

CLARK COUNTY MULTIPLE SPECIES HABITAT CONSERVATION PLAN

RIPARIAN RESERVES MANAGEMENT PLAN

Version 1.3

July 2021



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Acronyms and Abbreviations

°F	degrees Fahrenheit
AFY	acre-feet per year
BCC	Board of County Commissioners
BCCE	Boulder City Conservation Easement
BGO	Biological Goals and Objectives
BLM	Bureau of Land Management
cfs	cubic feet per second
DCP	Desert Conservation Program
HUC	Hydrologic Unit Code
m	Meters
MSHCP	Multiple Species Habitat Conservation Plan
NDEP	Nevada Division of Environmental Protection
NDOW	Nevada Department of Wildlife
NPS	National Park Service
NRS	Nevada Revised Statutes
Permittees	Clark County, the cities of Boulder City, Henderson, Las Vegas, North Las Vegas, Mesquite, and the Nevada Department of Transportation
RMP	Resource Management Plan
SNPLMA	Southern Nevada Public Lands Management Act
SNWA	Southern Nevada Water Authority
SR	State Route
TNC	The Nature Conservancy
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service



Executive Summary

This management plan identifies the actions to manage the Riparian Reserves as part of the Clark County Reserve System under the Multiple Species Habitat Conservation Plan (MSHCP, Clark County 2000a). This management plan links management actions to the management goals and objectives (as distinct from the biological goals and objectives; Clark County 2016) to restore, conserve, and protect desert riparian habitats for the MSHCP-covered riparian birds, which include southwestern willow flycatcher (*Empidonax traillii extimus*), yellow-billed cuckoo (*Coccyzus americanus*), Arizona Bell's vireo (*Vireo bellii arizonae*), blue grosbeak (*Passerina caerulea*), summer tanager (*Piranga rubra*), and vermilion flycatcher (*Pyrocephalus rubinus*). It defines management responsibilities and serves as a guide for the management of the riparian properties acquired by Clark County along the Muddy River and Virgin River to fulfill Condition K of the Incidental Take Permit.

This management plan describes the evolution of the MSHCP, the background of acquiring the riparian properties, and provides detailed descriptions of the reserves including physical, biological, water, and cultural resources; land uses; and ecological stressors to the natural resources. The primary section of this plan is the identification of management goals, objectives, and actions. As listed in the table below, the goals are broad, general statements that establish the management direction of the reserves, whereas the management objectives provide further explanation regarding the intent of the goals. Numerous actions are planned that define day-to-day management activities and identify additional actions, steps, and tools to meet these management objectives and to achieve goals. Each management action is linked to measures that assess the effectiveness of the action, the success of this management plan.

Goal/ Objective	Management Goals and Objectives for the Riparian Reserves
Goal 1	Manage reserves to provide habitat for the six MSHCP covered avian species
Objectives	1.0 Restore, create, and enhance habitat for riparian bird species
Goal 2	Manage reserves to support resource values for other MSHCP and sensitive species when practicable
Objectives	2.0 Manage habitat to avoid harm to aquatic species
Goal 3	Manage reserves to meet conservation and landowner obligations
Objectives	3.0 Control invasive plant species and noxious weeds
	4.0 Reduce threat of fire and maintain safe conditions
	5.0 Manage property rights and property infrastructure
	6.0 Build and maintain positive relationships in the community
Goal 4	Expand property holdings of desert riparian habitats for MSHCP covered species
Objectives	7.0 Acquire title to private lands from willing sellers
	8.0 Acquire conservation easements to public and private lands with willing landowners as appropriate



Summary of Updates

Version	Summary of Updates
1.1 (2017)	<ul style="list-style-type: none"> • Added discussion on ecological resilience and its relationship to ecological stressors (Section 2.6.3) • Incorporation of the 2016 Biological Goals and Objectives (BGOs) in the Appendix E table (Management and effectiveness measures)
1.2 (2019)	<ul style="list-style-type: none"> • Restructured document to better accommodate sites added since the last document revision and streamline addition of future sites • Addition of specific management actions and descriptions of each site
1.3 (2021)	<ul style="list-style-type: none"> • Updated property information to reflect additional properties purchased since the 2019 version. • Restructured document to reduce redundancy and overall streamline the text. • Added clarifying language to differentiate between the management goals and objectives in this management plan versus the Biological Goals and Objectives (Section 3) • Added a discussion on the 3 R's of ecological resiliency (Section 1.7) • Appendix E (Management and effectiveness measures table) incorporated into Section 3.3 • Moved select information from the body of the document to appendices to improve overall readability (list of plants [Appendix C] and birds [Appendix D] observed in the Riparian Reserves). • Added a new Section, Section 4- "Considerations for Future Versions of the Riparian Management Plan" intended to keep track of suggestions from members of the Science Advisor Panel that were not implemented in the current version for various reasons, but that should be considered before conducting the next management plan update.



Section 1 Introduction

The Clark County Desert Conservation Program (DCP) manages Endangered Species Act compliance on behalf of Clark County and the cities of Boulder City, Henderson, Las Vegas, North Las Vegas, Mesquite, and the Nevada Department of Transportation (collectively, the Permittees) through implementation of the Clark County Multiple Species Habitat Conservation Plan (MSHCP) and associated Section 10(a)(1)(B) incidental take permit. Condition K of the incidental take permit stipulates that take of covered avian species is conditioned upon the acquisition of private lands in desert riparian habitats along the Muddy and Virgin rivers and the Meadow Valley Wash (U.S. Fish and Wildlife Service [USFWS] 2001). To comply with this permit condition, the DCP has acquired properties with riparian habitat along the Virgin and Muddy Rivers in Clark County, Nevada (Figure 1; Appendix A). These properties comprise the Muddy River Reserve and the Virgin River Reserve (collectively, the Riparian Reserves), part of the overall Clark County Reserve System portfolio, which serves to mitigate impacts to covered species and conserve habitats and important wildlife connectivity corridors. To date, Meadow Valley Wash properties have not been included in the Riparian Reserves because willing sellers of suitable habitat within the Meadow Valley Wash system have not been identified.

The purpose of this management plan is to identify actions by which to manage the Riparian Reserves in a manner that restores, conserves, and protects desert riparian habitats for avian species covered by the MSHCP, as listed in Table 1. Species listed in Table 1 are the focus of management goals and objectives for the Riparian Reserves; however, it is expected that management for the protection of these species will provide benefits for many other species, including additional MSHCP-covered species.

Table 1. Riparian Avian Species Covered by the MSHCP

Common Name	Scientific Name	Status
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	FE, SE
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	FT, SS
Blue grosbeak	<i>Passerina caerulea</i>	-
Summer tanager	<i>Piranga rubra</i>	-
Vermillion flycatcher	<i>Pyrocephalus rubinus</i>	-
Arizona Bell's vireo	<i>Vireo bellii arizonae</i>	-
FE – federally listed endangered FT – federally listed threatened SE – state listed endangered SS – state listed sensitive		

This plan links management actions to the management goals and objectives for the reserves (Section 3.2) and establishes overall direction and clarifies management responsibilities (Section 1.4). It serves as a guide for nondiscretionary activities and defines future discretionary actions to achieve desired riparian habitat conditions. Implementation of some management actions will continue to be detailed in separate and specific restoration or management plans. This management plan and the management goals, objectives, and actions will be reviewed and revised as appropriate every two years by the DCP. Updates to this management plan may also occur whenever new information that influences management is available (adaptive management) and when additional properties are acquired for desert riparian habitat conservation. This current plan is Version 1.3 and incorporates revisions and updates from Version 1.0 (Clark County 2015), Version 1.1 (Clark County 2017b), and Version 1.2 (Clark County 2019a). Revisions and updates will ensure this management plan is current with changes to internal and surrounding land use, changes in ecological conditions (floods, fire), changes as a result of management activities (closed roads, restoration of habitat), and



changes based on new information from on-site research studies and other published sources. See Clark County (2017a) for the adaptive management and monitoring plan for MSHCP-covered riparian species and their habitats.

Several terms are used here to describe management areas. Parcels are the smallest spatial units, with discrete property boundaries, locations, and acreages. Adjacent parcels are often aggregated into a 'site' and may be generally referred to as a collective 'property' for management actions (e. g., Riverside or Bunkerville East). On the Virgin River, sites are also identified by river reaches within Clark County (numbered 1-5, upstream to downstream, based on Hydrologic Unit Codes designated within the National Hydrography Dataset). There are no reaches yet identified on the Muddy River. The Virgin River, the Muddy River, and Meadow Valley Wash are designated as individual reserves within the Riparian Reserve of the DCP. The organization of sites and parcels has evolved over the lifetime of the Reserve System and will continue to do so with new additions.

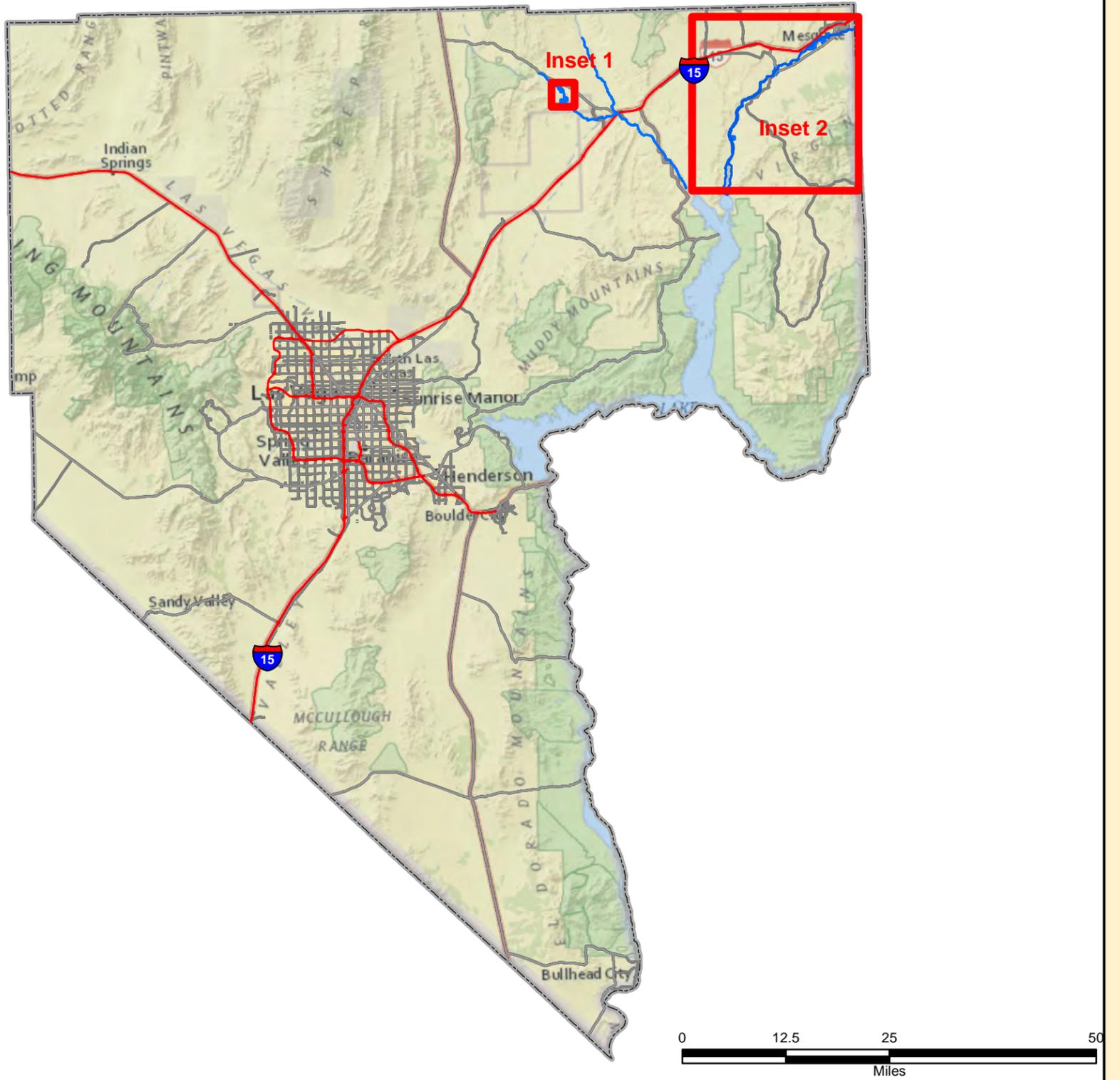
1.1 History and Expansion of the Riparian Reserves

The desert riparian watersheds of the Muddy River, Virgin River, and Meadow Valley Wash are identified as unique habitats and resources addressed by the MSHCP. The Biological and Conference Opinion (USFWS 2000) for the MSHCP was issued on the basis that private land within these riparian watersheds would be acquired for conservation of the MSHCP-covered bird species listed in Table 1. Expansion of the Riparian Reserves is through voluntary sales only and is directed by guidance described below. The current total acreage in the Riparian Reserves is 662 acres.

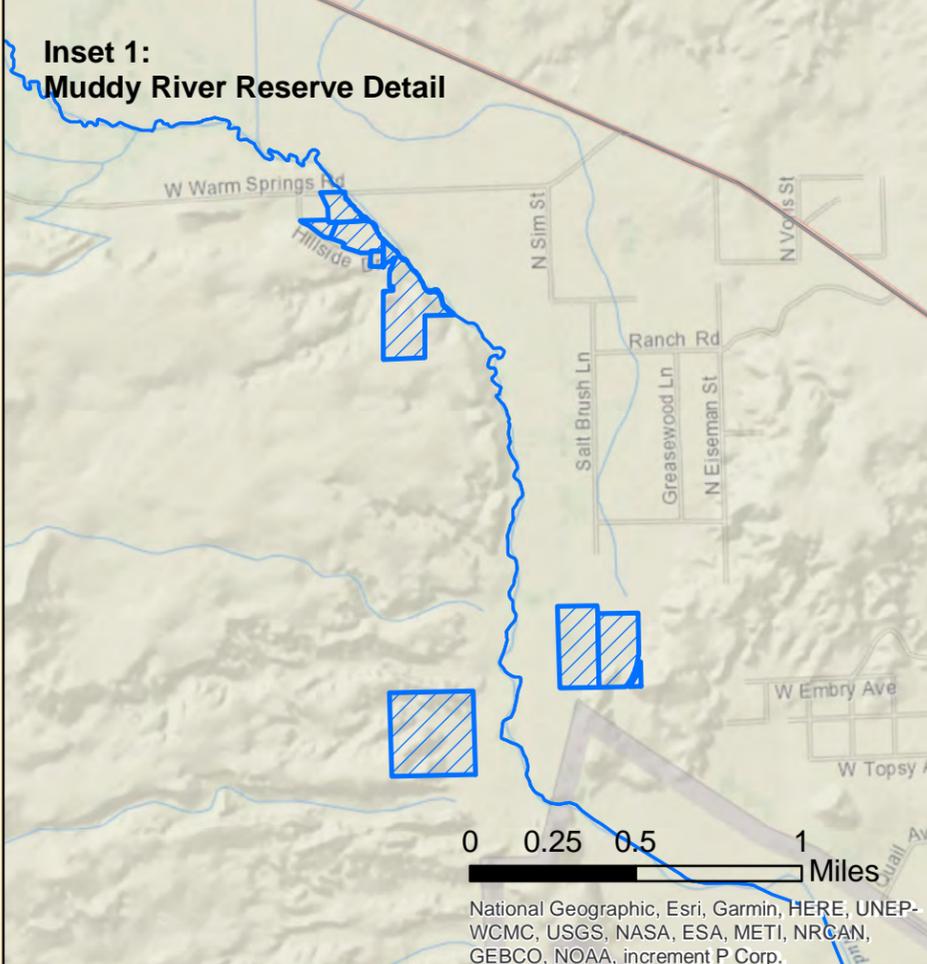
The initial phase of the MSHCP's implementation included the Muddy River Land Acquisition Program (USFWS 2000). The Nature Conservancy (TNC) assisted Clark County in implementing this program by working with willing sellers to explore the use of a variety of real estate options to implement conservation actions on priority parcels. TNC, on Clark County's behalf, acquired nine parcels of land, including water and development rights, from three willing sellers from 2002 through 2004 using funds from the Southern Nevada Public Lands Management Act (SNPLMA) account for purchasing of environmentally sensitive lands. The nine parcels of land total 116.5 acres (Figure 1). TNC managed these properties until they were transferred to Clark County in 2010 and 2011.

Clark County has also acquired property in the lower Virgin River watershed totaling 545.5 acres (Figure 1). These parcels are grouped into five sites: Bunkerville East, Bunkerville West, Mesquite (sometimes referred to as Mesquite West), Mormon Mesa, and Riverside. The Mormon Mesa property was the first on the Virgin River to be acquired by Clark County when it was transferred from Clark County Parks and Recreation Department to the DCP in 2011. Since then, 15 additional parcels have been acquired as property from willing private sellers becomes available.

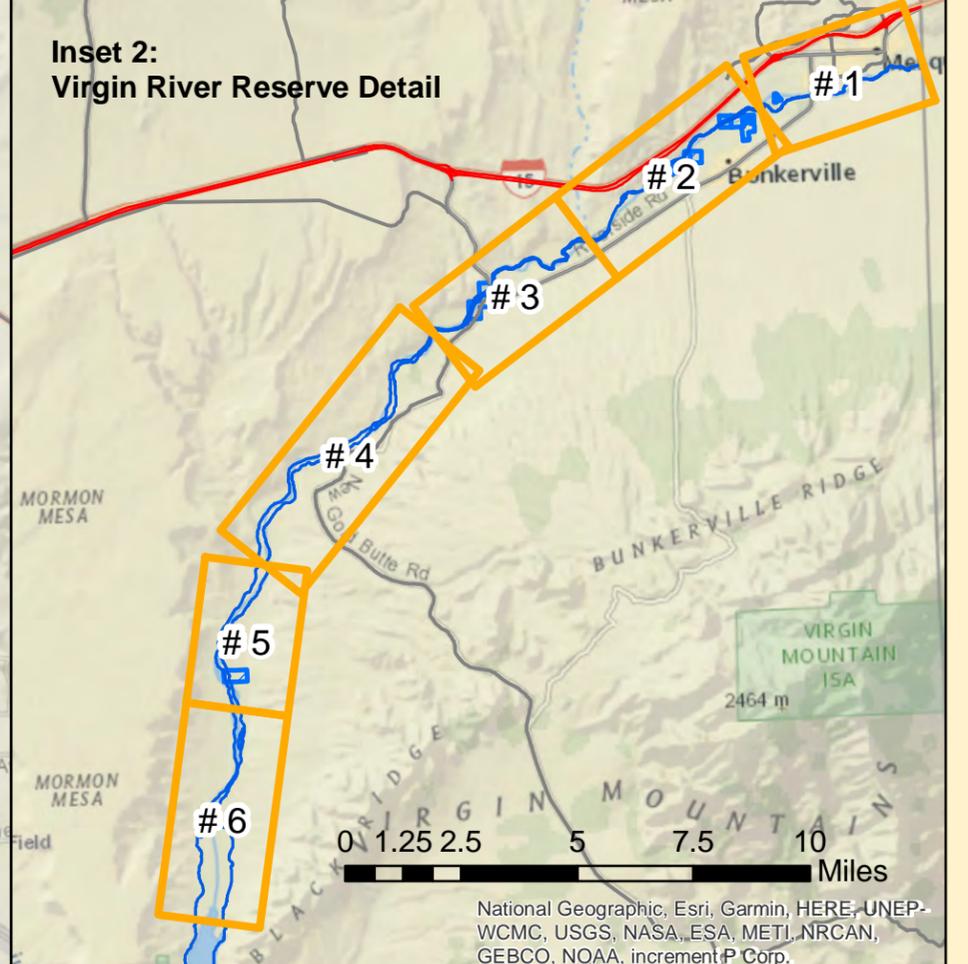




National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.



National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.



National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

<p>Riparian Reserves</p>	<h2>Riparian Reserves Overview</h2> <h3>Figure 1</h3>	<p>Projection: Transverse Mercator Coordinate System: UTM Zone 11 Datum: NAD83 Date: 06/03/2021 Name: Riparian_Management_Overview Fig 1 20210603</p>
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1.1.1 **Expansion Criteria**

The DCP, either directly through Clark County or in cooperation with a third negotiating party, will continue to acquire interests in real property and water rights in the riparian areas on a willing-seller/willing-buyer basis. Interest in real property could include fee title (legal ownership by County) or a conservation easement (legal agreement between landowner and County for permanent restrictions on land use for conservation values).

The DCP developed an acquisition selection tool to rank and prioritize properties based on the environmental and administrative criteria listed in Table 2. A series of questions were generated for each criterion to further define, describe, and explain the criterion. A value of 1 is assigned if the question can be answered affirmatively or the response is desirable and 0 if answered negatively or undesirable. The only exception to these values is for the species evaluation criterion, which is assigned a value of 2 if affirmative or desirable. The total possible value each for environmental criteria and administrative criteria is divided into thirds to set three ranges by where to assign priority. The list of questions and criteria are applied to each prospective property to arrive at a total value and then assigned a priority of 1, 2, or 3 based on what value range the property falls within. The list of criteria questions and example value matrix are included in Appendix B. The DCP will use the selection tool for acquisition of riparian properties from willing sellers along the Muddy River, Virgin River, and Meadow Valley Wash as specified in the incidental take permit but may consider opportunities to acquire riparian property throughout Clark County.

Table 2. Acquisition Selection Criteria

Administrative Criteria
Ease of management Complexity of land acquisition process Potential for degradation of habitat if not purchased for conservation
Environmental Criteria
Species evaluation Proximity to sensitive lands Restoration Potential

The BLM Cadastral Survey Office was funded to complete a metes and bounds survey under an agreement with the DCP to define the federal property boundaries in the unincorporated towns of Riverside and Bunkerville along the Virgin River, and to create official final survey plats. The final survey plats will be used to locate and identify encroachments on federal land by adjacent private landowners. Any encroachments will need to be resolved to ensure clear title of private property before DCP can pursue acquisition from willing sellers.

1.2 **Guiding Documents**

The primary guiding documents for the MSHCP include:

- MSHCP and Environmental Impact Statement (Clark County 2000a)
- Incidental Take Permit No. TE034927-0 (USFWS 2001)
- MSHCP Implementing Agreement (Clark County 2000b)
- Biological and Conference Opinion (USFWS 2000)

These documents are available electronically at:



https://www.clarkcountynv.gov/government/departments/environment_and_sustainability/desert_conservation_program/guiding_documents.php

The Section 10(a)(1)(B) incidental take permit is the primary guiding document that specifies the acquisition and management of riparian properties. Condition J.2 of the incidental take permit requires the “development and/or revision of conservation management plans that identify the management and monitoring actions” for riparian habitats of the Muddy River, Virgin River, and Meadow Valley Wash. In fulfillment of Condition J.2, the DCP has prepared and/or participated in the development of the Virgin River Conservation Management Assessment (Entrix Inc. 2008), Final Upper Muddy River Watershed Assessment (Provencher et al. 2005), and the Meadow Valley Wash Final Baseline Ecological Assessment (BIO-WEST Inc. 2005).

The “acquisition of private lands in desert riparian habitats” along these waterways for covered MSHCP avian species is mandated under Condition K.1 of the incidental take permit. Further, the MSHCP and the Biological and Conference Opinion describe measures to minimize and mitigate impacts of take, while the MSHCP and the Implementing Agreement specify the responsible parties to undertake these measures. These measures include acquisition by Clark County of conservation easements or other interests in real property by purchase, exchange, or donation to meet management goals and objectives necessary or appropriate for riparian birds.

1.2.1 Muddy River Guiding Documents

Several planning documents have been developed for the Muddy River Reserve on behalf of the DCP. These include the Upper Muddy River Site Conservation Plan (TNC 1999; 2000), the Draft Preliminary Management Plan for Upper Muddy River Aquatic and Floodplain Habitats in Clark County, Nevada (Wainscott 2004), and the Integrated Science Assessment for the Upper Muddy River, Clark County, Nevada (Provencher et al. 2005). Preliminary restoration and conservation actions on the Muddy River Reserve conducted by TNC and funded by the DCP on behalf of the MSHCP were based primarily on these documents.

1.2.2 Virgin River Guiding Documents

The DCP has funded several planning documents to guide management actions within the Virgin River Reserve. In 2008, the Virgin River Conservation Management Assessment (Entrix Inc. 2008) was developed in conjunction with land management agencies to identify the management and monitoring actions needed for the desert riparian habitat within the Virgin River watershed. In 2013, two reports were produced for Reach 5 located in the Lower Mormon Mesa area: the Mormon Mesa Ecohydrology Assessment Final Report (Orr et al. 2013b) was produced to recommend locations and strategies for restoration for the area, and the Clark County Mormon Mesa Parcel Restoration Plan (Orr et al. 2013a) was developed to provide property-specific restoration planning recommendations. An Ecohydrology Assessment, including flood-scour analysis, vegetation mapping, and restoration suitability for the entire Virgin River was completed in 2014 (Stillwater Sciences 2014) and a more focused Ecohydrology Assessment was prepared for the Gold Butte Reach of the Virgin River (including the Bunkerville site) (Stillwater Sciences 2017). These reports help identify restoration potential for acquisition.

1.3 Applicable Regulations

Certain federal, state, and local regulations apply to the actions that occur on the Riparian Reserves. Any restoration or conservation action that could adversely affect the flood capacity of the 100-year floodplain is subject to review and approval by the Clark County Department of Public Works to meet the requirements of the National Flood Insurance Program. Fill material



(e.g., soil, rip-rap) placed below the ordinary high water mark of the rivers or in adjacent wetlands is subject to review and permit by the U.S. Army Corps of Engineers and by the Nevada Division of Environmental Protection (NDEP) under Sections 404 and 401, respectively, of the Clean Water Act. If construction equipment or any discharge must enter the waterway to implement a restoration or conservation action, review and approval of working in the waterway is required by NDEP under Section 402 of the Clean Water Act. Any restoration project that disturbs more than one acre is subject to the provisions of stormwater discharge controls under Section 402 of the Clean Water Act and requires compliance with the Construction Stormwater General Permit issued by NDEP. Land clearing using machinery is subject to dust control permitting under Section 94 of the Clark County air quality regulations. Restoration that could involve actions on Bureau of Land Management (BLM) land would be subject to the Federal Land Policy and Management Act for applicable right-of-way authorization. Involvement of the U.S. Army Corps of Engineers or BLM triggers environmental and cultural assessments under the National Environmental Policy Act and National Historic Preservation Act.

Water rights conveyed with the properties are managed in accordance with chapters 533 and 534 of the Nevada Revised Statutes (NRS). Lastly, any restoration, conservation, or other management action that could disturb or otherwise cause take of nesting songbirds or raptors is prohibited by the Migratory Bird Treaty Act and will likely require consultation with the USFWS.

1.4 Management Roles and Responsibilities

Clark County serves as the implementing agent on behalf of the Permittees, and the DCP is the Plan Administrator for the MSHCP. The MSHCP and Implementing Agreement set forth the responsible parties for required management activities for the conservation of covered species. The DCP, as administrator of the MSHCP, has the primary management role for the Clark County Riparian Reserves.

The Clark County Board of County Commissioners (BCC) review and approve the budget and expenditure of funds by DCP to manage the reserves, as well as review the DCP's selection of contractors, approve contract awards, and obligate funds for conservation projects.

The DCP acts on behalf of the BCC as the landowner and serves in the primary role of implementing the day-to-day activities to manage the reserves in accordance with Clark County codes and ordinances and the guiding documents of the MSHCP. The DCP is responsible for planning and implementing nondiscretionary management actions for the long-term maintenance of the reserves for the benefit of species covered by the MSHCP. The DCP is responsible for reviewing this management plan for any changes or additions to management goals, objectives, and actions for the reserves, and to update the priority and implementation status of management actions.

1.5 Implementation Plan and Budget Process

The MSHCP provides guidance on developing biennial budgets for implementation. The DCP, as the MSHCP Administrator, is responsible for developing a biennial Implementation Plan and Budget that is responsive to key provisions outlined in the MSHCP. Although the process of developing the Implementation Plan and Budget has varied over the past biennia, the general steps of the budget development process are to determine available funding and to identify and recommend actions that further the purpose of the MSHCP. Certain actions that are stipulated by the Section 10 incidental take permit are considered required expenditures to maintain compliance, and therefore are nondiscretionary. These nondiscretionary actions include administering and managing the MSHCP implementation, supporting the Adaptive Management



Program, managing the Boulder City Conservation Easement, managing acquired properties and water rights, maintaining the tortoise fencing program along major roads, wild tortoise pick-up services, and the public information and education program. Other actions that further the goals and objectives of the MSHCP but are not directly specified in the incidental take permit are considered discretionary, such as scientific research projects and desert tortoise augmentation projects. The administration and management of the Riparian Reserves necessary to protect and maintain the existing resource values are nondiscretionary actions. This Riparian Reserves Management Plan serves as the guiding document for planning and implementation of nondiscretionary activities for managing acquired properties and water rights, as well as discretionary actions that further the goals and objectives of the MSHCP but are not directly stated in the incidental take permit. Both nondiscretionary and discretionary actions are funded through the biennial Implementation Plan and Budget process and are approved by the BCC.

Management actions on the Clark County Riparian Reserves are primarily funded through Section 10 mitigation fees and from grants funded by the proceeds from federal land sales under SNPLMA. Other outside sources of funding for conservation actions could include private grants, donations of in-kind services and labor, and mitigation fees paid by third parties as part of their compliance with Section 7 of the Endangered Species Act, or Section 404 of the Clean Water Act. These third-party Section 7 mitigation fees are typically restricted to enhancement or restoration of habitat for listed or sensitive species, and Section 404 mitigation fees are restricted to established in-lieu fee agreements or mitigation banks.

1.6 Historical and Biological Resources Setting

1.6.1 Cultural History and Resources

The history of the area has been extensively documented. The archaeological sequence and record of the Moapa Valley and Virgin River Valley indicate continuous occupation of the areas from 300 B.C. to historic times. The earliest recorded occupation of the southern Nevada region was by the Virgin Anasazi peoples whose culture is characterized by a horticultural subsistence base, permanent architectural features, ceramic production, and tools such as hoes, digging sticks, and grinding implements suitable for processing large quantities of grain. Remains of this culture have been recorded on the high bluffs overlooking the confluence of the Muddy and Virgin rivers. Early settlers of the valley recorded the presence of numerous irrigation ditches leading from the Muddy River to fields in the floodplain, indicating that they had an extensive irrigation system. With the decline of the Virgin Anasazi came Numic-speaking peoples, especially the Southern Paiute and Patayan (Ezzo 1996).

The earliest Europeans were Spanish explorers who traveled through the area in the 1770s. The first travelers over what is now known as the Old Spanish Trail were probably fur trappers. The Mormon Wagon Road originating in Salt Lake City and traversing southern Nevada along the Muddy and Virgin rivers helped to establish the region as a Mormon stronghold (Ezzo 1996).

European settlement began in the mid-1860s and the Moapa Indian Reservation was created in 1873. The town of Bunkerville was founded on religious (Mormon) principles in 1877. After several years, this area was initially abandoned due to challenges associated with trying to “tame” the Virgin River and quicksand, but around 1895, Mormons returned to the area and began to farm. West Point was the first recorded Mormon settlement in the upper Muddy River valley in 1968. The settlement began with the construction of a fort, irrigation ditch, and a willow corral. The present day remains of the West Point settlement include several mounds of adobe melt, partially intact cobble foundations, tent dugouts, and a portion of an irrigation ditch (Ezzo 1996).



In 2015, a Cultural Resources Class I Review was conducted for the Muddy River Reserve (KLA. 2015) and a Cultural Resources Site Assessment for the Virgin River Reserve was conducted in 2020 (SWCA 2020a).

1.6.2 Flora and Fauna Resources

Desert riparian habitat used to be prevalent on the Colorado River and its tributaries (Virgin, Muddy, and Pahranaagat) (Wildlife Action Plan Team 2012). The primary native vegetation species in this ecosystem are Fremont cottonwood (*Populus fremontii*), velvet ash (*Fraxinus velutina*), and Goodding's willow (*Salix gooddingii*). These deciduous tree species are important as nesting habitat for bird species and provide shade and mitigate water temperatures for native stream and river species. This habitat has been significantly reduced in extent (by development, agriculture, fire, and the lowering of the local and regional aquifers) and quality (non-native invasive plant species, including tamarisk [Tamarisk spp.]). The loss of the desert riparian habitat has impacted many bird and fish species.

Native plants observed during surveys conducted in 2012 in the Muddy River Reserve and in 2013 in the Virgin River Reserve are included in Appendix C.

Avian species observed during bird surveys in the Muddy River Reserve (2008, 2009, and 2017-present) and Virgin River Reserve (2017-present) are included in Appendix D.

Federally endangered species that occur in the Muddy River or Virgin River include the Moapa dace (*Moapa coriacea*), woundfin (*Plagopterus argentissimus*), and Virgin River chub (*Gila seminude*). Fish surveys are conducted annually by the Nevada Department of Wildlife (NDOW) but are not covered species under the MSHCP and are therefore not discussed in detail in this document. Surveys for other taxa of wildlife have not been conducted at this time.

Noxious and Invasive Weeds

Noxious weeds are those weeds designated as a pest by state or federal law or regulation. The state of Nevada designates plants as noxious if the plant is found to be “detrimental or destructive and difficult to control or eradicate” (NRS 555.005). Invasive weeds are non-native species whose introduction does or is likely to cause economic or environmental harm (The National Invasive Species Council 2006).

Surveys for noxious and invasive weeds are conducted throughout the year on the Riparian Reserves. Further surveys and treatment of noxious weeds will continue to occur on a semi-annual basis. Noxious and invasive species are treated using an integrated weed management approach. Treatment methods may include, but are not limited to, herbicide application, cut-stump with herbicide application, or hand-pulling, with the particular treatment method depending on the species being treated and the time of year that the treatment is applied. A list of noxious and invasive species that have been documented during surveys is provided in Table 3 below.



Table 3. Noxious and Invasive Weeds

Common Name	Scientific Name	State Listed Noxious ¹
Muddy River Reserve		
Russian knapweed	<i>Acroptilon repens</i>	B
Australian saltbush	<i>Atriplex semibaccata</i>	No
Fivehook bassia	<i>Bassia hyssopifolia</i>	No
Red brome	<i>Bromus rubens</i>	No
Malta starthistle	<i>Centaurea melitensis</i>	A
Field bindweed	<i>Convolvulus arvensis</i>	No
Horseweed, marestalk	<i>Conyza canadensis</i>	No
Bermuda grass	<i>Cynodon dactylon</i>	No
Redstem stork's bill	<i>Erodium cicutarium</i>	No
Prickly lettuce	<i>Lactuca scariola</i>	No
African mustard	<i>Malcolmia africana</i>	No
Russian thistle	<i>Salsola kali</i>	No
London rocket	<i>Sisymbrium irio</i>	No
Saltcedar	<i>Tamarix ramosissima</i>	C
Puncturevine	<i>Tribulus terrestris</i>	C
Virgin River Reserve		
Camelthorn	<i>Alhagi maurorum</i>	A
Bermuda grass	<i>Cynodon dactylon</i>	No
Tall whitetop	<i>Lepidium latifolium</i>	C
Saltcedar	<i>Tamarix ramosissima</i>	C
¹ Nevada Department of Agriculture noxious weed categories: <ul style="list-style-type: none"> • Category A weeds are generally not found or are limited in distribution throughout the state. These species are subject to active exclusion from the state, eradication where found, and eradication from nursery stock. • Category B weeds are generally established in scattered populations in some counties of the state. These species are subject to active exclusion where possible and active eradication from nursery stock. • Category C weeds are generally established and widespread in many counties of the state. These species are subject to active eradication from nursery stock. Source: Nevada Department of Agriculture (https://agri.nv.gov/Plant/Noxious_Weeds/Noxious_Weed_List/ ; accessed 16 Feb 2021)		

1.6.3 Climate

Climate in the Moapa Valley and lower Virgin River watershed is typical of the Mojave Desert with low humidity and high evaporation rates. Summers are hot and dry with temperatures in excess of 100 degrees Fahrenheit (°F) and winters are short and generally mild. Average daily temperatures during the summer are over 90 °F, with average winter daily temperature around 46 °F. Spring and autumn are generally moderate with average daily temperatures of 80 °F (Provencher et al. 2005, Entrix Inc. 2008).

Precipitation is generally from longer-duration, low-intensity winter events associated with frontal systems or from shorter-duration, high-intensity summer storms. In general, the valley floors receive 3 to 5 inches of precipitation per year while the highest mountain elevations receive an average annual precipitation of 12 inches or more. Maximum precipitation normally falls between November and March, while minimum precipitation occurs in May, June, September, and October. Thunderstorms are common during July and August, contributing between 25 and 30 percent of annual precipitation. Little precipitation infiltrates to groundwater and storm events



of intense precipitation result in sheet flow across the desert floor and flash flooding in washes that are normally dry (Provencher et al. 2005, Entrix Inc. 2008).

Future climate conditions are discussed in Section 1.8.

1.7 Ecological Resilience

Ecological resiliency (as defined in Clark County 2016) is the capacity of an ecosystem to withstand acute and diffuse stressors without experiencing widespread negative regime changes, such as species extirpation or a fundamental loss of ecosystem function. To better understand how ecological resiliency can be practically addressed on the Riparian Reserves, putting it in the context of ecological conservation is important. Ecological representation, redundancy, and resiliency make up “The Three R’s of Conservation” and are described here:

- Representation— describes the ecosystems or vertebrate species present on a landscape within designated management units or study areas (e.g., riparian parcel, site, or reach). Key concepts regarding representation include:
 - Saving something of everything.
 - Conserving a full variety of habitat types or species.
 - If representation exists within designated management units or study areas, there is a higher potential for protecting biodiversity under climate change.
- Redundancy— describes the redundancy (i.e., number of occurrences) an ecosystem, habitat type, or vertebrate species is on a particular landscape within designated management units or study areas. Key concepts regarding redundancy include:
 - Redundancy can be a hedge against the failure of any particular species population or habitat type.
- Resiliency— describes the capacity of an ecosystem, habitat type, or vertebrate species to respond to perturbation by resisting, recovering, and/or transforming. It is important to identify the target:
 - What is the focal system, habitat type, or vertebrate species?
 - Resiliency...of what? [key components of the system, habitat type, or vertebrate species].
 - Resiliency...to what? [specific disturbance, disruption, and uncertainty].

Representation, redundancy, and resiliency, and their applicability to specific project and management concepts were discussed at an internal workshop in 2018 (Alta 2018). Each of the Three R’s were discussed in relation to both fine-scale and landscape levels and a multitude of project concepts were evaluated (project concepts were both new concepts and those already being implemented). Overall, the following management concepts work to achieve or inform representation, redundancy, and resiliency:

- Maintain spatial connectivity and spatiotemporal variability in ecological processes
- Understanding natural levels of spatial and temporal variability
- Strategic property acquisition and partnerships; and



Identification of key ecosystem stressors and the types of ecological changes that may be affected by these stressors (i.e., filling in the blanks of “Resiliency...of what?” and “Resiliency...to what?”).

1.8 Ecological Stressors for MSHCP-Covered Species and Habitats

Ecological resilience within the Riparian Reserves can be increased through such actions as maintaining and enhancing habitat connectivity at site and landscape scales, as well as identifying and addressing uncertainties related to management actions and broader planning goals and objectives. Managing for ecological resilience benefits from an understanding of natural levels of spatial and temporal variability, identification of key ecosystem stressors, and the types of ecological changes that may be affected by these stressors.

The primary stressors (or threats) affecting desert riparian habitats in southern Nevada are summarized from several documents, including the MSHCP (Clark County 2000a), site conservation plans developed by TNC (TNC 1999; 2000), and the Virgin River Conservation Management Assessment (Entrix Inc. 2008). The first two threats described are considered the priority threats on which to focus management actions in Section 3.

Non-native and Invasive Species

Non-native and invasive plant species can alter the structure and composition of desert riparian habitat, alter the stream hydrology and soil moisture, and alter the fire regime. Non-native plant species can severely affect riparian habitat over a wide range in both rivers, increasing the challenges of restoring these habitats. Many noxious weeds have been identified on both the Virgin and Muddy River reserves (Table 3) as well as documented in the watersheds. The DCP currently conducts weed surveys and treatments on the Muddy River and Virgin River Reserves.

Tamarisk (or saltcedar) is the primary invasive plant species in riparian habitat in the Mojave Desert, and is designated as a Category C noxious weed by the Nevada Department of Agriculture. The species has spread rapidly along riparian corridors, displacing native species and forming dense monocultures. Tamarisk can increase wildfire severity, adds salinity to the soil, and provides limited habitat for native species, although several riparian birds can and do use it for nesting.

Another non-native species that ecologically impacts riparian habitat is fan palm (*Washingtonia californica*). Fan palm displaces native species, reduces refugia, and establishes a new fire regime that is more frequent and intense.

The non-native tamarisk leaf beetle (*Diorhabda elongata*) was introduced by the U.S. Department of Agriculture (USDA) in the southwest U.S. as a biological control agent for tamarisk. The beetles feed on the leaves of tamarisk and defoliate the plant, which compromises the plant's ability to photosynthesize and store food resources in its roots. Prior to the arrival of the beetles, southwestern willow flycatchers had successfully nested in tamarisk-dominated habitats. Flycatchers rely on dense riparian tree and shrub communities for breeding. However, the rapid defoliation of tamarisk caused by the tamarisk leaf beetle has resulted in reproductive failure of southwestern willow flycatchers in areas that are recently defoliated. This rapid defoliation of tamarisk has affected numerous other species that also rely on the dense vegetation of desert riparian ecosystems. Widespread defoliation due to tamarisk leaf beetles was documented on the Virgin River Reserve, Mesquite site, 2010 and on the Muddy River Reserve and the Virgin River Reserve, Mormon Mesa site, in 2012 (Tom Dudley, personal communication).



Altered Local and Regional Aquifers and Altered Surface Flow

The flow of the Muddy River has been reduced by almost one-third over the last 2 to 3 decades, primarily due to groundwater removal for power generation but also for municipal water, agricultural irrigation, and domestic water supplies (TNC 2000). It is the perennial nature of the river with a relatively constant flow of water throughout the year that makes the Muddy River one of the most unique riparian systems in the Mojave Desert ecoregion. Residential growth in the Moapa Valley has historically been 2 to 3 percent annually (TNC 2000), but there have been proposals for larger-scale developments, not only in the valley but also in areas that would affect the groundwater flow to the Muddy River, such as the Coyote Springs development. The BLM Rapid Ecological Assessment for the Mojave Desert Ecoregion projects that surface water and groundwater use will increase by over 25 percent in the Moapa Valley in the next 50 years (Comer et al. 2013).

The Lower Virgin River has a relatively natural flow regime as it is not dammed, but some water is diverted for municipal and industrial use, stockwater and recreation use, and irrigation purposes (Winters and Johnson 2004).

Altered local and regional aquifers reduce the amount of water available for riparian and aquatic species in both rivers and result in changes to the flood regime, further altering native vegetation structure.

Fire

Wildfires are becoming more common in the Mojave Desert ecosystem (Van Linn et al. 2013). Mojave Desert species did not evolve with fire; thus, fire has a detrimental ecological effect in the ecosystem. Fire is fueled primarily by invasive annual grasses and introduced plants in the uplands that provide fine and large fuels. Fires from the uplands can spread into riparian habitat. Fire scars within the Virgin River Reserve and Mormon Mesa suggest that fire has played a role in the dominance of tamarisk. Fire alters the composition and structure of the riparian habitat, reducing structure for woody species that survive fire and eliminating some woody species. The increase of non-native grasses establishes a reoccurring cycle of fire that further degrades habitat. Fire threat can be very severe and restoration after a fire is difficult. Fire is a threat in both river systems.

Livestock Trespass

Trespass by livestock occurs on all parcels of the Virgin River Reserve. Livestock modifies habitat (e.g., soil surface topography, permeability of soil) and trample and graze on native plants.

Livestock trampling and grazing is a high risk for revegetation efforts. Reducing or eliminating this threat can occur by installing barriers to prevent entry by trespass livestock but may be costly to install and maintain.

Development

Natural conditions, including water supplies within the northeast planning area of Clark County, present constraints to new development. Large portions of the area are mountainous, have steep slopes, or are in regulated floodplains. The requirements of the MSHCP may also further restrict development. Large contiguous areas for residential developments are limited because of the extent of federal land ownership in Clark County. Development would likely occur on in-fill parcels based on planned land uses and existing zoning. Areas designated for disposal by the BLM for development are not in riparian habitats. The threats to riparian habitats from development would be low.



Infrastructure

Transportation and transmission corridors are low threats to the riparian systems on both rivers. Siting of transmission lines and utility corridors are predominately governed by the BLM through the Resource Management Plan (RMP) process because of the extent of federal land ownership within Clark County. Transportation and transmission corridors cause habitat alteration and fragmentation, and avian species are at risk from collisions with transmission lines. Existing infrastructure is low in severity and low in areal extent near the Riparian Reserves. There is water conveyance infrastructure i.e., an irrigation canal that runs through the Riverside parcels.

Agriculture

Agriculture (row crops, fruit and landscape trees, and pasture) is not extensive near the Muddy River Reserve but does cover large areas along the lower Muddy River and south of the Virgin River Reserve around the community of Bunkerville. The threats from agriculture include livestock trespass, altered hydrologic regime from water withdrawal, habitat loss and fragmentation, and toxins and organic enrichment to the river system from runoff. Revegetation from past agricultural clearing is an option in some reaches of both rivers.

Climate Change

Projections of climate change for the northeast Mojave Desert suggest that the changes will be profound by 2060 (Comer et al. 2013), including substantial changes in most monthly maximum temperatures, July maximum temperature, and August minimum temperature. Some of the potential effects of climate change include decrease in plant growth, expansion of invasive species distribution and density, increase in fire frequency, increase in wind erosion, higher evapotranspiration rates, earlier drawdown of stream levels and ground water, shrinkage of areas of perennial flow, reduction of riparian vegetation, reduction of groundwater recharge, and increase in flood events from higher precipitation levels at high elevations (Comer et al. 2013). Climate change can be a severe threat to these ecological systems and species over the next 50 years.

Specific predictions quoted below are intended to provide context to current climatic condition (Section 1.6.3) and are taken from Kalansky et al. 2018:

“.....warming could range between 3-5°F by 2030-2050 and 5-10°F by 2100 in southern Nevada.....The largest seasonal temperature changes in the future occur in the fall, closely followed by the summer and particularly for nighttime temperatures.”

“By mid-century, Clark County will likely experience approximately 40 – 50 more days above 100°F compared to today.....Temperatures rapidly rise through the end of the century under RCP8.5, where extreme heat days (>115-120°F) are projected to increase to over 50 days per year.”

“Projected changes in precipitation are small and highly uncertain, in part due to the large natural interannual and decadal variability of precipitation in the region, but also because rainfall is difficult to model given GCM resolution. Projections indicate increasing precipitation variability and more frequent extreme precipitation events in the future. Seasonally, spring may be drier by the end of the century, although the number of wet days will increase which means fewer large springtime precipitation events.”



1.9 Land Use

1.9.1 Land Use Planning

Land use and land management practices can have a significant impact on natural resources, including water, soil, nutrients, plants, and animals. Land use of parcels held in private, by the Southern Nevada Water Authority (SNWA), or under Clark County ownership is governed by the Northeast Clark County Land Use Plan (Clark County 2019b), Warm Springs Natural Area Stewardship Plan (SNWA 2011), and Clark County Regional Flood Control master plans for Bunkerville (2017), Mesquite (2017), and the Muddy River (Moapa Valley 2016). Management and future use of the BLM lands are governed by the Las Vegas Resource Management Plan (BLM 1998). Other plans that govern uses on adjacent and nearby federal and state lands include the Lower Colorado River Multi-Species Habitat Conservation Plan (Lower Colorado River Multi-Species Conservation Program 2004), Desert National Wildlife Refuge Complex Comprehensive Conservation Plan (USFWS 2009), and Overton Wildlife Management Area Conceptual Management Plan (NDOW 2014). The riparian properties along the Muddy and Virgin rivers are within the geographic boundaries of the Northeast Clark County Land Use Plan (Clark County 2019b). Existing and planned land uses do not always coincide with current zoning classifications.

1.9.2 Land Use Permit Requests

The Riparian Reserves are available for use for scientific surveys and data collection. The DCP developed a procedure by which third parties request permission to participate in allowable conservation-based activities on the Riparian Reserves. In general, activities that disturb the soil, remove vegetation or seeds, or require handling or removal of animals (including insects or spiders) require written permission from the DCP. Any interested third party will follow the permit request process included in Appendix E and submit a permission form to the DCP before accessing the reserves to start work. Contractors for DCP projects are not required to complete the permission form.

1.10 Public Services and Safety

Public services and safety address the agencies responsible for utilities and emergency response to the areas that encompass the Riparian Reserves and the safety procedures followed by the DCP and contractors that access the reserves. Since the Riparian Reserves are located in the unincorporated areas of Clark County, public safety services are provided by County agencies.

Agency contacts and telephone numbers are listed in Appendix F.

1.10.1 Fire and Medical

The Clark County Fire Department provides fire protection and emergency medical response for the northeast area of the County. The Riparian Reserves are served by volunteer firefighters from Station 71 in Bunkerville and Station 72 in Moapa. The BLM rangers are responsible for fire and medical emergency response on BLM land.

1.10.2 Law Enforcement

The Las Vegas Metropolitan Police Department is the agency providing police protection in the northeast area of the County. The Department has a resident officer program serving the communities of Bunkerville, Moapa, Glendale, Overton, and Logandale. The Nevada Highway



Patrol enforces traffic regulations on the highways and state routes. The BLM rangers patrol federal lands and are responsible for protecting the resources, illegal dumping, and traffic code enforcement on BLM land.

1.10.3 Utilities

Muddy River Reserve, Parcel B is serviced by municipal water provided by the Moapa Valley Water District and by electrical service provided by Overton Power District. Sewer service for the house that was removed from Parcel B was a septic system. There are no utilities that service Virgin River Reserve.

1.10.4 Safety

The DCP follows standard health and safety procedures for working in desert environments, including guidelines for weather-related risks and biological hazards (snakes, insects).

In the past, illegal marijuana grow operations have been documented in the Muddy River area. Caution should always be taken when visiting the reserves while being cognizant of unknown irrigation lines or dumping areas. The BLM Office of Law Enforcement and Security should be notified of any suspect sign of illegal behavior in the area by reporting it to 702-515-5178.

Emergency contact is provided through the 911 service; non-emergency support is requested by dialing 311. Cell phone service is available on and near the reserves through most telecommunication carriers.

Section 2 Riparian Reserve Descriptions

The Riparian Reserves consist of the Muddy River Reserve and the Virgin River Reserve and are further described below. As previously noted, no properties along the Meadow Valley Wash have been acquired by Clark County, and therefore, this watershed is not described in this section.

2.1 Muddy River Reserve

The Muddy River Reserve is located in the northeastern Mojave Desert ecosystem within Moapa Valley and consists of 116.48 acres in nine parcels. For the sake of convenience, the parcels have been labeled sequentially from A to I (Figure 2). The locations of the properties shown in Figure 2 are listed by Clark County Assessor's parcel number in Muddy River Parcels.

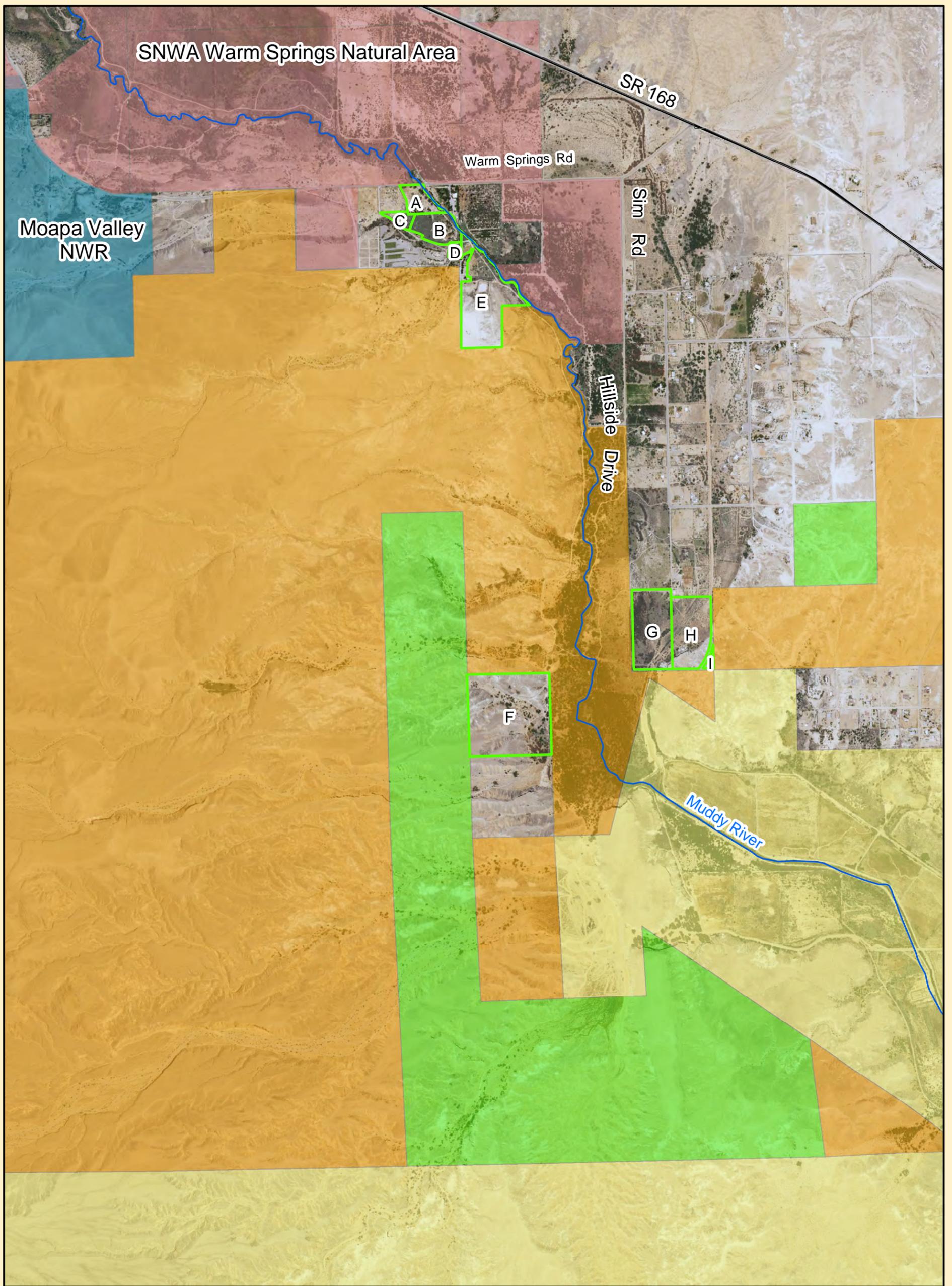


Table 4. Muddy River Parcels

Parcel Code	Parcel #	Acres	Year Acquired
A	030-22-501-004	6.37	2002
B	030-22-501-022	6.30	2002
C	030-22-501-021	2.07	2010
D	030-22-501-010	1.14	2010
E	030-23-201-003	25.06	2010
F	030-26-301-001	40.00	2010
G	030-26-601-001	18.65	2010
H	030-26-601-002	16.52	2010
I	030-26-601-003	0.37	2010

Total Acreage 116.48



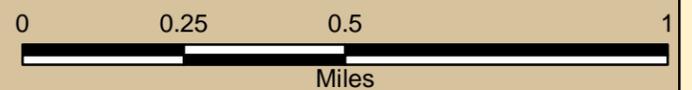


Legend

- Riparian_Reserves
- SNDO_land_status**
- NAME**
- Bureau of Indian Affairs
- Bureau of Land Management
- Bureau of Reclamation
- Fish and Wildlife Service
- Nevada State
- Private

Muddy River Reserve Land Ownership

Figure 2



Coordinate System: UTM Zone 11
 Datum: NAD83
 Date: 7/01/2021
 Name: Riparian_Management_muddy_fig2



2.1.2 Existing and Adjacent Land Use

Parcels within the Muddy River Reserve are zoned as rural open land (1 residential unit per 2 acres) with the planned land use shown in the Northeast Clark County Land Use Plan as public facilities, except for Parcel F, which is designated as open land. The public facilities category allows large areas of permanent open land and easements. One purpose of the open land use category is to prevent irreversible environmental damage to sensitive areas (Clark County 2019b). The existing use of the reserve is for the conservation of riparian habitat. Allowable uses include scientific surveys and data collection with the permission of the DCP.

Land ownership and use adjacent to the reserve in the upper Muddy River floodplain and surrounding upland is a combination of federal multiple use, refuge, and reservation (BLM, USFWS, and tribal lands), conservation use (SNWA land), and residential, agricultural, and commercial uses (private land) (Figure 2).

Notable adjacent land uses are described in the bullets below.

- The **Warm Springs Natural Area**, located north and east of the Muddy River Reserve (especially near parcels A, B, and E), is managed by SNWA to protect the federally endangered Moapa dace, restore natural habitat, protect water resources, and provide recreational and educational opportunities for the public (SNWA 2011). The area consists of 1,220 acres of floodplain and surrounding uplands, with 3.8 miles of Muddy River riverfront. Development of nature trails and interpretive zones at the Warm Springs Natural Area were completed in 2018 to include more opportunities for public use to increase awareness about the challenges of water management and the biodiversity of the area.
- **USFWS** manages the headwaters of the Muddy River as the Moapa Valley National Wildlife Refuge. The refuge was established in 1979 for the conservation of the Moapa dace and other species that depend on the thermal spring habitat of the headwaters. The refuge covers 116 acres and is managed as part of the Desert National Wildlife Refuge Complex. This refuge is not directly adjacent to the Muddy River Parcels, but is considered a notable land use.
- The **Moapa River Indian Reservation** encompasses the floodplain south of Parcel H along approximately 2.4 river miles.
- **NV Energy** manages the property to the west and north of Parcels A and C. This area was used to pump and deliver groundwater for the operation of the Reid Gardner Power Plant (since closed and demolished) located approximately 5.5 river miles downstream.
- **Private property** on the east bank of parcels A, B, and E are used for agriculture (tree farm) as well as a rural residence with commercial recreation/RV park. The planned land use designation for these properties is commercial neighborhood. This designation allows low to medium intensity commercial services, including an existing recreational vehicle park.
- **Private property** owned by the Moapa band of Paiutes adjacent to the south of Parcels B and C has a history of being used as a nursery for landscape plants.

The remaining adjacent land uses include BLM land managed for multiple uses, and private property that are used for rural residences or are open land.



2.1.3 Future Land Use

Any revisions or updates to the BLM Las Vegas Resource Management Plan (BLM 1998) could change which nearby parcels would be available for disposal and future private development, and which areas would have further restrictions on use under an Area of Critical Environmental Concern designation.

2.1.4 Geology and Soils

The soils in the upper Muddy River watershed have been mapped (Natural Resources Conservation Service 2015), albeit coarsely and lacking relevant detail for this management plan. The soils along the river are Anthony fine sandy loams, a floodplain soil that is moderately well drained with no or slight salinity. Downcutting by the river has isolated this floodplain soil from the current river flows, especially downstream from the Warm Springs Bridge to I-15 (TNC 2000). Several areas along the river have extensive fill along the river channel. The floodplain further from the river is Gila soil type; loam to sandy loam soils that are moderately well drained with no to slight salinity (Natural Resources Conservation Service 2015). These two soil types make up the 100-year floodplain of the upper Muddy River which has a spatial extent of approximately 7,700 acres (TNC 2000). The uplands are mostly badlands, with exposed rock and colluvium.

2.1.5 Topography

The topography of the area around the Muddy River Reserve consists of an entrenched river, a narrow to moderately wide floodplain along the river, and steeper slopes up to the surrounding flat mesas. The upper Muddy River cuts through dating back to 5.3 million years ago alluvial fans, dating back to 5.3 million years ago, and lacustrine sediments that form the surrounding uplands (TNC 2000). The Arrow Canyon Range and a series of small ridges of Quaternary alluvium are along the upper reaches of the river. Elevation ranges from 1,520 to 1,800 feet.

2.1.6 MSHCP-Covered Plant Species

Plant inventory surveys within the Muddy River Reserve were conducted by the National Park Service Exotic Plant Management Team in winter of 2012. No covered or evaluation MSHCP species were observed during the survey; however, one watch list species, barrel cactus (*Ferocactus cylindraceus*) was observed. A complete list of native plant species observed in the Muddy River reserve unit is included in Appendix C.

2.1.7 MSHCP-Covered Avian Species

Avian surveys were conducted within the reserve in 2008 and 2009 and have occurred annually since 2017 (SWCA 2017a, SWCA 2017b, SWCA 2019). The following MSHCP-covered species were observed during these surveys: Yellow-billed cuckoo, American peregrine falcon (*Falco peregrinus*), Arizona Bell's vireo, blue grosbeak, phainopepla, and summer tanager (the American peregrine falcon and phainopepla are not typically riparian species and as such are not included in Table 1). A southwestern willow flycatcher was detected during point count surveys in one year of surveys, but it was prior to June 25, indicating it could have been a migrant from the more northerly subspecies and not the federally protected southwestern subspecies (SWCA 2017a). Additionally, one evaluation species, the crissal thrasher (*Toxostoma crissale*) was also documented within the Muddy River Reserve.



2.1.8 Water Resources

Surface Water and Groundwater

The Muddy River is a perennial, spring-fed river that originates from a series of thermal springs approximately 60 miles northeast of Las Vegas in the unincorporated towns of Moapa and Glendale (Wainscott 2004) (Figure 3). The discharge from the thermal springs ranges from 86 to 89 °F and contributes 30 to 40 percent of the total river flow. Groundwater discharge contributes 60 to 70 percent of the total river flow. The groundwater flows come from the channel of the historical White River, which flowed from central Nevada to the Colorado River. The White River is now discontinuous along its length and is below ground from Pahranaagat to the source of groundwater discharge into the Muddy River (TNC 2000).

The Muddy River flows some 26 miles from its source into the impounded Colorado River. The Lake Mead impoundment submerges the last 7 river miles of the Muddy River. Prior to the impoundment of the Colorado River, the Muddy River joined with the Virgin River for a short distance before emptying into the Colorado River. The river has a relatively constant flow with an average annual discharge of 25,000 acre-feet per year (AFY) (TNC 2000). This has been reduced from 36,000 AFY over the past 2 to 3 decades, primarily due to groundwater removal for power generation but also for municipal water, agricultural irrigation, and domestic water supplies (TNC 2000). The perennial nature of the river with a relatively constant flow of water throughout the year is unique within the Mojave Desert ecoregion.

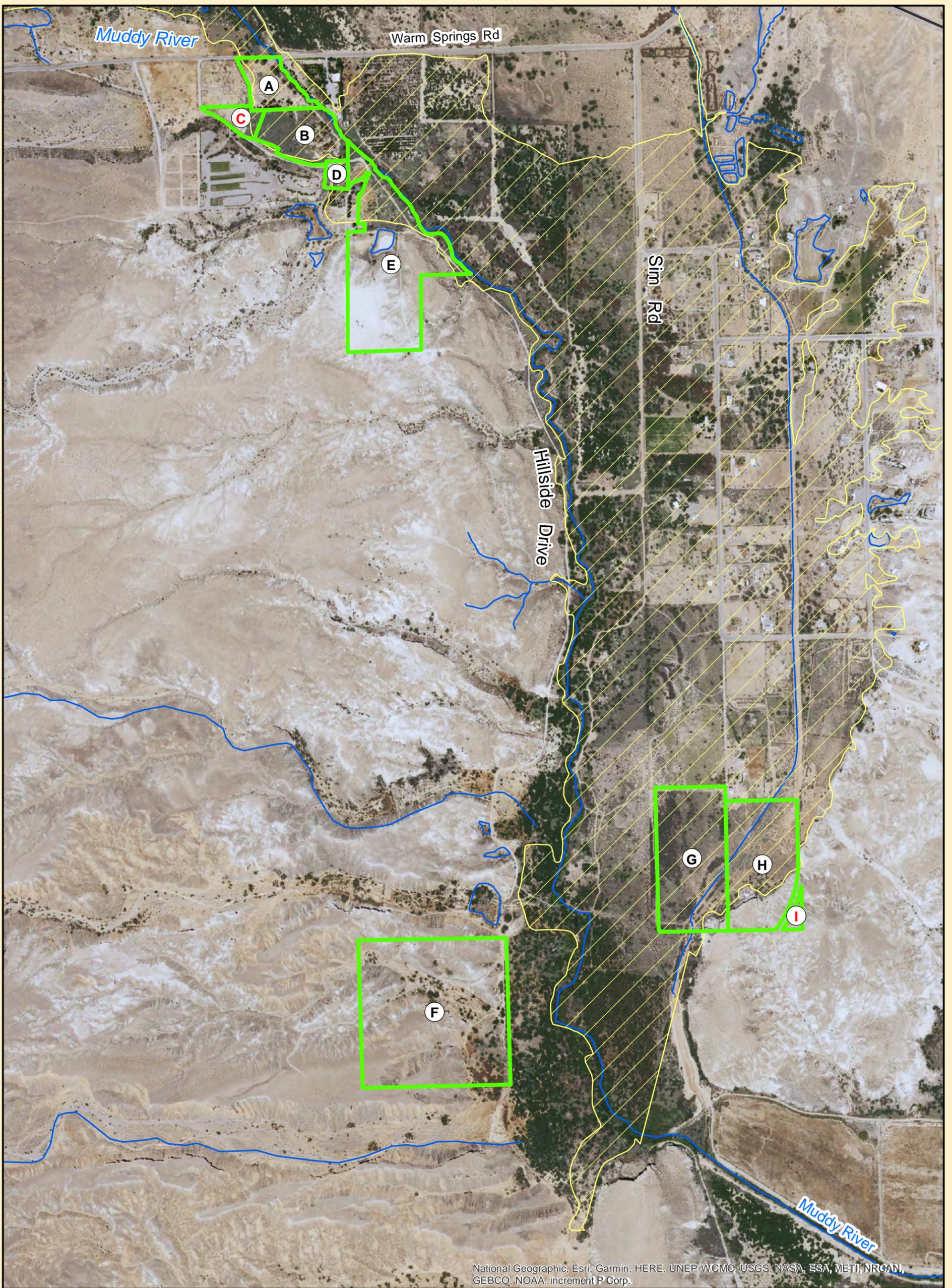
All or parts of Parcels A, B, C, D, E, G, and H are within the 100-year floodplain of the Muddy River (Figure 3). Parcels F and I are outside the floodplain.

Water Rights

All surface water and groundwater within the boundaries of Nevada belong to the public and are subject to appropriation for beneficial uses such as irrigation, recreation, wildlife, and stock watering, and for domestic, municipal, and industrial uses. The use of a water right is considered a property right and can be bought and sold like any other property. Water rights are purchased or sold as personal property or treated as an appurtenance in a real estate transaction. Holders of water rights must demonstrate an actual beneficial use of water in a timely manner. If holders stop using the water, the water right is lost.

Water rights were conveyed to Clark County with the purchase of Muddy River parcels C through F. There is also a municipal water connection on parcel C with the Moapa Valley Water District. The acquired rights were for groundwater for irrigation and domestic uses. The DCP filed a Report of Conveyance with the State Engineer to establish Clark County as the owner of record of the water permits.





National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Legend

 Muddy_River_Reserve

FEMA Flood Zone

FZONE

 ZONE A

 ZONE AE

 ZONE AO

 FEMA Rivers and Washes

**Muddy River Reserve
Water Resources**

Figure 3



Coordinate System: UTM Zone 11

Datum: NAD83

Date: 7/1/2021

Name: Riparian_Management_muddy_fig3



2.1.9 Site Narratives and Restoration Priorities

The following descriptions for Muddy River properties are based on staff observation, field notes, and reports from contractors performing surveys on each parcel. Information varies for each site and parcel due to factors such as: length of time the property has been owned by Clark County, access to property, number of ongoing and/or past projects, etc. The following narratives are intended to describe conditions at each site and provide general rationale for the types of restoration activities that may occur at each site.

Restoration priorities are based on specific site conditions, as well as the stressors described in Section 1.8. For example, all parcels include ‘tamarisk treatments’ as a restoration priority because tamarisk is an invasive species described in Section 1.8 that is widespread throughout the riparian reserve properties and has known negative ecological impacts.

Parcels A-E:

The Muddy River channel within these parcels is incised into a now-dry floodplain. Dominant species include quailbush (*Atriplex lentiformis*) and arrowweed (*Pluchea sericea*), with scattered domestic landscape species (i.e., palm, mulberry, and pine) from previous land uses. Some scattered willow and ash occur along the river.

Restoration priorities include reconnecting the Muddy River with its floodplain and creating habitat for bird species listed in the MSHCP.

Parcel F:

Parcel F is semi-desert grassland that lies outside the 100-year floodplain. Dominant vegetation includes tamarisk (*Tamarix sp.*), honey mesquite (*Prosopis glandulosa*), and quailbush (*Atriplex lentiformis*). Grassland areas are dominated by alkali sacaton (*Sporobolus airoides*). In March 2018, approximately 20% of the tamarisk (on this parcel) was cut and stump treated. In late 2020, the remainder of the tamarisk on this parcel was cut and stump treated.

Restoration priorities include a continuation of the ongoing tamarisk treatments, select weed treatments (ongoing by NPS), and revegetation after tamarisk treatments.

Parcels G and H:

Parcels G and H are semi-desert grassland with dominant cover species including tamarisk (*Tamarix sp.*), honey mesquite (*Prosopis glandulosa*), and quailbush (*Atriplex lentiformis*). Grassland areas are dominated by alkali sacaton.

These properties are split by a series of Clark County flood control channels. Four distinct channels of various cross sections enter the north-central portion of Parcel H, some of which are contained by tall berms. These channels appear to drain a significant catchment area, based on analysis of USGS topography maps, of approximately 8.6 square miles as they enter the site. Approximately 500 feet south of the northern boundary, all the containment berms end and channels become less defined and braided. This series of braided channels gather at the south-central boundary of parcel G as the valley is pinched by the large bluff to the east and exits the unit as a single gully. This confluence zone is characterized by significant erosion, with raw, steep channel banks and numerous headcuts.

Restoration priorities are general in nature and include tamarisk treatments, select weed treatments (ongoing by NPS), and revegetation after tamarisk treatments.

Parcel I:

Parcel I is located on the bluff outside the 100-year floodplain and is dominated by upland vegetation species. Its restoration priorities are general in nature and are identical to those for



parcels G and H, including tamarisk treatments, select weed treatments (ongoing by NPS), and revegetation after tamarisk treatments.

2.2 Virgin River Reserve

As of March 2021, Clark County has acquired title to 545.5 acres distributed across sixteen parcels in five locations in the lower Virgin River watershed. The locations are identified according to the Hydrologic Unit Code (HUC) reach location (Figure 1) and include Mesquite (sometimes referred to as Mesquite West) (Reach 1), Bunkerville East (Reach 2), Bunkerville West (Reach 2), Riverside (Reach 3), and Mormon Mesa (Reach 5). Due to their close proximity, Bunkerville East, Bunkerville West, and Mesquite parcels are often displayed on the same map and lumped together as ‘Bunkerville’. Parcels are labelled using their Reach ID followed by a letter (e.g., all parcels in HUC Reach 2 have labels beginning “2-”) (Table 5).

Table 5. Virgin River Parcels

Site Name	Reach Id*	Parcel #	Acres	Year Acquired
Mesquite West	1-A	001-19-201-009	11.19	2018
Bunkerville East	2-A	002-24-401-004	17.36	2017
	2-B	002-24-401-002	21.46	2017
	2-C	002-24-401-001	2.62	2014
	2-D	002-24-401-005	37.06	2014
	2-E	002-24-801-005	9.98	2014
	2-F	002-25-501-013	56.97	2014
	2-G	002-24-801-002	8.09	2014
Bunkerville West	2-I	002-27-801-002	40	2018
	2-J	002-26-401-001	61.73	2018
	2-K	002-26-301-002	0.76	2020
	2-L	002-26-301-004	15.59	2020
	2-M	002-26-301-007	42.59	2020
Riverside	3-A	034-00-001-013	39.85	2018
	3-B	034-00-001-019	100	2017
Mormon Mesa	5-A	039-19-000-002	80.22	1990

Total Acreage 545.47

*River reaches are designated based on the National Hydrography Dataset, Hydrologic Unit Codes and are numbered from upstream to downstream for purposes here.

2.2.2 Existing and Adjacent Land Use

Parcels within the Virgin River Reserve are zoned as rural open land (1 residential unit per 2 acres) with the planned land use designated as open land or rural residential. One purpose of the designated open land use category is to prevent irreversible environmental damage to sensitive areas (Clark County 2019b). The designated rural residential use category allows for a



large lot, single family residential (1 unit per 2 acres) (Clark County 2019b). The existing use of all the parcels on the reserve is for the conservation of riparian habitat. Allowable uses include scientific surveys and data collection with the permission of the DCP.

Adjacent land use descriptions are briefly described in the bullets below:

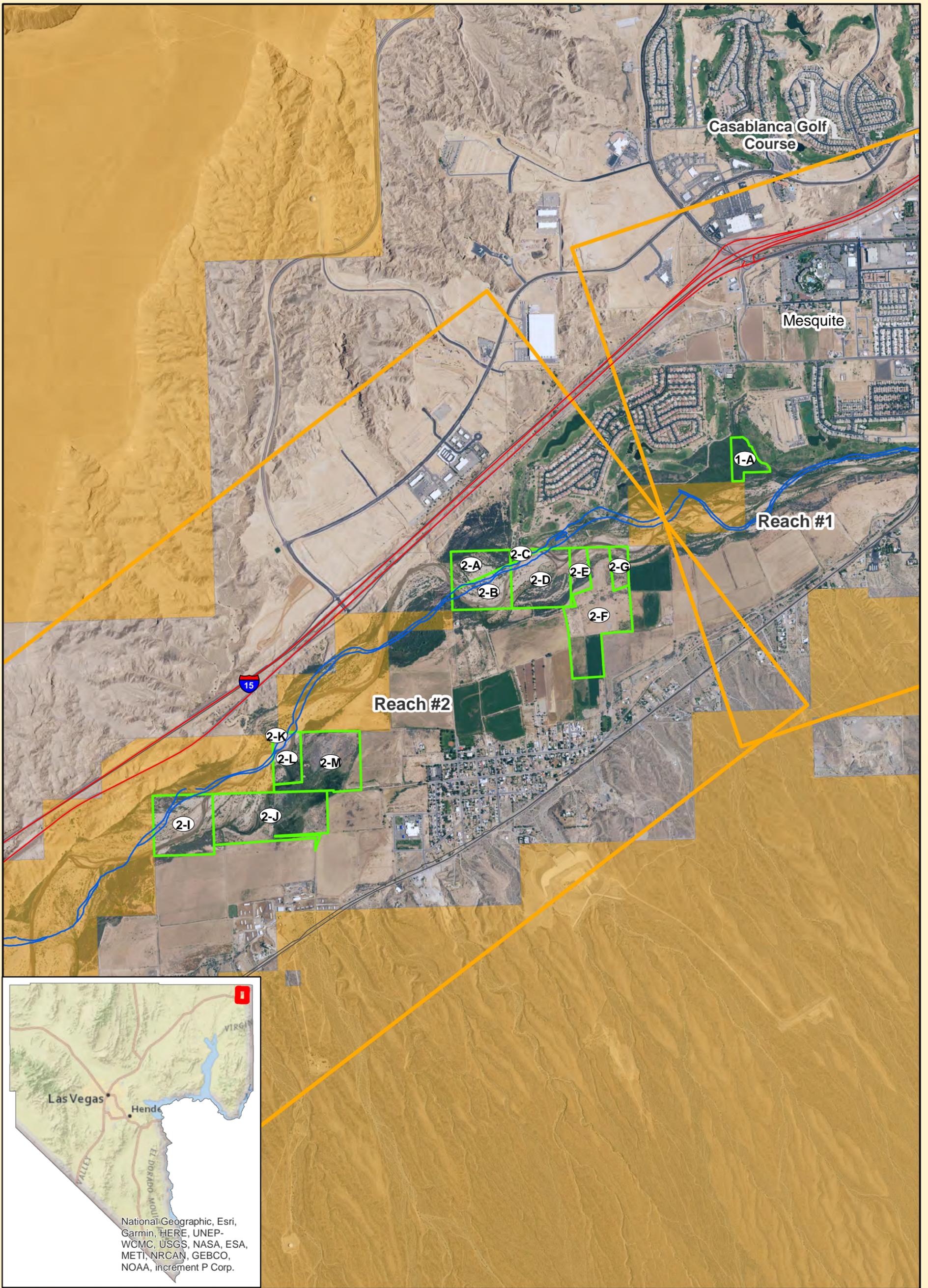
- The Mesquite parcel (Figure 4) is bordered to the south by land managed by the BLM and a golf course located in a private residential neighborhood. Zoning is for a Planned Unit Development (PUD, Clark County 2019b).
- Bunkerville East parcels (Figure 4) are bordered to the north by land managed by the BLM and a golf course located in a private residential neighborhood. Land bordering these parcels is zoned residential agricultural and the current use is agriculture. Surrounding private property is used for agriculture and open land.
- Bunkerville West parcels (Figure 4) are bordered by private owners and is zoned rural residential agriculture.
- The Riverside parcels (Figure 5) are bordered by both BLM land managed as multiple use land and private properties. Zoning is Rural Open Land (Clark County 2019b).
- The Mormon Mesa parcel (Figure 6) is bordered to the east and north by NDOW-managed land as part of the Overton Wildlife Management Area, which is managed for the protection of wildlife habitat. Property to the west and south is managed as multiple use land by the BLM.

Much of the river channel and adjacent floodplain along the lower Virgin River corridor south of the City of Mesquite is managed by the BLM, National Park Service, and NDOW, with some smaller parcels under the management of the Bureau of Reclamation. Parcels in private ownership are scattered along the length of the lower Virgin River. Existing uses of these parcels are open lands and agriculture, with zoning designations primarily as rural open land (1 residential unit per 2 acres) further south along the river, and residential agriculture (1 residential unit per 1 acre) in and near the communities of Bunkerville and Mesquite.

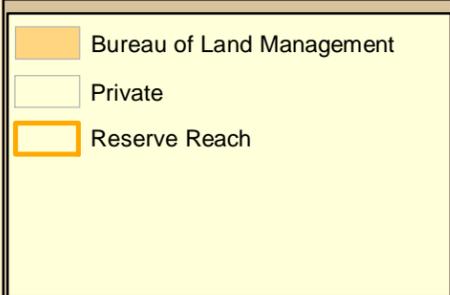
2.2.3 Future Land Use

Future uses of private properties adjacent to reserve parcels are likely limited for two reasons: 1) floodplain management restrictions, and 2) the entire length of the Virgin River in Clark County is designated critical habitat for the southwestern willow flycatcher (USFWS 2013) and the yellow-billed cuckoo (USFWS 2014).

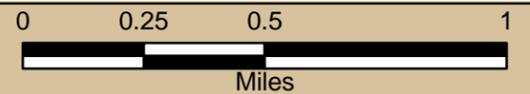




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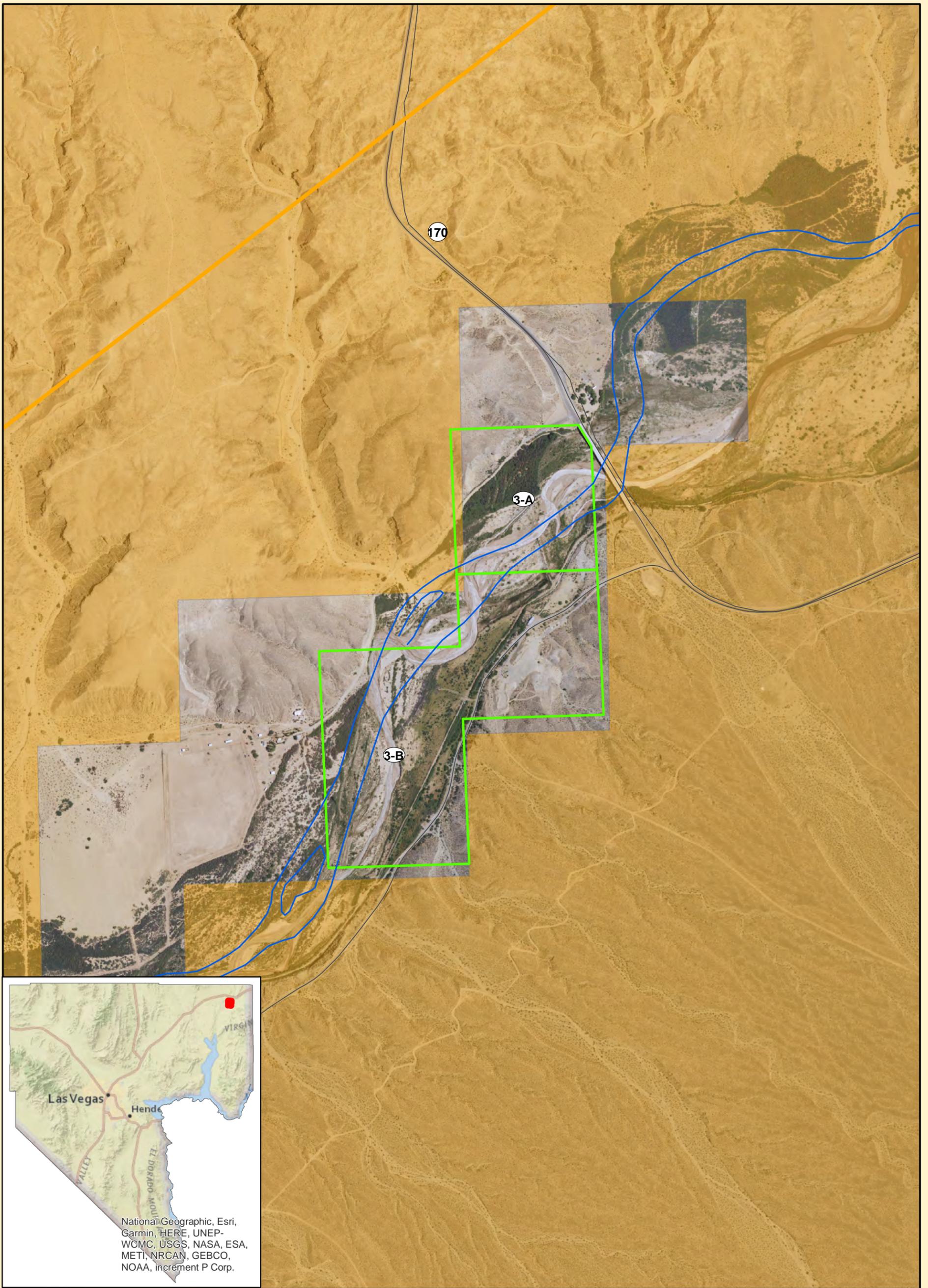


Virgin River Reserve Mesquite and Bunkerville Land Ownership Figure 4

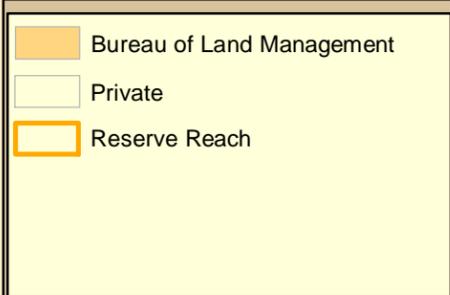


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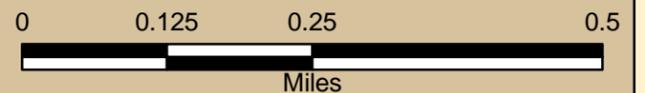




National Geographic, Esri,
 Garmin, HERE, UNEP-
 WCMC, USGS, NASA, ESA,
 METI, NRCAN, GEBCO,
 NOAA, increment P Corp.



Virgin River Reserve Riverside Land Ownership Figure 5



Coordinate System: UTM Zone 11
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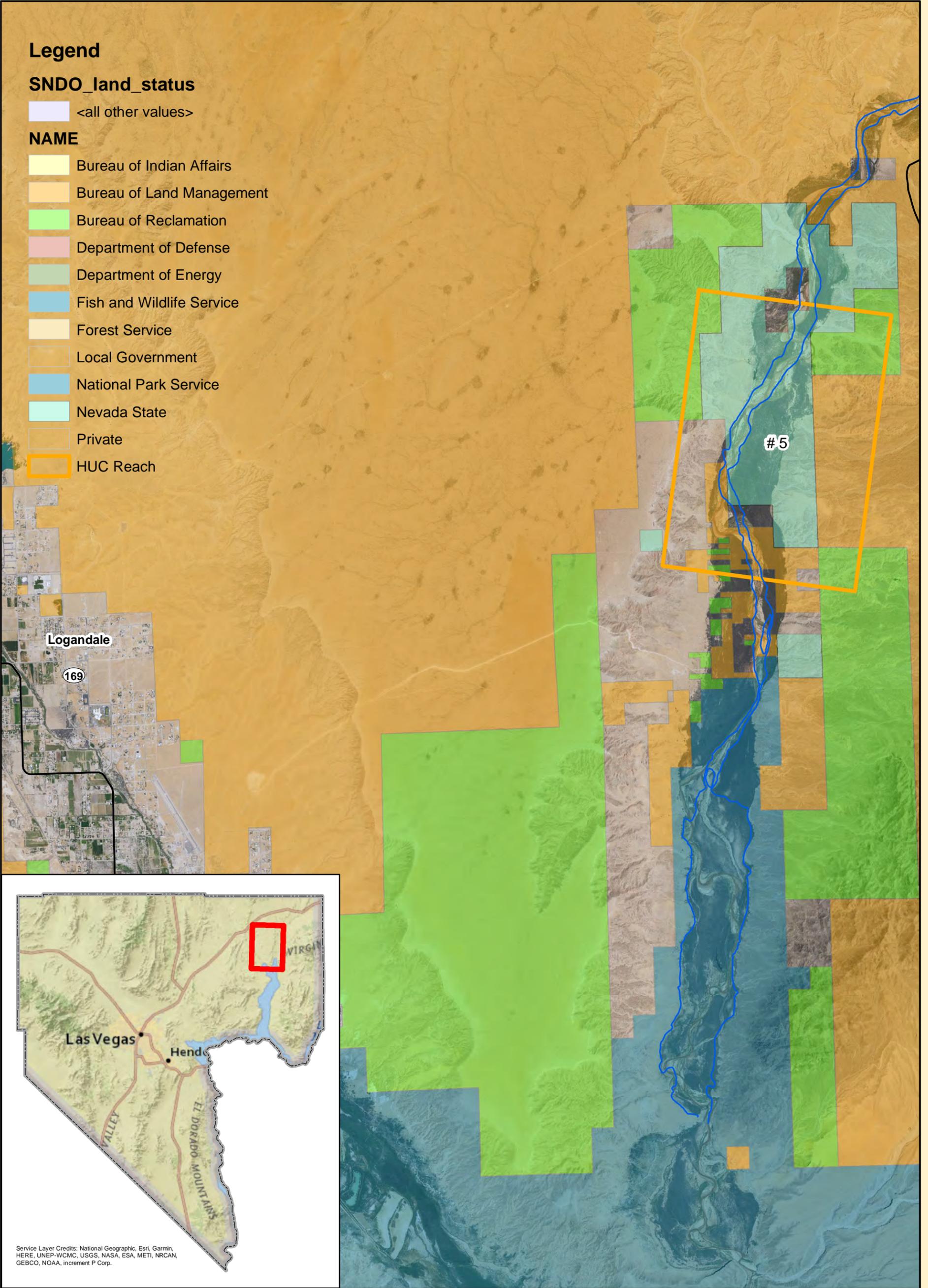
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NAME

- Bureau of Indian Affairs
- Bureau of Land Management
- Bureau of Reclamation
- Department of Defense
- Department of Energy
- Fish and Wildlife Service
- Forest Service
- Local Government
- National Park Service
- Nevada State
- Private
- HUC Reach



Logandale

169

#5

Las Vegas

Henderson

VIRGIN

VALLEY

EL DORADO MOUNTAINS

Service Layer Credits: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Virgin River Reserve Mormon Mesa Land Ownership Figure 6



Coordinate System: UTM Zone 11
Datum: NAD83
Date: 07/1/2021
Name: Riparian_Management_virgin



2.2.4 Geology and Soils

The majority of the soil types on the Virgin River sites consist of alluvium soils (Natural Resources Conservation Service 2015). The soils in the river channel (Riverwash – Water Complex) consist of gravelly coarse sand with clay in the lower soil profile. These soils experience frequent flooding and are poorly drained, with water at or within 2 feet of the soil surface. The vegetated floodplain stream terrace soils (predominantly Oxyaquic Torriorthents – Toquop Complex, Toquop Complex, and Toquop Fine Sand) consist of fine sandy loam and silty clay loams, and experience frequent flooding and are poorly drained. These soils can be productive farmland soils, known as loamy bottoms. Soils can be slightly to strongly saline depending on the source of the alluvium (Orr et al. 2013b, Natural Resources Conservation Service 2015). The pH of these soils ranges from 8 to 9 (Orr et al. 2013b).

To the southeast of the Bunkerville and Mesquite sites on a higher floodplain terrace is the Virgin River silty clay soil series. This soil is calcareous alluvium derived from sedimentary rocks and are silty clay and clay loams that are somewhat poorly drained and are slightly to strongly saline. These soils are considered farmland of state significance in Nevada.

The upland soils of the Mormon Mesa parcel are excessively well drained and do not experience flooding. On the eastern uplands the soils are primarily in the Sweetwater-Carrizo Association. These soils are found on the summits and drainage ways of fan remnants and are extreme gravelly loam with high calcium and moderate salinity. The western uplands are dominated by three soil types: Arada fine sands along the river (found on fan remnants and eolian in origin), badland soils on the slopes (shallow colluvium and exposed rock), and the Mormon Mesa soil series (lacustrine soils with a petrocalcic layer) on the upper flats.

The soils of the Virgin River Reserve reflect the geology of the surrounding mountains. To the south are the Virgin Mountains, with the highest elevations reaching nearly 6,500 feet. The rocks range in age from Precambrian to Tertiary. The Precambrian rocks consist of a metamorphic and igneous complex, marine carbonate rocks with subordinate, fine-grained clastic material represent the Paleozoic Era, and the Mesozoic and Cenozoic rocks consists of continental and marine deposits of siltstone, sandstone, limestone, gypsum, conglomerate, and shale. To the north is Mormon Mesa, a flat-topped unit that rises over 650 feet above the Virgin River. The cap of the mesa is part of the Muddy Creek Formation, deposited between 12 and 4 million years before present, with the petrocalcic layers of the formation originating toward the end of that period (Brock and Buck 2009).

2.2.5 Topography

The topography of the Virgin River Reserve is relatively flat, with approximately 15 feet of elevation change within the floodplain (river channel, active alluvium, and vegetated alluvium) to over 30 feet of elevation change between the floodplain and the surrounding uplands (Orr et al. 2013b). The boundary between the floodplain and the upland is steep, with elevations ranging from 1,260 to 1,600 feet.

2.2.6 MSHCP-Covered Plant Species

A limited inventory of plants has occurred within Virgin River Reserve. The Mormon Mesa site had a plant inventory to document native and nonnative plants conducted in the fall of 2013 by Stillwater Sciences and the University of California, Santa Barbara. Surveys to inventory MSHCP-covered plant species within the other Virgin River Reserve sites have not been conducted. No covered, evaluation, or watch list plant species are known to occur. A complete list of native plant species observed in the Virgin River reserve unit is included in Appendix C.



2.2.7 MSHCP-Covered Avian Species

Avian surveys have been conducted annually on Virgin River Reserve sites since 2017.

The following MSHCP-covered species (or evaluation species) have been observed since 2017, listed by site (SWCA 2017a, SWCA 2017b, SWCA 2019):

Mesquite—southwestern willow flycatcher, yellow-billed cuckoo, and crissal thrasher (evaluation species)

Bunkerville East—blue grosbeak and Arizona Bell's Vireo, and crissal thrasher (evaluation species).

Bunkerville West—yellow-billed cuckoo, vermilion flycatchers, phainopepla, blue grosbeak, Arizona Bell's vireo, and crissal thrasher (evaluation species).

Riverside—blue grosbeak, Arizona Bell's vireo, and crissal thrasher (evaluation species).

Mormon Mesa—southwestern willow flycatcher, yellow-billed cuckoo, blue grosbeak, Arizona Bell's vireo, summer tanager, and crissal thrasher (evaluation species).

2.2.8 Water Resources

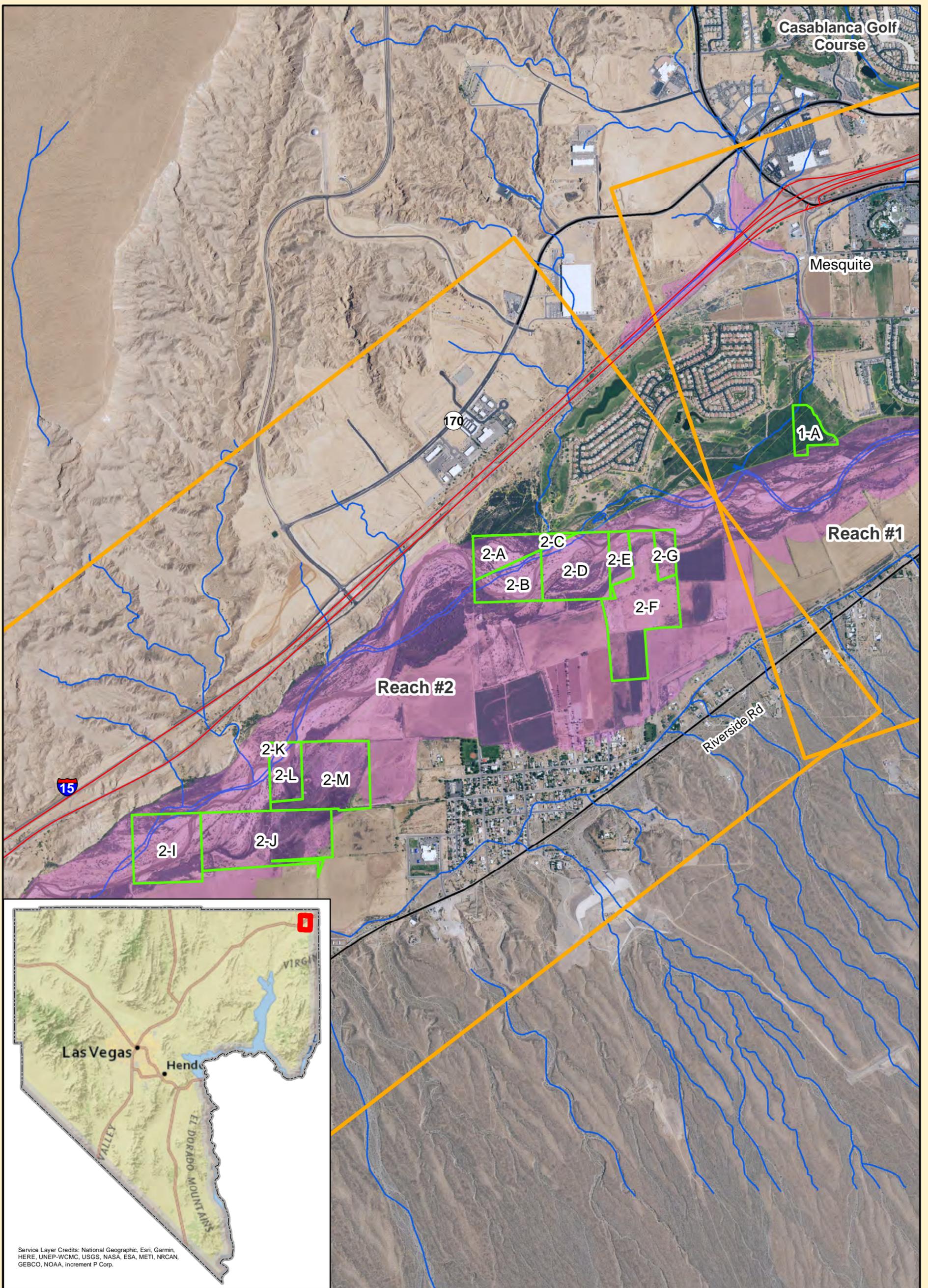
Surface Water and Groundwater

The Virgin River is a perennial tributary of the Colorado River, arising in southwestern Utah, flowing through northwest Arizona and southern Nevada, and emptying into Lake Mead. The river is approximately 162 miles long, with the last 30 miles forming the north arm of Lake Mead. Water resources for each parcel in the Virgin River Reserves are shown in Figure 7, Figure 8, and Figure 9.

The river has a relatively natural hydrologic regime, with only a few low-water dams in the upper reaches in Utah and local water withdrawal for agriculture in Nevada (Dixon and Katzer 2002). The annual river flow averages 140,000 AFY, which is a combination of river and spring flow and groundwater loss. The annual flow has ranged from 78,000 to 500,000 AFY between 1930 and 1998. Monthly flows are between 100 and 150 cubic feet per second (cfs) from June to October, increasing in volume from winter through spring with highs over 400 cfs in April and May. Shallow sub-surface water flow is generally parallel with the floodplain (Orr et al. 2013b).

No water rights were attached to or conveyed with parcels in the Virgin River Reserve, but there may be opportunities to lease water from the Mesquite or Bunkerville Irrigation Districts if needed to support restoration activities.

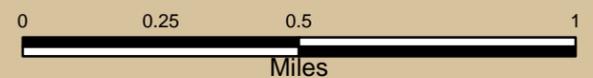




Service Layer Credits: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

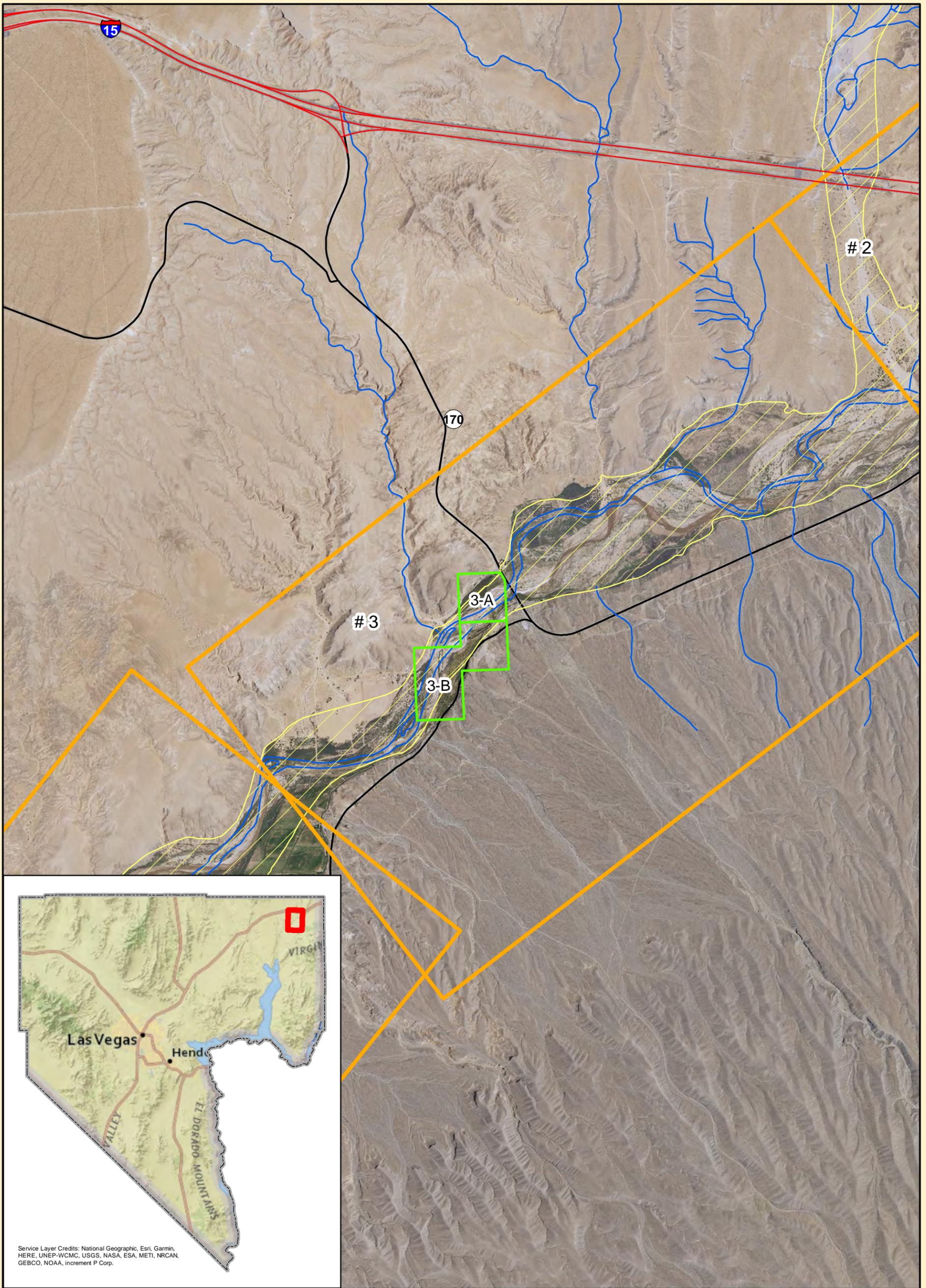
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 - HUC Reaches
 - FEMA Flood Zone**
 - FZONE**
 - ZONE A
 - ZONE AE
 - ZONE AO
 - FEMA Rivers and Washes

Virgin River Reserve Mesquite and Bunkerville Water Resources Figure 7



Coordinate System: UTM Zone 11
Datum: NAD83
Date: 7/1/2021
Name: Riparian_Management_virgin





Service Layer Credits: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

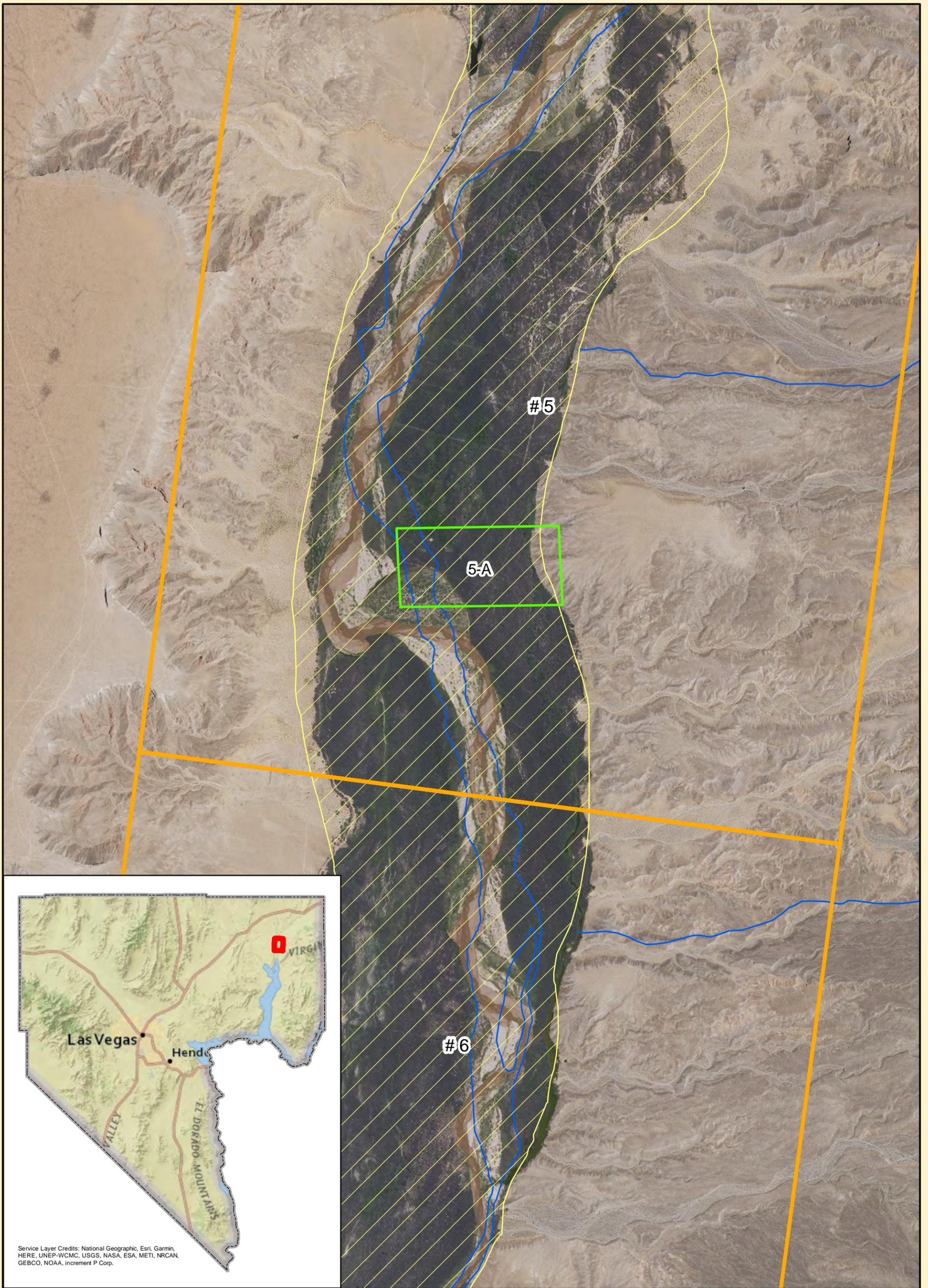
Legend

- Riparian_Reserves
- HUC Reaches
- FEMA Flood Zone**
- FZONE**
- ZONE A
- ZONE AE
- ZONE AO
- FEMA Rivers and Washes

Virgin River Reserve Riverside Water Resources Figure 8

0 0.25 0.5 1
Miles

Coordinate System: UTM Zone 11
Datum: NAD83
Date: 7/1/2021
Name: Riparian_Management_virgin



- Legend**
- Riparian_Reserves
 - FEMA Flood Zone**
 - FZONE**
 - ZONE A
 - ZONE AE
 - ZONE AO
 - FEMA Rivers and Washes
 - HUC Reaches

Virgin River Reserve Mormon Mesa Water Resources Figure 9



Coordinate System: UTM Zone 11
 Datum: NAD83
 Date: 7/1/2021
 Name: Riparian_Management_virgin

2.2.9 Site Narratives and Restoration Priorities

The following descriptions for each set of Virgin River properties are based on staff observation, field notes, and reports from contractors performing surveys on each parcel. Information varies for each site and parcel due to factors such as: length of time the property has been owned by Clark County, access to property, number of ongoing and/or past projects, etc. The following narratives are intended to describe conditions at each site and provide general rationale for the types of restoration activities that are recommended.

Restoration priorities are based on specific site conditions, as well as the stressors described in Section 1.8. For example, all parcels include ‘tamarisk treatments’ as a restoration priority because tamarisk is an invasive species described in Section 1.8 that is widespread throughout the riparian reserve properties and has known negative ecological impacts. Similarly, fence installation is recommended for all Virgin River properties because livestock trespass in specifically noted in Section 1.8 as being prevalent near all Virgin River reserve parcels.

Mesquite:

Mesquite (sometimes referred to as Mesquite West) consists of one 11.49-acre parcel in Reach 1.

There is extensive willow habitat and this site is located in southwestern willow flycatcher territory.

Restoration priorities include select noxious weed treatments.

Bunkerville East:

Bunkerville East consists of 153.54 acres in seven parcels labeled 2-A through 2-G based on physical location from west to east. The parcels are located in the town of Bunkerville across from the southwest corner of the Casablanca Golf Course in Mesquite. This site includes the active floodplain of the Virgin River, with the river cutting through the site from east to west. A historic levee is also present on the south side of the river.

Vegetation at the site are mosaics of varying types and sizes. Approximately 3.5 ha consists of various sparse mixtures of arrowweed (*Pluchea sericea*), tamarisk (*Tamarix spp.*), seep willow (*Baccharis salicifolia*), and screwbean mesquite (*Prosopis pubescens*), all of which were < 3 meters (m) in height. Information collected during bird surveys indicated three general types: 1) relatively contiguous tamarisk 3–5 m in height with canopy closure 60%–80%, 2) a mix of tamarisk and screwbean mesquite 3–5 m in height with canopy closure up to 50%, and 3) strips and clumps of tamarisk up to 4 m in height with an understory of arrowweed and canopy closure < 40%. Individual Goodding’s willows (*Salix gooddingii*) 8–10 m in height were present along the bank of the Virgin River in the southwestern corner of the parcel.

During this same survey, canopy height within each stand was described as uneven and the tops of many of the tamarisk plants appeared dead, likely as the result of repeated defoliation by tamarisk leaf beetles (*Diorhabda carinulata*). Both adult and larval beetles were detected at the site, and the tamarisk were partially defoliated.

Restoration priorities include levee dispersal, tamarisk removal and revegetation, and fence installation.

Bunkerville West:

Bunkerville West consists of 160.67 acres in five parcels, labeled 2-I through 2-M. The parcels are located in Bunkerville, west of the terminus of Vincent Leavitt Avenue. The parcels newly



acquired in 2020 do not have descriptions available yet. Additional narrative information including them will be added in the next management plan revision (expected revision in 2023).

The river cuts through parcel 2-H and is known to have smaller tributary/channels with both active and inactive beaver dams.

Scattered willows occur in this site and there appears to be a high potential for more willows in the old beaver dam pond and marsh habitat.

Restoration priorities include levee dispersal, tamarisk removal and revegetation, and fence installation.

Riverside:

The approximate 140 acres owned in Riverside can be characterized as having an active Virgin River floodplain. Upland plants present include tamarisk, threecorner milkvetch, sticky buckwheat, Nye milkvetch, and limestone violet. Other vegetation includes arrowweed (*Pluchea sericea*), Mesquite, and some willows are on site.

Restoration priorities include tamarisk removal, subsequent revegetation, and fence installation.

Mormon Mesa:

The 80-acre Mormon Mesa property is on the east side of the Virgin River and includes a scour area along the western bank. Its river and floodplain habitat is adjacent to existing breeding habitat for southwestern willow flycatcher.

During site visits in 2017, surface water and saturated soils were observed in late spring in channels on the eastern third of the site and had dried to damp soil by July. The southwestern portion of the property was scoured during the December 2010 flood event, leaving a mix of open water and wet-moist riverwash sediments that have been colonized in some areas by wet meadow species and tamarisk.

The property is currently dominated by dense stands of nonnative tamarisk shrubland, primarily *Tamarix ramosissima* (or the hybrid form *T. ramosissima x chinensis*). The tamarisk dominated areas consist primarily of dense, monotypic tamarisk 3–5 m in height that is 80%–90% dead as the result of repeated defoliation by tamarisk leaf beetles. In the western half of the site, several small plots were cleared of tamarisk in the fall of 2013 and subsequently planted with willows and other native species (SWCA 2020b).

Other vegetation at the site consists of willows and other native species found in small patches, generally in wetter areas. The southwestern edge of the site is sparsely vegetated by Goodding's willow, tamarisk, and arrowweed (*Pluchea sericea*), all < 3 m in height. Mesquite and other native shrubs are scattered in a narrow zone of transition from the floodplain to the upland along the eastern edge of the property.

Restoration priorities include MSHCP-covered bird habitat enhancement, especially given that the parcel is adjacent to southwestern willow flycatcher breeding habitat; continued tamarisk removal and treatments; and fence installation.

Section 3 Management Goals, Objectives, and Actions

The management goals for the Riparian Reserves are based on the Section 10 incidental take permit and the guiding documents for the reserves.



3.1 Management Goals and Objectives

Management goals are broad, general statements to establish the direction for the management of the easement. **Management objectives** provide further explanation regarding the intent of the management goals and are established to measure progress towards achieving management goals for the Boulder City Conservation Easement (BCCE). Management goals and objectives are presented in Table 6. These management goals and objectives are related to, but not identical to, the Biological Goals and Objectives (BGO) that were drafted in 2016 (Clark County 2016). The BGOs are used to quantitatively gauge implementation and success of specific projects conducted under the MSHCP. Specific management actions listed in Section 3.3 are linked to both the management goals and objectives as well as the biological goals and objectives.

Table 6. Riparian Reserves Management Goals and Objectives

Goal 1	Manage reserves to provide habitat for the six MSHCP covered avian species
<i>Objectives</i>	<i>1.0 Restore, create, and enhance habitat for riparian bird species</i>
Goal 2	Manage reserves to support resource values for other MSHCP and sensitive species when practicable
<i>Objectives</i>	<i>2.0 Manage habitat to avoid harm to aquatic species</i>
Goal 3	Manage reserves to meet conservation and landowner obligations
<i>Objectives</i>	<i>3.0 Control invasive plant species and noxious weeds</i>
	<i>4.0 Reduce threat of fire and maintain safe conditions</i>
	<i>5.0 Manage property rights and property infrastructure</i>
	<i>6.0 Build and maintain positive relationships in the community</i>
Goal 4	Expand property holdings of desert riparian habitats for MSHCP covered species
<i>Objectives</i>	<i>7.0 Acquire title to private lands from willing sellers</i>
	<i>8.0 Acquire conservation easements to public and private lands with willing landowners as appropriate</i>

3.2 Discussion of Objectives and List of Management Actions

Objectives are what guide identification and development of management actions and day-to-day activities. Management actions are defined as specific actions, methods, or tools by which objectives are met and goals are achieved. This section provides a general discussion of each objective and lists management actions that would meet each objective. Section 3.3 contains the table of management actions with further details on what, where, when, and who implements each action, and how to measure effectiveness of implementation of the action.

Objective 1.0 - Restore, create, and enhance habitat for riparian bird species

Desert riparian habitats have been significantly reduced in extent by development, agriculture, fire, and the lowering of the local and regional aquifers, and reduced in quality primarily by the invasion of tamarisk. The restoration, creation, and enhancement of desert riparian habitats is necessary for survival of MSHCP-covered riparian bird species. There is substantial experience among agencies, consultants, and within the DCP on how to restore riparian habitat.

The management actions that will restore, create, and enhance habitat for riparian bird species include:

- 1.1 Identify and prioritize sites for restoration



- 1.2 Develop restoration plans for priority restoration sites
- 1.3 Implement restoration plans
- 1.4 Monitor and adaptively manage restored riparian habitat
- 1.5 Collaborate with others to manage riparian habitat restoration along the Muddy and Virgin rivers
- 1.6 Assess opportunities to obtain water from irrigation districts to support restoration
- 1.7 When feasible, assess opportunities to establish in-lieu fee agreement with U.S. Army Corps of Engineers for Clean Water Act permit mitigation options
- 1.8 Analyze relevant landscape matrix elements and composition

Objective 2.0 - Manage habitat to avoid harm to aquatic species

The Muddy and Virgin rivers have several aquatic fish and invertebrate species that are of federal or state significance and that are not MSHCP-covered species. Among these are the federally listed endangered Moapa dace on the Muddy River and the woundfin on the Virgin River, and the federally listed endangered Virgin River chub, found in both rivers. Activities related to the restoration, creation, and enhancement of riparian habitat should be conducted in such a way to reduce impacts to the river channel that could affect aquatic species and in accordance with all laws and regulations. Additionally, other management actions such as invasive species control and removing underground utilities should also be conducted so that impact to aquatic species is minimized.

The management actions that will manage habitat to avoid harm to aquatic species include:

- 2.1 Coordinate with the USFWS on management actions to avoid negative effects to aquatic species

Objective 3.0 - Control invasive plant species and noxious weeds

Saltcedar (Tamarisk sp.) is the primary invasive plant species on the Riparian Reserves. Some of the other non-native plant species on the Muddy River Reserve identified during a botanical inventory and mapping project (2005-NPS-561N) completed in 2012 included Malta star thistle, Australian saltbush, African mustard, Russian knapweed, red brome, and cheatgrass. Noxious weeds, camelthorn and tall whitetop, are also present on the Virgin River Reserve, Mormon Mesa parcel. See Section 1.6.2 for additional information.

These species can spread rapidly along riparian corridors and displace native species. The DCP, as a landowner, is required under the NRS to control the spread of noxious weeds. The DCP is assisted by the National Park Service Lake Mead Exotic Plant Management Team (project 2017-NPS-1720A) to control and manage non-native plant species on the Riparian Reserves.

The management actions that will control invasive plant species include:

- 3.1 Conduct control activities for invasive species and noxious weeds
- 3.2 Adaptively manage the control of invasive species and noxious weeds

Objective 4.0 - Reduce threat of fire and maintain safe conditions

One of the most destructive threats to the ecosystems of the Mojave Desert is the occurrence of fire. Fires reduce or eliminate riparian trees and shrubs and thus reduce the vegetation structure required by all riparian bird species. Frequency of fire in the Mojave Desert is related to the availability of fuels, the source of which is primarily non-native invasive plant species. The



control of non-native invasive plant species assists in reducing fire. Firebreaks, strips where all flammable vegetation is cleared, are effective in reducing the spread of fire and protecting the natural and human resources. The DCP has removed and trimmed non-native palm trees (sources of fuel) and has established and maintains fire breaks on several of the Muddy River Reserve parcels.

The management actions that will address reducing the threat of fire include:

- 4.1 Control of non-native invasive plant species to reduce fuel availability
- 4.2 Maintain existing fire breaks and establish new firebreaks when necessary

Objective 5.0 - Manage property rights and property infrastructure

For purposes of this objective, property rights and infrastructure address those rights, structures, utilities, easements, and roads that were acquired by the DCP along with title to the land.

Groundwater rights were attached to Muddy River Reserve Parcels C through F, and a house (since demolished) was included with Parcel B. The house was serviced by a municipal water connection from the Moapa Valley Water District and electrical from Overton Power. Some infrastructure must be maintained to support the conservation obligations of the reserves. The certificated groundwater rights have been updated in the County's name. This objective also addresses property rights and infrastructure held by others that are used indirectly to manage the Riparian Reserves.

The management actions that will address property rights and property infrastructure include:

- 5.1 Update title to and use of groundwater rights
- 5.2 Maintain functional municipal water connection and maintain pump equipment
- 5.3 Identify presence and location of operational and abandoned underground utilities (water, sewer, electric)
- 5.4 Maintain fences, as needed, and add additional fences if needed
- 5.5 Obtain permission to cross private lands to access reserves
- 5.6 Identify options for road access to the Virgin River Reserve, Subunit 1
- 5.7 Maintain road access to the Muddy River Reserve
- 5.8 Maintain relationships and coordinate with adjacent landowners to protect conservation values of the reserves

Objective 6.0 - Build and maintain positive relationships in the community

In achieving conservation obligations, it is important to ensure that the DCP and the County maintains a positive relationship with the local neighbors and community as a whole. Currently, the Riparian Reserves are not open to public use, but it is important that the public understands the purpose for the Riparian Reserves, knows the allowable and prohibited uses, and can locate the physical extent (boundaries) of the reserves. Information can be provided through personal interactions, signage, interpretive materials, kiosks, and the DCP webpage.

The management actions that can help maintain community relationships for the Riparian Reserves include:

- 6.1 Maintain positive interactions with neighbors
- 6.2 Perform general maintenance on reserves as needed



- 6.3 Be responsive to community concerns related to the reserves
- 6.4 Prepare public information material that provides information to the public

Objective 7.0 - Acquire title to private lands from willing sellers

The incidental take permit requires the acquisition and management of riparian properties, specifically Condition K.1 requires the “acquisition of private lands in desert riparian habitats” along the Muddy River, Virgin River, and Meadow Valley Wash for covered avian species. Acquisition can be by purchase, exchange, transfer or donation.

The management actions to pursue acquisition of private lands from willing sellers include:

- 7.1 Identify priority parcels for purchase using Acquisition Selection Tool
- 7.2 Ensure clear title to property before proceeding with acquisition
- 7.3 Pursue acquisition of priority parcels
- 7.4 Pursue transfer of parcels held by local and state entities when available

Objective 8.0 - Acquire conservation easements to public and private lands from willing landowners as appropriate

The incidental take permit requires the acquisition and management of riparian properties. Although Condition K.1 specifically requires the acquisition of “private lands” in desert riparian habitats along the Muddy River, Virgin River, and Meadow Valley Wash, opportunities for entering into conservation easements on public lands in addition with private landowners may also be an option.

The management actions to pursue conservation easements to public and private lands from willing landowners include:

- 8.1 Identify priority parcels for easements using Acquisition Selection Tool
- 8.2 Develop a conservation easement template
- 8.3 Pursue easements of priority parcels

3.3 Management Actions and Effectiveness Measures

The primary purpose of a management plan is to provide guidance for selecting management actions that support or meet management objectives, and ultimately achieve management goals. The management actions for the Riparian Reserves have been identified from day-to-day management operations, as well as other actions necessary to meet the objectives and goals for managing the reserves.

The table includes the management objectives (noted as 1.0, 2.0, etc.) and the management actions (1.1, 1.2, 2.1, 2.2, etc.) related to each management objective. Some management actions can fulfill more than one objective and are noted in parentheses after the management action title. Management actions can be separate individual activities or be interrelated with other actions and sequential in implementation.

Each management action is presented in the following table by the columns that include:

- Management Action Description: a brief description of what the action entails and why it is important.
- Reserve Parcel or Location: the location in the particular reserve and reserve parcel(s) where the management action will take place.



- **Timeframe:** the year or time period in which the action will take place, such as weekly, quarterly, 2015, or one year after a previous management action is complete.
- **Lead:** the agency or entity that is responsible for implementing the management action.
- **Permit(s):** the approvals, written permissions, or permits required to initiate the management action.
- **Priority:** the importance of the action in meeting the management objectives and determines the priority for resources.
 - **VH (very high):** an action that is essential for meeting the management objective and requires immediate implementation to protect the resource.
 - **H (high):** an action that is essential for meeting the management objective and requires implementation in the near future to protect the resource.
 - **M (medium):** an action that is important but not essential for meeting the management objective or protecting the resource and does not require implementation in the near future.
 - **L (low):** an action that is not essential to meeting the management objective or protecting the resource and can be delayed until funding is available.
- **Cost:** an estimate of the financial cost (DCP labor, contractor labor) to complete the management action, and generally coincides with Clark County contracting and acquisition limits.
 - **L (low):** < \$25,000
 - **M (medium):** \$25,000 to \$50,000
 - **H (high):** \$50,000 to \$100,000
 - **VH (very high):** > \$100,000
- **Effectiveness Measures:** a listing of metrics to be measured to assess the effectiveness (success) of the management action.
- **Frequency (of Effectiveness Measures):** when the effectiveness measures are reviewed, ranging from monthly to the end of a specific project.
- **Status:** current status and tracking of the management action.
- **BGO:** A list of the Biological Goals and Objectives addressed by the management action. Some management actions are not associated with a BGO because there is no direct connection for the action supporting a specific BGO. These actions support management and stewardship of the riparian reserves and thus generally support all of the BGOs.

The management action table is a tool to guide day-to-day management activities and is intended as a working document for the DCP to update, add to, and/or change actions as conditions warrant.

Each update to the table should be tracked by entering a current date in the footer of the table.



Riparian Reserves Management Plan

Management Action Description	Location	Timeframe	Lead	Permit(s)	Priority	Cost	Effectiveness Measures	Frequency	Status	BGO
1.0 Restore, create, and enhance habitat for covered species										
1.1 Identify and prioritize locations for habitat restoration and enhancement										
Determine sites that have the greatest potential for restoration and result in the most contiguous habitat	MR, VR	2014 and ongoing	DCP		H	L	Completed assessment of sites for restoration	Upon completion of assessment	Process completed for current properties. Continue as new properties become available.	R1.2, R1.5, R4.2
1.2 Develop restoration plans for priority restoration sites										
Establish restoration goals and objectives, assess site condition and restoration potential, restoration design includes plant materials, planting methods, and weed control; incorporate natural riparian processes wherever possible	MR, VR	2015-2017 IPB and ongoing	DCP, contractor(s)		H	M	Plans are complete with goals and objectives for restoration and with all components needed for implementation	Upon completion of each restoration plan	Restoration Plan has been developed for Mormon Mesa, and is in the process of being completed for the Muddy	R1.3, R1.5
1.3 Implement restoration plans										
Implement restoration plans; prepare scope of work/contract; clear vegetation, plant vegetative materials as designed, and fence restoration sites to eliminate cattle trespass, if needed.	MR, VR	Begin within 1 year after development of restoration plan	DCP, contractor(s)	As needed on a site specific and activity basis	H	H	Implementation meets restoration goals and objectives, contract requirements	Upon completion of each restoration project	Restoration has begun in VR 1, MR Parcel A, B and E	R1.2, R1.5
1.4 Monitor and adaptively manage restored riparian habitat										
Establish success criteria and monitoring schedule; assess success of restoration/enhancement against criteria; continue/augment restoration actions to maintain investment; further discussion is available in the Adaptive Management and Monitoring Plan (DCP <i>in prep</i>)	MR, VR	Quarterly assessments for first 2 years post-restoration, then annually	DCP		H	M	Restoration/enhancement plantings and topographic modifications meet success criteria	Quarterly after restoration enhancement activities phase	Not started	R1.2, R2.1
1.5 Collaborate collectively with others to manage riparian habitat restoration along the Muddy and Virgin Rivers										
Collaborate with other agencies for sharing of information on successes, failures, and techniques	MR, VR	As needed	DCP and other partners		H	L	Knowledge is shared supportive of habitat restoration	As needed	Ongoing	R3.1
1.6 Assess opportunities to obtain water from irrigation districts to support restoration										
Water from irrigation districts could be used in restoration projects to increase survival of planted materials	VR	2015-2017 IPB and ongoing	DCP		H	L	Assess quality and quantity of planted materials because of water obtained from irrigation districts for conservation purposes.	End of project	Water from irrigation districts could be used in restoration projects to increase survival of planted materials	-
1.7 When feasible, assess opportunities to establish in-lieu fee agreement with U.S. Army Corps of Engineers for Clean Water Act permit mitigation options										
Discuss requirements for in-lieu fee agreement with Corps; assess options and locations for establishing agreement	MR, VR	Ongoing	DCP	Corps of Engineers	M	L	Decision to pursue in-lieu fee agreement	After assessment of options is completed	Coordinating with Regional Flood Control on this issue	-
1.8 Analyze relevant landscape matrix elements and composition										
Analyzing the matrix of landscape elements, including developed areas, roads, dominant vegetation cover types, etc., both within the riparian reserve units and the surrounding landscape will serve to achieve biological objectives R 4.1 and R 4.2. R 4.1 involves identifying critical ecological and management uncertainties and R 4.2 involves identifying critical connectivity corridors.	MR, VR	Ongoing	DCP, contractor		H	L	Maps of areas with ecological or management uncertainty; maps of landscape matrix to identify habitat and desert tortoise connectivity	Every 4 years	Not started	R1.5, R4.1, R4.2
2.0 Manage habitat to avoid harm to aquatic species										
2.1 Coordinate with USFWS on management actions to avoid negative effects to the Moapa dace population										
Obtain input from USFWS on management actions that may impact the river system. Determine which management actions require input from USFWS.	MR	Prior to restoration activities that impact the river	DCP		H	L	Negative effects from restoration and land management are avoided	Prior to restoration activities that impact the river		R2, R3.1
3.0 Manage reserves to control invasive plant species and noxious weeds										
3.1 Conduct control activities for invasive species and noxious weeds										
Prepare contracts, schedule, and implement control activities	MR, VR	Ongoing	DCP, contractor/NPS		H	L	Treatment/eradication is completed and meets goals and objectives or plan and contract requirements	Semi-annually	ongoing	R1.4
3.2 Adaptively manage the control of invasive species and noxious weeds										
Establish monitoring schedule; assess success of treatment/eradication against criteria; schedule additional treatments as needed	MR, VR	As prescribed in weed control contracts	DCP, contractor/NPS		H	L	Monitor to area and/or numbers to assess eradication or reduction	Semi-annually	ongoing	R1.4



Management Action Description	Location	Timeframe	Lead	Permit(s)	Priority	Cost	Effectiveness Measures	Frequency	Status	BGO
4.0 Manage reserves to reduce threat of fire and maintain safe conditions										
4.1 Maintain existing fire breaks and establish new fire breaks when necessary										
Fire breaks control the spatial spread of fire and protects the conservation values of the parcels and the property of adjacent landowners. Prepare contracts, schedule, and implement the maintenance or establishment of fire breaks.	MR, VR	Annually or as needed	DCP, Contractor		H	M	Fire breaks control the spatial spread of fire and protects the conservation values of the parcels and the property of adjacent landowners	Ongoing	ongoing	R1.2
5.0 Manage property rights and property infrastructure										
5.1 Update title to and use of groundwater rights										
The certificated groundwater rights must be changed for title and for use for wildlife purposes.	MR Parcels C-F	2015-2017 IPB	DCP, Contractor		VH	M	Groundwater rights are certificated to Clark County for wildlife uses	After certificate is received	Completed	-
5.2 Maintain functional municipal water connection and maintain pump equipment										
Inspect Moapa Valley Water District water connection backflow device, pay monthly connection fees	MR Parcels A-C	Annually and monthly respectively	DCP, Contractor		VH	M	Functional municipal water connection that meets restoration needs	Annually and Monthly respectively	Pump is currently out of order and infrastructure on BLM land needs to be fixed	-
5.3 Identify presence and location of operational and abandoned underground utilities (water, sewer, electric)										
Determine likely locations for utilities; prepare contract, schedule, and implement action to search and assess the underground utilities.	MR Parcels A-E	2015-2017 IPB	DCP, Contractor		M	L-M	Presence and location of underground utilities are identified	End of project/inspection		-
5.4 Maintain existing fencing and add additional fencing if needed										
Inspect existing fencing on a continual basis, repair fences when needed; assess reserves for additional fencing needs and installation as needed	MR, VR	Weekly, quarterly	DCP, Contractor		H	L	Location, length, and percent of fencing inspected. Length and percent of fencing needing repair. Completion of repairs, time period between notification and repair.	Weekly	ongoing	-
5.5 Obtain permission to cross private lands to access reserve units										
Determine the timing, frequency, and extent of access needed; contact owners of property where access is needed; obtain written permission for access	MR, VR	ongoing	DCP		VH	L	Permission is obtained to cross private lands to access properties	When permission is received		-
5.6 Identify options for road access to reserve units										
Determine the timing, frequency, and extent of access needed; contact owners of property where access is needed; obtain written permission for access	MR, VR	2015	DCP		H	L	Road access is obtained to Virgin River Parcel 1	End of project		-
5.7 Maintain road access to the Muddy River Reserve										
Monitor condition of access roads; determine type of maintenance needed for safe conditions; conduct maintenance. Weekly to parcels A-E, monthly F-I	MR	Weekly and monthly	DCP, Contractor		H	L	Road access is maintained to all Muddy River Reserve parcels	Weekly and monthly		-
5.8 Maintain relationships and coordinate with adjacent landowners to protect conservation values of the reserve										
Communicate (formal and/or informal, as appropriate) with landowners regarding property management actions, issues, and ongoing and pending projects	MR, VR	As needed	DCP		H	L	Relationships with adjacent landowners is reviewed annually	Annually, at year end		R3.1
6.0 Build and maintain positive relationships in the community										
6.1 Maintain positive interactions with neighbors										
Engage with neighbors when safely provided the opportunity	MR, VR parcels	Ongoing	DCP		H	L	Good relationship is maintained	When possible	ongoing	R3.1
6.2 Perform general maintenance on reserves as needed										
Identify and implement maintenance activities, direct maintenance contractor as needed	MR, VR	ongoing	DCP, Contractor		M	L-H	Maintenance activities are performed	As needed	ongoing	-
6.3 Be responsive to community concerns related to the reserves										
Listen to and respond to concerns from members of the community if appropriate	As identified	ongoing	DCP, contractor		M	H-VH	Community concerns are addressed	As needed	ongoing	-
6.4 Prepare public information material that provides property information to the public										



Public information can include webpage, signs, interpretive materials that discuss allowable uses, property boundary, resource values and purpose	MR, VR	Review biannually	DCP, contractor		M	L-M	Current webpage and other materials	Biannually	ongoing	R3.2
Management Action Description	Location	Timeframe	Lead	Permit(s)	Priority	Cost	Effectiveness Measures	Frequency	Status	BGO
7.0 Acquire title to private lands from willing sellers										
7.1 Identify priority parcels for purchase using Acquisition Selection Tool										
Use the Acquisition Section Tool to assess the priority of parcels when offered by willing sellers; prioritize patches that enhance landscape-level habitat connectivity	MR, VR habitat	As parcels are offered by willing sellers	DCP		H	L	Properties offered by willing sellers are assessed with the Acquisition Selection Tool within 3 months of being offered and a decision on acquisition provided within 6 months of being offered	As parcels are offered by willing sellers	ongoing	R1.2, R1.5, R1.6, R4.2
7.2 Ensure clear title to property before proceeding with acquisition										
Coordinate with County Surveyor to review property boundaries and deeds to ensure clear title; review cadastral survey when complete	MR, VR habitat	After lands have been prioritized	DCP, County Surveyor		VH	L	Decision on clear title from County Surveyor	As parcels are offered by willing sellers	ongoing	-
7.3 Pursue acquisition of priority parcels										
Conduct appraisal, determine fair market value, make offer, negotiate as needed	VR, MR as identified in Priority Ranking Tool	After clear title has been determined	DCP		H	L-VH	Decision on acquisition	As parcels are offered by willing sellers	ongoing	R1.2, R1.5, R1.6, R4.2
7.4 Pursue acquisition of parcels held by local and state entities when available										
Identify parcels held by County Treasurer or other Departments, other municipalities, or state; discuss planned or future needs for parcels to determine best use or benefit to County; transfer management responsibility to DCP.	MR, VR habitats	ongoing	DCP,		H	L	Decision on acquisition	As parcels are available	ongoing	R1.2, R1.6
8.0 Acquire conservation easements to public and private lands from willing landowners as appropriate										
8.1 Identify priority parcels for conservation easements using Acquisition Selection Tool										
Evaluate feasibility of conservation easement; use the Acquisition Section Tool to assess the priority of parcels when offered by willing sellers; prioritize parcels that enhance landscape-level habitat connectivity	MR, VR habitats	As parcels are offered by willing landowners	DCP		H	L	Easements offered by willing landowners are assessed with the Acquisition Selection Tool	As parcels are offered by willing landowners		R1.2, R1.5, R1.6, R4.2
8.2 Develop a conservation easement template										
Develop an easement template that outlines approved and prohibited actions, access for monitoring, and communication schedule	As identified	After priority parcels are identified	DCP, Legal		H	L	Completed conservation easement template			-
8.3 Pursue easements of priority parcels										
Negotiate terms of easement.	As identified	When appropriate	DCP, Legal		H	L-H	Decision on easements provided within 12 months of being contacted	After easement granted		-



Section 4 Considerations for Future Versions of the Riparian Management Plan

Suggestions that may be considered prior to the next revision of the Riparian Reserve Management Plan are listed below. These suggestions are a compilation from multiple Science Advisor Panel members and likely would not all work if implemented at the same time. The following suggestions are primarily intended to spur discussion prior to the next revision.

- Providing additional content and context for each site. Sections 2.1.9 and 2.2.9 include narratives of each site, but the amount of information available (and written) for each site varies greatly. A similar suggestion is to provide photos of each site to illustrate site conditions and ongoing restoration projects.
- Consider grouping parcels by intended management actions instead of by those that are contiguous or adjacent.
- As additional parcels are acquired, consider a separate management plan for each watershed. If this were pursued, we encourage considering splitting background and historical information that is less relevant on a day-to-day basis into its own stand-alone document and focusing the management plans solely on the management goals, objectives, and actions, including progress updates and rationale for each.
- Consider providing more information on each management action (and therefore, each restoration project) including progress, outcomes, next steps, etc. This information would likely be part of the site narrative for each grouping of parcels. This suggestion lends itself to more frequent updates to management plan (contrary to the suggestion immediately below).
- Consider decreasing the interval of revision to the document, but do not remove the clause that the management plan may be updated whenever new information that influences management is available (e.g., new parcels are acquired). Extending the timeline of regular updates will facilitate taking a 'hard look' at the management plan and making major management or management strategy updates.



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Appendix A
Access to Reserves



Muddy River Access

The Muddy River property consists of nine parcels in the Moapa Valley. The primary access is via Interstate 15 (I-15) north to State Route (SR) 168 at Glendale, north to Warm Springs Road, and then west to a gated drive past Palm Creek RV Park on the west bank of the Muddy River for parcels A and B. Continue farther west on Warm Springs Road to Hillside Drive for parcels C through F (Figure 1).

The route to parcels G through I is south from Warm Springs Road on Sim Street, east on Marley Way, and then south on Saltbrush Lane to the access road along the flood channel, then hike into parcels. The preferred route is east on Learned Cactus Way from Saltbrush Lane to a gated unimproved trail that heads south across private property to Parcel G (Figure 1).

Virgin River Access

Mormon Mesa: West access: Take I-15 north to SR 168 at Glendale, south on SR 168 (Moapa Valley Boulevard) through Logandale and Overton, then north on Cooper Street to Mormon Mesa Road and past the duck club on a private dirt trail (Figure 5).

Access from the east is via I-15 south to SR 170 (Riverside Road), southwest on Gold Butte Road, and then west on a dirt trail through a wash to the river.

Bunkerville East: Parcels A-G can be accessed from Riverside Road to E. Virgin Street, northeast to Canal Street, north on Cemetery Road for approximately 0.25 mile to a locked gate.

Alternative access: I-15 north to SR 170, northeast on Riverside Road to Second West Street, north to the end of the pavement and continue on the unimproved section line, east on an unimproved road to the flood channel right-of-way, and then north to the river (Figure 8).

Bunkerville West: Access via a dirt access road west of First South Street. Riverside: Take I-15 north to exit for SR 170 to River Cliff Road.

Mesquite: May be accessed via foot through the southwest end of Coyote Willows Golf Course.



Appendix B
Acquisition Selection Tool



Acquisition Selection Tool – Criteria and Questions

An acquisition selection tool was developed by the Desert Conservation Program (DCP) to guide decisions for acquiring title or easement to riparian properties from willing sellers and landowners. The tool is used to rank and prioritize properties based on specific environmental and administrative criteria, and the values derived by responding affirmatively or negatively to a series of questions that further define, describe, and explain each criterion. The criteria and questions are applied to each prospective property to arrive at a total value and then assigned a priority of 1, 2, or 3 based on what value range the property falls within. The criteria and questions and example value matrix are presented here.

Administrative Criteria

- Ease of Management
 - Are lands difficult to access due to legal issues, safety or other reasons?
 - Are lands difficult to access due to difficult terrain?
 - Are there known land use practices, such as grazing, occurring on adjacent lands that will negatively affect habitat or species?
 - Does the property need a fence to keep out cattle?
 - Are agreements needed for water with irrigation districts or others?
- Complexity of Land Acquisition Process
 - Are there existing structures?
 - Is an environmental assessment likely needed due to underground storage tanks or other reasons?
 - Will the desired property require further parceling?
 - Will an additional private survey need to be conducted?
 - Is the property held in limbo due to the cadastral survey?
- Potential for Degradation of Habitat if not Purchased for Conservation
 - Is habitat in identified flood scour zone?
 - Is the habitat reasonably protected from degradation from existing or potential future land practices?

Environmental Criteria

- Species Evaluation
 - Are SWFL currently present at the site?
 - Is there existing SWFL habitat on the site?
 - Is there SWFL occurrence data on desired land (occurrence data)?
 - Is there habitat or potential habitat on the property (NNHP SWFL)?
 - Is there habitat or potential habitat on the property (BOR SWFL) (wifl hab distr nad 83)?
 - Is there habitat or potential habitat on the property (NPS SWFL model)?



- Do other covered riparian birds occur at the site? If yes, complete species evaluation for each covered bird species.
- Proximity to Sensitive Lands
 - Does the desired property abut or is it adjacent to federal, state or conserved lands?
 - Does the desired property abut or is it adjacent to known or potential habitat for SWFL?
- Restoration Potential
 - Are plans in place or easily established for leveraging funds, projects to benefit habitat or species?
 - Does the desired property boundary border the Virgin or Muddy River?
 - Is there standing water at the site?
 - Is there access to water at the site via irrigation district or other means?
 - Does the desired property support native riparian trees or other native riparian wetland plants?
- Level of Disturbance
 - Are noxious weeds (such as tamarisk, tall whitetop) absent that would require treatment?
 - Is minimal restoration needed?
 - Is the desired property absent of infrastructure (such as roads, chemical tanks, out buildings, septic tanks, fences) that may require removal?



Environmental Criteria – Example Value Matrix

property number	A001	A002	A003	A004	A005	A006	
Species Evaluation (2 points for affirmative, 0 points for negative)							
	0	2	0	2	0	0	Are SWFL currently present at the site?
	0	2	0	2	0	0	Is there existing SWFL habitat on the
	0	0	0	2	0	0	Is there SWFL occurrence data on desired land (occurrence data)
	0	0	2	2	0	0	Habitat or potential habitat on the property (NNHP SWFL)
	2	2	2	2	0	0	Habitat or potential habitat on the property (BOR SWFL) (wiff hab distr nad 83)
	2	0	2	2	0	0	Habitat or potential habitat on the property (NPS SWFL model)
	0	0	0	0	0	0	Do other covered riparian birds occur at the site? If yes, complete species evaluation for each covered bird species.
total (14)	4	6	6	12	0	0	
Proximity to Sensitive Lands (1 point for affirmative, 0 for negative)							
	1	1	0	1	1	1	Does the desired property abut or is it adjacent to federal, state or conserved lands?
	1	1	1	1	0	0	Does the desired property abut or is it adjacent to known or potential habitat for S
total (2)	2	2	1	2	1	1	
Restoration Potential (1 point for affirmative, 0 for negative)							
	1	0	0	0	0	0	Are plans in place or easily established for leveraging funds, projects to benefit habitat or species?
	1	1	0	1	0	1	Does the desired property boundary border the Virgin or Muddy River?
	1	1	0	0	0	1	Is there standing water
	1	1	1	1	0	?	Is there access to water at the site via irrigation district
	1	1	1	1	0	0	Does the desired property support native riparian trees or other native riparian wetland plants?
total (5)	4	4	2	3	0	2	
Level of Disturbance (1 point for affirmative, 0 for negative)							
	0	1	1	1	?	0	Are noxious weeds absent that will require treatment, such as tamarisk, tall whitetop?
	0	1	0	0	0	0	Is minimal restoration needed?
	1	1	1	1	0	1	Is the desired property absent of infrastructure that may require removal, such as roads, chemical tanks, out buildings, septic tanks, fences?
total (3)	1	3	2	2	0	1	
total	11	15	11	19	1	4	

Environmental Criteria Ranking		
17-24	priority 1	yes 1
9-16	priority 2	no 0
0-8	priority 3	



Administrative Criteria – Example Value Matrix

property number	A001	A002	A003	A004	
Ease of Management no (1) yes (0)					
	no	no	no	no	
	1	1	1	1	Are lands difficult to access due to legal issues, safety or other reasons?
	1	1	1	1	Are lands difficult to access due to difficult terrain?
	1	1	0	0	Are there known land use practices, such as grazing, occurring on adjacent land that will negatively affect the habitat or species?
	1	1	1	1	Does the property need a fence to keep out cattle?
	0	0	0	0	Are agreements needed for water with irrigation districts or others?
total (5)	4	4	3	3	
Complexity of Land Acquisition Process no (1) yes (0)					
	no				
	1	1	1	1	Are there existing structures?
	1	1	1	1	Is an environmental assessment likely needed due to underground storage tanks or other reasons?
	1	1	1	0	Will the desired property require further parceling?
	?	?	?	0	Will an additional private survey need to be conducted?
	1	1	1	1	Is the property held in limbo due to the cadastral survey?
total (5)	4	4	4	3	
Potential for Degradation of Habitat if not Purchased for Conservation no (1) yes (0)					
	1	1	0	0	Is habitat in identified flood scour zone?
	0	0	1	1	Is the habitat reasonably protected from degradation from existing or potential future land practices?
total (2)	1	1	1	1	
grand total	9	9	8	7	

Administrative Criteria Ranking			
9-12	priority 1	no 1	desirable
5-8	priority 2	yes 0	undesirable
0-4	priority 3		



Appendix C
Native Plants in the Riparian Reserves during 2012 and 2013 Surveys



Riparian Reserves Management Plan

Common Name	Scientific Name	Muddy River Reserve	Virgin River Reserve
Catclaw	<i>Acacia greggii</i>	X	
Iodinebush	<i>Allenrolfea occidentalis</i>	X	
White bursage	<i>Ambrosia dumosa</i>	X	
Fiddleneck	<i>Amsinckia</i> sp.	X	
Yerba mansa	<i>Anemopsis californica</i>	X	X
Four-wing saltbush	<i>Atriplex canescens</i>	X	X
Wheelscale saltbush	<i>Atriplex elegans</i>	X	
Desert holly	<i>Atriplex hymenelytra</i>	X	
Quailbush	<i>Atriplex lentiformis</i>	X	X
Cattle saltbush	<i>Atriplex polycarpa</i>	X	
Mulefat	<i>Baccharis salicifolia</i>	X	X
Desert brickellbush	<i>Brickellia desertorum</i>	X	
Sedge	<i>Carex</i> sp.		X
Spiny herb	<i>Chorizanthe rigida</i>	X	
Rabbitbrush	<i>Chrysothamnus nauseosus</i>	X	
Horseweed	<i>Conyza canadensis</i>	X	
Saltgrass	<i>Distichlis spicata</i>	X	
Hedgehog cactus	<i>Echinocereus</i> sp.	X	
Mormon tea	<i>Ephedra californica</i>	X	
Skeleton weed	<i>Eriogonum deflexum</i>	X	
Desert trumpet	<i>Eriogonum inflatum</i>	X	
Barrel cactus	<i>Ferocactus cylindraceus</i>	X	
Singleleaf ash	<i>Fraxinus velutina</i>	X	
Snakeweed	<i>Gutierrezia</i> sp.	X	
Sunflower	<i>Helianthus</i> sp.	X	
Salt heliotrope	<i>Heliotropium curassavicum</i>	X	X
White ratany	<i>Krameria grayi</i>	X	
Rush	<i>Juncus</i> sp.		X
Prickly lettuce	<i>Lactuca serriola</i>	X	
Creosote bush	<i>Larrea tridentata</i>	X	X
Wolfberry	<i>Lycium andersonii</i>	X	X
Pale desert thorn	<i>Lycium pallidum</i>	X	
Mojave aster	<i>Machaeranthera tortifolia</i>	X	
Common mallow	<i>Malva neglecta</i>	X	
Four o'clock	<i>Mirabilis</i> sp.	X	
Beavertail cactus	<i>Opuntia basilaris</i>	X	
Common reed	<i>Phragmites australis</i>	X	
Desert plantain	<i>Plantago ovate</i>	X	
James' galleta	<i>Pleuraphis jamesii</i>	X	
Saltmarsh fleabane	<i>Pluchea odorata</i>		X
Arrowweed	<i>Pluchea sericea</i>	X	X
Honey mesquite	<i>Prosopis glandulosa</i>	X	X
Screwbean mesquite	<i>Prosopis pubescens</i>	X	X
Indigo bush	<i>Psoralea fremontii</i>	X	
Willow	<i>Salix</i> sp.	X	
Coyote willow	<i>Salix exigua</i>		X
Goodding's willow	<i>Salix gooddingii</i>		X
Desert globemallow	<i>Sphaeralcea ambigua</i>	X	
Copper globemallow	<i>Sphaeralcea angustifolia</i>	X	
Alkali sacaton grass	<i>Sporobolus airoides</i>	X	
Iodine weed	<i>Suaeda torreyana</i>	X	
Arrowweed	<i>Tessaria sericea</i>	X	
Fiveneedle pricklyleaf	<i>Thymophylla pentachaeta</i>	X	
Cattail	<i>Typha</i> sp.	X	X



Appendix D
Bird Species Observed during Bird Surveys in 2008, 2009, 2017, and 2018



Riparian Reserves Management Plan

Avian surveys were conducted at the Muddy River sites 2008 and 2009. Surveys conducted in 2017 and 2018 on included both the Muddy River and Virgin River (Note: if a property was not owned by DCP at the time of survey, it was not included in the survey).

Common Name	Scientific Name	Bunkerville	Mormon Mesa	Riverside	Muddy River
Abert's towhee	<i>Pipilo aberti</i>	X	X	X	X
American coot	<i>Fulica americana</i>				X
American kestrel	<i>Falco sparverius</i>	X			X
American robin	<i>Turdus migratorius</i>	X			X
Anna's hummingbird	<i>Calypte anna</i>	X			
Ash-throated flycatcher	<i>Myiarchus cinerascens</i>	X	X	X	X
Barn swallow	<i>Hirundo rustica</i>				X
Bell's vireo	<i>Vireo bellii arizonae</i>				X
Bewick's wren	<i>Thryomanes bewickii</i>		X		X
Black phoebe	<i>Sayornis nigricans</i>			X	X
Black-chinned hummingbird	<i>Archilochus alexandri</i>				X
Black-crowned night heron	<i>Nycticorax</i>	X			
Black-tailed gnatcatcher	<i>Polioptila melanura</i>	X	X	X	X
Black-throated gray warbler	<i>Setophaga nigrescens</i>	X			
Black-throated sparrow	<i>Amphispiza bilineata</i>			X	X
Blue-gray gnatcatcher	<i>Polioptila caerulea</i>				X
Blue-winged teal	<i>Anas discors</i>				X
Brewer's sparrow	<i>Spizella breweri</i>	X			X
Brown-crested flycatcher	<i>Myiarchus tyrannulus</i>		X		
Brown-headed cowbird	<i>Molothrus ater</i>	X	X	X	X
Bullock's oriole	<i>Icterus bullockii</i>	X			X
Bushtit	<i>Psaltiriparus minimus</i>	X			X
California gull	<i>Larus californicus</i>	X			
Cassin's vireo	<i>Vireo cassinii</i>				X
Cedar waxwing	<i>Bombycilla cedrorum</i>	X			X
Cliff swallow	<i>Petrochelidon pyrrhonota</i>	X		X	X
Common raven	<i>Corvus corax</i>	X		X	X
Common yellowthroat	<i>Geothlypis trichas</i>	X	X	X	X
Cooper's Hawk	<i>Accipiter cooperii</i>	X			
Double-crested cormorant	<i>Phalacrocorax auritus</i>	X			
Eurasian collaredove	<i>Streptopelia decaocto</i>	X		X	X
Gambel's quail	<i>Callipepla gambelii</i>	X		X	X
Great blue heron	<i>Ardea herodias</i>	X		X	X



Riparian Reserves Management Plan

Common Name	Scientific Name	Bunkerville	Mormon Mesa	Riverside	Muddy River
Greater roadrunner	<i>Geococcyx californianus</i>	X	X		X
Great-tailed grackle	<i>Quiscalus mexicanus</i>	X		X	X
Green Heron	<i>Butorides virescens</i>	X			
Hooded oriole	<i>Icterus cucullatus</i>				X
House finch	<i>Haemorhous mexicanus</i>	X		X	X
House sparrow	<i>Passer domesticus</i>	X			X
Indigo bunting	<i>Passerina cyanea</i>	X	X	X	X
Killdeer	<i>Charadrius vociferus</i>	X		X	
Ladder-backed woodpecker	<i>Dryobates scalaris</i>	X	X	X	X
Lark Sparrow	<i>Chondestes grammacus</i>			X	
Lazuli bunting	<i>Passerina amoena</i>	X			X
Lesser goldfinch	<i>Spinus psaltria</i>	X		X	X
Lesser nighthawk	<i>Chordeiles acutipennis</i>	X	X	X	X
Lucy's warbler	<i>Oreothlypis luciae</i>	X	X	X	X
Mallard	<i>Anas platyrhynchos</i>	X		X	X
Marsh wren	<i>Cistothorus palustris</i>				X
Mourning dove	<i>Zenaida macroura</i>	X	X	X	X
Northern mockingbird	<i>Mimus polyglottos</i>	X		X	X
Northern roughwinged swallow	<i>Stelgidopteryx serripennis</i>	X	X	X	X
Olive-sided flycatcher	<i>Contopus cooperi</i>				X
Orange-crowned warbler	<i>Vermivora celata</i>				X
Plumbeous vireo	<i>Vireo plumbeus</i>				X
Red-tailed hawk	<i>Buteo jamaicensis</i>				X
Red-winged blackbird	<i>Agelaius phoeniceus</i>	X		X	X
Ring-necked pheasant	<i>Phasianus colchicus</i>				X
Rock wren	<i>Salpinctes obsoletus</i>	X		X	X
Ruby-crowned kinglet	<i>Regulus calendula</i>				X
Say's phoebe	<i>Sayornis saya</i>	X		X	X
Snowy egret	<i>Egretta thula</i>	X			
Song sparrow	<i>Melospiza melodia</i>	X	X	X	X
Spotted sandpiper	<i>Actitis macularius</i>	X			X
Townsend's warbler	<i>Setophaga townsendi</i>	X			
Turkey vulture	<i>Cathartes aura</i>	X	X	X	X
Verdin	<i>Auriparus flaviceps</i>	X	X	X	X
Violet-green swallow	<i>Tachycineta thalassina</i>				X
Warbling vireo	<i>Vireo gilvus</i>	X			X



Riparian Reserves Management Plan

Common Name	Scientific Name	Bunkerville	Mormon Mesa	Riverside	Muddy River
Western kingbird	<i>Tyrannus verticalis</i>	X		X	X
Western meadowlark	<i>Sturnella neglecta</i>	X			X
Western scrub-jay	<i>Aphelocoma californica</i>				X
Western tanager	<i>Piranga ludoviciana</i>		X		X
Western wood-pewee	<i>Contopus sordidulus</i>	X			X
White-crowned sparrow	<i>Zonotrichia leucophrys</i>				X
White-winged dove	<i>Zenaida asiatica</i>		X		X
Willow flycatcher	<i>Empidonax traillii</i>		X		X
Wilson's warbler	<i>Cardellina pusilla</i>	X		X	X
Wood duck	<i>Aix sponsa</i>				X
Yellow warbler	<i>Setophaga petechia</i>	X	X		X
Yellow-breasted chat	<i>Icteria virens</i>	X	X	X	X
Yellow-headed blackbird	<i>Xanthocephalus</i>	X			X
Yellow-rumped warbler	<i>Setophaga coronata</i>	X			X



Appendix E
Permit Request Process





Requests for Third Party Activities on Reserve Units

While the primary purpose of the Desert Conservation Program (DCP) reserve system properties is to provide mitigation for loss of covered species and their habitat, there are a variety of other allowable activities in the reserve system. The types of allowable uses vary among the reserve system properties as do requirements for formal, written permission for certain activities. In general, activities on DCP reserve properties that disturb the soil outside of open roads and trails, remove rocks, vegetation, seeds or require handling or removal of animals (including insects or spiders) require written permission from the County.

Hunting: Hunting is allowed in the Boulder City Conservation Easement where allowable by state law and local ordinances. The DCP does not process hunting requests but defers to Nevada Department of Wildlife permits, rules, and regulations. Hunting is not an allowable activity in any other reserve property.

Request requirements

All requests must be made in writing or by email. Minimum request details include:

- Requestor name and contact info,
- Location of the activity,
- Date of the activity (range of dates is OK),
- Description and purpose of the activity,
- Description of any ground or species disturbance, and
- Description of collection of plant/animal/mineral or other materials.

Please complete and submit the attached form to DCP@ClarkCountyNV.gov but do not sign it. A signature will be requested from the applying party upon approval and will acknowledge any terms and conditions set forth by the DCP.

Notification

Approval or rejection of each request, along with any conditions on the request, will be provided to the requestor by email. Approval of a request will contain a signed copy of the following form and any terms and conditions set forth by the DCP. The actions requested are not completely approved until the requestor returns a copy of the form with their signature and date acknowledging acceptance of the Reserve Use Permission terms and conditions. Rejected applications will receive an email with a brief explanation as to why the application was rejected.



Request for Third Party Activities on the Reserve Units

Clark County Desert Conservation Program
4701 W Russell Rd, Suite 200
Las Vegas, NV 89118

dcp@ClarkCountyNV.gov
Phone (702)455-3536

Requestor's name, email, phone number(s) and mailing address:

Permission is sought for the undersigned to conduct the following activities. Requestor may also attach a summary or complete methods description.

Activities:

Dates Requested:

Name of Desert Conservation Program Reserve:

This permission is not valid until a countersigned and dated copy of this form is received from the Clark County Desert Conservation Program. The undersigned shall indemnify, defend and hold harmless Clark County, Nevada and its officers, agents, and employees against any and all damages, claims, or causes of action arising from or in connection with the activities described on this form. The undersigned is responsible for compliance with all federal, state, and local laws, rules, and regulations and any terms and conditions attached to this Reserve Use Permission. A copy of the final form, including terms and conditions, must be with the undersigned at all times while conducting these activities on the reserve property.

Requestor's Signature

Date

Department of Environment and Sustainability Director or Assistant Director Signature

Date

Appendix F
Contact Information for Management, Safety, and Services



Contacts
Property Management, Safety, and Services

Agency	Phone Number	Purpose
Desert Conservation Program	702-455-3536	Property Management
Clark County Fire Department	911	Fire – Emergency
		Medical – Emergency
Las Vegas Metropolitan Police Department	911	Law Enforcement – Emergency
	311	Law Enforcement – Non-emergency
Nevada Highway Patrol	911	Traffic – Emergency
	702-486-4100	Southern Command
	702-864-2323	Southern Command – Moapa Substation
Bureau of Land Management	702-631-2350	Wildland Fire – Emergency
	702-515-5300	Interagency Communications Center – Non-emergency
	702-293-8932	Law Enforcement – Emergency
	702-293-8998	Law Enforcement – Non-emergency
Moapa Valley Water District	702-397-6893	Municipal Water Connection
Overton Power District	702-397-2512	Electrical Service Connection
	888-409-6735	Electrical Service Connection – Emergency

