Permit to Clark County, Nevada for a Multiple Species Habitat Conservation Plan. File No. 1-5-00-FW-575. November 19, 2000.
- USFWS. 2001. Federal Fish and Wildlife Permit Number TE034927-0. Clark County MSHCP Permittees. Effective January 9, 2001.
- USFWS. 2002. Memorandum of Agreement among United States Bureau of Land Management, National Park Service, United States Department of Agriculture-Forest Service, United States Fish and Wildlife Service (Refuges), United States Fish and Wildlife Service

(Ecological Services) and Clark County, Nevada in its Capacity as Administrator of the Desert Conservation Program Regarding Adaptive Management of the Clark County Multiple Species Habitat Conservation Plan. December 12, 2002.

USFWS, BLM, USFS, NPS, NDOW, NDF, NDSP, NDOT, Clark County, and the cities of Las Vegas, North Las Vegas, Boulder City, Henderson, and Mesquite. 2000. Clark County Multiple Species Habitat Conservation Plan Implementing Agreement. November 2000.

Appendix A
Summary of Recommendations from previous biennial AMR

Summary of recommendations from the 2020 Biennial AMR and DCP's responses to each recommendation in preparation for the 2022 AMR.

Assessment section	Summary of recommendations	DCP Response for 2022 AMR
Section 2—Analyze land-use trends	The Science Advisor Panel does not have any specific recommendations for the DCP to implement in this section.	NA
Section 3—Track habitat loss by ecosystem.	<p>Develop conservation actions for ecosystems undergoing the highest total habitat loss and the highest proportional habitat loss since both metrics could be important to the conservation and management of covered species. These include:</p> <ul style="list-style-type: none"> ○ Desert Riparian, Mesquite/Acacia, Salt Desert Scrub, and Playa ecosystems due to their low prevalence and high historic and recent relative rate of development. ○ Mojave Desert Scrub ecosystems due to the total high rate of habitat loss. Reconcile developed acreages via GIS processing and analysis. Two sets of numbers were provided to the Science Advisor Panel, especially highlighting an increase in total developed Mojave Desert Scrub acres when looking at a subset of the County compared to the whole County, which should not be possible. 	<ol style="list-style-type: none"> 1. DCP acquired more desert riparian lands and continue to implementing projects on desert riparian lands. Mesquite restoration has been planned for the Muddy River properties and there are areas on and near the BCCE where Salt desert scrub is planned but has not started yet. No projects have been implemented for playa. 2. DCP continues to implement restoration on the BCCE (Mojave Desert Scrub) and have received SNPLMA funding to restore areas in the Piute Eldorado Valley. 3. The GIS and processing methods were updated and documented for the current AMR. Acreages of habitat loss by ecosystem varied from previous AMRs, but the calculation method is now verifiable and will be consistently used in future AMRs.
Section 4—Evaluate the effectiveness of management actions	Implement all effectiveness worksheets, which are expected to be updated in 2020 (Appendix B of the AMMP). By doing so, and collating in a spreadsheet, direct quantitative assessment within the next Biennial AMR will be possible.	Updates to the effectiveness worksheets are not complete, but they have been started. They are planned to be completed during the planned revision of the AMMP in 2022 and will be implemented by the next Biennial AMR for the AM Evaluation.
Section 5—Monitor population trends and ecosystem health.	<p>Prior to the next adaptive management evaluation process, the Science Advisor Panel and DCP should discuss the targets and triggers metric to resolve the statistical and practical difficulty of attempting to ascertain 'population stability'. One potential solution would be to only assess whether triggers are being met to identify population declines, with the lack of a statistically significant population decline being sufficient population performance.</p> <p>The remaining species populations and habitats should have monitoring plans developed and enacted as soon as is feasible.</p> <p>The DCP should consider starting monitoring and reporting for species that are expected to be of management or conservation concern in the future, for example due to Permit amendment or future state or federal listing status.</p>	<ol style="list-style-type: none"> 1. The targets and triggers metric will be updated in the planned revision of the AMMP in 2022. 2. DCP and the Science Advisor Panel are currently developing monitoring plans for all covered species and habitats that were not being monitored. The 2021 Sampling and Assessment Workshop addressed this issue and the resulting report is forthcoming. Final monitoring plans for these species and habitats will be included in the planned AMMP revision in 2022. 3. Currently we monitor for all the bats, birds, and the desert tortoise. We are currently have projects that are addressing desert pocket mouse, gila monster and a number of plant species that may make monitoring more possible in the future for these species.

Appendix B
Ecosystem Disturbance Mapping Procedure

Ecosystem Disturbance Mapping Procedure

Disturbance Mapping occurs every year based on updated aerial imagery obtained by Clark County or cooperating agency. This should follow a very specific procedure using specific layers.

Prior to starting:

Create a Local copy of Z:\CrGeoDb\Source\Parcel.gdb

For Performance concerns this database should not be run over a network drive.

Load the Following Layers:

Y:\Permit_Amend_2015\D21_Final_Model_target_2_playa.lyr

Y:\Permit_Amend_2015\Permit_Amend.gdb\Layers\Disturbed{Current year}spr_priv_fed

(i.e. For 2019 – 2021 biennium the file is

Y:\Permit_Amend_2015\Permit_Amend.gdb\Layers\Disturbed2021spr_priv_fed)

Parcel.gdb\Parcel\AOParcels

Parcel.gdb\AOExtract

Procedure:

Step 1: Create a Join AOParcels

Inputs:

1: APN

2: AOExtract

3: PARCEL

Join Options:

Keep All Records

Step 2: Set the Layer Definition Query of the layer “AOParcels” as Follows

AOExtract.OWNER IN('USA' , 'USA BUREAU LAND MANAGEMENT' , 'USA BUREAU OF MINES' , 'USA BUREAU RECLAMATION' , 'USA CORPS OF ENGINEERS' , 'USA CORPS OF ENGINEERS ARMY' , 'USA DEPT OF AGRICULTURE' , 'USA DEPT OF TRANSPORTATION FAA' , 'USA FISH & WILDLIFE SERVICE' , 'USA FOREST SERVICE' , 'USA FOREST SERVICE ETAL' , 'USA FT MOHAVE INDIAN RESERVATION' , 'USA INDIAN SPRINGS AIR BASE' , 'USA LV INDIAN RESERVATION' , 'USA MOAPA INDIAN RESERVATION' , 'USA MOAPA PAIUTE INDIANS' , 'USA PARK SERVICE' , 'USA PARK SERVICE ETAL' , 'USA POSTAL SERVICE' , 'USA TRUST LAS VEGAS PAIUTE TRIBE' , 'USA TRUST LV PAIUTE INDIANS' , 'USA TRUST MOAPA PAIUTE INDIANS' , 'USA TRUST MOAPA PAIUTES INDIANS')

*This layer is now the Federal Land in Clark County Layer.

Step 3: Union

Input Features:

Disturbed{Current year}spr_priv_fed
AOParcels(With Definition Query)

Output Feature Class:

Disturbed{Current year}_Union

Step 4: Set the Layer Definition Query of the layer “Disturbed{Current year}_Union” as Follows
FID_Disturbed2021spr_priv_fed <> -1
This removes the features that are not disturbed.

Step 5: Select the layer “Disturbed{Current year}_Union” by Attributes with the following criteria
FID_AOParcels_AOExtract =-1 AND Private NOT IN (1,2,3)

Step 6: Calculate Field in layer “Disturbed{Current year}_Union” ‘Private’ = 1

Step 7: Select the layer “Disturbed{Current year}_Union” by Attributes with the following criteria
FID_AOParcels_AOExtract <> -1 AND Private NOT IN(1,2,3)

Step 8: Calculate Field “Disturbed{Current year}_Union” ‘Private’ = 3

Step 9: Run Geoprocessing “Raster to Polygon” with the following inputs (This can be skipped if a Vector version of the Ecosystems map is available.)

Input Raster: D21_Final_Model_target_2_playa

Field: Value

Output Polygon: D21_Final_Model_target_2_playa_Vector

Uncheck “Simplify Polygons”

Step 10: Select the layer “Disturbed{Current year}_Union” by Attributes with the following criteria
‘Private’ = 1

Step 11: Clip D21_Final_Model_target_2_playa_Vector with Selected features from Step 10.

Input Features: D21_Final_Model_target_2_playa_Vector

Clip Features: “Disturbed{Current year}_Union” with applied selection “Private” = 1

Output Feature Class: Disturbed{Current year}_priv_ecosystems

Step 12: Run Geoprocessing “Dissolve”

Input Features: “Disturbed2021_priv_ecosystems”

Output Feature Class: Disturbed2021_priv_ecos_Dis

Dissolve Fields: gridcode

Check Create Multipart Features

Step 13: Add Field to Disturbed2021_priv_ecos_Dis

Name: Acres

Type: Double

Step 14: Add Field to Disturbed2021_priv_ecos_Dis

Name: Ecosystem

Type: Text

Step 15: Calculate Geometry for "Acres" Field

Property: Area

Use Coordinate system of the data source: PCS: NAD 1983 UTM Zone 11N

Units: Acres

Step 16: Calculate Field for "Ecosystem" Field

Parser: Python

Check: Show Code Block

Pre-Logic Script Code:

```
def eco(gc):
    options = {0 : "0",
               1 : "Alpine",
               2 : "Blackbrush",
               3 : "Bristlecone Pine",
               4 : "Desert Riparian",
               5 : "Mesquite/Acacia",
               6 : "Mixed Conifer",
               7 : "Mojave Desert Scrub",
               8 : "Pinyon/Juniper",
               9 : "Sagebrush",
               10 : "Salt Desert Scrub",
               12 : "Water",
               13 : "Playa"
    }
    return options[gc]
```

Ecosystem =

```
eco( !gridcode!)
```


Appendix C
Current Projects Linked to BGOs

Project Number	Master Project/Contract Title	Project Title	Lead Agency/Contractor	Status (contract date cutoff of 7/31/21)	R1	R2	R3	R4	D1	D2	D3	D4
803	DT Hotline and Pick-Up Service		Desert Conservation Program (DCP)		Not assessed							
803G	CLOSED Zoo Med Natural Grassland Tortoise Food	Wild DT Assist Hotline	RodentPro.COM, LLC		Not assessed							
1920A	Science Advisor Panel	AMP	Alta Sciences & Engineering, Inc.	In Progress	1	1	1	1	1	1	1	1
804	Desert Tortoise Fencing		Desert Conservation Program (DCP)		Not assessed							
1997A	Assess Genetic Diversity of Gila Monster	Gila Monster Threats Assessment	US Geological Survey (USGS) -Western Eco Rsrch Ctr	In Progress	0	0	0	0	0	1	0	0
804L	CLOSED Transportation Ecology Documentary	Transportation Ecology Workshop	University of Nevada LV (UNLV) -School of Life Sci	Complete	0	0	0	0	0	0	1	0
804M	CLOSED DT Transportation Capstone Workshop	Transportation Ecology Workshop	Center for Large Landscape Conservation	Complete	0	0	0	0	0	0	1	0
1997B	Gila Monsters Spatial Ecology and Habitat	Gila Monster Threats Assessment	Austin Peay State University	In Progress	0	0	0	0	1	1	0	0
807	OHV Education		Desert Conservation Program (DCP)		Not assessed							
1715AK	MSHCP Education Video	General Outreach	WE MARKET FOR HUMANS	In Progress	0	0	1	0	0	0	1	0
1410C	CLOSED Science Advisor Panel for the DCP	Science Advisor	Alta Sciences & Engineering, Inc.		Not assessed							
809	Restoration of DT & Gypsum Habitat		Desert Conservation Program (DCP)		Not assessed							
1510C	BCCE Boulder City Police Dept Drone Project	BCCE Law Enforcement	City of Boulder City	In Progress	0	0	0	0	0	0	1	0
803H	CLOSED EA for Pesticide Use	Brome Reduction	Wood Enviroment & Infastructure Solution	Complete	0	0	0	0	1	0	0	0
1905B	Law Enforcement for the BCCE	BCCE Law Enforcement	City of Boulder City	In Progress	0	0	0	0	0	0	1	0
917	Riparian Property Acquisition		Desert Conservation Program (DCP)		Not assessed							
1750F	Avian Nest Monitoring on Riparian Properties	Avian Nest Monitoring	SWCA Environmental Consultants	In Progress	1	1	0	0	0	0	0	0
1910B	CLOSED Avian Nest Monitoring on Riparian Properties	Avian Nest Monitoring	SWCA Environmental Consultants	In Progress	0	1	0	0	0	0	0	0
1411A	CLOSED Science Advisor (W/1410 & 901)	Science Advisor	Terragraphics		Not assessed							
1446D	CLOSED Muddy River Habitat Restoration	Muddy River Restoration	National Park Service (NPS)		Not assessed							
1570A	Muddy River Grading Plan	Muddy River Restoration	Louis Berger Engineering	Complete	1	0	0	0	0	0	0	0
1570C	Muddy River Habitat Restoration	Muddy River Restoration	Natural Channel Design, Inc	In Progress	1	0	0	0	0	0	0	0
917A	Title Rpt 030-23-101-004 & 030-22-501-011	Riparian Property Acquisition	Fidelity National Title Group		Not assessed							
917BD	CLOSED Parceling for APN 002-26-501-009	Riparian Property Acquisition	Stanley Consultants, Inc.		Not assessed							
917JC	CLOSED Appraisal Report 030-23-101-001	Riparian Property Acquisition	Tio S Difederico Real Estate Appraisal, Inc.		Not assessed							
917JD	CLOSED Appraisal Report 030-23-101-001	Riparian Property Acquisition	Anderson Valuation Group		Not assessed							
917K	COMPLETE DRB Holdings, LLC Land Acquisition	Riparian Property Acquisition			Not assessed							
917L	COMPLETE Happy Good Fortune, LLC Land Acquisiton	Riparian Property Acquisition			Not assessed							
917M	COMPLETE Bunkerville Compound, LLC Land Acquisition	Riparian Property Acquisition			Not assessed							
1014	Permit Amendment Transition		Desert Conservation Program (DCP)		Not assessed							
1014J	CLOSED Legal Services for DCP	Permit Amendment	Ebbin Moser & Skaggs, LLP		Not assessed							
1410	Adaptive Management Program-Baseline		Desert Conservation Program (DCP)		Not assessed							
1580A	CLOSED Desert Tortoise Connectivity Modeling	Desert Tortoise Connectivity Study	University of Nevada Reno (UNR) - BRRC	Complete	0	0	0	0	1	1	0	1
1420V	CLOSED Acquisition of GPS Receiver (w/1510B)	Program Administration	Frontier Precision		Not assessed							

Project Number	Master Project/Contract Title	Project Title	Lead Agency/Contractor	Status (contract date cutoff of 7/31/21)	R1	R2	R3	R4	D1	D2	D3	D4
1411	Adaptive Management Program-DT Modeling		Desert Conservation Program (DCP)		Not assessed							
1580C	DT Connectivity Solutions Modeling	Desert Tortoise Connectivity Study	University of Nevada Reno (UNR) - BRRC	In Progress	0	0	0	0	1	1	0	0
1412	Adaptive Management Program-DT Monitoring		Desert Conservation Program (DCP)		Not assessed							
1412D	CLOSED BCCE DT Telemetry and Health Assessments	Translocation	Great Basin Institute	Complete	0	0	0	0	0	1	0	0
1420	BCCE Management		Desert Conservation Program (DCP)		Not assessed							
1420U	CLOSED BCCE Culvert Wildlife Cameras	BCCE Management	Forestry Suppliers		Not assessed							
1460A	HCP Consultant for the MSHCP Amend	Permit Amendment	WRA Environmental Consultants	In Progress	1	1	1	1	1	1	1	1
1421	BCCE Restoration		Desert Conservation Program (DCP)		Not assessed							
1510D	CLOSED Replacement Kiosk Signage FY20	BCCE Management	KVO Industries		Not assessed							
1440	Other Property Management		Desert Conservation Program (DCP)		Not assessed							
917MB	CLOSED Parceling for Bunkerville Property	Riparian Property Acquisition	Stanley Consultants, Inc.		Not assessed							
1445	Riparian Property Management		Desert Conservation Program (DCP)		Not assessed							
917OA	CLOSED Appraisal Report 002-26-301-007	Riparian Property Acquisition	Lubaway & Associates, Inc		Not assessed							
917P	CLOSED Appraisal for Property Acquisition	Riparian Property Acquisition	Anderson Valuation Group		Not assessed							
1580D	CLOSED Mapping Potential DT Hab Conn in CC	Desert Tortoise Connectivity Study	Conservation Science Partners, Inc.	Complete	0	0	0	0	1	0	0	1
1446	Riparian Prop Restoration - Phase II				Not assessed							
917Q	Costa Land Acquisition	Riparian Property Acquisition			Not assessed							
1460	Permit Amendment		Desert Conservation Program (DCP)		Not assessed							
1460E	CLOSED Species Distribution Modeling, Phase II	Permit Amendment	University of Nevada Reno (UNR) - BRRC	Complete	1	1	0	0	1	1	0	0
1460F	CLOSED COMPLETE Golden Eagle Habitat Model	Permit Amendment	University of Nevada Reno (UNR) - BRRC	Complete	0	1	0	0	0	1	0	0
1421C	Restorations on the BCCE (w/809 & 1745)	BCCE Restoration	Gothic Landscape, Inc		Not assessed							
1782A	Desert Pocket Mouse Surveys	Permit Amendment	BEC Environmental, Inc.	In Progress	0	0	0	0	0	1	0	0
1510	BCCE MGMT & LAW ENFORCEMENT		Desert Conservation Program (DCP)		Not assessed							
1782B	Avian Surveys	Permit Amendment	SWCA Environmental Consultants	In Progress	0	0	0	0	0	1	0	0
1510E	CLOSED Acquisition of Gate Locks	BCCE Management	IML Security Supply		Not assessed							
1440D	Water Rights Consulting (w/1520Q & 1720E)	Water Rights Management	Farr West Engineering	In Progress	1	0	0	0	0	0	0	0
1710A	CLOSED Law Enforcement for the BCCE	BCCE Management	Boulder City Conservation Easement Law Enforce	Complete	0	0	0	0	0	0	1	0
1710C	CLOSED BCCE Maintenance	BCCE Management	Turf Tech, Inc.		Not assessed							
1515	INFORMATION, EDUCATION & OUTREACH		Desert Conservation Program (DCP)		Not assessed							
1715AA	CLOSED Acquisition of DCP Pencils	Mojave Max Education Program	My Promos&Apparel		Not assessed							
1520	RIPARIAN PROPERTY MANAGEMENT		Desert Conservation Program (DCP)		Not assessed							
917QA	CLOSED Appraisal Rpt 030-23-101-004 & 030-22-501-011	Riparian Property Acquisition	Anderson Valuation Group		Not assessed							
1521	RIPARIAN RESTORATION RSV UNITS & WATER RIGHTS		Desert Conservation Program (DCP)		Not assessed							
917R	Cavada Land Aquisition	Riparian Property Acquisition			Not assessed							

Project Number	Master Project/Contract Title	Project Title	Lead Agency/Contractor	Status (contract date cutoff of 7/31/21)	R1	R2	R3	R4	D1	D2	D3	D4
1720A	CLOSED Virgin River Weed Management	Riparian Property Management	National Park Service (NPS)	Complete	1	0	0	0	0	0	0	0
1720F	Riparian Reserves Maintenance	Riparian Property Management	Eagle View Contractors, Inc.	In Progress	1	0	0	0	0	0	0	0
1910C	Riparian Reserves Vegetation Management	Riparian Property Management	National Park Service (NPS)	In Progress	1	0	0	0	0	0	0	0
1525	WILDLIFE FENCING		Desert Conservation Program (DCP)		Not assessed							
1997C	Gila Monster Habitat Modeling	Gila Monster Threats Assessment	University of Nevada Reno (UNR) - BRRRC	In Progress	0	0	0	0	1	1	0	0
1541	DESERT TORTOISE MONITORING-SNPLMA		Desert Conservation Program (DCP)		Not assessed							
1580E	DT Telemetry around Culverts	Desert Tortoise Connectivity Study	Eco-centric, LLC	In Progress	0	0	0	0	0	1	0	0
1580F	Culvert Inspection for Tortoise Usage	Desert Tortoise Connectivity Study	Newfields	In Progress	0	0	0	0	1	0	0	1
1550	RELICT LEOPARD FROG CNSV PLAN & IMP		Desert Conservation Program (DCP)		Not assessed							
1792C	CLOSED Gold Butte AML Closures	Gold Butte AML Closures	Nevada Department of Minerals	Complete	0	0	0	0	1	1	0	0
1570	Restoration on the Clark County Muddy River Riparian Reserve Unit		Desert Conservation Program (DCP)		Not assessed							
1521E	CLOSED Virgin River Riparian Restoration	Virgin River Restoration	Nevada Division of Forestry (NDF) - Carson City	Complete	1	0	0	0	0	0	0	0
1521H	CLOSED Virgin River Restoration Treatment	Virgin River Restoration	Summitt Forests, Inc.	Complete	1	0	0	0	0	0	0	0
1580	Tortoise Connectivity		Desert Conservation Program (DCP)		Not assessed							
1580G	Connectivity Management Plan	Desert Tortoise Connectivity Study	Recon Environmental, Inc	In Progress	0	0	0	0	1	0	0	1
1580H	Culvert Image Inspection	Desert Tortoise Connectivity Study	SWCA Environmental Consultants	In Progress	0	0	0	0	1	0	0	0
1580J	Connectivity Data Analysis	Desert Tortoise Connectivity Study	Heron Ecological, LLC	In Progress	0	0	0	1	1	0	0	1
1445C	CLOSED Muddy River Grading Plan (w/722&805)	Muddy River Restoration	Louis Berger Engineering		Not assessed							
1920B	DT Occupancy on the BCCE	DT Occupancy Sampling	Bio Logical, LLC	In Progress	0	0	0	0	1	1	0	0
1445E	CLOSED Water Rights Consulting (w/805)	Water Rights Management	Farr West Engineering		Not assessed							
1445J	CLOSED Riparian Small Mammal Survey (w 1910A/1720G)	Species and Habitat Monitoring	BEC Environmental, Inc.		Not assessed							
1410D	CLOSED Eastern Mojave Consv Collaborative	Eastern Mojave Conservation Collaborative	Southwest Decisions Resources, Inc	Complete	1	1	1	1	1	1	1	1
1730J	CLOSED Effects of Exotic Forage on Mojave DT	Effects of Exotoc Forage on Mojave Desert Tortoises	US Geological Survey (USGS) -Western Eco Rsrch Ctr	Complete	0	0	0	0	0	1	0	0
1710	BCCE Management and Law Enforcement		Desert Conservation Program (DCP)		Not assessed							
1460G	Vegetation Map for Clark County (w/1965)	Permit Amendment	Cogan Technology Inc	In Progress	1	0	0	0	0	0	0	0
1710E	CLOSED Culvert Cameras for BCCE	BCCE Management	Forestry Suppliers		Not assessed							
1710F	CLOSED BCCE Kiosk Signage	BCCE Management	KVO Industries		Not assessed							
1905A	CLOSED Reserves Maintenance Materials & Tools FY20	BCCE Management	American Express		Not assessed							
1510B	CLOSED Acquisition of GPS Receiver (w/1420V)	Program Administration	Frontier Precision		Not assessed							
1715	Public Information, Education, and Outreach		Desert Conservation Program (DCP)		Not assessed							
1715AB	CLOSED Acquisition of Table Throw	Mojave Max Education Program	Logo Fusion USA, Inc.		Not assessed							

Project Number	Master Project/Contract Title	Project Title	Lead Agency/Contractor	Status (contract date cutoff of 7/31/21)	R1	R2	R3	R4	D1	D2	D3	D4	
1715AC	CLOSED Acquisition of Stainless Steel Water Bottles	Mojave Max Education Program	My Promos&Apparel		Not assessed								
1715AE	CLOSED Acquisition of Playing Cards	Mojave Max Education Program	Skyhigh Marketing		Not assessed								
1715AF	CLOSED Acquisition of DCP Gift Bags	Mojave Max Education Program	My Promos&Apparel		Not assessed								
1715AG	CLOSED Acquisition of Slim Sports Bottles	Mojave Max Education Program	Morgan Specialties, Inc.		Not assessed								
1715AH	CLOSED Acquisition of Shade Shelter	Mojave Max Education Program	International E-Z Up, Inc		Not assessed								
1715AJ	CLOSED Content Prod for MoMax Assemblies/Emergence	Mojave Max Education Program	MXT Media		Not assessed								
1715V	CLOSED Acquisition of Mojave Max Lapel Pins	Mojave Max Education Program	The Pincenter		Not assessed								
1715W	CLOSED Acquisition of Lip Balm Balls	Mojave Max Education Program	My Promos&Apparel		Not assessed								
1715X	CLOSED Acquisition of Safety Sunglasses	Mojave Max Education Program	Giftco		Not assessed								
1715Y	CLOSED Acquisition of MoMax Iron on Patches	Mojave Max Education Program	Giftco		Not assessed								
1715Z	CLOSED Acquisition of Rubber Wrist Bands	Mojave Max Education Program	My Promos&Apparel		Not assessed								
1915A	Mojave Max Education Program	Mojave Max Education Program	Outside Las Vegas Foundation	In Progress	0	0	0	0	0	0	1	0	
1915B	CLOSED Acquisition of Arlo Go Camera	Mojave Max Education Program	Verizon Wireless		Not assessed								
1720	Riparian Properties Baseline Mgmt		Desert Conservation Program (DCP)		Not assessed								
1521J	CLOSED Mormon Mesa Plant Propagation	Virgin River Restoration	National Park Service (NPS)	Complete	1	0	0	0	0	0	0	0	
1510F	BCCE Maintenance (w/1710D & 1905C	BCCE Management	Gothic Landscape, Inc		Not assessed								
1750B	VR Coalition Project Planning	VR Coalition	The Nature Conservancy (TNC) of Nevada	Complete	0	0	1	0	0	0	0	0	
1795A	Desert Tortoise Predator-Prey Dynamics	Predation Studies	US Geological Survey	In Progress	0	0	0	0	0	1	0	0	
1725	Fencing Installation and Maintenance		Desert Conservation Program (DCP)		Not assessed								
1755A	Rare Plant Surveys	Rare Plant Surveys	Ironwood Consulting, Inc.	In Progress	0	0	0	0	1	0	0	0	
1730	Adaptive Management Program		Desert Conservation Program (DCP)		Not assessed								
1515AC	CLOSED Mojave Max Education Program (w/1715)	Mojave Max Education Program	Outside Las Vegas Foundation		Not assessed								
1520Q	Water Rights Consulting (w/1440D & 1720E)	Water Rights Management	Farr West Engineering		Not assessed								
1521K	CLOSED Mormon Mesa Rest Svs -Phase II (w/1750C)	Virgin River Restoration	American Conservation Experience		Not assessed								
1992A	CLOSED Riparian Plant-Pollinator Ecology Phase 1	Riparian Plant Pollinator Ecology	University of Nevada (UNLV) - Board of Regents	Complete	1	1	0	0	0	0	0	0	
1525C	Tule Springs Monument Fence (w/804, 1725, 1780, 1975)	TUSK Boundary Fence	RFP/in progress	In Progress	0	0	0	0	1	1	1	0	
1541B	Desert Tortoise Range-Wide Monitoring	DT Rangewide Monitoring	Great Basin Institute	In Progress	0	0	0	0	1	1	0	0	
1730A	CLOSED Science Advisor Panel for the DCP	Science Advisor	Alta Sciences & Engineering, Inc.		Not assessed								
1745	BCCE Restorations		Desert Conservation Program (DCP)		Not assessed								
1905D	Reserves Maintenance Materials & Tools FY21	BCCE Management	American Express		Not assessed								
1750	Riparian Reserve Units Restoration		Desert Conservation Program (DCP)		Not assessed								
1580B	DT Connectivity Across Roadways (w/1920)	Desert Tortoise Connectivity Study	Ecoentric, LLC	In Progress	0	0	0	0	1	1	0	0	
1750D	Archeological Resource Evals on Rip Rsv Parcels	VR Restoration	SWCA Environmental Consultants	In Progress	1	0	1	0	0	0	0	0	
1750E	CLOSED Repellent Acquisition	VR Restoration	Helena Chemical Company		Not assessed								
1710D	BCCE Maintenance (w/1510F & 1905C)	BCCE Management	Gothic Landscape, Inc	In Progress	0	0	0	0	1	0	0	0	

Project Number	Master Project/Contract Title	Project Title	Lead Agency/Contractor	Status (contract date cutoff of 7/31/21)	R1	R2	R3	R4	D1	D2	D3	D4
1720E	Water Rights Consulting (w/1440D & 1520Q)	Water Rights Management	Farr West Engineering		Not assessed							
1755	Rare Plant Surveys		Desert Conservation Program (DCP)		Not assessed							
1550A	CLOSED Relict Leopard Frog Consv Plan and Impl	Relict Leopard Frog Conservation	University of Nevada (UNLV) - Board of Regents	Complete	0	0	0	0	0	0	0	0
1760	Evaluating Desert Tortoise Habitat Restoration - SNPLMA		Desert Conservation Program (DCP)		Not assessed							
1760A	Academic Consultant for DT Rest Workshop	Evaluating DT Habitat Restoration	Natural Resource Conservation LLC	In Progress	0	0	0	0	1	0	0	0
1760B	Restoration Workshop Facilitation	Evaluating Restoration Habitat Restoration	Southwest Decisions Resources, Inc	In Progress	0	0	0	0	1	0	1	0
1780	Tule Springs Fossil Beds Nat'l Monument Boundary Fencing		Desert Conservation Program (DCP)		Not assessed							
804K	CLOSED TUSK Trail Head Design	TUSK Boundary Fence	The WLB Group, Inc		Not assessed							
1782	PAmend Covered Species Surveys & Dist		Desert Conservation Program (DCP)		Not assessed							
1720G	CLOSED Riparian Small Mammal Survery (w 1445J/1910A)	Species and Habitat Monitoring	BEC Environmental, Inc.		Not assessed							
1725A	Tule Springs Monument Fence (w/804, 1525, 1780, 1975)	TUSK Boundary Fence	RFP/in progress		Not assessed							
1792	Arden Mine Complex Restoration and Bat Gate Installation		Desert Conservation Program (DCP)		Not assessed							
1730P	Avian Surveys (w/1920)	Species and Habitat Monitoring	SWCA Environmental Consultants	In Progress	0	1	0	0	0	1	0	0
1795	Desert Tortoise Predator-Prey Dynamics		Desert Conservation Program (DCP)		Not assessed							
1745A	Restoration at the BCCE (W/809 & 1421)	BCCE Restoration	Gothic Landscape, Inc		Not assessed							
1900	Administration		Desert Conservation Program (DCP)		Not assessed							
1750C	CLOSED Mormon Mesa Rest Svs -Phase II (w/1521K)	VR Restoration	American Conservation Experience	Complete	1	0	0	0	0	0	0	0
1780A	Tule Springs Monument Fence (w/804, 1525, 1725, 1975)	TUSK Boundary Fence	RFP/in progress		Not assessed							
1900A	CLOSED Office Supplies - Admin FY20	Program Administration	Staples		Not assessed							
1900B	CLOSED First Aid & Safety Supplies FY20	Program Administration	Cintas First Aid & Safety		Not assessed							
1900C	CLOSED Uniform Apparel - FY20	Program Administration	Inspire By Design		Not assessed							
1900D	CLOSED Document Shredding and Container FY20	Program Administration	Opportunity Village		Not assessed							
1900E	CLOSED Lot 4 -Safety Shoes for Staff FY20	Program Administration	Red Wing Shoes of America		Not assessed							
1900F	CLOSED Acquisition of 2019 Jeep Rubicon	Program Administration	Jim Marsh Chrysler Jeep		Not assessed							
1900G	CLOSED 2017-2019 BPR Graphic Design and Editing	Program Administration	MYS Project and Brand Management		Not assessed							
1900H	Case360 Upgrade	Program Administration	OpenText		Not assessed							
1900J	CLOSED Case360 Upgrade	Program Administration	Precision Business Technologies, Inc.		Not assessed							
1900K	CLOSED GIS Printer Preventative Maintenance	Program Administration	Monsen Engineering		Not assessed							
1900L	Office Supplies - Admin FY21	Program Administration	Staples		Not assessed							
1900M	Lot 4 - Safety Shoes for Staff FY21	Program Administration	Red Wing Shoes of America		Not assessed							
1900N	Document Shredding and Container FY21	Program Administration	Opportunity Village		Not assessed							
1900P	Uniform Apparel FY21	Program Administration	Inspire By Design		Not assessed							
1900Q	First Aid & Safety Supplies FY21	Program Administration	Cintas First Aid & Safety		Not assessed							

Project Number	Master Project/Contract Title	Project Title	Lead Agency/Contractor	Status (contract date cutoff of 7/31/21)	R1	R2	R3	R4	D1	D2	D3	D4
1905	BCCE Management and Law Enforcement		Desert Conservation Program (DCP)		<i>Not assessed</i>							
1905E	CLOSED Gabion Kiosks Build and Install	BCCE Management	Maile Concrete	Complete	0	0	0	0	0	0	1	0
809M	CLOSED BCCE Cultural Resource Survey	BCCE Restoration	SWCA Environmental Consultants	Complete	0	0	0	0	0	0	1	0
1905C	BCCE Maintenance (w/1710D & 1510F)	BCCE Management	Gothic Landscape, Inc		<i>Not assessed</i>							
1910A	CLOSED Riparian Small Mammal Survey (w 1445J/1720G)	Species and Habitat Monitoring	BEC Environmental, Inc.	Complete	1	1	0	1	0	0	0	0
1920E	Avian Surveys (w/1730)	Species and Habitat Monitoring	SWCA Environmental Consultants	In Progress	0	1	0	0	0	1	0	0
1910	Riparian Properties Baseline Management		Desert Conservation Program (DCP)		<i>Not assessed</i>							
1920F	DT Connectivity Across Roadways (w/1580)	Desert Tortoise Connectivity Study	Ecocentric, LLC		<i>Not assessed</i>							
1925A	DT Range-Wide Monitoring (w/1541)	DT Rangewide Monitoring	Great Basin Institute		<i>Not assessed</i>							
1965A	Vegetation Map for Clark County (w/1460G)	Permit Amendment	Cogan Technology Inc	In Progress	1	0	0	0	1	0	0	0
1915	Public Information, Education and Outreach		Desert Conservation Program (DCP)		<i>Not assessed</i>							
1915C	CLOSED Acquisition of Solar Panel & SD Cards	Mojave Max Education Program	CDW Government, Inc		<i>Not assessed</i>							
1915E	CLOSED Graphics Design Changes to Emergence Contest	Mojave Max Education Program	Paper Zombies		<i>Not assessed</i>							
807H	CLOSED DT Aware & Invasive Spec Ed for OHV Comm	OHV Outreach	MXT Media	Complete	0	0	0	0	0	0	1	0
807J	CLOSED Acquisition of Side Walls for E-Z Up Tent	OHV Outreach	International E-Z Up, Inc		<i>Not assessed</i>							
1920	Adaptive Management Program		Desert Conservation Program (DCP)		<i>Not assessed</i>							
1730H	CLOSED Acquisition of Acoustic Analysis Software	Species and Habitat Monitoring	Wildlife Acoustics, Inc.		<i>Not assessed</i>							
1730K	CLOSED Avian Species Surveys	Species and Habitat Monitoring	SWCA Environmental Consultants	Complete	0	1	0	0	0	1	0	0
1730M	CLOSED Desert Upland Small Mammal Surveys II	Species and Habitat Monitoring	BEC Environmental, Inc.	Complete	0	0	0	0	1	1	0	0
1730N	CLOSED Bat Recording Analysis	Species and Habitat Monitoring	SWCA Environmental Consultants	Complete	0	1	0	0	0	1	0	0
1970A	HCP Consultant for the MSHCP Amend w/1460	Permit Amendment	WRA Environmental Consultants		<i>Not assessed</i>							
1925	Range-Wide Desert Tortoise Monitoring Support - S10		Desert Conservation Program (DCP)		<i>Not assessed</i>							
1975A	Tule Springs Monument Fence (w/804, 1525, 1725, 1780)	TUSK Boundary Fence	RFP/in progress		<i>Not assessed</i>							
1930	Desert Tortoise Translocation		Desert Conservation Program (DCP)		<i>Not assessed</i>							
1930A	BCCE DT Telemetry and Health Assessments	Translocation	Great Basin Institute	In Progress	0	0	0	0	1	1	0	0
1950	Baseline Support for Volunteer Maintenance of Existing Tort Exclusion Fencing		Desert Conservation Program (DCP)		<i>Not assessed</i>							
1950A	Fence Maintenance Survey	Road Warriors	Tortoise Group	Complete	0	0	0	0	1	0	0	0
1955	RoadWarriors: Citizen Scientist Monitoring for Mojave Rd Mortality		Desert Conservation Program (DCP)		<i>Not assessed</i>							
1955A	CLOSED COMPLETE Road Warrior DT Mortality Survey	Road Warriors	Tortoise Group	Complete	0	0	0	0	1	1	0	0
1965	Baseline Vegetation Map		Desert Conservation Program (DCP)		<i>Not assessed</i>							
1900R	CLOSED Acquisition of Technology Refresh Equipment	Program Administration	Dell Marketing LP		<i>Not assessed</i>							
1970	Permit Amendment Support		Desert Conservation Program (DCP)		<i>Not assessed</i>							
1900S	CLOSED Shed Key Duplication	Program Administration	ABC Locksmiths		<i>Not assessed</i>							

Project Number	Master Project/Contract Title	Project Title	Lead Agency/Contractor	Status (contract date cutoff of 7/31/21)	R1	R2	R3	R4	D1	D2	D3	D4
1975	Tule Springs Fossil Beds National Monument Boundary Fence Phase III		Desert Conservation Program (DCP)		<i>Not assessed</i>							
1987A	DT Predator-Prey Dynamics (w/1795)	Predation Studies	US Geological Survey (USGS) -Western Eco Rsrch Ctr		<i>Not assessed</i>							
1985	Demography/Population Viability of Tortoises in Translocation Sites		Desert Conservation Program (DCP)		<i>Not assessed</i>							
1985A	Desert Tortoise Nesting Study on the BCCE	Translocation	University of Nevada Reno (UNR) - BRRRC	In Progress	0	0	0	0	1	1	0	0
1985B	CLOSED DT Mating Opportunities on the BCCE	Translocation	University of Nevada Reno (UNR) - BRRRC	Complete	0	0	0	0	0	1	0	0
1987	Desert Tortoise Predator-Prey Dynamics, Phase II		Desert Conservation Program (DCP)		<i>Not assessed</i>							
1920D	Avian Surveys	Species and Habitat Monitoring	SWCA Environmental Consultants	In Progress	0	1	0	0	0	1	0	0
1990	Protected Plant Species Propagation Research		Desert Conservation Program (DCP)		<i>Not assessed</i>							
1990A	Rare Plant Propagation Research (w/809)	Rare Plant Propagation	US Geological Survey (USGS) -Western Eco Rsrch Ctr		<i>Not assessed</i>							
1992	Inventory and Ecology of Plant-Pollinator Systems within Riparian Areas		Desert Conservation Program (DCP)		<i>Not assessed</i>							
1541A	CLOSED DT Monitoring Data Management Year 2-5	Species Monitoring - Desert Tortoise	US Fish & Wildlife Service (USFWS) -Las Vegas		0	0	0	0	0	1	0	0
1995	Brome Reduction & Native Plant Establishment at Trout Canyon & Stump Springs		Desert Conservation Program (DCP)		<i>Not assessed</i>							
1997	Understanding Threats to the Persistence of NV Gila Monsters		Desert Conservation Program (DCP)		<i>Not assessed</i>							
804N	Tule Springs Monument Fence (w/1525, 1725, 1780, 1975)	TUSK Boundary Fence	RFP/in progress		<i>Not assessed</i>							
809N	Rare Plant Propagation Research (w/1990)	Rare Plant Propagation	US Geological Survey (USGS) -Western Eco Rsrch Ctr	In Progress	0	0	0	0	1	0	0	0
809P	Restorations on the BCCE (w/1421 & 1745)	BCCE Restoration	Gothic Landscape, Inc	In Progress	0	0	0	0	1	0	0	1

Excluded Projects include:

Supply acquisition

Property acquisition

Contracts with split funding were only counted once