Programmatic Environmental Assessment
Cropland Management Plan for the Land Management District 3

Navajo Nation, Coconino County, Arizona
2023-2024

May 2024

Bureau of Indian Affairs Navajo Region
Western Navajo Agency
P.O. Box 127
Tuba City, Arizona 86045-0127

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LIST OF ACRONYMS

Acronym	Definition
ºC	degrees Celsius
ºF	degrees Fahrenheit
AFHF	Agricultural Food Hub Facility
AIARMA	American Indian Agriculture Resource Management Act
ALUP	Agricultural Land Use Permit
amsl	above mean sea level
ATC	Agricultural Technical Center
AUM	Abandoned uranium mine
BIA	Bureau of Indian Affairs
BMP	best management practice
BNR	Branch of Natural Resources
CEQ	Council on Environmental Quality
CFA	Community Farmer Association
CFR	Code of Federal Regulations
cfs	cubic feet per second
CLUP	Community Land Use Plan
CMP	Cropland Management Plan
EA	Environmental Assessment
EMI	Ecosystem Management, Incorporated
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FBFA	Former Bennett Freeze Area
FONSI	Finding of No Significant Impact
IRMP	Integrated Resource Management Plan
IWMP	Integrated Weed Management Plan
KVFA	Kerley Valley Farmers Association
lb/acre	pounds per acre
LCR	Little Colorado River
LMD-3	Land Management District 3
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NESL	Navajo Endangered Species List
NGO	non-governmental organization
NHPA	National Historic Preservation Act
NNDFW	Navajo Nation Department of Fish and Wildlife
NNDNR	Navajo Nation Division of Natural Resources
NNDWR	Navajo Nation Department of Water Resources

Acronym	Definition
NNEPA	Navajo Nation Environmental Protection Agency
NNHHPD	Navajo Nation Heritage and Historic Preservation Department
NNHP	Navajo Nation Heritage Program
NO_2	nitrogen dioxide
NRCS	Natural Resource Conservation Service
NRHP	Natural Register of Historic Properties
O_2	ozone
PEA	Programmatic Environmental Assessment
PL	Public Law
PM2.5	particulate matter
RCP	Biological Resource Land Use Clearance Policies and Procedures
SMU	Soil Mapping Unit
SO_2	sulfur dioxide
Sundance	Sundance Consultants, LLC
TCP	traditional cultural properties
USC	U.S. Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WHP	W.H. Pacific
WNA	Western Navajo Agency

Executive Summary

The Western Navajo Agency (WNA) of the Bureau of Indian Affairs (BIA), Branch of Natural Resources contracted Sundance Consultants, LLC (Sundance), to prepare a 10-year Cropland Management Plan (CMP; see Appendix A). The CMP will be a tool to improve agriculture resource management and monitoring in Land Management District 3 (LMD-3). This Programmatic Environmental Assessment (PEA) has been prepared to evaluate impacts of the CMP and meet the requirements of National Environmental Policy Act, a federal law with which BIA must comply). This CMP is authorized under the American Indian Agricultural Resource Management Act (AIARMA), the Former Bennet Freeze Area (FBFA) Integrated Resource Management Plan (IRMP), and Navajo Thaw planning. Implementation of the CMP would promote sharing between local producers who have valid Agricultural Land Use Permit (ALUP) or interested, producers, the Navajo Nation, and agency staff to build the human and natural capital essential to invigorate all levels of food production. This plan can be used by Navajo Nation ALUP holders and producers, and it may be adopted by other federal agencies. A Finding of No Significant Impact is anticipated for the project.

LMD-3 encompasses 1.425 million acres of usable crop or range land, of which approximately 1,030 acres are current croplands, in the WNA portion of the Navajo Nation (Figure 1). There are about 12,000 people in the four Chapter areas of LMD-3. These areas include Bodaway-Gap, Cameron, Coalmine Canyon, and Tuba City. All four chapters are in the Former Bennet Freeze Area (FBFA) of the Navajo Nation. At least 90% of farmlands have been abandoned in recent decades, with little groundcover or litter. Biocrusts are essentially non-existent. The conditions exacerbate soil erosion, evaporation, and destructive runoff; therefore, it takes more rain and irrigation water to ensure adequate soil moisture for germination and growth of plants.

The goal of the Preferred Alternative for this CMP is to turn the current LMD-3 farmland into an active state by expanding a patchwork of year-round green vegetation and increasing produce production through producers. This will be accomplished through progressive water management provided by the local Farmer Water System Associations, which will be guided by a new Western Navajo agricultural non-governmental organization (NGO). The IRMP is also authorized under the AIARMA, and now able to make substantial changes in policy, procedures for agriculture permitting and development, coordinating BIA and Navajo Nation rule of law with Fundamental Law and Traditional Knowledge. With improved management, current and newly farmed acreage can contribute to meeting the nutritional and employment needs of many residents. Three scales of crop production are facilitated by the CMP:

1) Water Association Irrigation Projects (serving up to 90% of the estimated 200 farms over one acre in size),
2) Individual and small group irrigation projects (serving approximately 10% of the estimated 200 farms over one acre in size); and
3) Home, school, and community gardening on homesite leases (less than 1-acre in size by law) and institutional properties including many community centers and schools.

Water availability is a key focus of this CMP. All scales of food, forage and fiber production depend on more development, effective transfer, and judicious conservation use of limited water resources to meet socio-cultural economic needs.

1 Introduction

This Programmatic Environmental Assessment (PEA) is being prepared to evaluate the effects of implementing the Cropland Management Plan (CMP) for Land Management District 3 (LMD-3) on the environment. LMD-3 is one of 23 districts formed by the Soil Conservation Service (now the Natural Resources Conservation Service [NRCS]) on the Navajo Nation in 1936. Several projects have been proposed to improve cropland management in LMD-3. An approved CMP and PEA is the next step to funding and implementing the proposed projects. Through public scoping, residents of LMD-3 have stated a desire to improve cropland conditions and productivity. The CMP contains information and recommendations to fulfill that desire.

The CMP is consistent with the Former Bennet Freeze Area (FBFA) Integrated Resource Management Plan (IRMP) (Navajo Nation Division of Natural Resources [NNDNRC]/BIA 2022), and will be in harmony with the **Vision of the Navajo Nation** to create a "holistic relationship between the mother earth, father sun, and the community through sustainable land stewardship practices to ensure a Diné livelihood for future generations" (placeholder for citation; possibly Food and Agricultural Organization of the United Nations 2021;). Implementation will also be in harmony with the **Fundamental Laws of the Diné** that guide the Navajo people in fulfilling the Diné Life Way (Navajo Nation Council). Specifically, the CMP will 1) help grow a thriving Navajo Nation farming community (Section D2); 2) ensure all creation has the freedom to exist (Section C5); and 3) fulfill the sacred obligation and duty to respect, preserve, and protect all that was provided to the Navajo people (Section D5), especially the beauty of the natural world for future generations (Section G5).

The CMP further supports the following missions of the Bureau of Indian Affairs (BIA) Navajo Region and the BIA Western Navajo Nation (WNA)-Branch of Natural Resources (BNR):

Navajo Region: Enhance the quality of life, facilitate economic opportunity, and protect and improve the trust assets of the Navajo Nation and individual Indians.

WNA-BNR: Maintain overall productivity and achieve the highest return from grazing, farming, water, and wildlife resources through sustained yield management.

1.1 Background

Farming has been an integral part of the Navajo way of life for over 400 years; small fields of corn in areas occupied by Navajos were observed by Spaniards as early as 1583 (Bailey and Bailey, 1986; Redsteer, 2014). As part of the Navajo Treaty of 1868, single males and families were offered up to 80 and 160 acres, respectively, to farm after they returned from exile to their newly designated reservation (Smithsonian Institute, 2019). U.S. government agents provided seeds for those who accepted the offer. Corn (particularly blue corn) was most popular, but beans, watermelon, muskmelon, squash, pumpkin, and wheat were also sown (Bailey and Bailey, 1986). Farming was on a small scale in dryland or flood plains; snowpack during the preceding winter governed the amount of land cultivated (Bryan, 1929). Seeds mostly were sown using a digging stick, a form of cultivation that encouraged deeper growth of roots and thereby improved survival in the arid environment (Bryan, 1929; Bailey and Bailey, 1986).

Historical records from the mid-1800s through the mid-1900s record growing conflicts between Navajo and Hopi farmers, which was exacerbated by Anglo settlers, particularly in the Tuba City area, who came there to use the waters and springs along Moenkopi Wash. Though Anglo

settler-farmers were bought out by the federal government and removed by 1903, tensions continued between Navajo and Hopi land use claims. In 1966 the Bennett Freeze was legislated by Congress, stopping development in the disputed areas and contributing to poor living conditions for the many residents who continued to stay in the area. LMD-3 constitutes 90% of the 1.6 million-acre FBFA. The freeze was lifted in 2006 after 40 years, but little development has occurred since, due to lack of funding by residents, and lack of appropriate regulations and plans in place for government to develop needed water and infrastructure. A complete history of these events and references are listed in the FBFA IRMP (NNDNRC/BIA 2022).

1.2 Purpose and Need for Action

The purpose of this PEA is to decide whether the LMD-3 CMP will be implemented or not. The purpose of the LMD-3 CMP is to fulfill a key requirement of the American Indian Agriculture Resources Management Act (PL 103-177; AIARMA), which is to create a 10-year cropland management plan. All currently permitted agricultural farmlands on the Navajo Nation are held in trust by the BIA, which in turn leases parcels to tribal members through the Land Use Permit program for 10 to 25 years, the latter time span being for parcels in which the permittee has made financial investments (Raymond and Falk, 2018). Permitting and management are subject to the regulations of AIARMA. Projects that benefit farming cannot be approved and are not eligible for federal funding without a management and monitoring plan and an accompanying environmental analysis that identifies benefits and impacts of proposed actions on the natural environment and local communities. Four projects have been proposed for LMD-3: 1) Tuba City/Moenkopi Irrigation Project; 2) Moenave Spring-fed Irrigation Project; 3) Van Zee Spring Irrigation Project; and 4) irrigated pastures along the Little Colorado River (LCR)

1.2.1 Need

The Navajo people need economic opportunity. The 77% of irrigable acres not being farmed represents $14 million in lost revenue (Raymond and Falk 2018). In addition, median income of the Navajo Nation ($27,389) is 47% less than that of Arizona ($51,677) and 55% less than that of the United States ($61,372) (Ecosystem Management Incorporated [EMI], 2016; https://www.census.gov/, accessed January 26, 2019). Additionally, 38% of Navajos live below the poverty level, 2.5 times higher than residents of Arizona (15%) and three times higher than citizens of the U.S. (12.3%) (EMI, 2016; https://www.census.gov/, accessed January 26, 2019).

The Navajo people also need a path to better health. Problems of wellness largely stem from chronic obesity[1], which was uncommon among Navajos until the latter part of the twentieth century. Indeed, VanDuzen et al. (1976) found 65% of Navajo children they examined to be undernourished (deficient in calories and protein (Merck, 2021); and below average in height (25th percentile) and weight (35th percentile). Increasing the percentage of total acres farmed and the productivity of existing farms will provide a source of healthy nourishing food and contribute to improving the health of the Tribal community members.

[1] In this report, the term "Chronic Obesity" refers to those who are both overweight and obese. Overweight = Body Mass Index (BMI) greater than 24 kg/m^2 (Cole et al., 2000) or greater than 85% of the US population (White et al., 1997); Obese = BMI greater than 30 kg/m2 (Cole et al., 2000) or greater than 95% of the US population (White et al., 1997).

1.3 Existing Conditions

Farming across much of the Navajo Nation has declined during the past 50 years; for example, only 36% of irrigable land was in production in 1985 and only 23% of irrigable acres along the San Juan River in New Mexico currently are in production and most cultivated parcels are 10 acres or less (Raymond and Falk, 2018). In Land Management District 3 in the western Navajo Nation, 218 parcels, ranging in size from 0.25 to 85 acres and totaling 1,030 acres are available for farming but, during a field survey in summer 2018, most appeared abandoned or fallow. Contributing factors in the decline of farming across the Navajo Nation include inheritance disputes, lack of equipment, water disputes within and among communities, inadequate irrigation systems, and difficulties in marketing crops. Consequently, these issues have discouraged Navajo youth from trying to farm (Raymond and Falk, 2018).

1.4 Goals and Objectives of the Cropland Management Plan

The goal of the CMP is to develop a strategy for creating a sustainable agriculture system through the production of nutritious and healthy food along with stimulating economic growth from marketing and sales of produce in excess of home consumption.

CMP objectives include:

1. Delineating agricultural zones for irrigated and dryland farmlands;
2. Increasing participation of the local people in farmland and commercial-scale irrigated farming, and home gardening;
3. Determining available agriculture resources for improving, conserving and protecting farmlands;
4. Providing for the management of farmlands to achieve AIARMA's six key objectives, including providing holistic management objectives; and
5. Defining critical agricultural values of Tribal members, defining holistic management objectives.

1.5 Area of Analysis

LMD-3 encompasses 1,420,374 acres along the western Navajo Nation in Coconino County, Arizona; 96% is undeveloped (Figure 1). Roads include U.S. Highways 89 (73 miles), 89A (11 miles), and 160 (26 miles); Arizona State Highways 264 (18 miles) and 64 (19 miles); and 1,536 miles of mostly unpaved secondary roads. Communities include Cameron and Tuba City. Four Chapters are included within LMD-3:

- Coalmine Canyon (403,666 acres, 691 residents, 303 houses),
- To´Nanees´Dizi (Tuba City) (234,174 acres, 9,265 residents, 1,287 houses),
- Bodaway-Gap (559,767 acres, 1,704 residents, 504 houses), and
- Cameron (222,567 acres, 1,122 residents, 399 houses) (EMI], 2016).

LMD-3 has been subdivided by the BIA into four smaller units (3-1, 3-2, 3-3, and 3-4), and each unit is subdivided into compartments to facilitate grazing management (Figure 1). Compartments are designated with two digits (unit number and compartment number) separated by a dash, (e.g., 3-1 = Unit 3 – Compartment 1).

LMD-3 is within the Colorado Plateau Major Land Resource Area, a region that is a geological product of uplift, volcanism, and erosion. The landscape of LMD-3 is characterized by sandstone uplift and rolling ridge lines and swales shaped over time by wind and water erosion. Gravels and cobbles of sandstone, shales, and limited quantities of siliceous materials are dispersed within the general region. Long-term average rainfall for LMD-3 is 6.0 inches. Average annual precipitation can vary widely across LMD-3, between 5 and 17 inches per year (Figure 3). Summer rain accounts for approximately 40% of the annual precipitation and generally occurs as short, high intensity thunderstorms. Winter precipitation occurs mostly as snowfall. Drought is prevalent in the region and likely to increase due to changes in precipitation and heat patterns associated with climate change.

High temperatures in Tuba City average 34 degrees Celsius (°C) (93 degrees Fahrenheit [°F]) in July and August and low temperatures average around −6°C (21°F) in December and January.

Figure 1. Land Management District 3

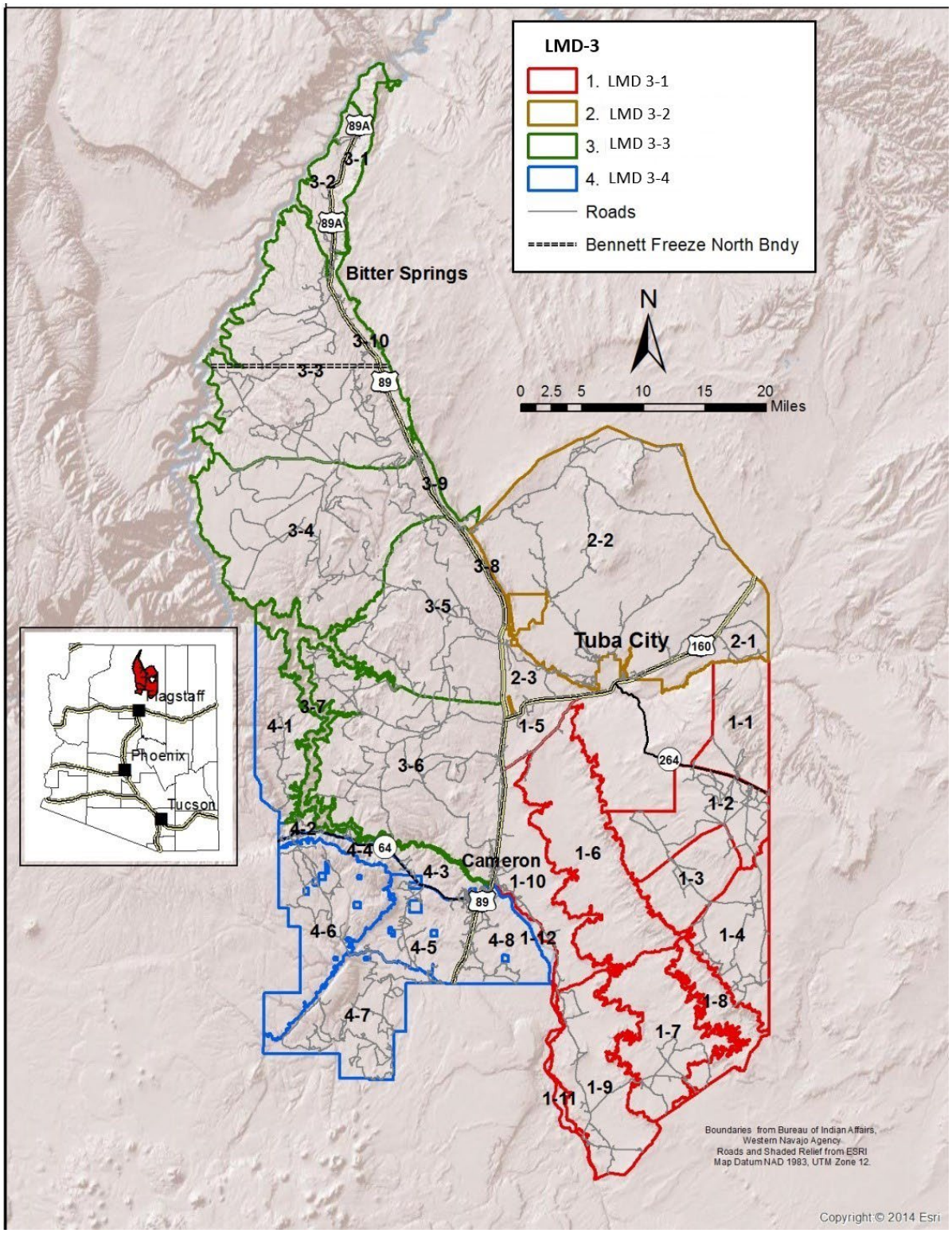


Figure 2. Elevations in LMD-3

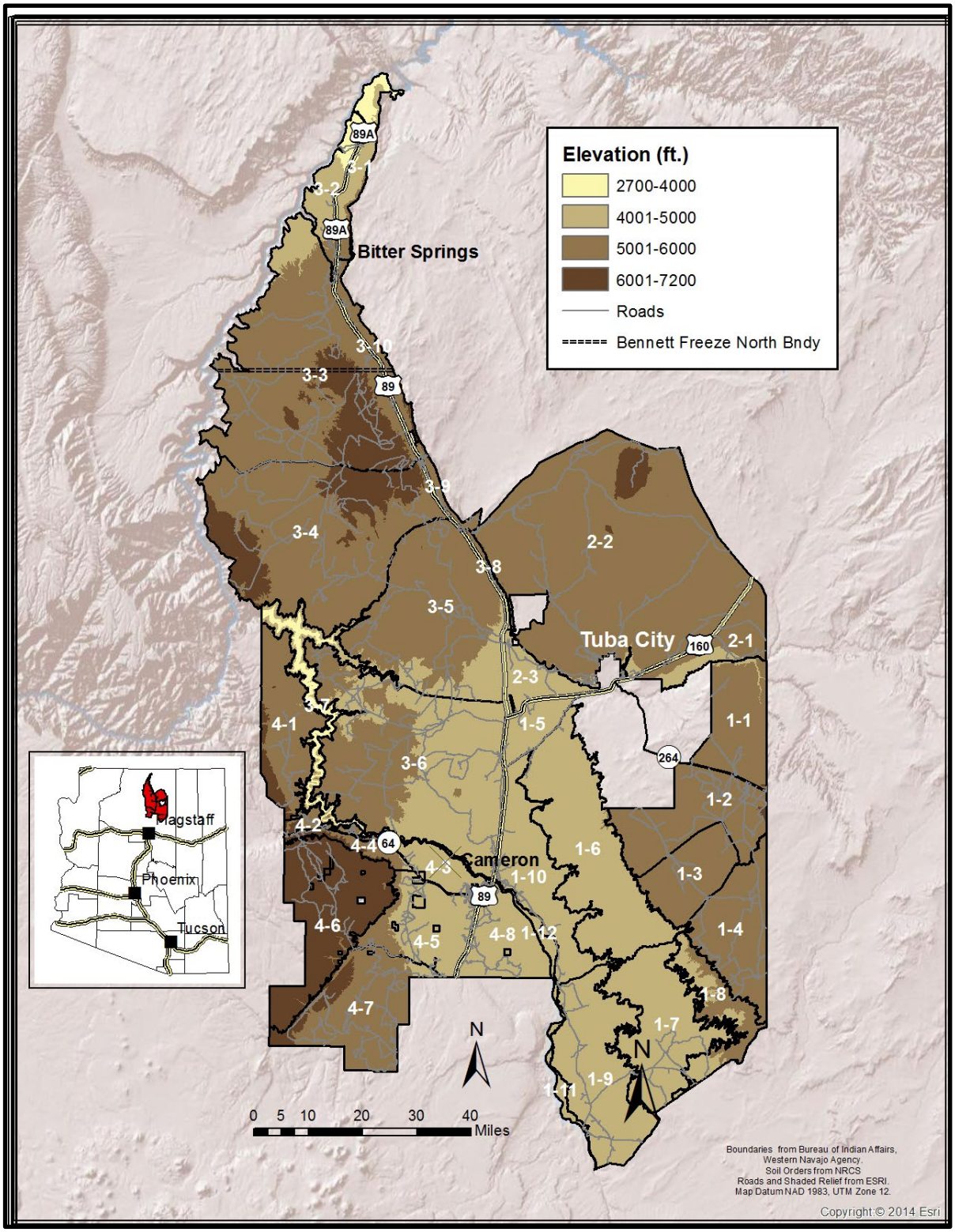
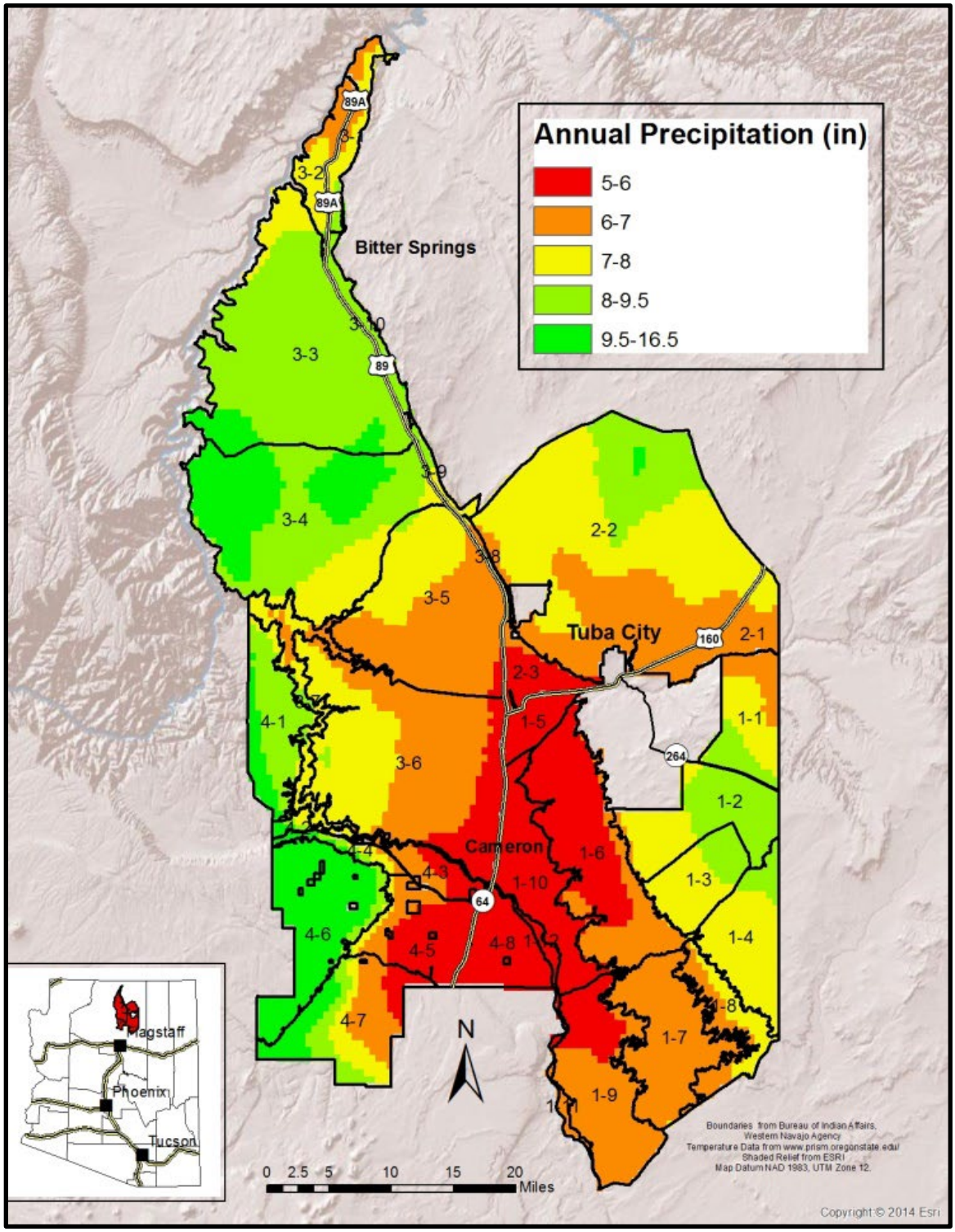


Figure 3. Annual precipitation for LMD-3



1.6 Applicable Federal and Tribal Laws

This PEA was prepared to thoroughly examine the potential environmental impacts of the proposed action and alternative actions to support informed decision-making. This PEA is consistent with the purpose and goals of the National Environmental Policy Act of 1969 (NEPA), 42 U.S. Code (USC) § 4321 et seq.; the requirements of the Council on Environmental Quality's (CEQ) implementing NEPA regulations at 40 Code of Federal Regulations (CFR) Parts 1500-1508 (promulgated September 14, 2020); longstanding federal judicial and regulatory interpretations; the Department of the Interior's NEPA regulations (43 CFR Part 46); the Indian Affairs NEPA Guidebook, 59 IAM 3-H (BIA August 2012); and Administration priorities and polices including Secretary's Order No. 3399 requiring bureaus and offices to use "the same application or level of NEPA that would have been applied to a proposed action before the 2020 Rule went into effect."

Authority to prepare and implement the CMP lies with two BIA regulations (25 CFR 166 Subpart D – Land and Operations Management, 25 CFR 171 – Irrigation Service, and the AIARMA (Public Law).

Regulation 25 CFR 166 Subpart D requires Indian agricultural land to be directly managed through contracts, compacts, cooperative agreements, or grants by Tribes, individual Indian landowners, and the BIA.

Regulation 25 CFR 171 provides direction specific to Indian trust lands on the Navajo Nation. This includes arrangements of incentive agreements to farm idle lands.

AIARMA was implemented to promote conservation and sustained yield of agricultural lands held in trust by the BIA. Tribes (or Secretary of Interior in their stead) must create a 10-year CMP that identifies available agricultural resources, and through public input, specifies management goals and objectives as well as actions to obtain objectives. This PEA analyzes the 10-year CMP for LMD-3.

Returning the land to green production by implementing the CMP also would fulfill the goal of the Indian Self-Determination and Education Assistance Act of 1975, giving the Navajo people the opportunity to oversee their own welfare.

Lastly, the CMP, prepared and implemented with federal funds, must comply with three other federal laws: NEPA, the Endangered Species Act (ESA), and the National Historic Preservation Act (NHPA). NEPA requires investigation of impacts on all potentially affected natural and cultural resources. NEPA compliance is fulfilled by this PEA. Section 7 of the ESA requires investigation of impacts on all potentially affected species that are listed as threatened or endangered. Also addressed in this document are impacts to species of concern identified by the Navajo Nation Department of Fish and Wildlife (NNDFW). Section 106 of NHPA requires a review of the impact on all historic and archeological sites within the project area.

1.7 Relevant Environmental Analyses and Planning Documents

This CMP/PEA will contribute to fulfilling the goal and objectives of the FBFA Recovery Plan (2008a) and Integrated Resource Management Plan (NNDNR/BIA, 2022), the Navajo Nation Integrated Weed Management Plan (BIA, 2022), Rangeland Management Plan for the Land Management District 3, and Community Land Use Plans (CLUPs) for the Bodaway-Gap, Cameron, Coalmine Canyon, and Tuba City (To´Nanees´Dizi, WHP) Chapters. Specifically, it

will contribute to the FBFA IRMP goal of helping restore harmony and a sustainable environment among all living things, and objectives such as providing education and training for jobs that contribute to self-sustaining and independent communities, building respect and honor for traditional values, and protecting natural and cultural resources.

1.8 Scoping and Key Issues

Scoping is an early and open process to obtain input from affected residents and interested members of the public concerning Proposed and Alternative Actions and environmental issues that might occur because of these actions. BIA-WNA conducted both internal scoping with staff and external scoping with the public and interested and affected groups and agencies. Potential issues, alternatives, resource impacts, and cumulative effects were identified.

Public scoping for this project consisted of a series of community meetings held in April 2019 attended by 121 attendees (Table 1). Residents of LMD-3 and other interested parties were invited to four public scoping meetings during the spring of 2019 to learn about and provide comments concerning the proposed CMP/PEA. Meetings were held at four Chapter houses: Hogan Family Restaurant (April 3, 2019), Coalmine Canyon (April 4, 2019), Cameron Chapter House (April 5, 2019), and Bodaway-Gap Chapter House (April 6, 2019). Meetings provided public disclosure of the proposed action and discussed the critical elements of the National Environmental Policy Act (NEPA) Environmental Assessment (EA) process. The scoping meetings included a presentation of the CMP planning process, the goal of the scoping process, background information on historical farming on the Navajo Nation; existing conditions; and CMP goals, needs, and best management practices (BMPs).

CMP scoping meetings noted:

- Agricultural Land Use Permits (ALUPs) need to be re-issued,
- Upgrades are needed to the irrigation canal systems,
- A soil sedimentation system assessment and control plan need to be completed,
- Four projects have been proposed for LMD 3:
    1. Tuba City/Moenkopi Irrigation Project,
    2. Moenave Spring-fed Irrigation Project,
    3. Van Zee Spring Irrigation Project (South Moenave), and
    4. Irrigated pastures along the LCR upstream from Cameron, section 7.2.2 gives a more detailed description of key irrigation systems.

BIA's scoping meeting data, and general surveys of residents (80+% who live in urbanized settings on LMD 3 in Tuba City and Cameron), show that many of the approximately 12,000 residents of LMD 3 would like to include locally grown foods in their lives through home-scale gardening. Based on this response, during interagency consultations in 2019, all participating agencies agreed this CMP needs to define and advance the vision of a strong agricultural community that includes home gardens and school and community gardens, as well as the larger farm plots requiring ALUPs.

Table 1. LMD 3 2019 CMP Scoping Meetings

LOCATION	DATE	TIME
Hogan Family Restaurant	April 3, 2019, Wednesday	4:00 PM – 8:00 PM
Coalmine Canyon Chapter House	April 4, 2019, Thursday	9:00 AM – 4:00 PM
Cameron Chapter House	April 5, 2019, Friday	9:00 AM – 4:00 PM
Bodaway-Gap Chapter House	April 6, 2019, Saturday	9:00 AM – 1:00 PM

Issues and concerns raised by this process are summarized in a Public Scoping Report. One-hundred twenty-one individuals provided 153 comments. Topics, number (n) of comments, and specific concerns include the following.

- Abandoned Uranium Mines (AUM) (n=6) – concerns related to uranium contamination
- Climate (n=1) – climate change, no rain, drought, etc.
- Culture (n=11) – to include historical farming, cultural importance of farming
- Development (n=21) – economic developments such as road improvements, range improvements, etc.
- Education (n=8) – educating farmers, incorporating curriculum in schools, etc.
- Enforcement (n=26) - permit compliance, oversight, management, etc.
- Equipment (n=6) – need for tractors, plows, and other farming equipment
- Organic (n=8) – access to healthy food options through local farming
- Other (n=26) – comment not tied to a specific category
- Soils (n=4) – comments related to soil testing and improvement
- Water (n=21) – to include water development, lack of water, earthen dams, windmills, etc.
- Youth (n=15) – involvement of youth

Because of the 3-year delay, new Navajo Nation vision and direction in the IRMP, and input received from planners and leaders, and many local farmers, the BIA decided to conduct meetings and consult with local stakeholders. The meetings were to provide updates, explain the CMP goals, and gather data instead of holding additional public scoping meetings. Table 2 includes significant meetings in 2022. The results of these discussions are described throughout this plan.

Table 2. LMD 3 CMP 2022 Meetings with Planners and Leaders, Stakeholders, and Farmers

LOCATION	DATE	MEETING HOST
Tuba City Chapter House	February 16, 2022	Kerley Valley Farmers Association (KVFA) training with Tolani Lake Enterprises. Eighteen people attended, including all three Farm Board Members. BIA and Sundance presented.
Tuba City Chapter House	March 17, 2022	KVFA training with Tolani Lake Enterprises. Twelve people attended, including one Farm Board Member. Sundance presented.
Coalmine Canyon Chapter zoom meeting	April 5, 2022	Land use planning meeting with 23 leaders, including Navajo Power, Navajo Thaw, Farm Board. Sundance presented.
Tuba City Chapter House	April 16, 2022	KVFA training with Tolani Lake Enterprises. Twenty people attended. BIA and Sundance presented.
Kerley Valley farms next to Tuba City, AZ	May 25, 2022	KVFA kickoff meeting with 36 people, including non-governmental organizations (NGOs) and County Supervisor. BIA and Sundance presented.
Coalmine Canyon Chapter House	August 8, 2022	Coalmine Canyon Chapter Planners meeting with six planners. Sundance presented.
Kerley Valley farms next to Tuba City, AZ	August 11, 2022	KVFA soil health day with NRCS. Forty people attended, including one Farm Board member. BIA and Sundance presented
Cameron, AZ and three LCR farms	August 30, 2022	Choice Humanitarian tour of farms and greenhouses on a 30-mile stretch of the LCR, 9 farmers involved.
Moenave, AZ	September 30, 2022	Interviews with farmers Wayland Riggs and Arlin Begay before tour of Moenave, Van Zee, Little Field, and Mesa Springs areas.
Moenave, AZ	October 6, 2022	Interview with Lawrence Kaibetoney, Farmer and Melanie Hildebrandt, Northern Arizona University Professor.

1.9 Decision Framework

The Regional Director of the BIA Navajo Region is responsible for final approval of the CMP/PEA (IA-NEPA, 2012). After considering the findings of the PEA and comments raised during the public scoping process and on site-specific analysis conducted in consultation with

resource specialists, the BIA will follow guidance contained in the Indian Affairs NEPA Guidebook (59 IAM 3-H) to make decisions regarding the Proposed Action. NEPA and BIA decision making is addressed in Section 2 of 59 IAM 3-H.

2 Proposed Action and Alternatives

The Interdisciplinary Team (see Section 8) considered two alternatives in detail. The No Action and Proposed Action alternatives. No additional alternatives were considered.

2.1 No Action Alternative

No CMP would be implemented for LMD-3.

2.2 Proposed Action – Implement Cropland Management Plan

This is the Preferred Alternative, which "causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources" (40 CFR 1505.2[b]).

The action would be to create and implement a CMP for LMD-3 that would include developing a plan to have optimal farming based on capability of the land, water, and interest; implementing BMPs to improve and maintain farm productivity; and bringing cropland management into compliance with the current federal and Navajo Nation laws, regulations, policies, and agreements.

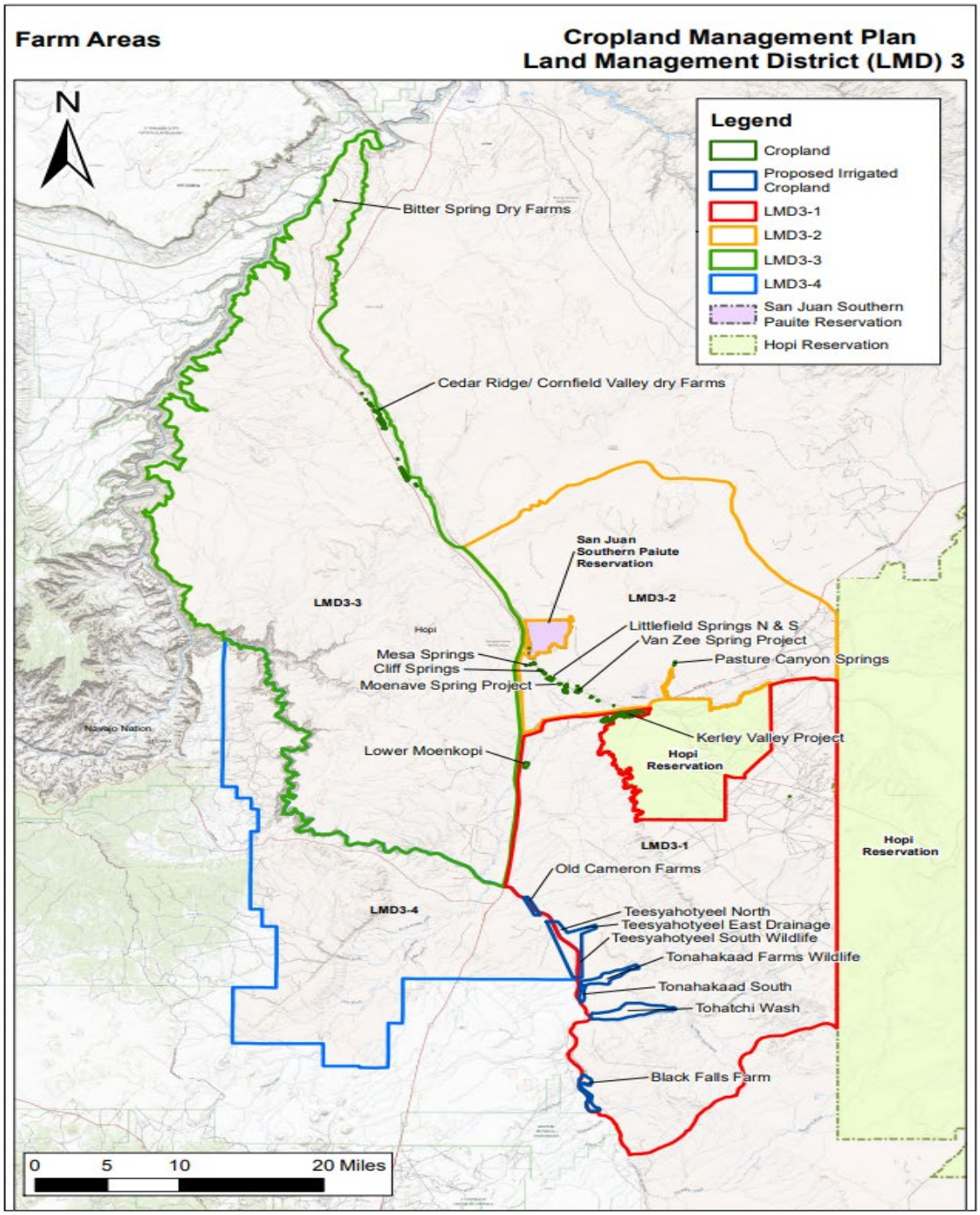
Action steps would include the following:

- BIA and Navajo Nation managers to coordinate establishment of a local LMD-3 Agricultural Technical Center (ATC) for the common purpose of reissuing Agriculture Land Use Permits (ALUP), making farmland improvements, and approving potential new farmlands (in general meeting AIARMA Objectives). This ATC will employ full-time certified and experienced extension experts authorized and directed to assist farmer and rancher associations in the district. ATC staff will direct studies and engineering to provide adequate clean water to farmlands, as well as organize Community Farmer Associations (CFAs), provide farmer training and equipment use, and assist with irrigation and produce marketing needs.
- The ATC will establish localized watershed CFAs, which will be issued ALUP to work with the farmers typically living on historical alluvial fan farm areas, for perpetual self-governing associations with bylaws and farm plans to oversee all aspects of keeping farmlands in production. The ATC staff will begin by doing an extensive farmland inventory to map lands and waters to sort out water rights for each of the several historical irrigation systems. The ATC will then conduct multiple meetings on sites with local residents to determine able farmers to perform work. The goal is to have 90% of LMD-3 farmers as members of CFAs.
- The ATC will work with home gardeners, schools, and other institutions in doing small-scale indoor, hoophouse, and outdoor gardening.
- The ATC will include the establishment of an Agricultural Food Hub Facility (AFHF) with staff qualified to optimize value-added income by helping farmers and home gardeners to market produce, do canning, and use special branding to improve sales income.

Table 3. Breakdown of Cropland by Acreage

Project area name	# of Farmers	Acreage	Type of Farm
Moenkopi/Tuba (Kerley Valley) includes Pasture Canyon	57	455.70	Irrigated
Lower Moenkopi	10	47.50	Dry
Van Zee (Moenave S.)	29	49.40	Irrigated
Moenave (Moenave N.)	13	53.52	Irrigated
Tissi Ei (Cliff Spring)	5	6.75	Irrigated
Little Field (includes Mesa Spr)	16	55.03	Irrigated
Cedar Ridge	41	284.00	Dry
Willow Springs	8	48.90	Irrigated
TOTALS	179	1,000.80	128/ 623.20 Irr 51/ 377.60 Dry
Estimated Abandoned Acres (90%)			901 acres
Estimated Currently Farmed Acres (10%)			100 acres

Figure 4. LMD-3 Cropland and Springs



3 Affected Environment and Environmental Impacts

This section describes the environment that would be affected by implementing the alternatives described in section 2, as well as the potential impacts expected to result from implementing those alternatives. The affected environment addressed in this PEA focuses on resources that have the potential to be affected by actions recommended in the CMP. The purpose of the CMP is to utilize, maintain, preserve and protect the highest productive potential of the land; increase production and expand diversity of agricultural products for subsistence, income, and employment through developing agricultural resources; manage agricultural resources consistent with IRMP to protect soil, water, wildlife, recreation and cultural resources; enable Indian farmers and gardeners to maximize potential benefits by providing technical assistance, training and education in conservation practices, management, and economics of agribusiness, credit, and marketing of agricultural products; and develop agricultural lands associated value-added industries to promote self-sustaining communities. The actions recommended in the CMP are intended to have beneficial effects for natural resources with no significant impacts anticipated from the project.

Table 4. Resources Eliminated from Impacts Analysis

Resource	Rationale for Not Discussing in Further Detail for this Programmatic Environmental Assessment
Topography	Implementing the Proposed Action does not propose major earth moving activities. Effects to topography or unique topographical features would be evaluated when a project-action is proposed, and design features or other mitigation measures would be implemented to limit or avoid potential impacts.
Geology	Implementing the Proposed Action does not propose major earth moving activities. Effects to geology would be evaluated when a project- action is proposed, and design features or other mitigation measures would be implemented to limit or avoid potential impacts.
Minerals	Implementing the Proposed Action does not propose major earth moving activities, nor would it prevent any access to mineral resources. Impacts to mineral features would be evaluated when a project- action is proposed, such as fence building or creation of a water source, and design features or other mitigation measures would be implemented to limit or avoid potential impacts.
Timber Harvesting	Woodlands are forestlands not included within the timberland classification. Thereare no commercial forestlands in LMD-3. The Proposed Action would not affect timber harvesting.
Mineral Extraction	Commercial amounts of copper, coal, and uranium occur in LMD-3 (WHP, 2008a-e), but none currently are being mined. Uranium was mined from 1951 to 1963 (McLemore and Chenoweth, 1989) and there are now approximately 74 AUMs in LMD-3 (24 in southern Unit 3-4). Seven locations pose health risks; the highest radiation readings have been detected near U.S. Highway 89 between the junction of U.S. Highways 89/160 and Hidden Springs. Implementing the Proposed Action does not propose major earth moving activities, nor would it recommend any activities in or nearby AUM sites. Effects to mineral resources would be evaluated when a projectaction is proposed, and design features or other mitigation measures would be implemented to limit or avoid potential impacts to, or from, mineral resources.

Resource	Rationale for Not Discussing in Further Detail for this Programmatic Environmental Assessment
Recreation	The LCR Tribal Park and Marble Canyon Tribal Park are in LMD-3. These parks would continue to be managed by the Navajo Nation Parks and Recreation Department. There are plans to develop these parks further; however, the Proposed Action does not include any actions that would affect either park. The Proposed Action would not impact recreation.
Transportation Use Network	While the CMP would recommend more fencing as part of the management actions to control livestock, which could include animal crossing guards and gates at some intersections, these are not anticipated to impact the use or access of transportation networks in LMD-3.
Wilderness	There are no Wilderness areas in LMD-3. Implementing the Proposed Action would have no effect on Wilderness areas.
Noise	The addition of structures such as fences and water sources to manage croplands at the scale proposed in the CMP will contribute very little to noise in LMD-3. No effects are expected.
Visual Resources	The addition of structures such as fences and water sources to manage grazing at the scale proposed in the CMP will do little to change visual resources. No effects are expected.
Public Health and Safety	Implementing the Proposed Action would not impact public health and safety. While recommendations within this CMP are supportive of the BIA goals and objectives for noxious weed management, which includes potentially using chemical treatment, no specific actions are authorized in this CMP. These actions would be addressed in the Navajo Nation Integrated Weed Management Plan, which is currently in process. No other actions are recommended in the CMP that would impact public health and safety.
Indian Trust Assets	Indian Trust Assets, or resources, are defined as legal interests in assets held in trust by the U.S. Government for Native American Indian Tribes or individual Tribal members. Examples of Indian Trust Assets are lands, minerals, water rights, other natural resources, money, or claims. Indian Trust Asset Reform Act (Public Law [PL] 114-78). Under the Act, the federal government has a unique responsibility to Indian Tribes, including a duty to promote Tribal self-determination regarding governmental authority and economic development. Implementing the Proposed Action would have no impacts on IndianTrust assets.
Hazardous Materials	Implementing the Proposed Action would not involve the use of hazardous chemicals (see Public Health and Safety above). Hazardous materials would continue to be managed pursuant tofederal and Tribal regulations.

3.1 Soils

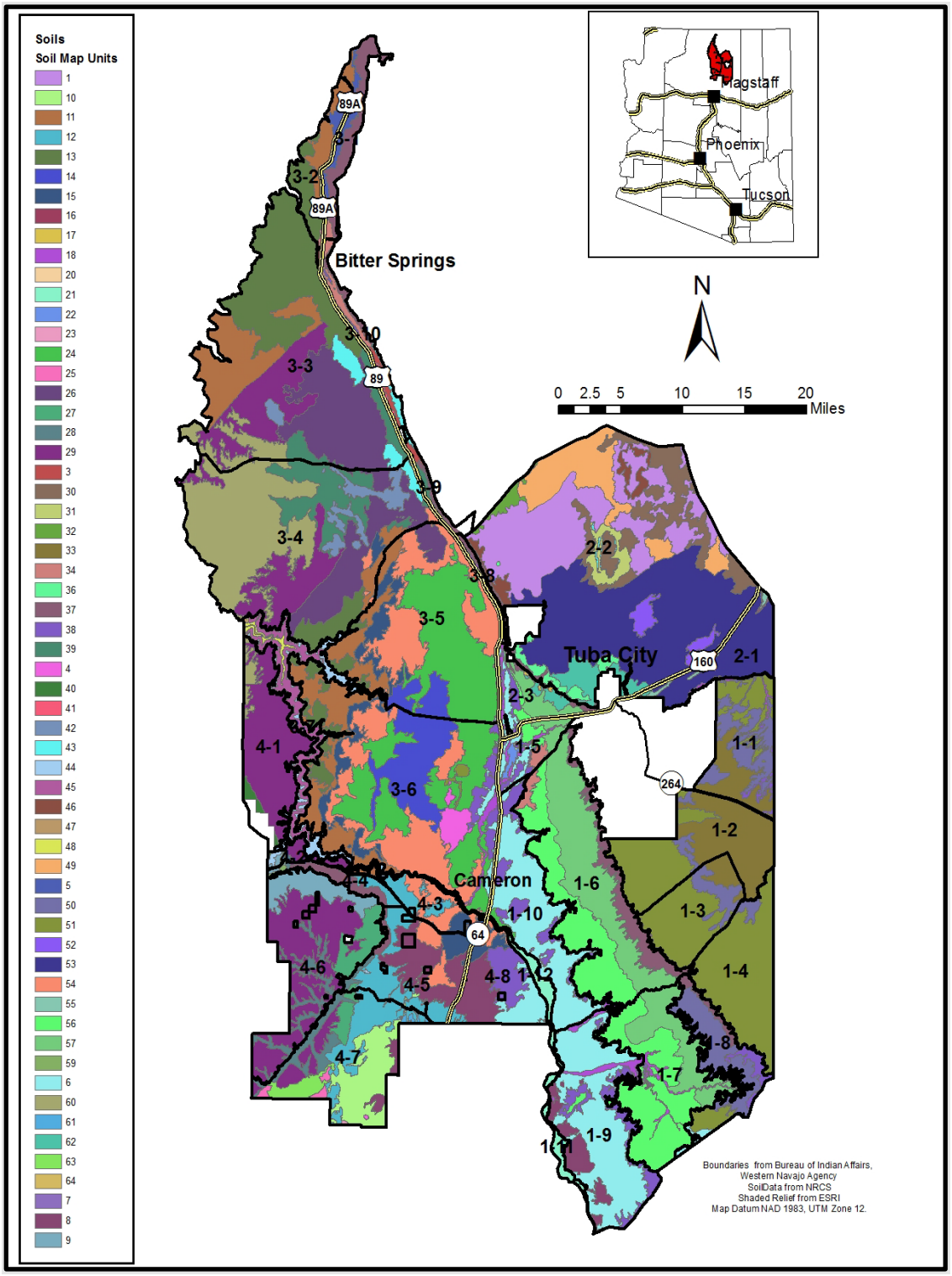
3.1.1 Affected Environment

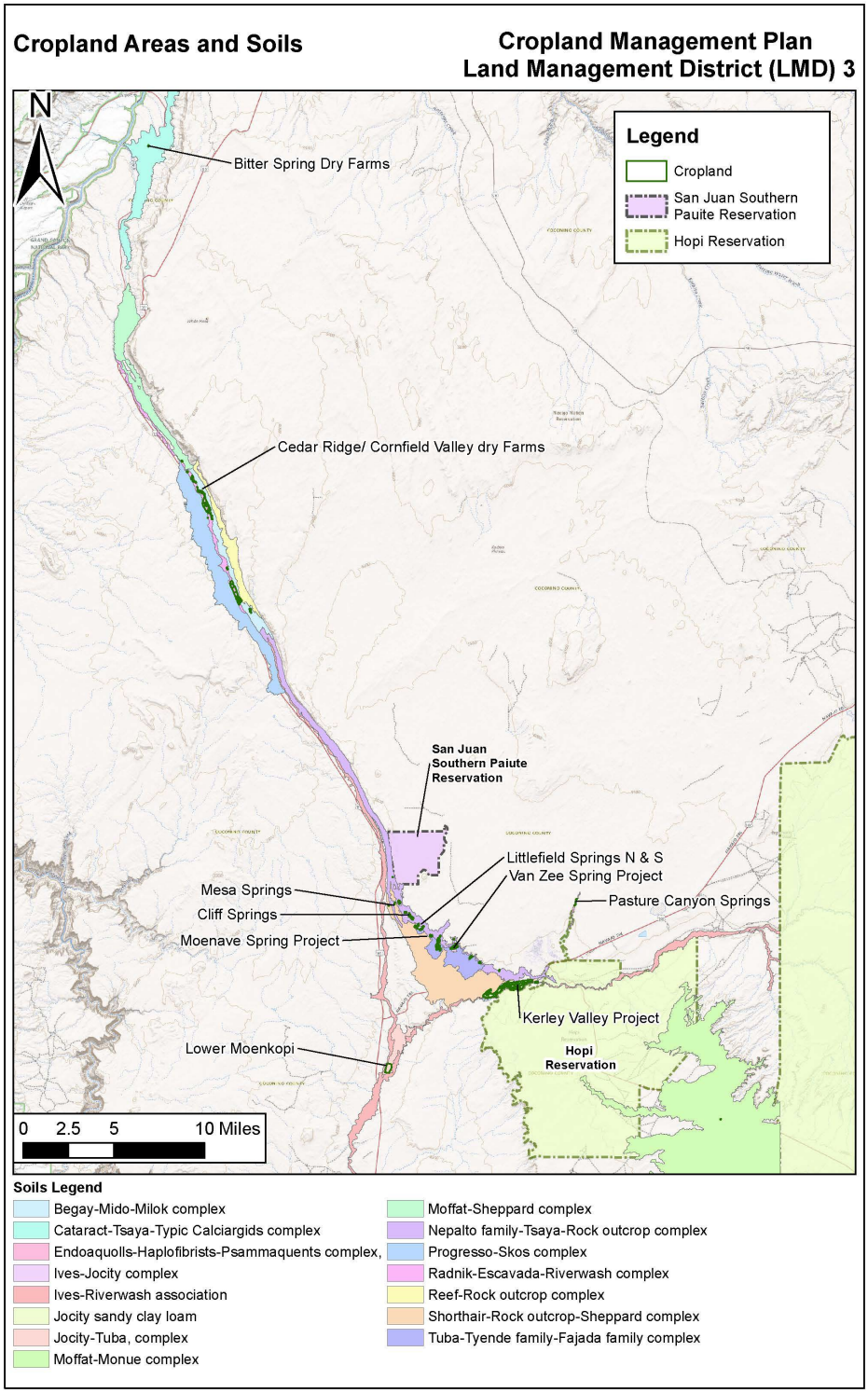
Soil management in LMD-3 utilizes the U.S. Department of Agriculture (USDA)/NRCS Soil Surveys and Ecological Site Descriptions as resources to guide decision making. Soils in LMD-3 have formed from several different types of parent material (including shale, sandstone, and limestone) and from alluvial, residual, and eolian sources. Sixty types of soil (known as soil map units [SMU]) occur in LMD3, but ten encompass half of the District (USDA, 2018; Figure 4). Soils contain low amounts of organic matter and do not support abundant vegetation. Two-thirds

are comprised mostly of sand and one-third have high infiltration/low runoff potential because of their high sand/gravel composition (Appendix C). Conversely, one-third of them have very low infiltration rates because they are shallow and underlain by rock.

Rangeland overutilization by both authorized and unauthorized livestock, wildlife, and Navajo free-ranging horses can diminish vegetation cover, exposing soils to erosive forces. Drought and climate change may also contribute to soil erosion and loss as vegetation cover and water availability are diminished.

Figure 5. Soil Map Units in LMD-3




Cropland Areas and Soils
Cropland Management Plan
Land Management District (LMD) 3
N
Legend
Cropland
San Juan Southern Pauite Reservation
Hopi Reservation
Bitter Spring Dry Farms
Cedar Ridge/ Cornfield Valley dry Farms
San Juan Southern Paiute Reservation
Littlefield Springs N & S
Van Zee Spring Project
Pasture Canyon Springs
Mesa Springs
Cliff Springs
Moenave Spring Project
Kerley Valley Project
Hopi Reservation
Lower Moenkopi
0 2.5 5 10 Miles
Soils Legend
Begay-Mido-Milok complex
Cataract-Tsaya-Typic Calciargids complex
Endoaquolls-Haplofibrists-Psammaquents complex,
Ives-Jocity complex
Ives-Riverwash association
Jocity sandy clay loam
Jocity-Tuba, complex
Moffat-Monue complex
Moffat-Sheppard complex
Nepalto family-Tsaya-Rock outcrop complex
Progresso-Skos complex
Radnik-Escavada-Riverwash complex
Reef-Rock outcrop complex
Shorthair-Rock outcrop-Sheppard complex
Tuba-Tyende family-Fajada family complex

3.1.2 Environmental Impacts to Soils

3.1.2.1 No Action

Impacts of the No Action alternative would be adverse, direct and cumulative, local, long term, and minor. Establishment of the CMP management actions, including BMPs that would beneficially affect soil stability and reduce runoff and erosion, would not be implemented. Therefore, soils and the entire cropland ecosystem would continue to degrade. Desired future conditions, including those described in the FBFA IRMP, would not be achieved. Some degree of soil degradation will likely continue from drought, wind and water soil erosion, however the magnitude of degradation is difficult to assess as it depends on a variety of unknown factors such as droughts, the implementation or lack of implementation of a rangeland management plan, and whether the transition from native to invasive plant species continues or has reached some homeostatic balance (see plant resources for further review) (Mullin et al., 2000).

3.1.2.2 Proposed Action

The Proposed Action would implement integrated cropland, soil, water, and vegetation management actions to meet the goal of reducing the impacts from erosion. These actions are intended to improve soil quality, retain plant and animal/microbial life above and below the soil surface, and rehabilitate soil damaged by overutilization. Actions recommended by the Proposed Action would preserve and restore habitats, which would beneficially affect soil stability and reduce runoff and erosion (Patten, 1998; Zaimes, 2007). The Proposed Action would implement management actions to identify reaches along streams, rivers, and washes that need bank stabilization and other erosion mitigation. These restoration projects would result in long-term beneficial effects on soils in LMD-3. As the total proposed and currently farmed acres in the LMD-3 is low consisting of approximately 1,030 acres or only 0.073% of the 1,420,3741 acres of the LMD-3, the magnitude and intensity of the positive effects of the CMP will significantly depend on the total amount of bank stabilization and restoration efforts completed.

Impacts of the Proposed Action alternative would be beneficial, direct and cumulative, local, long term, and minor-moderate (depending on the intensity of the restoration efforts). The hot, arid climate of LMD-3 means vegetation will always be relatively sparse with a low density of roots and a low amount of litter to provide nutrients to soil and to hold it in place. The loss of soils through erosion makes it increasingly difficult to support vigorous stands of native vegetation. However, some reversal of the downward trend in soil quality at the local level will occur by removing invasive vegetation in farmed areas, planting and irrigating crops which will establish areas of greater plant density than unfarmed areas with more established root systems. These areas of higher density ground cover will stabilize local soils, increasing nutrients and water retention, with fertility and stability increasing over time (Patten, 1998; Zames, 2007). The CMP will provide the information needed to properly manage croplands and, in turn, improve vegetation and stabilize soils. **No adverse effects on soils are expected from implementing the Proposed Action.**

3.2 Water Resources

3.2.1 Affected Environment

All water resources on the Navajo Nation are subject to the Navajo Nation Water Code and are managed by the Navajo Nation Department of Water Resources (NNDWR). The Navajo Nation has enacted the Navajo Nation Clean Water Act and Water Quality Standards. Watersheds within LMD-3 include the Lower Colorado-Marble Canyon, Moenkopi Wash, and Lower Little Colorado. Surface water resources consist of perennial streams, intermittent streams and drainages, vernal pools, ephemeral streams, springs, and wetlands. The major surface water features within LMD-3 are the Colorado River and the LCR. Utilizing these resources is complicated by many factors, including legal and environmental issues, flow variability, and water quality.

Groundwater is more plentiful in LMD-3 than surface water and has served as the primary source of drinking water supply for many years. Two aquifers underlay LMD-3. The Navajo Sandstone aquifer (N-aquifer), the most productive in northeastern Arizona (Brown and Caldwell, 2016), is found east of US Highway 89 from the northern end of LMD-3 to the intersection with US Highway 160, and east of the base of the north-south escarpment that bisects LMD-3 Unit 3-1. It possesses water of unusually high quality, naturally exceeding U.S. Environmental Protection Agency (EPA) drinking water standards (Brown and Caldwell, 2016). The Coconino Sandstone aquifer (C-aquifer), encompassing Units 3-3, 3-4, and the western third of 3-1, consists of highly mineralized water found deep in beds of sandstone between impermeable layers of siltstone and mudstone (Brown and Caldwell, 2016). Groundwater depths in LMD-3 vary from $\leq$ 200 feet near Tuba City (within the N-aquifer) to 1,500 feet near Cameron (within the C-aquifer), although wells in Unit 3-4 near the LCR are relatively shallow (Ecosphere, 2017).

LMD-3 contains 354 current or former water sources; many that could potentially be used by farms; 111 (31%) are natural (springs and seeps) and 243 are manmade (earthen dams and wells [windmills]) (Ecosphere, 2017; Table 1). Of these, 66% of natural and 88% of manmade sources are in good or fair condition. About 20% of former natural sources no longer exist. The LCR below Blue Spring (the lower 13 miles of the LCR until its confluence with the Colorado river) is the only perennial stream located in LMD-3 (Redsteer et al., 2014), with the upstream portions being ephemeral. However, this perennial section of the LCR is approximately 45 river miles below the most downstream of the proposed farms in the CMP (USFWS 2023). Half of all water sources in LMD-3 are in Unit 3-4, but almost all are earthen dams because extensive drilling has failed to yield sufficient groundwater for windmills (R. Hardy, NNDWR, personal communication, March 5, 2018).

Irrigated croplands occur in Moenkopi Wash (an ephemeral stream) and near small springs (USFWS 2023). Of the 1,030 acres of formerly irrigated farmlands, 62% have potential access to water. However, as Moenkopi water is unreliable and heavily silt-laden, only 214 acres (21%) have access to perennial spring water.

Water quality (lead and copper, microbial contaminants, nitrates, and radiological contaminants) of residential sources is tested periodically by the Navajo Tribal Utility Authority (N. Tariq, NNDWR, personal communication, 5 March 2018). Sources for Tuba City, Coalmine Canyon, and Bodaway-Gap communities currently meet quality standards for all tests. Sources for the

Cameron community meet all standards except for arsenic and polychlorinated biphenyls (a drinking water disinfectant byproduct), which were 1.5 and 4 times the maximum acceptable levels, respectively (Consumer Confidence Survey, Navajo Tribal Utility Authority, 2016). There are water quality issues associated with AUMs in the Bodaway-Gap, Cameron, Coalmine Canyon, and Tuba City Chapters. During 2018, water sources in LMD-3 used by livestock were tested for contaminants. Preliminary results indicate uranium exceeds safe levels in some, but not most, sources (J. Ingram et al., 2019).

Table 5. Water Sources in the Four Units of LMD-3 [1,2]

Type and Condition	3-1	3-2	3-3	3-4	Total Water Sources
Natural					
Good	24	17	5	2	48
Fair	11	9	4	1	25
Poor	7		1		8
N/A		14	6	9	29
Manmade					
Good	7	9	95	25	136
Fair	4	6	54	14	78
Marginal		1	8	1	10
Poor	11	5	3	1	20
Totals	64	61	176	53	354[2]

[1] Data are from Ecosphere (2017). Natural sources are springs and seeps. Manmade sources are stock ponds, windmills, and tanks.
Condition:
Good = normal maintenance sufficient
Fair = minor repairs required
Marginal = significant repairs required
N/A = natural source no longer exists or was not examined
Poor = major renewal or total replacement required
[2]Most of these sources are distant from cropland

3.2.2 Environmental Impacts to Water Resources

3.2.2.1 No Action

Impacts of the No Action alternative would be adverse, direct, widespread, long term, and moderate-minor. The riparian areas of the LMD-3 are currently significantly degraded by past and current cattle overgrazing, drought, and other erosive factors. Overgrazing by cattle and free-ranging horses reduces the vegetative cover in riparian areas and the recruitment of juvenile cottonwood trees into adulthood (Auble et al., 1998; and Casey Francisco BIA staff personal communication). These factors have combined to produce perennial streams with greater than historical bank erosion collapsing banks and decreased riparian cover increase the sediment load in streams, reducing the amount of instream habitat by burying deeper holes, woody debris and other cover, and reducing overall water quality (Krzeminksa et al., 2019). In the no action alternative, abandoned cropland would not be planted, so continued degradation of riparian vegetation would likely occur contributing to increasingly aggressive runoff during storms that would discourage percolation into the root zone and recharge of aquifers and encourage increased deposition of sediment into streams and earthen ponds.

3.2.2.2 Proposed Action

Impacts of the Proposed Action alternative to surface waters would be beneficial, direct and cumulative, widespread, long term, and moderate-minor. Long-term beneficial impacts on water

quality would result from stabilized soils and reduced sedimentation from erosion, and increased plant ground cover. It is important to water resources in the LMD-3 that riparian zone vegetation and trees are not disturbed or removed during the addition of new farms. The greatest positive effect of the CMP will be achieved if adjacent riparian areas are reseeded with native cottonwoods and other native plants and protected from grazing. This will allow for increased bank stabilization and the filtration of rainwater entering stream systems (Zaimes, 2007). Therefore, the intensity of the proposed action is contingent on the amount of riparian zone restoration work conducted.

Impacts to subsurface water would be indirect, minor to moderate, local, long term, and both beneficial and adverse. Slowing runoff would allow water to percolate into the root zone of soils and replenish aquifers. Conversely, increasing the number and distribution of water sources may reduce groundwater at some sources, such as springs along U.S. Highway 89 from which pipelines could transport water to tanks in Bodaway-Gap where groundwater is lacking. Due to this possible decrease in the water table beneath farmed areas, subsurface water monitoring is recommended.

3.3 Air Quality

3.3.1 Affected Environment

The Navajo Nation Environmental Protection Agency (NNEPA) has the authority to regulate sources of air pollution in the Navajo Nation through its Navajo Air Quality Control Program. The EPA regulates criteria pollutants using the National Ambient Air Quality Standards (NAAQS), which establish ambient levels for each criteria pollutant using health and welfare-based criteria. The NAAQS are regulated to protect human health and the environment. Air quality is managed under the regulations of the Navajo Nation Air Pollution Prevention and Control Act of 2004 (Navajo Nation Council, 2004).

The Navajo Nation monitors four criteria air pollutants: particulate matter (PM2.5), ozone (O_3), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2). LMD-3 is within a Class II air shed, which allows emissions of particulate matter and sulfur dioxide up to the maximum concentrations of pollutants over baseline values. Over the past 10 years, air quality in Coconino County, where LMD-3 is found, has been rated as good an average of 251 days/year, and bad for only 7 days/year. Diminished vegetation cover and an increasingly arid environment have resulted in an increase in the extent of dust and sand susceptible to becoming airborne. Additionally, regionally significant sand and dust storms are becoming commonplace during the spring. Thus, high, possibly unhealthy, levels of airborne particulates are likely during windy conditions.

3.3.2 Environmental Impacts to Air Quality

3.3.2.1 No Action

Impacts of the No Action alternative would be adverse, indirect, local, long term, and minor. Vegetative cover would continue to degrade thereby exposing increasing amounts of bare soil. In turn, dust, which can contribute to asthma and other respiratory maladies, would continue to be prevalent on windy days.

3.3.2.2 Proposed Action

Impacts of the Proposed Action alternative on air quality would be beneficial, indirect, local, long term, and minor. Though increased tilling of soil may increase dust from fields, increasing vegetative cover through irrigation and cover crops would reduce airborne particulates from bare soil at the local level, thus decreasing the negative health effects associated with increasing dust storms.

3.4 Vegetation

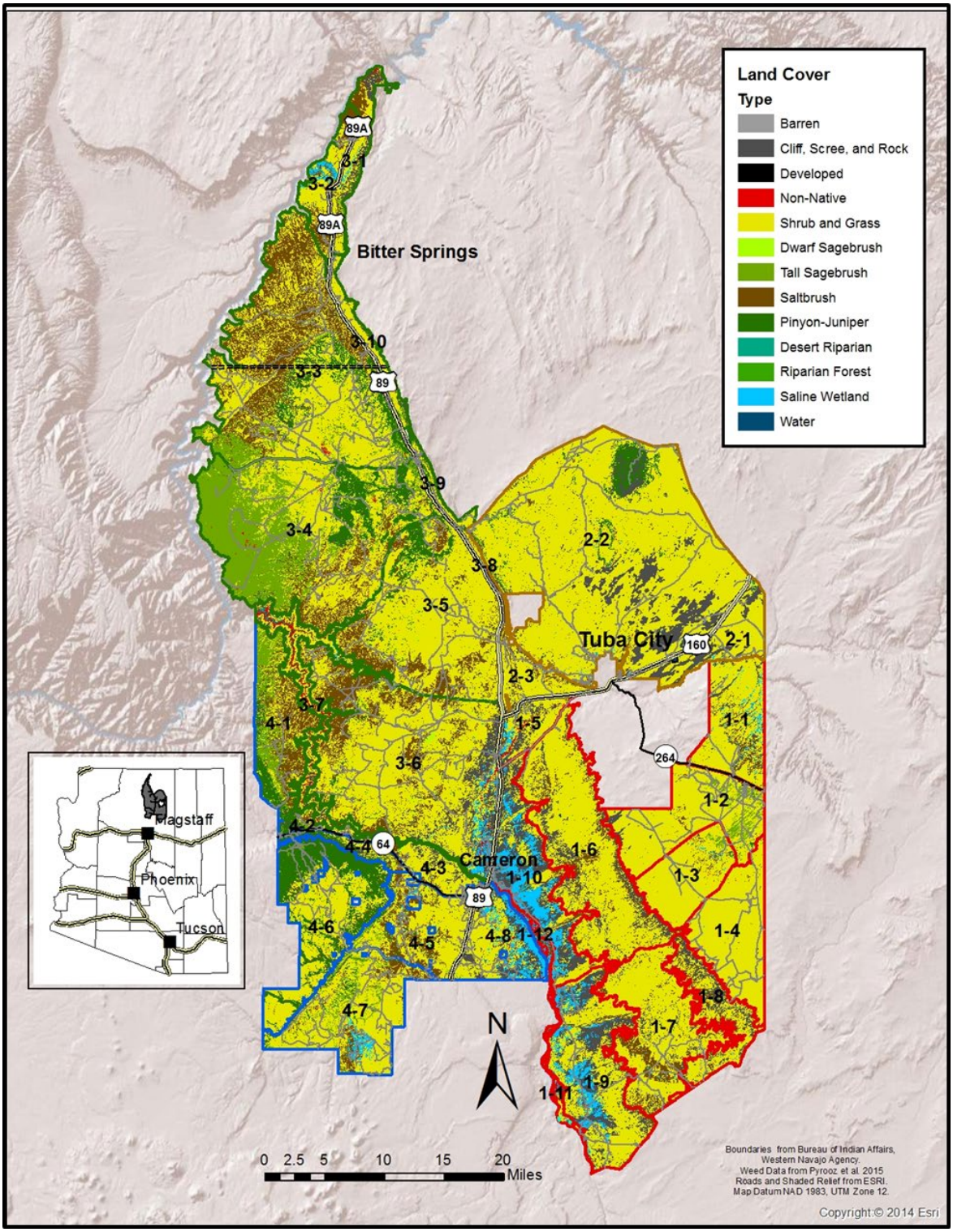
3.4.1 Affected Environment

3.4.1.1 Native Vegetation Communities

Land cover types for LMD-3, mapped from satellite images, are comprised of 13 landcover types (Utah State University, 2017) (Figure 6; Appendix E). The shrub and grass type covers 65% of the district; saltbush, cliff/scree/rock, and tall sagebrush cover 12, 9, and 6%, respectively. Native riparian species are mapped, although much of the riparian habitat in LMD-3 is dominated by non-native salt cedar (*Tamarisk ramosissima*) and Russian olive (*Elaeagnus angustifolia*). Vegetation mapped for LMD-3 are divided into the following categories:

- **Sparsely vegetated** communities include developed areas and four landcover types dominated by rock or sand (barren, cliff, scree, rock) and interspersed with small pockets of soil that support scattered grasses (Indian ricegrass [*Achnatherum hymenoides*], needle and thread grass [*Hesperostipa comata*], and sand dropseed [*Sporobolus cryptandrus*]), and shrubs (Mormon tea [*Ephedra viridis*], four-wing saltbush [*Atriplex canescens*], and cliffrose [*Purshia stansburiana*]).
- **Woodlands** are comprised of two landcover types. Scattered juniper is characterized by sparse (<20% cover) one-seed juniper (*Juniperus monosperma*) or Utah juniper (*Juniperus osteosperma*) with bare ground or scattered shrubs and grasses in the understory. Pinyon-juniper woodlands grow above 6,500 feet and are characterized by a mixture of pinyon pine (*Pinus edulis*) and juniper in the understory with a low to moderate density of grass and shrub.
- **Shrublands** have greater than 50% vegetative cover of shrubs and are comprised of three landcover types: big sagebrush (*Artemisia tridentata* or *Artemisia filifolia*), dwarf sagebrush (*Artemisia nova*), and saltbush (*Atriplex canescens* or *Atriplex confertifolia*). Other common shrubs in these three types include winterfat (*Krascheninnikovia lanata*), blackbrush (*Coleogyne ramossissima*), and greasewood (*Sarcobatus vermiculatus*).
- **Shrub and Grass Mix** is similar to Shrublands, but shrubs are more scattered, and grasses comprise more than 50% of vegetative cover. Major shrub species include those listed under Shrublands. Grasses include blue grama (*Bouteloua gracilis*), black grama (*Bouteloua eriopoda*), James' galleta (*Pleuraphis jamesii*), dropseed (*Sporobolus spp*.), and needle and thread grass (*Hesperostipa comata*).
- **Aquatic and Riparian** communities include the Desert Riparian, Saline Wetland, and Open Water landcover types. Native species include willow (*Salix goodingii*, *Salix bebbiana*, *Salix lasiolepis*, *Salix exigua*,), Baccharis (*Baccharis thesioides*), encelia (*Encelia frutescens*), tarbush (*Flourensia cernua*), and saltgrass (*Distichlis stricta*).

Figure 6. Land cover within LMD-3



3.4.1.2 Non-Native Vegetation and Noxious Weeds

Due to the low 6-inch average rainfall of the mostly sandy farmland soils of LMD-3, farmlands remain bare for decades after being used or abandoned. Some non-native vegetation and noxious weeds have established sporadically on some farm areas. The Navajo Nation is experiencing rapid encroachment of non-native and noxious weeds that can degrade the native environment and croplands that Navajo people rely on (Pyrooz, 2016a, 2016b). Non-native plants are spread by three main causes: (1) wind, (2) vehicles and farm equipment, and (3) animals. When equipment is transported from one location to another, it increases the possibility of spreading non-native and noxious weeds if precautions are not taken.

Some non-native species are highly competitive, and eventually dominate vegetation communities. These species provide less quality wildlife habitat and compete with crops for space and nutrients. In addition to reducing populations of desirable native species, invasive species are a major concern for land managers because they can alter soil temperature, soil salinity, water availability, nutrient cycles and availability, native seed germination, water infiltration, and precipitation runoff (De Waal et al., 1994) (Mullin et al., 2000). Once established, removing invasive species can be difficult and often costly.

Non-native vegetation species, especially salt cedar (tamarisk) and Russian olive, are found throughout LMD-3 riparian and wetland habitats, particularly in Compartment 3-6 and Compartment 1-5 (Fig. 7). Non-native species also occur in relatively arid areas of LMD-3.

Common non-native plant species in the LMD-3 include Russian thistle (Salsola kali), Russian knapweed (*Acroptilon repens*), halogeton (*Halogeton glomeratus*), camelthorn (*Alhagi camelorum*), cheatgrass (*Bromus tectorum*), red brome (*Bromus rubens*), puncture vine (*Tribulus terrestris*), and diffuse knapweed (*Centaurea diffusa*) (Pyrooz, 2016a, 2016b). Non-natives in mesic and riparian environments include salt cedar (*Tamarix ramosissima*), Russian olive (*Elaeagnus angustifolia*), and Siberian elm (*Ulmus pumila*). Noxious weeds were documented along road rights-of-ways and riparian corridors (including the LCR) of LMD-3 in 2016 (Pyrooz, 2016a, 2016b). Acres of occurrence and acres infested were 40,235 (31,165 along LCR) and 20,070 (16,930 along LCR), respectively. The most common species were Russian thistle (656 infestations, 10,628 acres of occurrence, and 4,204 acres infested), salt cedar (341 infestations, 11,611 acres of occurrence, and 6,331 acres infested), camelthorn (463 infestations, 10,423 acres of occurrence, and 6,051 acres infested), and Russian knapweed (152 infestations, 5,453 acres of occurrence, and 2,623 acres infested).

In addition, vegetation in the area is characterized by impacts to riparian areas due to overgrazing by cattle and free-ranging horses, which particularly reduces the recruitment of juvenile cottonwood trees into adulthood (Auble et al., 1998; Casey Francisco personal communication).

3.4.2 Environmental Impacts to Vegetation

3.4.2.1 No Action

Impacts of the No Action alternative would be adverse, direct, local, long term, and minor. Likely some continued encroachment of non-native plants will continue in the LMD-3 without intervention. It is difficult to extrapolate past current conditions to predict whether and which species of invasive plants will continue to encroach on native plant assemblages without intervention. However, nationally and in the arid southwestern U.S., the general trend has been

for increasing encroachment by invasive plants species especially tamarisk and Russian thistle (Mullin et al., 2000; Jarnevich and Reynolds, 2010). There are no current factors in the LMD-3 that would cause an expected deviation from this pattern.

3.4.2.2 Proposed Action

Impacts of the Proposed Action alternative will be beneficial, direct and cumulative, local, long-term, and minor. Improving ground cover in farmland will increase percolation of rainfall into the root zone and aquifer. The decrease in erosion and increase in vegetation will result in greater organic matter to create more productive soils with greater water retention which would have a small local benefit to native plants that may exist on the fringes of cropped areas (Mullin et al., 200). Furthermore, some local benefit may be derived by removing invasive plants to clear areas for crop planting, thereby reducing their overall numbers and eliminating them from the reproductive population (i.e., some localized reduction in seed dispersal). Replacing native vegetation with crops would have adverse effects in terms of the removal of native plants. In areas with little native vegetive cover, the impacts would be minimal.

3.5 Wildlife

3.5.1 Affected Environment

Common wildlife species are listed by habitat type.

- **Sparsely vegetated**: raptors (prairie falcon, golden eagle, and red-tailed hawk) and passerines (cliff swallow, canyon wren, and rock wren) found in cliff habitats.
- **Woodlands**: mule deer, elk, cavity-nesting birds (common flicker, downy woodpecker, and Lewis's woodpecker), passerines (pinyon and scrub jay, chickadee, and nuthatch), and raptors (Cooper's hawk and red-tailed hawk).
- **Shrublands**: mule deer (especially in sagebrush), pronghorn, coyote, badgers, raptors (golden eagle, Cooper's hawk, Great-horned owl), shrubland passerines (sagebrush sparrow, sage thrasher) black-tailed jackrabbit, burrowing rodents such as ground squirrel and kangaroo rats, and reptiles (sagebrush lizard, whiptail lizard, striped racer, and gopher snake).
- **Shrub and Grass**: pronghorn, prairie dogs, coyote, raptors (Swainson's hawk, golden eagle, ferruginous hawk, prairie falcon, northern harrier, and burrowing owl), grassland passerines (horned lark, western meadowlark, and lark sparrow), and amphibians (Red-spotted toad).
- **Aquatic and Riparian**: shorebirds (killdeer and sandpipers), waterfowl (ducks and geese), riparian passerines (flycatchers), cavity-nesting birds (common flicker, Lewis's woodpecker), tiger salamander (*Ambystoma tigrinum*), and western chorus frog (*Pseudacris triseriata*).

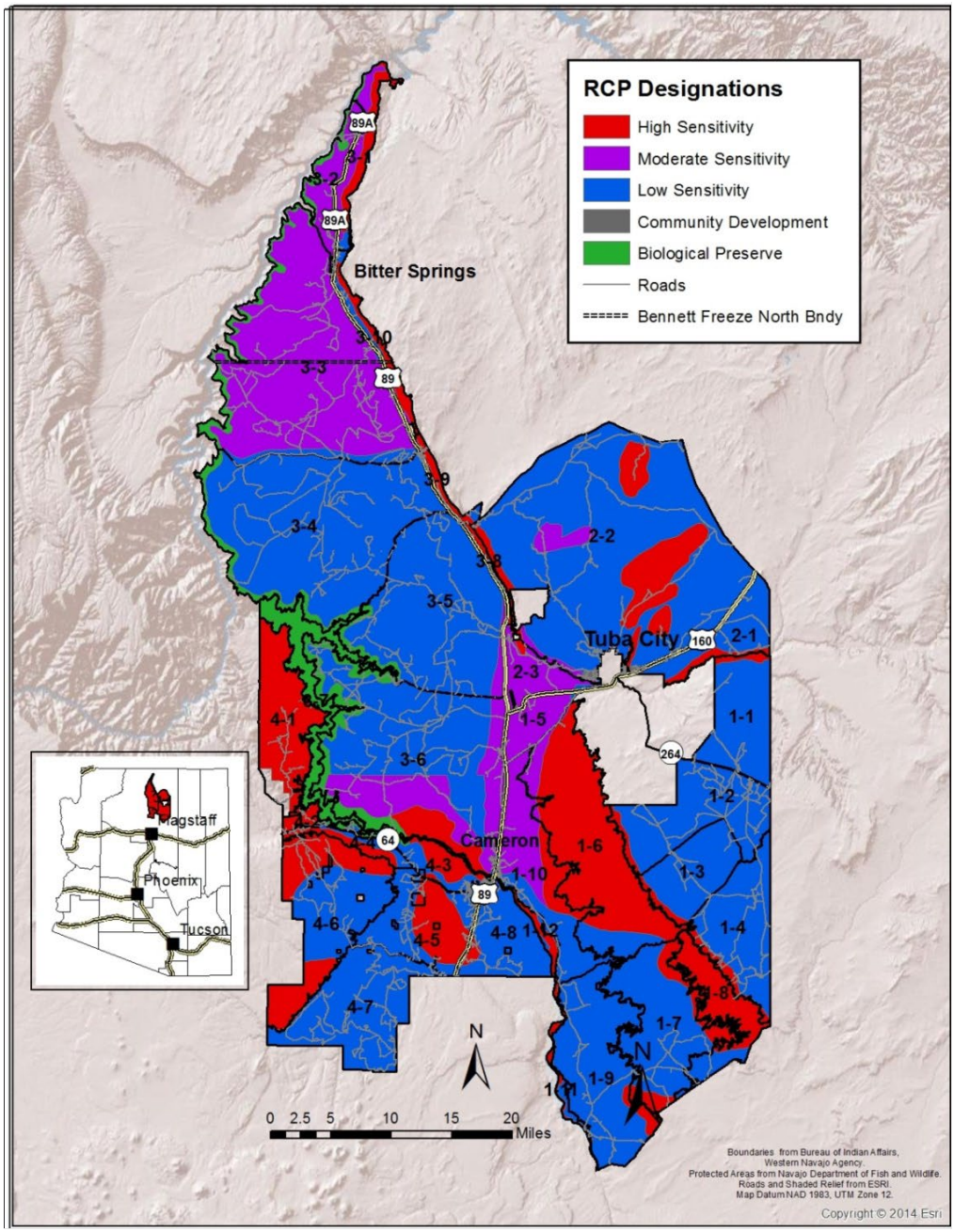
The Navajo Natural Heritage Program (NNHP), a division of the NNDFW, has implemented management plans to protect nesting ferruginous hawk, bald and golden eagles, and Mexican spotted owl populations on the Navajo Nation (NNHP, 2021; NNHP, 2008; NNHP, 2000). These species are of cultural significance to the Navajo Nation. The guidelines limit the level of human activity and development near occupied and unoccupied nests, as well as survey and management guidelines for occupied habitat (NNHP, 2021; NNHP, 2008; NNHP, 2000).

The NNDFW has also prepared a development planning tool to avoid biologically sensitive areas throughout the Navajo Nation. The Biological Resource Land Use Clearance Policies and Procedures (RCP) were created by the NNDFW and approved in 2003 by the Resources Committee of the Navajo Nation Council. RCP provides guidance for complying with federal and Navajo Nation laws that protect plants, animals, and their habitats. Areas in the Navajo Nation are categorized according to the potential impact of development on wildlife and their habitats in those areas. NNDFW has identified and mapped wildlife habitat and sensitive areas that cover the entire Navajo Nation (Figure 7). Six types of wildlife areas are described below.

1. **Highly Sensitive**: This area contains the best habitat for endangered and rare plants, animal and game species, and the highest concentration of these species on the Navajo Nation. The purpose of this area is to protect these valuable and sensitive biological resources to the maximum extent practical. No activity or development that is going to result in significant impact to wildlife resources.
2. **Moderately Sensitive**: This area has a high concentration of rare, endangered, sensitive, and game species occurrences or has a high potential for these species to occur throughout the landscape. The purpose of this area is to minimize impacts on these species and their habitats, and to ensure the habitats do not become fragmented. All activity or development should avoid species and their habitat, with adequate buffers.
3. **Less Sensitive**: This area has a low, fragmented concentration of species of concern. Species in this area may be locally abundant on 'islands' of habitat, but islands are relatively small, limited in number and well-spaced across the landscape. These may not be completely surveyed for the potential occurrence of sensitive species or habitats. Generally, the need to avoid sensitive habitats should be less frequent in this area; therefore, development in these areas is more likely to proceed as planned with proper and timely planning.
4. **Community Development:** Areas around certain communities that do not support the habitat for species of concern and therefore development can proceed without further biological evaluation.
5. **Biological Preserve:** These areas contain excellent, or potentially excellent, wildlife habitat and are recommended by the NDDFW for protection from most human-related activities, and in some cases are recommended for enhancement. No development unless compatible with the purpose of the area.
6. **Recreation Area:** These areas are used for recreation that involves wildlife or have potential for development for this purpose. Recreation can involve consumptive and/or non-consumptive uses of wildlife resources and is often a part of a broader outdoor experience. No new development is allowed within Recreation Areas unless it is compatible with management goals for the area.

Biological Evaluations are required for three of six categories: Biological Preserve, High Sensitivity, and Moderate Sensitivity.

Figure 7. Habitat and Species Sensitivity Ratings of LMD-3



The actively farmland and proposed farmland of the CMP represent a diversity of ecosystems comprising of at least four distinct areas: 1) the Cedar Ridge area dry farmlands composed of primarily shrubs and grasses, 2) the Littlefield and Van Zee Spring farmlands occur along spring seeps and small arroyos at the base of Kaibeto Plateau and are composed of primarily shrub, grasses, and saltbush habitats, 3) the Kerley Valley farmlands all of which is on the Moenkopi Wash and is primarily composed of shrub, grasses, and saltbush habitats, 4) the proposed farmlands, a series of larger farmlands located in the LCR valley and adjacent washes. These farmlands are primarily saline wetland, shrub grass, and to a lesser extent dwarf sagebrush habitat. The LCR also contains large riparian areas that are significant to wildlife. In addition to literature and map desktop reviews, field surveys to quantify habitats and associated species were conducted from January 24 to January 27, 2023 (Table 6).

Table 6. Detailed Description of Current and Proposed Farmlands in the LMD-3

Farmlands (acreage)	Affected Environment (current condition)	Expected Environmental Impacts (from CMP)	Effect	Intensity
Old Cameron Farmlands (405 acres)	This proposed site is approximately 405 acres total, with 129 acres of low to very low (33% or less) vegetative cover, and 241 acres of moderate to heavy (34-66%) cover. It is bisected by the LCR and floodplain composing another 35 acres. The riparian area of the LCR was dominated by salt cedar (*Tamarix spp.*) and willow (*Salix spp.*). The riparian corridor is currently undisturbed by farming and in some cases reaches 400 feet wide. The site is immediately adjacent to the currently existing Cameron Farm to the east (approximately 1 acre). The site itself contains an approximately 20 acre-controlled burn, which removed stands of invasive tamarisk and camelthorn (*Acacia erioloba*), to clear an area for farming. Otherwise, the site is undisturbed except for impacts to plant species from past grazing. The site alternates between small sand dunes and flat areas dominated by sand or clay soils. The dominant plants on this site consisted of invasive salt cedar, camelthorn, and lesser amounts of Russian thistle (*Salsola tragus*). Tamarix is the dominant tree cover on this site with camelthorn being the most common shrub. The most common native plant observed was the rubber rabbitbrush (*Ericameria* nauseosa). Also common were four-wing saltbush (*Atriplex canescens*), shadscale or spiny saltbush (*Atriplex confertifolia*), blue grama (*Bouteloua gracilis*), sand dropseed (*Sporobolus cryptandrus*), cocklebur (*Xanthium spp.*), silverleaf nightshade (*Solanum elaeagnifolium*), and spectaclepod (*Dimorphocarpa* wislizeni). Wildlife species observed in the riaprain area included red-tailed hawk (*Buteo jamaicensis*), dark-eyed junco (*Junco hyemalis*), and white-crowned sparrow (*Zonotrichia leucophrys*).	Native habitat would be adversely impacted by conversion to farming. However, the site's plant composition is dominated by invasives which would be removed for farming resulting in a minor benefit. Farming the riparian areas would result in a moderate adverse impact as riparian areas provide valuable habitat for wildlife and help preserve water quality by removing nutrients and preventing sedimentation.	Beneficial Adverse	Minor Moderate

Farmlands (acreage)	Affected Environment (current condition)	Expected Environmental Impacts (from CMP)	Effect	Intensity
Teesyahotyeel Wash Farmlands (4,400 acres)	This site is composed of undeveloped land bisected by the LCR and its in-channel floodplain (approximately 202 acres). The vegetative cover on the site consists of 2,700 acres of medium to heavily vegetated areas and 1,500 acres of low to very low vegetative cover. The riparian area in the NE portion of the site contained the highest numbers of mature cottonwoods (*Populus deltoides*), The dominant plants consisted of the invasive salt cedar, camelthorn, and the native rubber rabbitbrush. Also, common were, Russian thistle, blue grama, four-wing saltbush, shadscale or spiny saltbush, and cocklebur. Less commonly observed were sand dropseed, Mormon tea (*ephedra*), and prickly pear (*Opuntia spp.*), spectaclepod, and dune primrose (*Oenothera deltoides*). The tree cover was thickest near riparian areas and dominated by salt cedar with larger specimens of cottonwood either singly or in stands. Three infrequently occurring brush species were not identified on this site due to the desiccated condition of the plants during the winter season. Wildlife species observed include northern harrier (*Circus cyaneus*), great horned owl (*Bubo virginianus*), dark-eyed junco of the Oregon variant, white-crowned sparrow, house finch (*Haemorhous mexicanus*), American goldfinch (*Spinus tristis*), and crow (*Corvus spp.*). The majority of these birds were in denser tree cover in the riparian zone at the north end of the site.	Native habitat would be adversely impacted by conversion to farming. However, the site's plant composition is dominated by invasives which would be removed for farming resulting in a minor benefit. Farming the riparian areas would result in a moderate adverse impact as riparian areas provide valuable habitat for wildlife and help preserve water quality by removing nutrients and preventing sedimentation.	Beneficial Adverse	Minor Moderate
Tonahakaad Wash Farmlands (1,765 acres)	This farmland is dominated by land with naturally occurring low to very low vegetative cover (approximately 1,527 acres). It is bisected by the NE-SW flowing Tonahakaad wash (86 acres). There are approximately 152 acres of medium to heavily vegetated land situated from N-S along the LCR. The dominant plants on this site were similar to other areas of LMD 3 primarily consisting of invasive salt cedar, camelthorn, Russian thistle, and the native rubber rabbitbrush, four-wing saltbush, and shadscale or spiny saltbush.	The proposed farmland is dominated by lands lacking significant vegetative ground cover for wildlife habitat. Therefore, impacts to native flora and fauna should be negligible. Additionally, the removal of invasives to clear areas for farming could provide a minor benefit by reducing the number of invasive plants available for reproduction.	Beneficial	Minor
Tohatchi Wash Farmlands (2,900 acres)	The proposed Tohatchi wash farmland is just north of Tohatchi wash and contains primarily undeveloped land with sparse vegetative cover and sandy soils. There are a small number of invasive shrubs at this site including camelthorn, Russian thistle, and native plants such as rubber rabbitbrush four-wing saltbush	The proposed farmland is dominated by lands lacking significant vegetative ground cover for wildlife habitat. Therefore, impacts to native flora and fauna should be negligible. The removal of invasives to clear areas for farming could provide a minor benefit by reducing the number of invasive plants available for reproduction.	Beneficial	Negligible

Farmlands (acreage)	Affected Environment (current condition)	Expected Environmental Impacts (from CMP)	Effect	Intensity
Black Falls Farmlands (900 acres)	This 900-acre site is predominantly dominated by land with low to very low vegetative cover (680 acres). This area is significantly impacted by current cattle grazing activity. Cattle trails and erosion were observed with bushes being heavily grazed. The site consists of approximately 220 acres of medium to heavily vegetated land primarily in the northern third of the site along the riparian zone. The site is bordered by the LCR on the west. In a few places the riparian zone contained large enough Tamarisk stands and rarely cottonwoods to house flocks of birds with dark-eyed junco, white-crowned sparrow, and a single great horned owl being observed. The dominant plants on this site consisted of invasive salt cedar with salt cedar densities being the highest at this site compared to other areas of the LDM 3. Camelthorn, Russian thistle, and the native rubber rabbitbrush were also common. Observed but less common were, blue grama, four-wing saltbush, shadscale or spiny saltbush, cocklebur, sand dropseed, and Mormon tea. Two infrequently occurring brush species were not identified on this site due to the desiccated condition of the plants during the winter season.	Native habitat would be adversely impacted by conversion to farming. However, the site's plant composition is dominated by invasives which would be removed for farming resulting in a minor benefit to native species. Farming the riparian areas would result in a moderate adverse impact as riparian areas provide valuable habitat for wildlife and help preserve water quality by removing nutrients and preventing sedimentation.	Beneficial Adverse	Minor Moderate
Land Management District 3 Previously Farmlands.				
Kerley Valley Farmlands (Moenkopi wash, 450 acres)	The Kerley Valley farmland is a series of farms on Moenkopi wash totaling about 450 acres, 2.5 miles west of the town of Moenkopi on highway 160. These are some of the larger previously developed farms in LMD 3 with bigger plots ranging from 70, 35, and 17 acres, down to very small individual plots of less than 1 acre. The area is dominated by farmed fields in various stages of succession anywhere from currently being plowed and planted, to being overgrown with shrubs and a few trees. From satellite photos only 60 acres of the area is currently or recently farmed. The riparian zone was not adequate in many places with fence lines approaching or on the banks of the Moenkopi wash. The vegetative composition was the same as previous sites but with less species diversity. Dominant plants included: invasive saltcedar, camelthorn, and the native rubber rabbitbrush. Less common but observed were Russian thistle, silverleaf nightshade, and four-wing saltbush.	The existing farmland is dominated by previously farmed or lands recolonized by invasives. Therefore, impacts to native flora and fauna should be minimal. Additionally, the removal of invasives could provide minor benefit by reducing the number of invasive plants available for reproduction.	Beneficial	Minor
Van Zee Spring Farmlands (Mori Mesa Area, 50 acres)	A series of small active or recently cleared farmlands ranging from 1-8 acres. For most of these sites the only cover consists of species compositions seen elsewhere in LDM 3 including: saltcedar, camelthorn, and Russian thistle, and rubber rabbitbrush, and four-wing saltbush.	The existing farmland is dominated by previously farmed or lands recolonized by invasives. Therefore, impacts to native flora and fauna should be negligible. Additionally, the removal of invasives could provide minor benefit by reducing the number of invasive plants available for reproduction.	Beneficial	Negligible

Farmlands (acreage)	Affected Environment (current condition)	Expected Environmental Impacts (from CMP)	Effect	Intensity
Moenave Springs Farmlands (and north to Willow Springs, 112 acres)	Sites at and above Moenave Spring and north to below Willow Springs were not observed during field surveys due to road closures. However, adjacent field surveys, satellite data, and historical research indicate conditions at these sites are likely highly similar to those observed at the other previously farmed sites. Satellite photos indicate 80% or more of these areas are currently or have been recently farmed. The total acreage of this series of farms is approximately 112 acres, with 63 acres of farms in Moenave Canyon, another 48 acres of farms between cliff and mesa spring, and 11 acres of farms below willow springs.	The existing farmland is dominated by previously farmed lands. Therefore, impacts to native flora and fauna should be minimal. Additionally, the removal of invasives could provide minor benefit by reducing the number of invasive plants available for reproduction.	Beneficial	Minor
Cedar Ridge Dry Farmlands (260 acres)	Dry Farmlands at Cedar Ridge were not observed during field surveys due to road closures. However, adjacent field surveys, satellite data, and historical research indicate conditions at these sites are likely highly similar to those observed at other previously farmed areas in LMD 3. Overall, the area is approximately 260 acres, with 150 showing no evidence of farming, 50 being previously farmed land that is reverting back to shrub species, and 60 acres of the site being currently or recently farmedSatellite imagery from Google Earth Pro captured in 2023 indicates the entire area is of low to very low plant density with trees occurring only rarely.	The existing farmland is dominated by lands lacking significant vegetative ground cover, previously, or currently farmed areas. Therefore, impacts to native flora and fauna should be minimal. Additionally, the removal of invasive species to clear areas for farming could provide minor benefit by reducing the number of invasive plants available for reproduction	Beneficial	Minor

3.5.2 Environmental Impacts to Wildlife

3.5.2.1 No Action

Impacts of the No Action alternative would be negligible, indirect, widespread, long-term, and minor. Under the No Action alternative, current habitat conditions are likely to persist. In most areas, there would be no significant changes. Areas with large numbers of non-native plants, there is a potential for some continued encroachment from invasives. Increases in non-native species could cause the quality of wildlife habitat to decrease over time, causing adverse impacts to wildlife.

Without the intervention of riparian area restoration there is likely to be some continuing degradation of riparian habitat in the LMP-3. Implementation of the CMP management actions, especially riparian corridor restoration, would be a benefit to a variety of wildlife species. The habitat provided by the greater density of plant cover and larger trees as well as the close proximity to water causes riparian areas to be some of the most important wildlife habitats in semi-arid environments areas (Patten, 1998; Zaimes 2007). This relationship is documented in the habitat sensitivity area maps with all major farmed and proposed farmed areas of the CMP being on or adject to “high sensitivity” habitat zone except for the Kerley Valley Project.

3.5.2.2 Proposed Action

Impacts of the Proposed Action alternative on wildlife would be negligible to beneficial, direct, local, long term, and minor to moderate. If management practices listed in the CMP are implemented, impacts could be mitigated and potentially provide some benefits for wildlife. These effects are contingent on whether CMP recommendations are implemented. Conversion of habitat dominated by native vegetation to cropland would have a slight negative impact on wildlife. Agricultural activities, such as removal of vegetation and soil disturbance, will result in habitat alteration or loss. While the goal of the CMP is to develop self-sustaining agricultural lands, there are management activities recommended by the CMP that are intended to mitigate potential impacts to natural resources. The CMP lists agricultural BMPs that promote sustainable production methods. Implementation of BMPs, such as off-season cover cropping and considering wildlife habitat during planning, could be beneficial to wildlife. The CMP incorporates recommendations listed in Section 2.2.2 of the FBFA FPFA for actions concerning water and agriculture. Some recommendations include: "Inventory, conserve, restore wetlands, riparian areas, and natural springs; Identify areas of concern, implement restoration projects, and preserve productive areas; coordinate weed control." If recommendations are followed to preserve and restore riparian and other sensitive areas, there would be improvements to wildlife habitat. These habitat improvements could benefit wildlife in the long term. Areas where habitat is primarily composed of non-native plants, impacts of implementing the CMP would be negligible or slightly beneficial. Removal of invasives would reduce regrowth and implementation of weed control practices would reduce the number of individuals.

3.6 Special Status Species

Areas identified in the NNDFW Wildlife Biological Resource Land Use Clearance Policies and Procedures for special status species are already subject to conservation practices. Under both the No Action and Proposed Action Alternatives, there would be no change in the Biological Resource Land Use Clearance Policies and Procedures and how it is implemented in LMD-3. Continued management under this policy would serve to avoid or mitigate impacts to special status species. There would be no change to existing regulations to protect species of cultural significance.

3.6.1 Affected Environment

3.6.1.1 Special Status Wildlife

LMD-3 contains potential habitat for 43 special status species. Twelve are U.S. Fish and Wildlife Service (USFWS) threatened, endangered, or candidate species and all 43 are Navajo Endangered Species List (NESL)-listed species. Four culturally significant plant species occur within LMD-3 (See Section 4). The areas of the proposed CMP provide habitat for nine special status wildlife species, three of which are known to occur in or within 3 miles from CMP boundaries (Table 3). The other six species have the potential to occur within the CMP area, based on habitat requirements and species range. These species are on the NESL, and some are also ESA-listed species. Table 7 lists federally listed species which have the potential to occur in the area.

Table 7. Special status wildlife known to occur or have the potential to occur in the CMP[1]

Species	Status	Habitat	Presence
Golden eagle *(Aquila chrysaetos)*	NESL G3	Nests on steep cliffs, typically at least 100 feet in height, normally adjacent to foraging habitat of desert scrub and grasslands. These vegetation types provide primary prey of cottontail and jackrabbits. Nests are usually placed in middle to upper parts of cliffs in sheltered areas.	Known
Wupatki pocket mouse (Perognathus amplus cineris)	NESL G4	Occupy desert scrub usually with sparse ground cover of greasewood, snakeweed, rabbitbrush, ephedra, shortgrass, and, possibly, short junipers. Potential range on the Navajo Nation likely extends from the Colorado River (Marble Canyon) east to Kaibito Plateau, south through Cameron to the Leupp area.	Known
Northern leopard frog (Lithobates pipiens)	NESL G2	Breeds in wetlands usually with permanent water and aquatic vegetation (especially cattails), ranging from irrigation ditches and small streams to rivers, and small ponds and marshes to lakes or reservoirs. Historically found in the LCR and near Tuba City and Cameron.	Known
Ferruginous hawk *(Buteo regalis)*	NESL G3	Inhabits dry grassland, sagebrush plains, saltbush and greasewood flats, rangeland, desert. Nest sites are usually in top of tree, 20-50 feet above ground, but can be as low as 6 feet (available trees may be very short). Sometimes nests on cliff or on ground.	Potential
Southwestern willow flycatcher *(Empidonax traillii extimus)*	NESL G2/FE	Breeds in relatively dense riparian tree and shrub communities associated with rivers, swamps, and other wetlands, including lakes and reservoirs. Habitat patches must be at least 0.25 acre in size and at least 30 feet wide.	Known
Burrowing owl *(Athene cunicularia)*	NESL G4	Nests in deserted prairie dog burrows typically in dry, open grasslands or Desert scrub, but grasslands with sparse junipers may also be used on the Navajo Nation.	Potential
American dipper *(Cinclus mixicanus)*	NESL G3	Nests near clear, unpolluted streams usually no more than 45 feet in width and 6 feet or less in depth, with a variety of riffles, pools, and waterfalls with substrate of rocks, sand, and rubble. Nests are on ledges or in crevices.	Potential
Yellow-billed cuckoo *(Coccyzus americanus)*	NESL G2/FT	Nests near water in mature riparian woodlands with dense understories. Suitable habitat should be at least 40 acres in size with more than 7 acres of closed-canopy broad-leafed forest.	Potential
Yellow warbler *(Dendroica petechia)*	NESL G4	Nests primarily in wet, deciduous thickets, especially those dominated by willows, and in disturbed and early successional habitats. Migration habitats are mainly semi-open scrub and second-growth forests, often associated with wetlands.	Potential

[1] Status designations are for the Navajo Nation, and if applicable, followed by federal ESA listing status. Codes for NESL status: G2=species in jeopardy; G3=Likely to be in jeopardy in the foreseeable future; G4=Status unknown, but NNDFW has reason to consider them. FT=federally threatened; FE=federally endangered.

Table 8. Federally listed Species with the Potential to occur in LMD 3 Proposed Project Sites, Coconino County, AZ.

Common Name (*Species Name*)	Status*	Range and Habitat	Potential for Occurrence in Project Area
California Condor (*Gymnogyps californianus*)	USFWS ENEP	Two experimental populations occur in specific portions of Arizona, Nevada, and Utah, and in the Pacific Northwest Usual habitat is mountainous country at low and moderate elevations, especially rocky and brushy areas with cliffs available for nest sites, with foraging habitat encompassing grasslands, oak savannas, mountain plateaus, ridges, and canyons.[1]	Low: This site lacks suitable habitat for this species.
Mexican spotted owl (*Strix occidentalis lucida*)	USFWS T	Nesting and roosting occur in both forested and steep rocky-canyon habitats. Forests used are primarily mature or old-growth stands with complex structure (i.e., uneven-aged, multistoried, and have high canopy cover.) The owls appear to use a wider variety of cover types for foraging than for roosting or nesting.[3]	Low: This site lacks suitable habitat for this species.
Yellow-billed Cuckoo (*Coccyzus americanus*)	USFWS T	Inhabit wooded areas with dense cover and water nearby, including woodlands with low, scrubby, vegetation, overgrown orchards, abandoned farmland, and dense thickets along streams and marshes. In the West, nests are often placed in willows along streams and rivers, with nearby cottonwoods serving as foraging sites.[2]	Possible: The site contains some suitable habitat for this species.
Southwestern willow flycatcher (*Empidonax traillii extimus*)	USFWS E	The southwestern willow flycatcher occurs in riparian habitats along rivers, streams, or other wetlands, where dense growths of willows (*Salix* sp.), Baccharis, arrowweed (*Pluchea* sp.) tamarisk (*Tamarix* sp.), often with a scattered overstory of cottonwood (*Populus* sp.)[4]	Possible: The site contains some suitable habitat for this species.
Monarch butterfly (*Danaus plexippus*)	USFWS C	In general, breeding areas are virtually all patches of milkweed in North America. The critical conservation feature for North American populations is the overwintering habitats, which are certain high altitude Mexican conifer forests or coastal California conifer or Eucalyptus groves.[3]	Low: This site lacks suitable habitat for this species.
Mexican wolf (*Canis lupus baileyi*)	USFWS E, (ENEP New Mexico/ Arizona)	Mexican gray wolves are found in a variety of habitats, including mountain woodlands and the Chihuahuan and Sonoran deserts.[5]	Low: The site lacks suitable habitat and is outside the range for this species.
Northern Mexican garter snake (*Thamnophis eques megalops*)	USFWS T	The northern Mexican garter snake is considered a riparian obligate and occurs chiefly in the following general habitat types: (1) Source-area wetlands [e.g., cienegas (mid-elevation wetlands with highly organic, reducing (basic, or alkaline) soils), stock tanks (small earthen impoundment), etc.]; (2) large river riparian woodlands and forests; and (3) streamside gallery forests (as defined by well-developed broadleaf deciduous riparian forests with limited, if any, herbaceous ground cover or dense grass).[6]	Low: The site lacks suitable habitat for this species. Although riparian areas exist on multiple proposed farming sites in the LMD 3 they are all intermittent and are not likely to house riparian obligate species.

Note: Information on animal and plant taxa is from: [1]USFWS 2022b; [2]USFWS 2022c; [3]Biota Information System of New Mexico (BISON-M) 2022; [4]Center for Biological Diversity 2022; and [5]UNM 2022; [6]USFWS 2022d; and [7]NNDFW 2022.

* Federal (USFWS) status definitions:
E = **Endangered.** Any species considered by the USFWS as being in danger of extinction throughout all or a significant portion of its range. The ESA specifically prohibits the take of a species listed as endangered. Take is defined by the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to engage in any such conduct.
T = **Threatened.** Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The ESA specifically prohibits the take (see definition above) of a species listed as threatened.
C = Candidate. Any species (taxon) for which the USFWS has sufficient information to propose that it be added to the list of endangered and threatened species, but the listing action has been precluded by other, higher priority listing activities.
ENEP = Experimental, Non-essential Population. Any reintroduced population established outside the species' current range, but within its historical distribution. For purposes of Section 7 consultation, experimental, non-essential populations are treated as proposed species (species proposed in the *Federal Register* for listing under Section 4 of the ESA), except on national wildlife refuges and national parks, where they are treated instead as threatened.

3.6.2 Environmental Impacts to Special Status Wildlife

3.6.2.1 No Action

Impacts of the No Action alternative would be negligible, indirect, local, long term, and minor to moderate. Under the No Action alternative, there would be no changes in current management practices. Current conditions are likely to continue to persist, having minimal impacts for wildlife. Areas with large numbers of non-native plants could potentially see some continued encroachment of invasives. This could lead to a decrease in wildlife habitat quality over time, causing adverse impacts to wildlife. As stated earlier, riparian habitat in the LMD-3 is currently degraded by past and current overgrazing. Without intervention, there is likely to be some continuing degradation of riparian habitat in the CMP areas. Continued degradation of riparian habitat could have adverse impacts on species that rely on these areas.

3.6.2.2 Proposed Action

Under the Proposed Action, any change to agricultural lands managed under this CMP would be reviewed as part of the planning process, and any potential effects to Special Status Wildlife analyzed, mitigated, and disclosed as required under all federal regulations and consistent with the IRMP for the FBFA (NNDNRC/BIA, 2022) and BIA procedures for NEPA (Office of Indian Affairs, 2012). Given this commitment, impacts of the Proposed Action alternative on wildlife would be negligible to beneficial, direct, local, long term, and minor to moderate. Activities associated with the implementation of the CMP could potentially impact sensitive species through management activities such as removal of native vegetation. The goal of the CMP is to develop agricultural land to promote self-sustaining communities while also being mindful of natural resources. The CMP recommends management activities which are intended to mitigate potential impacts that may result from implementation of the Proposed Action.

Of the sensitive species known to or potentially occur in the CMP, five out of the nine are riparian obligates. Under the CMP, recommendations are made to preserve and restore riparian and other sensitive habitat areas. If followed, the recommendations could be beneficial to these species through habitat improvements.

3.6.2.3 Special Status Plants

The CMP area provides habitat for 2 special status plant species, one of which is known to occur in or within 3 miles from LMD-3 (Table 9). The other species has the potential to occur within

LMD-3, based on the presence of suitable habitat within the species range. These species are on the NESL, and one is also an ESA-listed species.

Table 9. Special status plants known to occur or have the potential to occur in the CMP[1]

Common Name	Status	Habitat	Presence
Fickeisen plains cactus (*Pediocactus peeblesianus fickeiseniae*)	NESL G3/ Endangered	Found on soils overlain by Kaibab Limestone in grasslands along canyon rims and flat terraces along washes, typically with limestone chips scattered across the surface from 4,000 to 6,000 feet. It is known to occur from Gray Mountain to southwest of Bitter Springs and possibly to Marble Canyon.	Known
Round dunebroom (*Errazurizia rotundata*)	NESL G3	Found on outcrops ranging from sandy soils in sandstone, gravelly soils in incalcareous outcrops, to deep, alluvial cinders in sandstone breaks in the desert scrub type. On the Navajo Nation, populations have been found in sandy pockets between outcroppings of Moenave Sandstone from 4,600 to 5,200 feet. It is known to occur between Moenave and Willow Springs but may occur between Gap and Petrified Forest National Park.	Potential
Brady pincushion cactus *(Pediocactus bradyi*)	Endangered	Grows in scattered populations over a 70 km ^{2} (27 mi^2) area near Marble Canyon along the Colorado River in Arizona. Its soil requirements are specialized: it grows only on chips of Kaibab limestone that overlay soils derived from Moenkopi shale and sandstone outcrops.	Potential along Little Colorado

[1] Status designations are for the Navajo Nation, and if applicable, followed by the federal ESA. Codes for Navajo Endangered Species List status: G2=species in jeopardy; G3=likely to be in jeopardy in the foreseeable future; G4=status unknown. FT=federally threatened; FC=federal candidate. All known species in, or within 1 mile of, LMD-3.

3.6.2.4 Culturally Significant Plant Species

Four of the five most culturally significant plant species for the Navajo people are found in LMD-3:

1. **Yucca** is a common plant that grows in sand and gravel. It is used in ceremonies and to make soap, garments, bedding, jewelry, baskets, paintbrushes, and pottery (both weaving and waterproofing) (Elmore, 1943).
2. **Sagebrush** has ceremonial and medicinal uses for the Navajo people (Murphy, 2017). Before ceremonies, the atmosphere is cleared of negative energy and purified by "smudging," a process by which sage is burned along with other herbs to clear bad energy. Additionally, sage is used to clear the inner ear as well as erase negative inner thoughts.
3. **Piñon Pine** nuts are a culturally important food for the Navajo people. Piñon nuts, as a commercial food source, have an annual commercial market value of $100 million (Geisler, 2011).

4. **Salt Cedar**, a non-native shrub/tree, can be used to treat diarrhea and dysentery, clean and reduce bleeding from wounds, accelerate healing, and act as a laxative (Abbas, 2012).

3.6.3 Environmental Impacts to Special Status Plant Species

3.6.3.1 No Action

Impacts of the No Action alternative would be adverse, direct and cumulative, local, long term, and minor. As with non-status plants some level of continued degradation of available habitat and encroachment by non-native species is likely without intervention.

3.6.3.2 Proposed Action

Under the Proposed Action, any change to agricultural lands managed under this CMP would be reviewed as part of the planning process, and any potential effects to special status plant species analyzed, mitigated, and disclosed as required under all federal regulations and consistent with the IRMP for the FBFA (NNDNRC/BIA, 2022) and BIA procedures for NEPA (Office of Indian Affairs, 2012). Impacts to federally or tribally listed species could occur from implementing CMP recommended management actions that would involve ground and vegetation disturbance, such as tree and shrub cutting, tilling soil and establishment of more localized water resources, resulting in habitat alteration or loss.

The general purpose of the CMP is to develop agricultural lands associated value-added industries of Indians to promote self-sustaining communities with regards to protecting special status species and their habitats. Therefore, the management activities recommended by the CMP are intended to mitigate potential impacts that may result from the CMP. Adherence to species-specific avoidance measures, presence/absence surveys, and site-specific analyses and biological evaluations in compliance with Navajo Nation regulations and the ESA will avoid or minimize impacts or effects to USFWS-listed and NESL species.

Table 10. List of special status species that could potentially occur around the proposed cropland management area with causes for declining populations.

Common Name	Pesticides & Rodenticides	Water Manipulation	Degraded Riparian Habitat	Timber Harvest	Soil Alteration	Climate Change and Drought	Other - See Appendix
Yellow-billed Cuckoo	X		X				
Bald Eagle	X			X			X
American Dipper			X				X
Northern Goshawk				X			
Clark's Grebe	X	X	X				
Northern Saw-whet Owl				X			
Belted Kingfisher		X					
Yellow Warbler	X		X				
Northern Pygmy-Owl	X		X	X			
California Condor	X						X
Band-tailed Pigeon				X		X	
Sora	X	X					
Tree Swallow	X					X	
Golden Eagle	X						X
Mexican Spotted Owl				X			X
Townsend's Big-eared Bat	X			X			
Northern River Otter		X					X
Northern Leopard Frog	X						X
Great Basin Silverspot			X				X
Yavapai Mountain snail					X		X
Humpback Chub		X					X
Razorback Sucker		X					X
Bluehead Sucker		X		X		X	
Cave Primrose					X		
Fickeisen Plains Cactus							X

3.7 Cultural Resources

Cultural resources represent the collective heritage of a people and are defined as physical evidence or place of past human activity such as a site, object, landscape, structure, or natural feature significant to a group of people traditionally associated with it. Cultural resources are managed by the Navajo Nation Heritage and Historic Preservation Department (NNHHPD), whose responsibilities include protection, preservation, and management planning for historic, archaeological, and cultural resources on the lands of the Navajo Nation or on lands in which the Navajo people have a traditional interest. The NNHHPD manages those resources in LMD-3.

The traditional cultural properties (TCP) division of NNHHPD maintains a database of known TCPs on the Navajo Nation. A TCP is property that is eligible for inclusion in the National Register of Historic Properties (NRHP) based on its associations with the cultural practices, traditions, beliefs, lifeways, arts, crafts, or social institutions of a living community. TCPs are rooted in a traditional community's history and are important in maintaining the continuing cultural identity of the community. The cultural practices or beliefs that give a TCP its significance are, in many cases, still observed at the time a TCP is considered for inclusion in the NRHP. As a result, it is sometimes perceived that the practices or beliefs themselves, not the property, make up the TCP. While the beliefs or practices associated with a TCP are of vital importance, the NRHP does not include intangible resources. The TCP must be a physical property or place-that is, a district, site, building, structure, or object (NPS, 2012).

3.7.1 Affected Environment

3.7.1.1 Archeological Resources, Historic, and Traditional Cultural Properties

Archaeological and historic sites within LMD-3 include the following:

1. Agricultural Sites: sites comprised of agricultural fields and/or agriculture-related features such as canals, rock piles, and rock alignments.
2. Artifact Scatters: sites composed entirely of artifacts and lacking associated features; some artifact scatters may be comprised of a single material, such as a flaked stone or ceramics, whereas others encompass multiple artifact types.
3. Habitation Sites: habitation sites cover a range of site manifestations, from ephemeral Paleoindian campsites to large villages to historic Navajo homesites.
4. Resource Procurement Sites: resource procurement sites cover a range of site sub-types, all of which focused on the procurement of some type of resource, such as raw tool stone or plants.
5. Rock Art: pictographs or petroglyphs on rock faces and cave walls.
6. Roads and Trails: historic and prehistoric transportation routes.

TCP types within LMD-3 include:

1. plant gathering location,
2. location for gathering contents of sacred bundles,
3. previous ceremony location,

4. former home site location,
5. former sweathouse location,
6. prayer offering place,
7. place associated with general Navajo origin,
8. place associated with origin or home of a clan, and
9. place identified as home of a Holy Being.

Cultural resources are only some of the features of the overall ethnographic landscape of the Diné people. While these discrete features are important, their overall value is only understood within the overarching cultural landscape of Navajo land, which includes not only cultural resources but geography, hydrological features, natural resources, wildlife, and livestock (NPS, 2012). In other words, Diné sense of place is critical to the expression of Diné culture and interpretation of the archaeological record. This bond to place is timeless, guiding the Foundation of Diné Law (Diné Bi Beehaz'áanii Bitse Siléí). Examples of the cultural and ethnographic landscape include the San Francisco Peaks (Dook'o'oosłííd)—one of the six sacred mountains (dził naat'ááh) that define the ethnographic landscape; the LCR (Bits'íís Nineez); natural springs; rock piles; boulders; lightning-struck trees; traditional sites for gathering plants; and game traps. While these examples are distinct features within the ethnographic landscape, Navajo land is not discontinuous, but experienced through herding, hunting, farming, and travel amongst these definitive features throughout time immemorial.

NNHHPD ensures Navajo traditional concerns are addressed in undertakings as they pertain to project management, land use planning, and cultural resource management. As such, NNHHPD maintains records of cultural resources investigations and cultural resources properties within lands of the Navajo Nation or on lands in which the Navajo people have a traditional interest.

NHPA sets forth government policy and procedures regarding "historic properties;" this includes districts, sites, buildings, structures, and objects included in or eligible for listing in the NRHP. Existing federal, state, and Tribal laws and rules protect archaeological sites, historic properties, and graves. These laws and rules include the Federal Antiquities Act of 1906; the NHPA; NEPA; "Protection and Enhancement of the Cultural Environment," May 13, 1971 (36 CFR 8921); the Archaeological Resources Protection Act of 1978; the American Indian Religious Freedom Act of 1978; the Native American Graves Protection and Repatriation Act (NAGPRA); Arizona laws protecting human remains on private lands; the Navajo Nation Policies and Procedures Concerning Protection of Cemeteries, Gravesites, and Human Remains of 1986 (ACMA-39–86); and the Navajo Nation Cultural Resources Protection Act (CMY-19–88).

A record search was conducted at the NNHHPD on April 11, 2018, and April 12, 2018. LMD-3 covers over 1.4 million acres and less than 2% of the area has been surveyed for cultural resources; therefore, a complete and exhaustive record search was not feasible. Due to the constraints imposed by the Bennett Freeze Act, limited infrastructure maintenance or new construction occurred in the area; consequently, few cultural resource inventories were conducted within LMD-3 for over 50 years and documentation is limited.

LMD-3 includes an area that has been occupied for thousands of years. Known archaeological sites recorded within LMD-3 include Ancestral Puebloan sites dating to AD 1050 – 1200; however, Diné oral histories and stories indicate their presence since time immemorial. Hopi

seasonal farming has been recorded in the area starting in the early 1700s. Mormon settlements, such as Moenave, began development in the 1870s. Although less than 2% of LMD-3 has been surveyed, well over 200 archaeological sites have been documented. Sites include Ancestral Puebloan sites as well as historic Navajo, Hopi, and Mormon sites. Over 40 known TCPs have also been documented within LMD-3.

3.7.1.2 Navajo Nation Policy for the Protection of Jishchaa': Gravesites, Human Remains, and Funerary Items

The Jishchaa' policy was implemented pursuant to the Navajo Nation Cultural Resources Protection Act (CMY-19–88). It is intended to complement provisions set forth in NAGPRA, the Archaeological Resources Protection Act of 1979, the NHPA, and others. The Navajo Nation requires those proposing a management action to make a good faith effort to locate gravesites, human remains, and funerary items within the project area prior to initiation of an undertaking. Such efforts shall include:

1. file searches of existing information, including files maintained at NNHHPD, mission records, and other pertinent materials as appropriate;
2. archaeological inventory and ethnographic interviews with residents of the local community and with other knowledgeable individuals; Navajo Nation permitting procedures require that investigators contact local Chapters prior to initiating field activities; and
3. other approaches, such as traditional diagnostic techniques, as necessary or appropriate.

Guidance and management recommendations will be developed in consultation with NNHHPD if Jishchaa' are encountered during a cultural resource inventory.

The Navajo Nation Policy for protection of Jishchaa' (Gravesites, human remains, and funerary items) was implemented pursuant to the Navajo Nation Cultural Resources Protection Act (CMY-19–88). It is intended to complement provisions set forth in NAGPRA, the Archaeological Resources Protection Act of 1979, and NHPA. The Navajo Nation requires those proposing a management action to make a good faith effort to locate gravesites, human remains, and funerary items within the project area prior to initiation of any activity. Such efforts shall include file searches of existing information (for example, data from NNHHPD, and mission records); archaeological inventories; ethnographic interviews with residents of the local community and with other knowledgeable individuals[2]; and other approaches, such as traditional diagnostic techniques, as necessary or appropriate. Guidance and management recommendations will be developed in consultation with NNHHPD if Jishchaa' are encountered during a cultural resource inventory.

3.7.2 Impacts to Cultural Resources

Under the Proposed Action, any change to agricultural lands managed under this CMP would be reviewed as part of the planning process, and any potential effects to cultural resources analyzed, mitigated, and disclosed as required under all federal regulations and consistent with the IRMP

[2] Navajo Nation permitting procedures require that investigators contact local chapters prior to initiating field activities.

for the FBFA (NNDNRC/BIA, 2022) and BIA procedures for NEPA (Office of Indian Affairs, 2012).

Cultural resources are evaluated based on whether they meet the eligibility criteria required for listing in the NRHP (National Register Bulletin #15). Section 106 of the NHPA requires that federal agencies consider the effects of their actions on such properties, following regulations issued by the Advisory Council on Historic Preservation (36 CFR 800). The BIA is the lead federal agency for Section 106 review of most undertakings on the Navajo Nation.

This assessment included a review of previous research on grazing impacts to cultural resources (Coddington, 2008; Halford, 1999; Nielson, 1991; Osborn et al., 1987; Roney, 1977). The results of previous research and field observations have all concluded that livestock grazing can have an adverse effect on cultural resources because of breakage, flake displacement (both horizontal and vertical), and the mixing of artifacts. Livestock grazing, corrals, water haul roads, pipelines, and fences can impact cultural resources through direct disturbance and erosion. Factors influencing the level and types of impacts include intensity of grazing, soil hardness, moisture, vegetation cover, and type. Coddington also observed that a lithic scatters' proximity to water is a significant factor in the level of impact a lithic scatter sustains (2008). Impacts to cultural resources, if present, could be short term due to alterations to the setting, or long-term resulting from direct disturbance.

Congregation areas experience the most intensive impacts. Intensive impacts occur in congregation areas (e.g., water troughs, shaded areas, and salt licks) because they are exposed to trampling and intense grazing, which causes artifact displacement (alterations in the horizontal and vertical distribution of artifacts due to soil compaction), breakage, deflation, and the mixing of depositional associations. Standing structures can be destroyed or deteriorated by rubbing or scratching. Indirect impacts to cultural resources can occur because of vegetation loss and breakage of topsoil, which can lead to an acceleration of natural erosion processes (Bureau of Land Management, 1981). All these impacts can diminish cultural resource integrity and decrease their significance from a scientific and public use standpoint.

3.7.2.1 No Action

Impacts of the No Action alternative to cultural resources for the most part would be adverse, direct, local, long-term, and minor to major depending on the location of the site. Wide-ranging searches for forage that occurs in the currently managed rangeland makes archaeological sites more susceptible to trampling from livestock and free-ranging horses. These animals can have an adverse effect on cultural resources via breakage, flake displacement (both horizontal and vertical), and the mixing of artifacts (Coddington, 2008; Halford, 1999; Nielson, 1991; Osborn et al., 1987; Roney, 1977). Areas where livestock and horses congregate (water sources and mineral licks) experience the most intensive impacts. Sites also are vulnerable to damage and exposure from soil erosion exacerbated by overgrazing, thunderstorms, and disturbance from range infrastructure such as corrals, water haul roads, pipelines, and fences.

3.7.2.2 Proposed Action

Impacts of the Proposed Action alternative should be beneficial, cumulative, long-term, widespread, and moderate to major. Management actions to adjust grazing activities—including fencing impacted areas, implementing seasonal use restrictions, signage, and timing/distance restrictions—would result in a decrease in soil erosion and ground disturbing activities and

therefore, less damage to, and displacement of, cultural resources. Adjusting livestock numbers, including free-ranging horses, to local carrying capacity will translate to a lower probability of trampling. Cultural resources are subject to meeting NRHP criteria. Historic and archaeological sites, as well as known TCPs, will be reviewed at the NNHHPD and ethnographic surveys will be conducted to provide guidance prior to implementing any proposed actions recommended by the CMP. Vulnerable cultural resources can be protected through management actions such as strategic placement of water and minerals or fencing. Lastly, increasing vegetative cover will reduce damage to cultural resources from erosion, as well as reduce exposure. Overall, rangeland management in LMD-3 will be largely reactive, not preventative, because many irreversible impacts to cultural resources are likely to have already occurred. However, implementing the CMP will prevent a worsening situation.

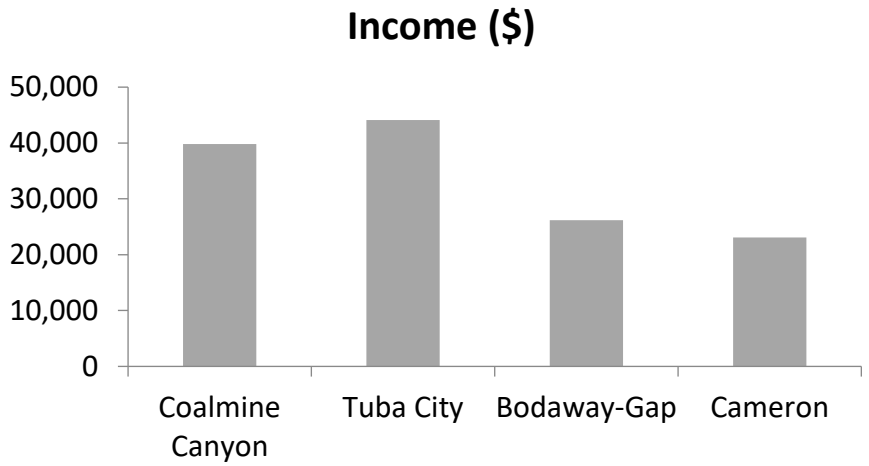
3.8 Socioeconomic Conditions

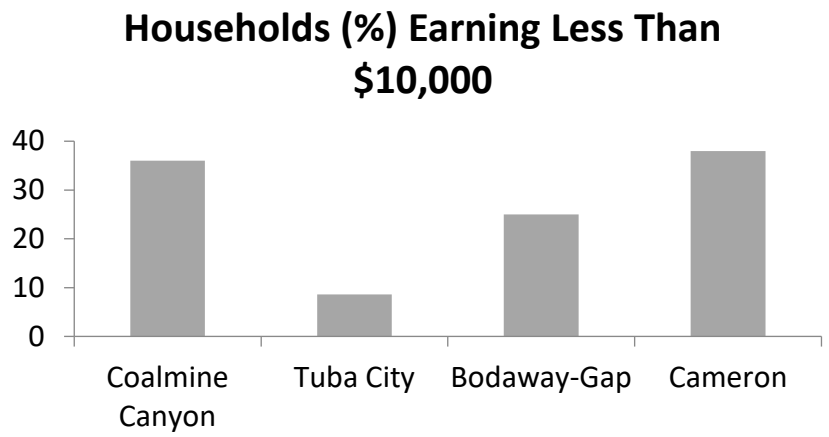
3.8.1 Affected Environment

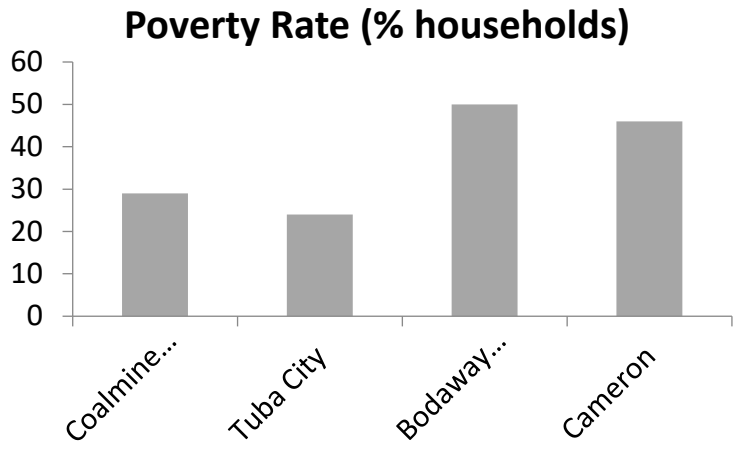
3.8.1.1 Employment and Income

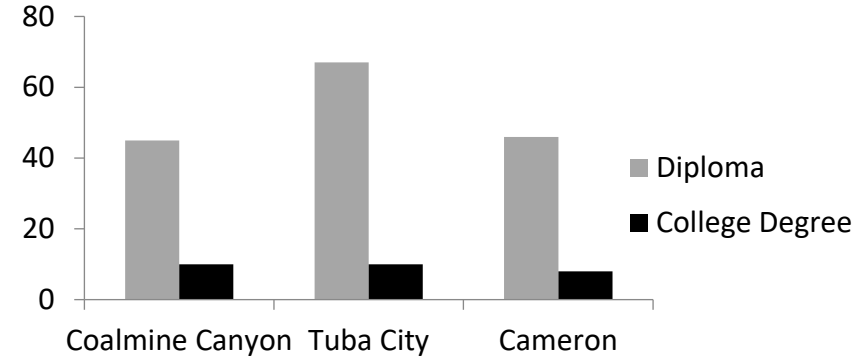
The percentage of Navajo Nation residents living below the poverty level is more than twice that (38% versus 12.8%) of Arizona residents and the median income is only slightly more than half ($30,275 versus $69,056) (EMI, 2016, Figure 8). Primary employers of the Navajo Nation are educational services, health care, social assistance, retail, manufacturing, and public administration (U.S. Census Bureau, 2010); however, 43.5% of Navajos over the age of 16 are unemployed. In LMD-3, the To´Nanees´Dizi Chapter has the highest income, least poverty, and most educated workforce. The percentage of its population that has earned a high school diploma exceeds that of Arizona (67% versus 57%).

Figure 8. Median household income ($), households (%) earning less than $10,000 per year, households (%) below the poverty level, and (d) level of education (%) for four chapters associated with LMD-3





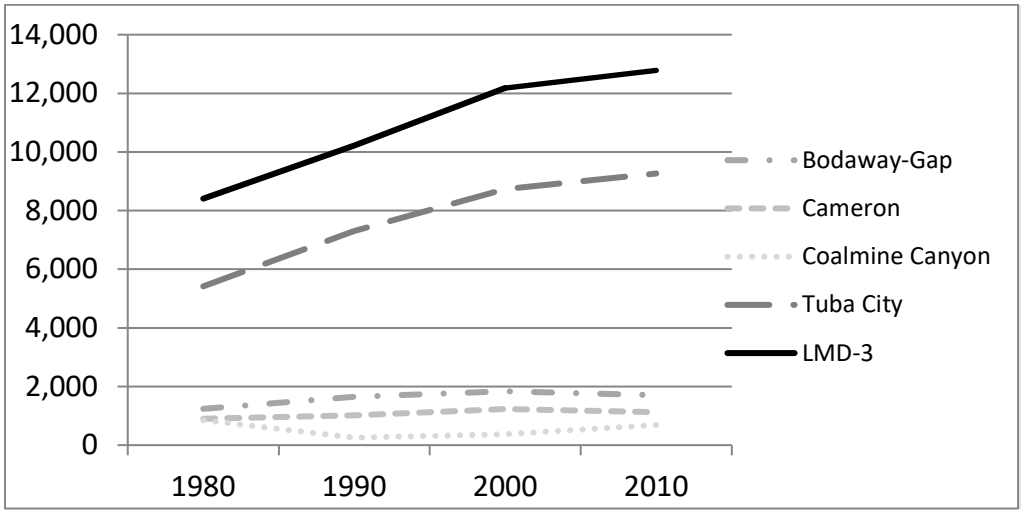




3.8.1.2 Demographics and Population Trends

As of 2010, the population on the Navajo Nation was 173,667, a decrease of 3.8% from the year 2000 (U.S. Census Bureau, 2010) The average family size was 4.1 and average household size was 3.5. The population of LMD-3 experienced a 52% increase between 1980 and 2010, almost entirely in Tuba City (Figure 9).

Figure 9. Population changes in LMD-3 from 1980 to 2010



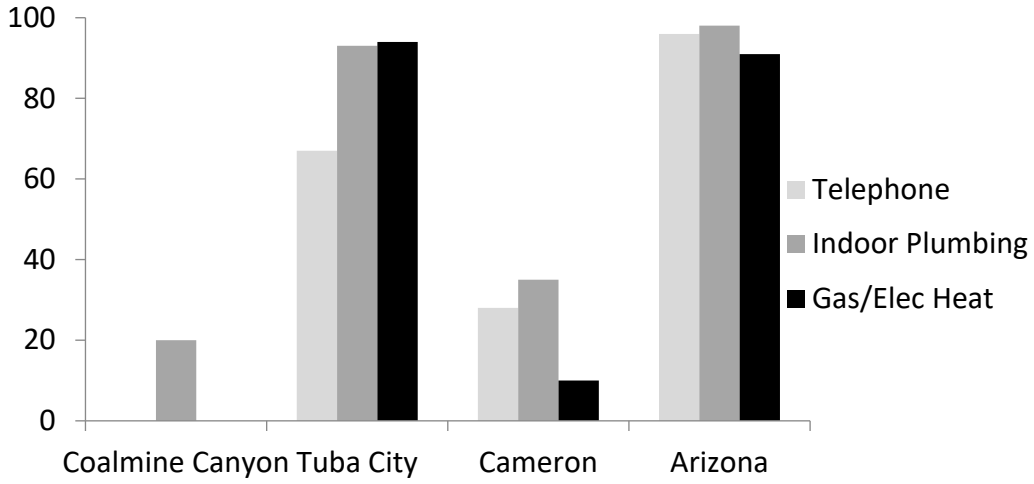
3.8.1.3 Lifestyles, Cultural Values, Attitudes, and Expectations

The Navajo Nation occupies the largest reservation in the U.S. and is one of the few Tribes that remains on ancestral lands. The Navajo culture has always maintained, and continues to strongly maintain, close connections to the landscape through herding, farming, and religious and cultural traditions.

3.8.1.4 Community Infrastructure

Amenities that characterize a higher quality of life are much more common for the To´Nanees´Dizi Chapter's largely urban (93%) population than for populations of the Coalmine Canyon and Cameron Chapters that have higher proportions of rural residents (100% and 20%, respectively). Information was not available for the Bodaway-Gap Chapter, but its population is largely rural, so availability of amenities is likely similar to the Coalmine Canyon and Cameron Chapters. In general, the proportion of the population of the To´Nanees´Dizi Chapter with telephones was slightly less than Arizona, but the proportion with indoor plumbing and natural gas or electric heat was the same (Figure 10). In contrast, markedly fewer residents in the Coalmine Canyon and Cameron Chapters had these amenities.

Figure 10. Percent of households in three chapters associated with LMD-3 and Arizona that have telephones, indoor plumbing, and heat provided by natural gas or electricity (not all data were available for Coalmine Canyon)



3.8.1.5 Environmental Justice

Environmental justice, the process of ensuring actions do not disproportionately impact minority and low-income populations[3] with adverse health and environmental effects, is enforced through Environmental Justice Executive Order 12898 of 1994. This process includes the opportunity for minority and low-income populations to (1) provide comments before plans are completed and actions implemented, (2) equitably share in the benefits of Proposed Actions, and (3) not be affected in a disproportionately high and adverse manner.

3.8.2 Impacts to Socioeconomics

3.8.2.1 No Action

Impacts of the No Action alternative will be adverse, direct and cumulative, widespread, long term, and moderate. Farming is an integral part of the Navajo culture and, for many residents, is an important source of income. However, the population of cropland producers is aging and, with the continuing degradation of croplands resulting in a decreasing return on investment, it is becoming more difficult to recruit younger Tribal members into farming. Instead, many find employment either in urban areas, such as Tuba City, or off the reservation. This exacerbates the already wide disparity in income and quality of life between rural and urban residents. Importantly, it is more difficult to obtain financial assistance from the USDA without a comprehensive plan that states how the producer will benefit from the financial investment.

3.8.2.2 Proposed Action

Impacts of the Proposed Action alternative will be beneficial, direct and cumulative, widespread, long term, and major. The remote location of LMD-3 and its lack of developed resources such as industry, mining, and forestry, equates to few opportunities for economic growth. Livestock

[3] Households that live below the subsistence or poverty level as defined by local, state, and federal governments.

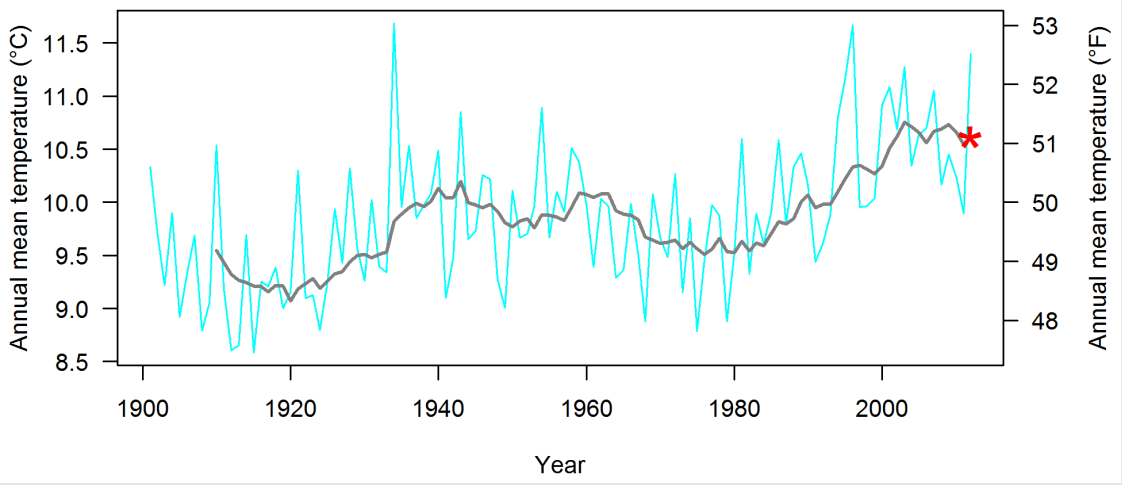
production is an already established component of the local economy. Adjusting the number of livestock to the local capacity of the range may cause a temporary reduction in income for some. Over the long term, the return from maintaining farms and investing in new infrastructure such as water sources, will greatly exceed what most producers in LMD-3 currently earn. Most importantly, residents of LMD-3 will have ample opportunity to provide comments to shape the CMP and fully participate in reaping the benefits of better cropland management. The CMP will give farmers equal status with non-Indian producers outside of the reservation who regularly improve their operations with funding from USDA.

3.9 Climate Change and Resilience

3.9.1 Affected Environment

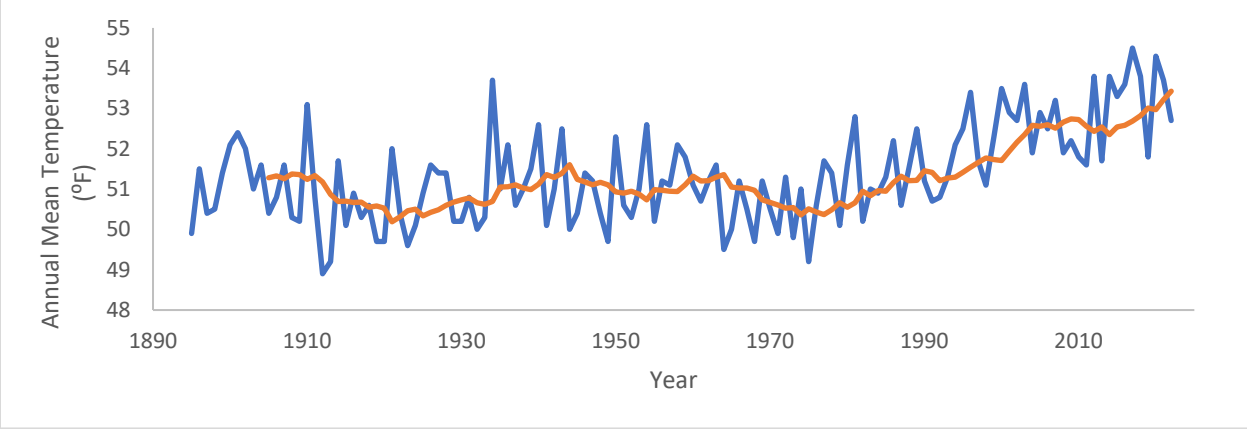
Climate change is human-accelerated warming of the earth due to emissions of carbon dioxide and other gasses that trap heat from the sun into the atmosphere (IPCC, 2014). Substantial increases in temperature linked to this phenomenon have occurred throughout the Southwest (California, Nevada, Utah, Arizona, New Mexico, and Colorado). Temperatures during 2001 through 2010 averaged 1.6°F warmer than during the previous 10 decades, with the most pronounced increases during spring and summer (Hoerling et al., 2013). Temperatures in the Colorado Plateau, where LMD-3 is located, increased an average of 1.8°F from 1901 to 2010 (Hoerling et al., 2013) and temperatures in Navajo National Monument (30 miles northeast of LMD-3) increased an average of 1.9°F from 1910 to 2010 (Monahan and Fisichelli, 2014; Figure 11). Climate models indicate a 6°F increase in average temperature could occur in the Southwest during the next 100 years (D'Antonio and Watkins, 2006).

Figure 11. Mean annual temperatures at Navajo National Monument[1]



[1] The blue line shows readings for each year. The black line represents the average for the 10 preceding years. Figure from Monahan and Fisichelli (2014).

Figure 12. Mean annual temperatures NOAA Divisional time series Arizona division 2. Northeast [1]



[1] The blue line shows readings for each year. The orange line represents the average for the 10 preceding years. Figure data form NOAA Divisional Time Series Arizona Division 2. Northeast (NOAA 2023).

Navajo elders noted a marked decrease in precipitation beginning in the 1940s, an observation supported by data and one that may be attributable to climate change (Enquist and Gori, 2008; Redsteer et al., 2014). Since the 1940s, the length of the annual monsoon has decreased by 5% to 40% (Hereford and Webb, 1992). Lastly, annual snowfall declined steadily from an average of 10 inches in 1930 to 3 inches in 2010 on and near the Navajo Reservation (Redsteer et al., 2010).

Precipitation trends described above have decreased surface water. During the 20th century, several springs and 30 perennial streams became dry or intermittent on the Navajo Reservation (Redsteer et al., 2014). The only remaining perennial stream is the LCR within 10 miles of its confluence with the Colorado River. Undoubtedly, increased withdrawal of water to serve growing communities (for example, Moenkopi Wash adjacent to Tuba City) contributed to some, but not all, loss of existing water sources.

Decreasing surface water and precipitation has impacted Navajo traditions and culture (Redsteer et al., 2014) by making: (1) corn, an integral component of many ceremonies, more difficult to grow; (2) some sacred sites unusable because nearby springs are now dry; and (3) certain plants and animals used for prayers and offerings more difficult to find.

The three by-products of climate change (less precipitation, higher temperatures, and increased carbon in the atmosphere) together will make it more challenging to support livestock in LMD-3 (Figure 11). Less precipitation (Redsteer et al., 2014) and warmer temperatures, in combination with increased evaporation from soils and transpiration from plants (Weiss et al., 2009), will result in less time during the growing season when water is adequate for forage to grow and provide protein to livestock (Milchunas et al., 2005). With fewer actively growing plants, livestock will have to ingest both growing and dormant plants to meet their nutritional needs, which in turn will decrease the already sparse vegetative cover. The man-caused increase in atmospheric carbon may indeed trigger more growth of individual plants through the photosynthetic process, but that growth will be in the form of more lignin (rigid tissue of grass stems that is hard to digest and provides few nutrients) and less protein (therefore less nutrition) (Milchunas et al., 2005). For cows and sheep, digestion of nutrients is limited by the ease and

amount of forage they can digest during a given period. Thus, forage composed of higher lignin and lower protein will result in less weight gain because it will take longer to process. Warmer temperatures also will contribute to weight loss of cattle through increased respiratory rates and decreased food intake (Hahn, 1999).

If vegetation cover is decreased by the means described above, evaporation from the soil surface will increase and runoff during thunderstorms will be more intense; together these factors will reduce saturation into soil and in turn, depress germination of seeds and plant growth. Additionally, runoff will accelerate the formation of gullies, which will worsen sediment flow into earthen stock tanks.

Climate change will also make water sources more vulnerable to drying because there will be less recharge of groundwater, higher evaporation rates (Weiss et al., 2009), and livestock will increase their water intake (Nania et al., 2014). Fewer water sources will constrict the distribution of livestock and increase grazing pressure on nearby forage, thereby contributing to less plant cover.

3.9.2 Impacts to Climate Change and Resilience

3.9.2.1 No Action

Impacts of the No Action alternative will be adverse, indirect, widespread, long term, and moderate. Failure to improve range conditions and manage livestock will worsen the impacts of climate change and resilience by continuing to degrade rangeland resources, including soils, native vegetation, and water resources. Protection of these resources is necessary to mitigate the long-term effects of climate and drought conditions in LMD-3.

3.9.2.2 Proposed Action

Impacts of the Proposed Action alternative will be beneficial, direct and cumulative, regional, permanent, and major. Implementing the CMP will make a minor, but positive, contribution to reducing the effects of climate change by decreasing methane in the atmosphere and increasing carbon stored in soil. Ruminants (cattle, sheep, and goats) are the largest contributors of methane, a by-product created during digestion, to the atmosphere. This gas is second only to carbon in capture of atmospheric heat that causes climate change (Lassey, 2007). Increasing the nutritional quality of forage by improving range conditions will increase efficiency of livestock in gaining weight (McAllister et al., 1996) and in turn, reduce the amount of methane produced.

Carbon captured by plants during photosynthesis, then transported by their roots and stored in soils, is a valuable means to reduce the amount of it in the atmosphere. However, the amount of soil organic carbon stored in soil in semi-arid grasslands generally is small and any meaningful contribution to reducing carbon in the atmosphere requires large areas and long time periods (Brown et al., 2010); the size of LMD-3 and the 10-year life span of this RMP meet both criteria.

4 Mitigation Measures

Potential impacts to natural, cultural, and socioeconomic resources would be analyzed and mitigated for any change to cropland management, consistent with the FBFA IRMP (NNDNRC/BIA, 2022) and in accordance with BIA NEPA procedures and the policies put forward in this CMP (Office of Indian Affairs, 2012). Mitigation measures regarding land, water, and air resources are included in the CMP, and would be added to or revised to address site-specific changes to cropland management or permitted uses of land for crops. Additional mitigation measures for specific resources are described below.

4.1 Natural Resource

Deer and Antelope: Construct wildlife-friendly fences that allow easy passage.

Vegetation: No hay (grass or alfalfa) should be purchased and fed to livestock in LMD-3 unless it is certified to be free of non-native seeds and plants ("weed free").

Black-footed Ferrets: Survey prairie dog towns. Negative results are valid indefinitely if all towns within 4 miles of each other are surveyed. Otherwise, surveys are valid for one year.

California Condors: From February through June, activity should be avoided within 1 mile of nests. During all times, activity should be avoided within ½ mile of communal roosts occupied by condors.

Ground-nesting birds: Surveys should be performed during nesting periods, prior to ground-disturbing activity (including, but not limited to: fence construction, addition of new water sources/features, new/increased use of access roads, and grazing in areas not previously utilized).

Mitigation measures for other wildlife are included in Table 11.

4.2 Cultural Resources

The Navajo Nation requires those proposing a management action to make a good faith effort to locate gravesites, human remains, and funerary items within the project area prior to initiation of an undertaking. Such efforts shall include:

1. file searches of existing information, including files maintained at NNHHPD, mission records, and other pertinent materials as appropriate;
2. archaeological inventory and ethnographic interviews with residents of the local community and with other knowledgeable individuals—Navajo Nation permitting procedures require that investigators contact local Chapters prior to initiating field activities; and
3. other approaches, such as traditional diagnostic techniques, as necessary or appropriate.

Guidance and management recommendations will be developed in consultation with NNHHPD if Jishchaa' are encountered during a cultural resource inventory.

4.3 Socioeconomic Conditions

All affected livestock producers should be consulted before implementing recommendations of the CMP to ensure that their concerns have been addressed.

Table 11. Distances and periods of avoidance for wildlife and special status plants and animals in LMD-3.

Species	What is to be Avoided	Distance of Avoidance (yards)	Period of Avoidance	Comments
Special Status Plants	Occupied Habitat	60	Year-round	
Pronghorn	Fawning Areas	1500	May – mid-July	
Cavity-Nesting Birds	Snags, esp. with missing tops	—	Year-round	
Prairie Dogs	Towns	100	Year-round	
Burrowing Owls	Nests	450	March - mid-August	
	Habitat	250	Year-round	Habitat should be preserved.
Peregrine Falcon	Active Nests	800	March – July	
Bald Eagle	Nests/Roost Trees	800	Mid-October – mid-July	
Raptors other than Peregrine Falcons and Bald Eagles	Active Nests	300	Nesting Season	
Sora	Active Nests	300	May – July	
	Nesting Habitat	75		
Belted Kingfisher	Active Nests	400	Mid-April – mid-August	
Yellow-billed Cuckoo	Active Nests	400	June – mid-September	
	Habitat	1000	Year-round	No alterations until cleared by survey.
Yellow Warbler	Active Nests	200	Mid-April – July	
	Habitat	250	Year-round	No alterations until cleared by survey
Mexican Spotted Owl	Active Nests	400	March – August	
	Habitat around nests	1000	Year-round	
Townsend's Big-Eared Bat	Occupied Roost Sites	60	Mid-April – August	Occupied mines/caves should not be closed without permission of NNDFW

Species	What is to be Avoided	Distance of Avoidance (yards)	Period of Avoidance	Comments
Chiseled-Tooth Kangaroo Rat	Burrow Systems	60	Year-round	
Bighorn Sheep	Lambing Areas	1500	April – September	Avoid individuals year-round
Wupatki Pocket Mouse	Occupied habitat	60	Year-round	
Milk Snake	Occupied habitat	—	Year-round	
Northern Leopard Frog	Lakes	65	Year-round	Avoid upstream activities that affect water chemistry and quantity
	streams	20-75		
	wetlands	75		
Bluehead Sucker	Top of streambank	30-65	Year-round	
Humpback Chub	Top of streambank	65	Year-round	No modification of critical habitat or habitat elements in 100-year floodplain.
Kanab Ambersnail	Occupied habitat	65	Year-round	No alteration of water chemistry or quantity upstream.

5 Individuals, Organizations, Agencies Consulted

Public notification and input included four public scoping meetings during the summer of 2019 to inform and obtain comments from residents of LMD-3 about the proposed CMP/PEA. Meetings were held at four Chapter houses: Coalmine Canyon (June 24, 2017, and July 11, 2017), Tuba City (June 16, 2017, and June 17, 2017), Bodaway-Gap (June 10, 2017), and Cameron (May 20, 2017). The issues and concerns raised by this process are summarized in the Public Scoping Report.

Endangered Species Act

BIA-WNA contacted and obtained lists of, and information on, threatened and endangered species, as well as those that are candidates for listing from the USFWS and NNDFW (Appendix F).

Section 106 of the National Historic Preservation Act

Section 106 consultation in regard to historic properties will be completed with the Navajo Nation Tribal Historic Preservation Officer. This PEA and a determination of "no adverse effect" will be sent to the Tribal Historic Preservation Office for review and comment, which would partially complete Section 106 compliance. Government-to-government consultation with American Indian Tribes will be initiated to ensure no adverse impacts to ethnographic resources and values.

Tribal Contacts

BIA-WNA has contacted the Navajo, Hopi, and Southern Paiute Tribes to determine if any ethnographic resources are located in the project area for which they would want input concerning environmental and cultural compliance. The PEA will be sent to the Tribes during the public review period for their review and comment.

Programmatic Environmental Assessment Review and List of Recipients

The PEA is subject to a 30-day public comment period. BIA-WNA will publish and distribute a letter to relevant agencies, Tribes, and individuals as well as place an ad in the local newspaper to inform the public of the availability of the PEA. Additionally, the document will be available for review at the BIA-WNA office in Tuba City, Arizona, and copies will be provided by BIA-WNA to interested individuals upon request.

During the 30-day period, the public will be encouraged to submit their written comments to BIA-WNA. Following the close of the comment period, all public comments will be reviewed and analyzed prior to the release of a decision document. BIA-WNA will issue responses to substantive comments received during the public comment period and will make appropriate changes to the PEA as needed. BIA-WNA also will decide whether to revise findings in the FONSI or prepare an Environmental Impact Statement.

6 List of Contributors

6.1 Primary Preparers

Name/Title	Contribution
BIA – WNA	
Tony Robbins Supervisor Natural Resource Specialist	Provided technical information and review
Casey Francisco Rangeland Management Specialist	Provided technical information and review
Renee Benally Natural Resource Specialist	Provided technical information
BIA – Navajo Regional Office	
Myles Lytle Environmental Protection Specialist	Provided technical review
Robert Begay Archaeologist	Provided technical information on cultural resources
Sundance Consulting, Inc.	
Cassandra Shenk NEPA Project Manager	Lead Author
Norm Lowe Senior Rangeland Specialist	Resource Specialist, CMP Lead Author, Contributing PEA Author
William (Bill) Youman Biologist	Resource Specialist, Contributing Author
David Larsen, RPA Archaeologist/NEPA Specialist	Project Management, Resource Specialist, Contributing Author
Kelsey Patterson Ecologist/NEPA Specialist	Contributing Author, Resource Specialist
Pete David Natural & Cultural Resources Manager	Technical Review
Steve Gehring Technical Editor	Review and Formatting

7 Interdisciplinary Team

Name/Title	Organization
Kendal Hicks Assistant Conservationist	USDA - NRCS
James Jayne Director of Special Initiatives	Coconino County
Tony Robbins Natural Resource Manager	BIA-WNA
Casey Francisco Range Management Specialist	BIA-WNA
Renee Benally Natural Resource Specialist	BIA-WNA
Leonard Notah	Navajo Region Office-BIA
Myles Lytle	Navajo Region Office-BIA
Robert Begay	Navajo Region Office-BIA
Pete David, Natural Resource Lead	Sundance Consulting
David Larsen, RPA, Cultural Resource Specialist	Sundance Consulting
Kelsey Patterson, Natural Resource Specialist	Sundance Consulting
Norman Lowe, Range Specialist	Sundance Consulting

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APPENDIX A. CROPLAND MANAGEMENT PLAN FOR LAND MANAGEMENT DISTRICT 3, NAVAJO NATION, COCONINO COUNTY, AZ

PEA APPENDIX A
Cropland Management Plan for Land Management District 3, Navajo Nation, Coconino County, Arizona

Draft

Prepared for:

Bureau of Indian Affairs – Navajo Region

Western Navajo Agency
Branch of Natural Resources
P.O. Box 127
Tuba City, AZ 86045

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ACRONYMS

AF	Acre Feet of water
AFHF	Agriculture Food Hub Facility (proposed)
AIARMA	American Indian Agricultural Resources Management Act
ALUP	Agriculture Land Use Permit
ATC	Agricultural Technical Center (proposed)
BIA	Bureau of Indian Affairs
BMP	best management practice
CARES	Coronavirus Aid, Relief, and Economic Security
CFA	Community Farmer Association (proposed)
CFR	Code of Federal Regulations
CMP	Cropland Management Plan
CUA	customary use area
DEQ	Department of Environmental Quality
DGCM	District Grazing Committee Members
DOI	U.S. Department of the Interior
EA	Environmental Assessment
EQIP	Environmental Quality Incentive Program
FBFA	Former Bennett Freeze Area
FPEA	Final Programmatic Environmental Assessment
FPEIS	Final Programmatic Environmental Impact Statement
FSA	Farm Service Agency
ft	feet
GIS	geographic information system
gpm	gallons per minute
IRMP	Integrated Resource Management Plan
JFB	Joint Farm Board
KVFA	Kerley Valley Farmers Association
LCR	Little Colorado River
LMD-3	Land Management District #3
N Aquifer	Navajo Aquifer
NEPA	National Environmental Policy Act
NGO	non-governmental organization
NHLC	Navajo-Hopi Land Commission
NNC	Navajo Nation Code
NNDA	Navajo Nation Department of Agriculture
NNDWR	Navajo Nation Department of Water Resources
NRCS	Natural Resources Conservation Service
NTUA	Navajo Tribal Utility Authority
ONHIR	Office of Navajo and Hopi Indian Relocation
PEA	Programmatic Environmental Assessment
PPC	Program Performance Criteria
PVC	polyvinyl chloride

RMP	Range Management Plan
RU	Range Unit
SOP	Standard Operating Procedures
TK	Traditional Knowledge
USC	U.S. Code
USDA	U.S. Department of Agriculture
WNA	Western Navajo Agency

SECTION 1.0 EXECUTIVE SUMMARY

This Cropland Management Plan (CMP) is a conservation plan used to protect trust land for agricultural purposes. The CMP is a lower-level resource management plan developed under the framework of the Integrated Resource Management Plan (IRMP) for the 1.6-million-acre Former Bennett Freeze Area (FBFA). This CMP is the first 10-year plan authorized under the American Indian Agricultural Management Act (AIARMA) for the Bureau of Indian Affairs' (BIA) Western Navajo Agency's (WNA) 1.4-million-acre Land Management District 3 (LMD-3). The historical neglect of water and agricultural infrastructure deficits on the Navajo Nation requires an aggressive plan to develop a water development program. The goals and actions proposed in this CMP provide a direct response to the seven major issues of concern determined from public scoping sessions with local farmers:

1) Lack of functioning permitting system and resource enforcement.
2) Low crop production.
3) Low-income revenue from farming.
4) Lack of engagement in practicing the culturally vital Navajo farming lifeway.
5) Neglected farmlands resulting in severely degraded soils and other multiple resources.
6) Lack of sufficient clean water.
7) Lack of education, tools, and assistance to apply best management practices.

Because of this situation, the CMP's inter-agency scoping team agreed a CMP was needed that supported the six AIARMA objectives to achieve the following:

1) Regulate farmland use.
2) Maintain high agricultural production.
3) Increase income from agriculture.
4) Protect wildlife, plants, soil, and water.
5) Educate, train, and provide assistance to farmers.
6) Develop value-added industries. The Final FBFA IRMP complements these AIARMA objectives, as noted throughout the CMP.

This CMP proposes a new institutional perspective to close the gap between the current situation where the six AIARMA objectives are not being met to achieve desired outcomes in three steps:

1) Establishment of a Navajo Nation Agriculture Technical Center (ATC) with certified agricultural extension service staff to ensure progressive water development and monitoring with education and technical assistance to farmland associations and individual farmers.
2) Establishment, with ATC assistance, of Community Farmer Associations (CFA) at a dozen irrigation project locations to enhance local results.
3) Establishment of an Agriculture Food Hub Facility (AFHF) with the ATC to optimize value-added income to help farmers process and market products, and create wide-spread availability of local foods.

The ATC program will facilitate both 1) irrigated and dry farmlands of over 1 acre benefitting from a community-level farmer's association that would be issued an Agricultural Land Use Permit (ALUP) to ensure conservation plan implementation, and 2) home gardening practices available to families on their homesites. Producers are the foundation of the local food systems

and will be offered support and encouragement along with service delivery. There will be less emphasis on governing and more emphasis on support.

Water availability is key as all scales of food, forage, and fiber production depend on development, efficient delivery, and conservation use of limited clean water resources to meet sociocultural economic needs. This AIARMA-based CMP opens federal funding opportunities, including from Navajo Thaw program proposed funding, to develop the FBFA in a manner that supplies minimum needs for water (referred to as “water-thrifty” needs) for farmland and livestock, as well as human potable water needs.

SECTION 2.0 PLAN BACKGROUND

2.1 Purpose

This CMP is a conservation plan developed for use to protect trust land for agricultural purposes on LMD-3 located on the Navajo Nation within the WNA. The CMP is a lower-level resource management plan developed under the framework of the IRMP for the 1.6-million-acre FBFA as the proposed federal action of Balanced Growth Emphasis of the FBFA Final Programmatic Environmental Assessment (FPEA), authorized under AIARMA and the National Environmental Policy Act (NEPA). The AIARMA defines IRMP as a "plan developed pursuant to the process used by tribal governments to assess available resources to provide identified holistic management objectives that include quality of life, production goals, and landscape descriptions of all designated resources that include …agriculture…" (25 U.S. Code [USC] Section 3703 (11)). Under the AIARMA, "development and management of Indian agricultural lands in accordance with integrated resource management plans will ensure proper management of Indian agricultural lands and will produce increased economic returns, enhance Indian self-determination, promote employment opportunities, and improve social and economic well-being of Indian and surrounding communities." (25 USC 3701(4)). The FBFA IRMP is a strategic long-range management plan based on the Navajo Nation's vision, interests, needs, and concerns for their natural and cultural resources, and is a result of cooperative intergovernmental planning and intends to serve as a strategic planning document for the redevelopment of the FBFA (Section 1, FBFA IRMP, 2020). Specific purposes listed in the FBFA Programmatic Environmental Assessment (PEA) include:

- Preparation of soil inventories, farmland management plans and monitoring programs,
- Integrated pest management plans to control weeds,
- Administration of agricultural permitting activities,
- Technical assistance to individuals engaged in agricultural production, and
- Educational assistance in agriculture (Section 1.2 FBFA PEA, 2020).

As defined in the Indian Agriculture Manual (BIA 54 IAM 1-H): Agriculture/Agricultural refers to crops, marketable or traditionally used materials, and livestock production for commercial as well as subsistence use"; Farmland means "Indian land, excluding Indian forest land that is used for the production of food, feed, fiber, forage, seed, oil crops, or other agricultural products, and may be either dry land, irrigated land, or irrigated pasture." This CMP document is a 10-year agricultural plan required by the AIARMA to guide development, management, and education concerning resource management and monitoring for all scales of farming on BIA's Western Navajo Agency's 1.41-million-acre LMD-3. This CMP lies entirely within the 1.60-million-acre FBFA, comprising 88% for the FBFA. This CMP fulfills the BIA's trust responsibility as trustee of Indian lands to include a Three-Part Holistic Goal: Quality of Life, Production Goals, and Landscape Description [AIARMA Section 4 (11)] as identified in the following sub-sections.

This plan follows BIA Standards and Requirements listed in the 54 IAM 3 for Agricultural Resource Management Plans (the equivalent of Cropland Management Plan) which states:

The following standards and requirements are to be followed in order to assist Tribes/Tribal governments with developing, updating, and amending ARMPs and to help Tribes make sound natural resources management decisions on trust lands.

A. Manage each Tribe's agricultural resources in accordance with the goals and objectives set forth in the Tribe's approved ARMPs.
B. Promote efficient and cost-effective agricultural program resource management planning by requiring IRMPs written or funded by BIA meet the process and content requirements for ARMPs set forth at 25 USC 3711.
C. Work with authorized land users, Indian landowners, U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), and the Farm Service Agency (FSA), where indicated, to develop conservation plans for each agricultural lease and permit.
D. Meet the USDA NRCS and FSA conservation planning process and content requirements in conservation plans written by BIA where participation in USDA Farm Bill programs is anticipated.
E. Accept conservation plans written by the NRCS in cooperation with Indian Tribal entities, landowners, and land users as fulfilling the conservation planning requirements contained in 25 Code of Federal Regulations (CFR) 166.312, when consistent with a current Memorandum of Understanding between the U.S. Department of Interior (DOI), BIA, USDA NRCS, and FSA.

This CMP addresses two scales of crop production:

1) Farmlands — The Agency considers farmlands as fields of 1 acre or more. BIA requires an ALUP on farmlands which includes a conservation plan.
2) Home Gardens — Home gardens are small gardens of less than 1 acre inside a homesite.

2.2 Quality of Life Goals

The following list of goals reflect holistic AIARMA and Traditional Knowledge (TK) principles in the farm and garden landscapes for both greater farm and garden production and for resources stewardship. Quality of Life Goals are intended to provide a vision of health and happiness for stakeholders and their families involved in gardening and farming on LMD-3. The following may be used as goal statements for LMD-3 landholder residents, as it is balanced to the Diné 4-Direction Lifeway:

- Values/philosophy: Locally grown food anchors a sacred personal connection of Diné to their lands, building deep stories and strong k'e relationships. A revitalized agricultural community grows strong over time, where gardeners and farmers have agreed on a strong TK vision for themselves, and are in communication with each other through meetings, education, assistance programs, and shared media.
- Making a Living: Locally grown nutritious and healthy foods are widely grown and prepared to promote health and prevent diabetes, obesity, and other growing health problems. Much more dependable clean water is developed to support a great diversity of local employment in agriculture, from home gardens and greenhouses to farm plots, to large commercial farms and markets.

- Social Competence: A vibrant rural lifestyle is renewed for farmers and gardeners with strong connection to land and traditional culture and ceremony for all family members.
- Revitalized agricultural community: Landholder's working with the land builds family purpose, good family k'e connections, self-esteem, leadership skills, and promotes safe homes.
- Ecological Regeneration: Active land resource stewardship through regenerative agriculture cultivates a healthy "paired-community" of humans and land to sustain production for people that is reflected in beauty and health in the nature community to be shared by family, neighbors, and larger community.

  The combination of farmlands and home gardens can help Diné self-identify as members of a revitalized active agricultural community who provide locally grown nutritious food needed to sustain the health of residents.

2.3 Public Scoping and Stakeholder Meetings

Public scoping for this project consisted of a series of community meetings held in April 2019 attended by 121 participants. Meetings provided public disclosure of the proposed action and discussed the critical elements of the NEPA Environmental Assessment (EA) process. The scoping meetings included a presentation of the CMP planning process; the goal of the scoping process; background information on historical farming on the Navajo Nation; existing conditions; and CMP goals, needs, and best management practices (BMPs). CMP scoping meetings described the main farming areas, need for ALUPs re-issuance, and needed upgrades to irrigation canal systems. Details of the meeting locations and comments are included in the EA.

2.4 CMP Goal

The overall goal of this CMP is to produce a strategy for creating a sustainable agriculture system through the production of nutritious and healthy food and stimulate economic development from the marketing and sales of excess produce.

Plan goals listed in the 54 IAM 1-H include: "In order to protect, conserve, utilize, and manage Indian agricultural and grazing lands, BIA performs the following functions:

- Inventory and monitoring of agricultural resources;
- Development of agricultural resources management and conservation plans for trust Indian assets; and
- Conducting lease and permit administration, compliance, and enforcement."

Objectives of this CMP are:

1. To delineate agricultural zones for irrigated and dryland farmlands;
2. To increase participation of the local people in farmland and commercial-scale irrigated farming, and home gardening;
3. To determine available agriculture resources for improving, conserving, and protecting farmlands;
4. To provide for the management of farmlands to achieve AIARMA's six key objectives, including providing holistic management objectives; and
5. To define critical agricultural values of Tribal members, defining holistic management objectives.

The final sections of the plan outline recommendations for shared leadership required to achieve results, including the acquisition of major funding for needed water development, technical assistance, and education, as specified in the IRMP for the FBFA.

SECTION 3.0 LMD-3 Background

3.1 Location and Topography

LMD-3 encompasses over 1.4 million acres in the central area of northern Arizona and forms the westernmost portion of the Navajo Nation (Figure 1). Four Chapters are included within the boundary: (1) Bodaway-Gap, (2) Cameron, (3) Coalmine Canyon, and (4) Tuba City. Two US Highways (US 89 and US 160) and two Arizona State Highways (AZ 64 and AZ 160) traverse through LMD-3. LMD-3 is bordered by the Kaibeto Plateau to the north, the Colorado River and Coconino Plateau to the west, the Painted Desert to the south, and the Moenkopi Plateau to the east. The Little Colorado River (LCR) traverses through LMD-3 starting in the south and meandering west and eventually meeting up with the Colorado River at the confluence along the western border of LMD-3 (Figure 1).

3.2 Historical and Continuing Crops Inventory

The BIA Branch of Land Operations has kept historical crop production records since the issuance of ALUPs, but most of the records are archived. BIA has provided crop production records to the Navajo Nation Council Subcommittee, the Resources Development Committee, over time. Currently, the crop production reports are completed by the Navajo Nation Farm Boards who submit quarterly reports to the Navajo Nation Department of Agriculture. BIA Branch of Natural Resources at the agency level maintains and administers ALUP records. Historically designated water masters for each irrigation system made sure maintenance was done and water was distributed fairly among farmers.

The Navajo Nation Department of Water Resources (NNDWR) and BIA crop production records show almost 20 different crops have been grown in Kerley Valley. Corn is the most common crop, which typically uses 40 to 50% of irrigated acreage. The second most common crop has been a combination of pasture, hay or fodder, which also uses 40 to 50%. The third most common crop has been a combination of beans, melons, and squash. Apples, apricots, peaches, pears, and grapes were reported. Potatoes, onions, cantaloupe, green chili, and greens are also grown. Alfalfa in Pasture Canyon can have a possible five cuttings (NNDWR, 2000). The Navajo Nation Department of Agriculture maintains the Crop Inventory Reports for all the Navajo Nation farmlands.

Annual water flood irrigation demands are 39 inches for alfalfa, 22 inches for corn, 21 inches for potatoes and 30 inches for squash. Peak demands are 4.64 gallons per minute (gpm) per acre of alfalfa, 6.93 gpm per acre for corn, 5.89 gpm for potatoes and 7.14 gpm for squash, with peak demands between late June and early August. The flood and row irrigation systems used historically are only about 27% efficient; BMPs (as described in Section 8.0 of this CMP) can get this up to 35%, and using gated pipe can increase this to 60%, with highest efficiency using drip systems (NNDWR, 2000).

3.3 Climate

LMD-3 is semiarid desert. The long-term average rainfall for LMD-3 is 6.0 inches; 5.6 inches at Cameron at 4,200 feet (ft) elevation to 6.5 inches at Tuba City at 4,960 ft elevation (WNA BIA, 2021). The average annual precipitation in the Moenkopi Wash basin above Kerley Valley is

9.5 inches per year. Years fluctuate from 25% below normal rainfall in dry years to 25% above in wet years. The area has been in prolonged drought for over two decades. The average minimum temperature falls below freezing from November through March. The growing season for alfalfa extends from the beginning of February though the end of November (NNDWR, 2000).

Due to the scarcity of water, most farms are found along the Echo Cliffs formation, downhill from springs where the Navajo Aquifer (N Aquifer) flows from sandstone cliffs extending south from Gap, Arizona, to the Moencopi Wash at the south cliff-edge of Tuba City. Large farms are being proposed to the southeast of Cameron, Arizona, using alluvial aquifer water pumped to low benchlands above the LCR.

3.4 Demographics

According to 2020 U.S. Census data, LMD-3 has a population of about 12,000, living in four chapters: Bodaway Gap Chapter in the northeast section, Cameron Chapter in the southwest sector, Coalmine Canyon Chapter in the southeast sector, and Tuba City Chapter in the northeast sector. Most of the population is considered urban, with 70% living in Tuba City, approximately 15% living in Cameron and small communities. Approximately 15% live more remotely in dispersed ranching camps and single homes on customary use areas (CUAs).

3.5 Current Farmland Conditions

The Final Draft FBFA IRMP Table 4.5, reprinted below as Table 1, lists the following for LMD-3:

Table 1. Number of Farms and Acres for LMD-3

	Irrigated	Dryland	Total
Number of farms	128	51	179 each
Number of acres (ac)	633	378	1,030 ac

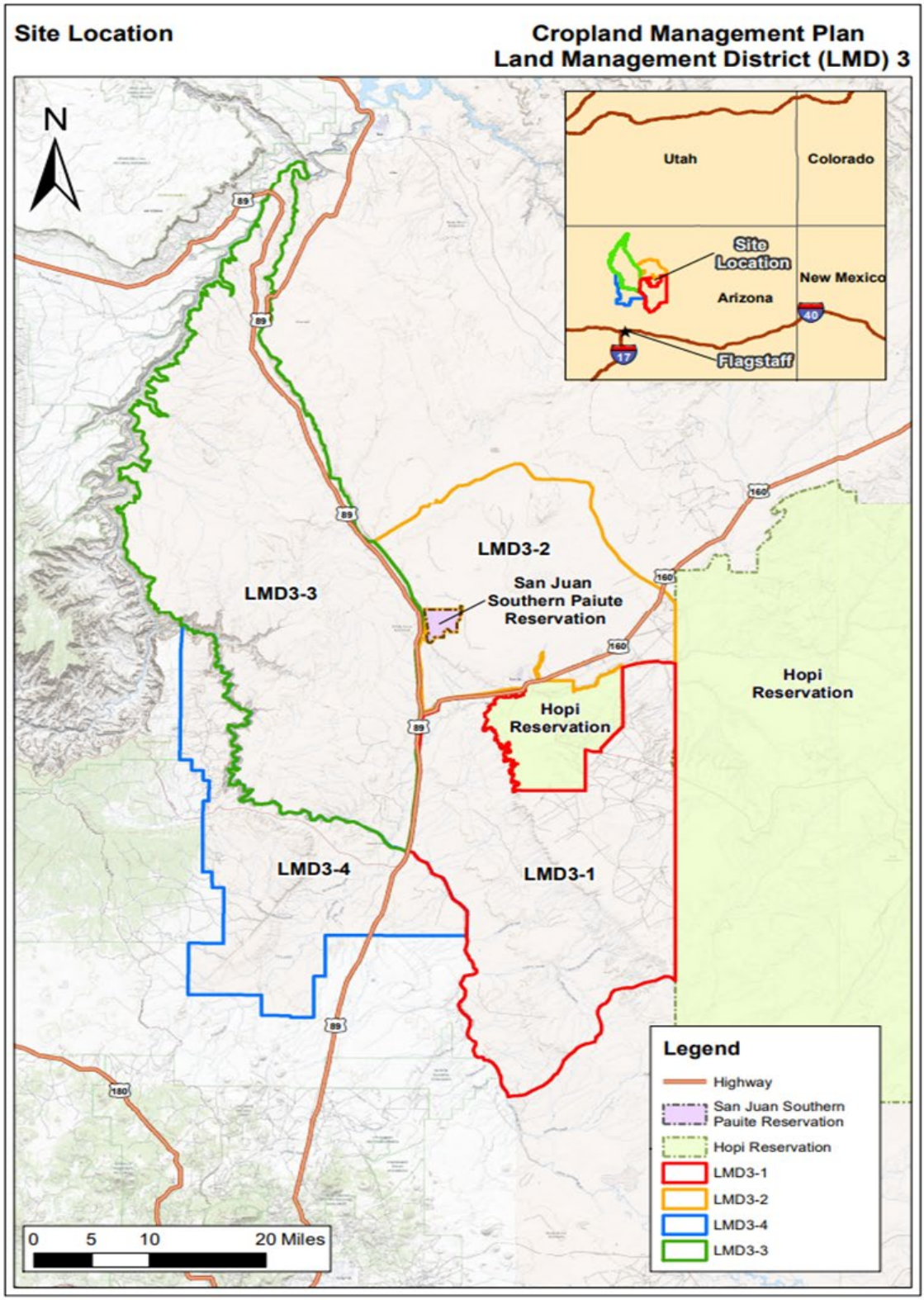
A complete list of farm numbers and acreage by plot is listed in section 6.4 of this CMP.

BIA's WNA ALUP inventory lists 32 of the farmlands (18%) as having been issued ALUPs, as most farmlands predate the policy requiring farmers to hold an ALUP. From discussions with BIA staff and area farmers, the CMP contractor estimates about half of the total farmland acres are available for annual production use, with the remaining acres in abandoned or in probate status. The FBFA IRMP lists 57 of the 128 irrigated farms (45%) on LMD-3 as being located in the Kerley Valley (see Table 2, Section 6.4 of this CMP). In a personal communication with the CMP contractor, the president of the recently formed Kerley Valley Farmers Association (KVFA) estimated only eight farms had been planted for the 2022 growing season (Williams, Rosemary, August 11, 2022).

An unknown number of people keep backyard gardens. The Navajo Nation Department of Agriculture has some information on this through their Agriculture Infrastructure Fund's Farm and Garden Crop Report. There is a seasonal farmers market in Tuba City and a few non-governmental organizations (NGO) promote home-scale gardening. The Church of Jesus Christ of Latter Day Saints is an NGO which gives gardening supplies out, including seeds, drip

irrigation systems, and tillers (Natalia Robbins Sherman, personal communication July 13, 2023).

Figure 1. Map of Roads, LMD-3 Boundaries, and Communities



SECTION 4.0 AUTHORITY

4.1 Government Authority

The BIA has responsibility for the management of Indian agricultural land under the AIARMA. The AIARMA obligates the Secretary of Interior to "conduct all land management activities on Indian agricultural land in accordance with the goals and objectives set forth in an approved agricultural resource management plan, in an integrated resource management plan, and in accordance with all tribal laws and ordinances" (25 USC 3712(a) – as quoted from FBFA IRMP, 2020). The Navajo Nation and the DOI BIA are responsible for managing all agricultural activity on the Navajo Nation as regulated by written rule of law in the AIARMA; NEPA; BIA IAM 1-H, PL 103-177; 25 USC 3711, 3712, and 3715; 25 CFR Part 166.311 and Part 167; and Navajo Nation Code (NNC) Title 2 (fundamental law); NNC Title 3 (agriculture); Navajo Nation Treaty of 1868; Draft BIA Standard Operating Procedures (SOPs), Navajo Nation Integrated Weed Management Plan/Final Programmatic Environmental Impact Statement (FPEIS), December 2022 EIS/CEQ No. 20220131; and FBFA IRMP/PEA, December 2022. The AIARMA was passed by Congress in 1993 to carry out federal trust responsibilities and provides for the management of Indian agricultural lands and related renewable resources in a holistic manner that increases economic returns, promotes educational and training opportunities, and improves social and economic well-being of Indian communities, while sustaining conservation of natural resources. These goals are incorporated within this 10-year plan to coordinate needs of Indian tribes and individual Indian land users in a manner that protects federal trust responsibilities.

The BIA has the trust responsibility to maintain agricultural and rangeland health on all acreage of LMD-3. For 98% of LMD-3's land base, this is executed through a Range Management Plan (Draft RMP) (WNA BIA, 2021) drafted in October 2021 that features a permitted grazing structure featuring CUAs and Range Units (RUs), as outlined in 25 CFR Section 167. The 1,030 acres of historical farmland, and 4,000+ acres of farmlands proposed on the LCR, would be managed under this CMP's guidelines.

The BIA WNA Branch of Natural Resources' mission is "to maintain overall productivity of grazing, farming, water, and wildlife. The goal and objectives are to improve and enhance all resources in line with the sustained yield management concept and to achieve the highest return on a sustained yield basis" (WNA BIA, 2018). Land leasing is covered under federal regulations 25 CFR 162 B. Procedural details are covered by the BIA Navajo Region's Draft SOP manual, Chapter 10.

Per AIARMA directive, this CMP serves as the guideline for LMD-3 agricultural activities/ projects and farmlands. NNC Title 3 covers Agriculture and Livestock and Subchapter 4, Sections 61-69, covers major Irrigation Projects under Farm Boards. LMD-3 is under the Western Navajo Farm Board, which exists to review and to make recommendations (issue, transfer, cancel) for ALUPs and to provide assistance to farmers. Navajo Nation Farm Boards operate under the jurisdiction of the Central Grazing Committee or the Resources and Development Committee, Subcommittee of the Navajo Nation Council. The Farm Board are elected officials; however, they are administered under the Navajo Nation Executive Branch, Division of Natural Resources, Navajo Nation Department of Agriculture. The Central Grazing

Committee provides final authority and approval of Farm Board legislation and/or Plan of Operation for (1) the Joint Farm Board (13 Farm Boards) and (2) Each individual Farm Board (13).

District Grazing Committee Members (DGCM) are instituted to manage (1) the inventory of livestock; and (2) dry land farming. The DGCM and Farm Board work together to ensure the natural resources are managed for sustainability and health of the environment. The Farm Boards have oversight of farmlands that meet one of the following projects:

Lake Powell farm land

River projects farm land, or

Miscellaneous project farm land.

The DGCM have oversight of those farm assignments outside the authority of the Farm Boards. Each chapter does NOT have a Farm Board elected representative (43); however, all chapters do have DGCM elected representatives.

The Navajo Nation Major Irrigation Farm Board (Farm Board) Plan of Operations explains the establishment, purpose, structure, responsibilities, authorities, and legislative oversight. The Farm Boards were established by the Navajo Tribal Council Resolution CAU-51-80 and Advisory Committee Resolution CIA-1-81, in accordance with Title 3, NNC Section 61-69.

The Farm Boards were created to enumerate farms, improve agriculture products and techniques, and to develop and improve irrigation systems. There are 13 Farm Boards in certain Chapters. Each affected Chapter elects a Farm Board member to represent, to administer, improve, and promote agriculture within their jurisdiction for a total of 43 Farm Board members throughout the Navajo Nation. Each Farm Board must have a Plan of Operation (Policy and Procedure) stating the specific acreage covered.

The current Farm Board Plan of Operation was approved by the Resources and Development Committee, Navajo Nation Council Subcommittee, on November 6, 2017. The Plan of Operation requires submittal of two Crop Reports annually, one report for planting and one report for harvest. In addition to meeting once a month, the 13 Farm Boards meet every quarter as a Joint Farm Board (JFB). The JFB developed and approved a standardized (1) Crop Report, (2) Farm Conservation Plan Template (reviewed by the Navajo Nation Department of Justice and approved by the Resources and Development Committee), (3) Quarterly Report Format, and (4) quarterly Program Performance Criteria (PPC). The JFB is also working to create a JFB Standard Operating Procedure, Plan of Operation, and ALUP Management Plan.

The JFB assists the 13 Farm Boards to achieve an overall goal to increase farming on the Navajo Nation. Longterm plans include the cancellation, transfer, and/or issuance of ALUPs to achieve active farming. The JFB established PPC helps Farm Boards work towards making recommendations to issue ALUPs to those that want to farm. As such, they are working to address idle or abandoned farms. Farm Conservation Plans and Crop Reports also play an important role as these documents are needed to properly manage existing and new farms. The Crop Report establishes a history of farming or non-farming within a two-year period, which is needed to cancel and/or transfer idle or abandoned ALUPs. In addition, the PPC assists the active farmer with farm management and operations.

Subchapter 5 of the NNC Title 3 covers Small Irrigation Projects under District Grazing Committees and Article 1, Sections 151-154, covers agricultural land assignment. Applications for assignments of farmland are made to the Grazing Committee, which recommends approval to the BIA Navajo Region Regional Director. Applications must include a Plan of Operation developed with the Navajo Nation Department of Agriculture and BIA WNA Branch of Natural Resources. Article 2, Sections 171-176, cover Regulation by District Grazing Committees. The District Grazing Committee will enforce and carry out the duties of small irrigation projects and scattered farm acreages. This includes supervision of fencing and waters.

4.1.1 Integrated Planning

The 1.4 million-acre LMD-3 lies completely within the 1.6 million-acre FBFA. Under authority of the AIARMA, the Navajo Nation and BIA signed a Memorandum of Understanding to develop the FBFA IRMP to promote the sustainable development of FBFA resources. This IRMP was published in May 2020 and approved by the Navajo-Hopi Land Commission (NHLC) resolution of September 28, 2020, and approved by Navajo Nation Resource and Development Committee resolution of October 7, 2020. The IRMP has four focus requirements: 1) RMP, 2. CMP, 3) Woodlands Management Plan, and 4) Water Management Plan (Figure 2). The IRMP acknowledges that successful farming, at all scales, depends on the structure of RUs and CUAs, and planning for water needs. Also, the IRMP commits to make available government funding for BMPs to address the adverse legacy effects of the FBFA. The Navajo Thaw is one such large funding program.

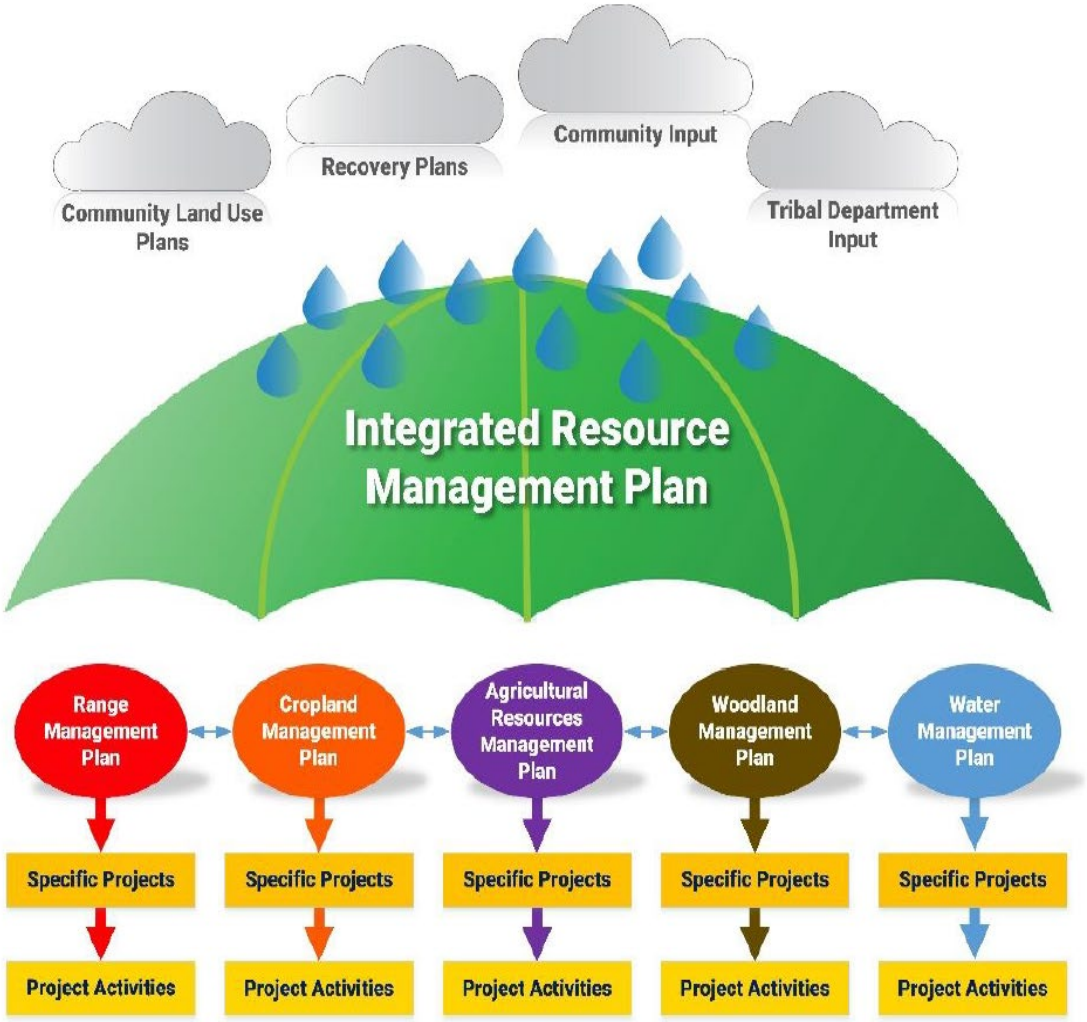
4.2 Navajo Nation Authority in Fundamental Law and Traditional Knowledge

Navajo Nation Fundamental Law and TK with grounded 4-Direction Lifeway provides guiding light for reestablishing a thriving agricultural community from home gardens to large farms.

Authorities to be respected include the people, traditional leaders, traditional law, customary law, natural law, and common law. Key elements, as adopted by Navajo Nation Council 102 in 2002, relate to agriculture. The Navajo 4-Direction Lifeway model defines true modern agricultural communities for the twenty-first century and beyond, which are fully capable of sustaining a healthy, beautiful way of living in harmony with nature (Navajo Division of Education. 1990).

In summary, Navajo Fundamental Law and TK relies on a democratic interconnected web with a base of local people, traditional leaders, and common law to keep building their agricultural rooted stories. Recommendations include: LMD-3 residents to have freedom and opportunity to have access to land for home gardening as well as larger scale farming; agencies to work with residents to ensure land is put to its most beneficial use by willing and able gardeners and farmers; policies to be aligned to ensure the most logical willing and able persons receive land use rights, and farmland to be kept intact and not fragmented over time. This CMP provides the policy; implementation of this policy once approved lies in the hands of the Tribal members together with the BIA.

Figure 2 Integrated Resource Management Plan Process (FBFA, IRMP, 2021)



4.3 Navajo Nation Farm Board Roles and Responsibilities

Navajo Nation Farm Boards are organized to fulfill an obligation as stated in Title 3 of the NNC, Section 62.

Section 4.2.1.1 of the FBFA IRMP describes the functions of the Farm Board as:

- Review and approve the granting, assignment, re-assignment, cancellation, relinquishment, transfer, leasing and subleasing of ALUPs with concurrence of BIA Navajo Region and Navajo Nation Department of Agriculture.
- Review and recommend approval of (1) ALUPs to the Navajo Nation Resources and Development Committee and (2) construction of irrigation project boundary fences, irrigation canal rights-of-way, water use assessments, other matters involving agricultural land or irrigation water management in accordance with applicable laws.
- Assess and collect fees for water assessments to be used to improve local irrigation operations and maintenance.

- Mediate and maintain office written records of disputes that may arise among ALUP holders. Copies of all official agreements and records shall be furnished to the Navajo Nation Department of Agriculture and BIA.

Farm Boards also coordinate agriculture conservation plans, maintenance of projects, and public education on farming. The goal of a farm conservation plan is to make beneficial use of the land through crop production, which involves improving soil health, reducing erosion, managing pests, managing irrigation better, and considering wildlife habitat.

The Navajo Nation Western Farm Board serves LMD-3. It is the 13th and most recent Farm Board formed by the Navajo Nation, established in the 1990s. A new Farm Conservation Plan template was approved by the Resources and Development Committee. Navajo Nation Council Subcommittee on December 29, 2022 (#12-22), including an eight-page template for topics to be covered. The only Farm Board with a Policy and Procedures approved by the Navajo Nation Resources and Development Committee is the Ganado Farm Board. It serves as the best model for a comprehensive Plan of Operations and is recognized by the BIA. The Navajo Nation Department of Agriculture (NNDA) will provide assistance to the Farm Boards. The NNDA worked with the JFB to draft the Farm Board Conservation Plan Template, which includes policy guidelines. The NNDWR issues water use permits, and the BIA approves and maintains records, including safeguarding Land Use Permits for agriculture.

SECTION 5.0 GOALS AND OBJECTIVES

This section explains how the government can meet both the six AIARMA objectives (AIARMA Section 101 (a) Management Objectives) and the eight Goals identified in the NEPA scoping process completed in conjunction with this CMP.

The FBFA IRMP's proposed action of Balanced Growth Emphasis includes goals to "direct and implement natural resources management to aid in FBFA recovery while effectively holistically managing natural resources." IRMP goals include:

- Providing gainful employment opportunities within the community for community members;
- Providing lifelong educational opportunities to community members;
- Providing economic opportunities that fosters education and training, and provides jobs that support community desire to be self-sufficient and independent;
- Respecting and honoring traditional values, such as livestock grazing and agriculture, while balancing the need for growth and development within the community; and
- Protecting natural and cultural resources (Section 2.3.2 FBFA IRMP, 2020).

The six Management Objectives listed in AIARMA section 101 are listed in subsections 5.1 to 5.6. Each subsection discusses how objectives are not now being met, and goals are listed for meeting each objective.

5.1 Objective of Regulating Farmlands

AIARMA section 101 (b) is entitled the Objective of Providing Management of Indian Agricultural Land through an Agricultural Resource Management Planning Program, which is anticipated to be completed through a 10-year Indian agricultural resource management and monitoring plan, such as this CMP. This management is carried out by the executive branches of the BIA and Navajo Nation responsible for the LMD-3 area.

CMP NEPA scoping meetings determined the number one farming issue is lack of enforcement by agencies to ensure farmland is used according to permit stipulations and fencing is maintained to keep livestock out. A review of BIA records of historical farm permits, and the many interviews with farmers in 2022 confirm the existing permitting system is broken and that most farmlands are no longer in use nor are livestock being kept out with fencing. This is due to the historical farm permitting system being based on an individual property system where many farms are not transferred to farmers willing and able to engage in annual farming practices and many individuals building homes on prime irrigated farmlands.

GOAL 1 is to Improve Regulation Enforcement by BIA and Navajo Nation working through a newly instituted ATC to issue ALUP farming permits to CFAs responsible for the inclusive management of large contiguous farmland areas. Democratically elected CFA leaders will issue sub-permits to qualified able bodied farmers and create and administer collective conservation plans to ensure achievement of the production and conservation goals. The CFA will work under the supervision of the ATC in organizing the association, formulating a conservation plan, installing farming infrastructure, and supplying water to fields. See Section 6.0 for details on creating the ATC and CFAs.

5.2 Objective of Maintaining High Agricultural Production

AIARMA Section 101 (a) (1) is entitled the Objective of Maintaining High Agricultural Production from sound conservation practices. Section 2.2.1 of the 2021 FBFA FPEA states that the goal for agriculture areas is "maximizing development, productivity, and economical use of local farmland and irrigation water systems while ensuring their protection, conservation, and sustainability."

CMP NEPA scoping meetings noted that farmers were troubled with the lack of active farming, which they stated as "very little green being found on area farmlands anymore." Field observations and interviews by the contractor estimated that in 2022 under 10% of agriculture lands are producing green crops, and crops are being produced for only short seasons, mostly due to lack of adequate water from early spring into the fall.

GOAL 2 is to Increase Food Production by active farming. Issuing ALUPs directly to CFAs will empower leaders to select able farmers to work the land and direct water to best fields to optimize green production. Establishing an ATC will enable the rapid organization of CFAs that recruit and educate farmers who will irrigate more land. This structure opens direct opportunities for healthy foods and "food sovereignty" projects, including through the reginal medical center in Tuba City to directly involve hundreds of residents. See Section 6.0 for details.

5.3 Objective of Increasing Product Diversity, Income and Employment

AIARMA Section 101 (a) (2) states the Objective of Increasing Production and Product Diversity for Food, Income and Employment.

CMP NEPA scoping meetings noted farmers' concern that so few younger and able-bodied people are authorized to farm or have opportunity to make a career and life farming. Contractor field observations and interviews confirm that few farmers live near their farms, and few earn more money or benefits from farming than they spend for inputs. Lack of water and protection against theft are common concerns.

GOAL 3 is to Improve Farm Revenue and Employment through creating many jobs for growing and marketing a diversity of farm products. These jobs will come from establishing new farms on the LCR south of Cameron, significantly increasing production of the current 1,030 acres of farmlands and increasing home garden produce sold locally. As the biggest cost for farming is maintaining consistent clean water delivery to farm plots, the ATC will work with CFAs to involve many people of all ages and skills. An objective of the CFAs will be to rotate field use to fallow and regenerate lands, including use of cover-cropping, a practice that can double production. CFAs will have the leadership to get grants and hire a greater spectrum of laborers to keep farms producing. See Section 6.0 for details on proposed management.

5.4 Objective of Protecting Multiple Resources Values

AIARMA Section 101 (a) (3) states the Objective of Managing to Protect the multiple resources of Cultural Resources, Recreation, Wildlife, Water, Soil, and Plants.

CMP NEPA scoping meetings documented farmers' concerns that they are losing agriculture as a valued Navajo identity and that lands may be lost to housing development. Thus far, most traditional farmlands have not yet been lost to housing. Thousands of residents on LMD-3 need

the land-connection access to local farm goods essential for cultural ceremonies as well as nutritious food.

GOAL 4 is to Increase Culturally Vital Navajo Farming Lifeway among LMD-3 residents. Valued cultural farm-related lifeways will be ensured through the ATC assisting CFA formation with permitting to able farmers so all farmlands are under production and conservation plans that are written to ensure cultural values are included. The Food Hub will assist with demonstration farms and marketing of fresh products for seasonal and year-round availability to all area residents to enable continuation of traditional lifeways. Several interviews by the contractor with farmers and planners on LMD-3 individually and at meetings confirm they support such technical support.

CMP NEPA scoping meetings documented farmers' concerns that the multiple-use values of soils, water, wildlife, plants, and cultural resources are being lost forever. Contractor field observations and interviews confirm that most farmlands look like "moonscapes" with serious erosion and weed issues.

GOAL 5 is to Protect Multiple Resource Values of Wildlife, Water, Soil, and Plants through establishing an ATC able to quickly organize CFAs and get land into irrigation and production that, via ALUPs with solid conservation plans, will provide stewardship for the health of multiple resources. With fenced farming areas, wildlife agencies can do plantings to help pollinators and wildlife. Increased collaboration between agencies and farmers will result from the ATC and CFA structure, which will improve monitoring and enforcement. Soil mapping and testing will result from good working relations with NRCS and university extension. Wildlife, including pollinators, will be protected and enhanced through collaborative projects.

5.5 Objective of Providing Technical Assistance, Training and Education

AIARMA Section 101 (a) (4) states the Objective of Providing Technical Assistance, Training, and Education on conservation and business. Section 2.2.2 of the FBFA FPEA recommends these actions concerning water and agriculture:

- Quantify consumptive water use in the FBFA;
- Annually update inventories of water resources — to include wells;
- Conduct and prepare water availability studies and hydrologic assessments;
- Provide viable water supply alternatives;
- Implement adequate protective buffers — to include Pasture Canyon Reservoir and working with Hopi for access by Navajo farmers;
- Inventory, conserve, restore wetlands, riparian areas, and natural springs;
- Identify reaches along streams, rivers, and washes that need bank stabilization and other erosion mitigation;
- Evaluate soil properties and soil quality through soils tests, and utilizing series information;
- Develop different types of irrigated and dryland farming practices to maximize production and improve air, water, plant, and soil quality using USDA NRCS conservation practices;
- Identify areas of concern, implement restoration projects, and preserve productive areas;
- Monitor, maintain, and evaluate specific conservation projects; and

- Coordinate weed removal efforts.

CMP NEPA scoping meetings documented most farmers are concerned about the scarce quantity and quality of available water. Though there is a reliable source of water from springs along cliffs for many of the farmers, most farms do not have reliable water, and not all farmers can use technology assistance for efficient water delivery to designated farm acreage. The former big farms on Upper Moenkopi (Kerley Valley) and Lower Moenkopi Wash are no longer viable due to climate change, siltation, and other issues. Good quality water for farming is scarce and expensive to provide so it is beyond the affordability of most farmers without some financial support. Well water is generally of poor quality over much of LMD-3, so better sources and pipelines are needed.

GOAL 6 is to Increase Water Availability through establishing an ATC with staff accredited and experienced to do water source and delivery engineering tasks to get N Aquifer and other reliable sourced water of the area piped to farmlands where farmers will be assisted in efficient watering methods. The ATC will include staff and materials to assist CFAs to properly maintain water systems and farming infrastructure. Inter-agency cooperation will be needed for source site, right of way, and storage site permits. State-of-art geographic information system (GIS) mapping will be required for water lines and all farmland plotting and monitoring.

CMP NEPA scoping meetings documented farmers' concerns about lack of education, training, and tools to apply BMPs. Agriculture-related education and training is sporadic and there is no farming assistance program available. As the AIARMA has an emphasis on agriculture education, BIA Natural Resources staff have requested education outreach, demonstration projects and cooperative marketing be a part of this CMP.

GOAL 7 is to Provide Education, Training and Demonstration farms. The FBFA IRMP section 4.2.1.1 indicates that ALUPs serve a purpose of demonstrating methods of agricultural production, farm management and crop marketing, irrigation management, and other measures (FBFA IRMP). According to BIA, ALUPs are issued for land areas of under 28 acres; thus, Agriculture Leases are needed for larger association-managed areas (Robbins, Tony. July 13, 2023, communication). Establishing an ATC, which will administer issuance of the ALUPs, is the best means to ensure constant availability of quality educational outreach to all farmers in the district. The ATC will include greenhouses and demonstration gardens for training farmers. Staff will provide ongoing educational workshops and conduct demonstration tours of farms within the region. The Food Hub center at the ATC will facilitate value-added preparation and branding of bulk foods and help with a Farmers Market and farmer's marketing cooperative. See Section 6.0 for ATC details.

5.6 Objective of Developing Value-added Industries

AIARMA Section 101 (a) (5) states the Objective of Developing Value-added Industries to promote self-sustaining communities. This objective combines elements of other objectives of increasing food production and food diversity, employment, and technical assistance.

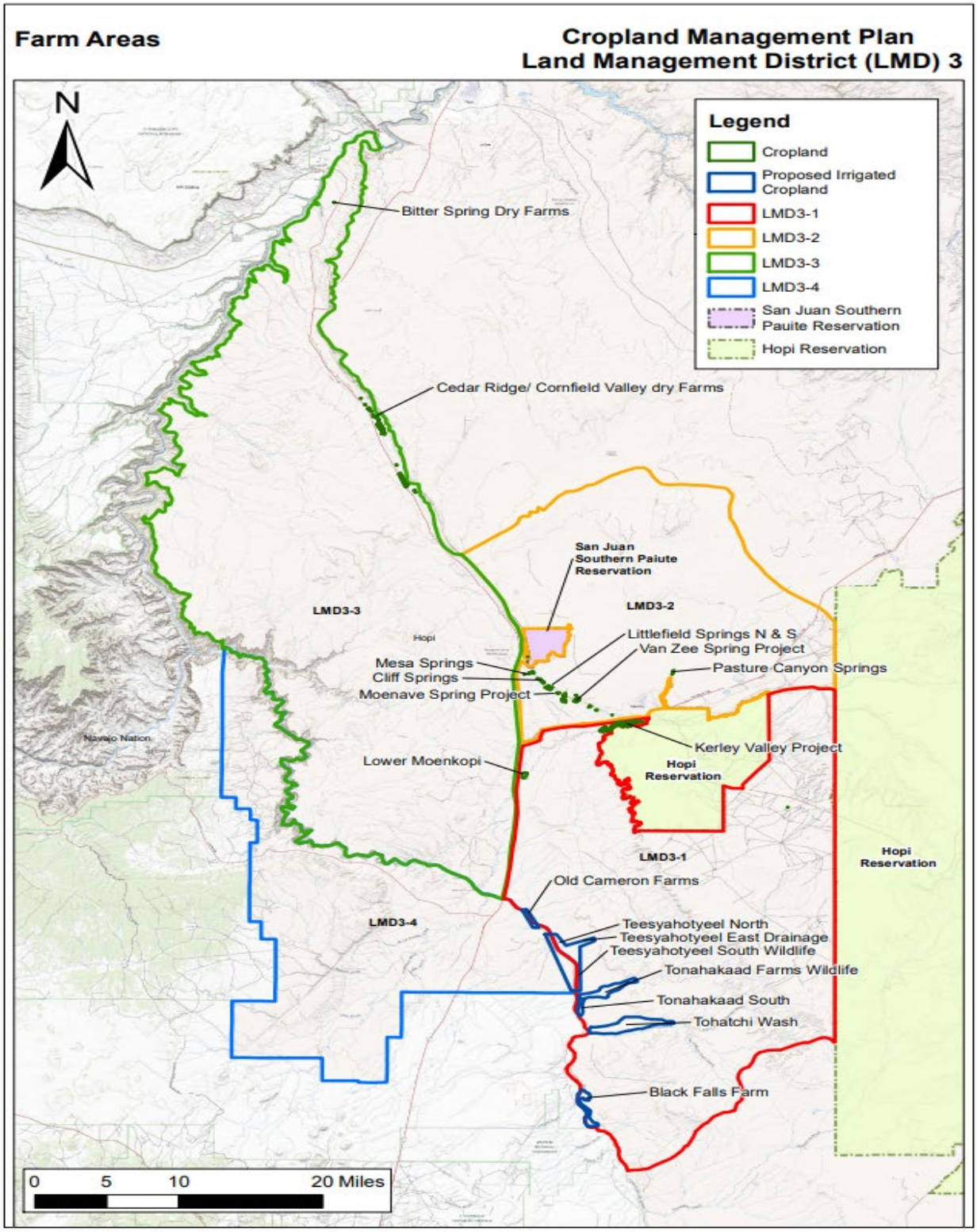
GOAL 8 is to establish a Food Hub at the ATC with a food processing area and kitchen, using seasonal staffing and volunteer workers to handle large volumes of seasonal produce, and to do canning, packaging, and branding to increase sale value. The site will be selected with assistance of the Farm Board and through an official land withdrawal through the Navajo Nation.

This Food Hub can multiply the efforts of farmers in achieving self-sustaining local communities.

5.7 Recommendations for Existing LMD-3 Farm Areas

This sub-section presents detailed maps and information on individual irrigation and dryland project areas of LMD-3. Table 4.5 of the Draft Final FBFA IRMP (See Table 1, above) shows a total of 1,030 acres historically farmed on LMD-3, with 623 acres irrigated (62%) and 378 acres dry farmed (38%). A review of maps and aerial photography indicates about 1/3rd more farm plot acreage than shown on BIA farm listings, so the farm associations will need to work with agencies to update records to include the additional acreage—which are typically the flood plains from springs and large washes. The process of issuing new ALUPs to CFAs will allow development to proceed on these farmlands already plotted on LMD-3, plus adding additional acreage in proposed projects along the LCR. These LCR projects have been engineered by Cameron Farms Enterprise, Inc., which has received its federal Employer Identification Number and is navigating the land withdrawal process. Biological compliance and historical preservation compliance has been completed, and an intensive Uranium Gama Ray Radiation Study has been completed. Agricultural leases, funding, and staffing are still required before farming can be done (Navajo Thaw, 2020 report). Figure 3 shows the locations of all LMD-3 farm areas.

Figure 3. LMD-3 Main Springs and Farmlands



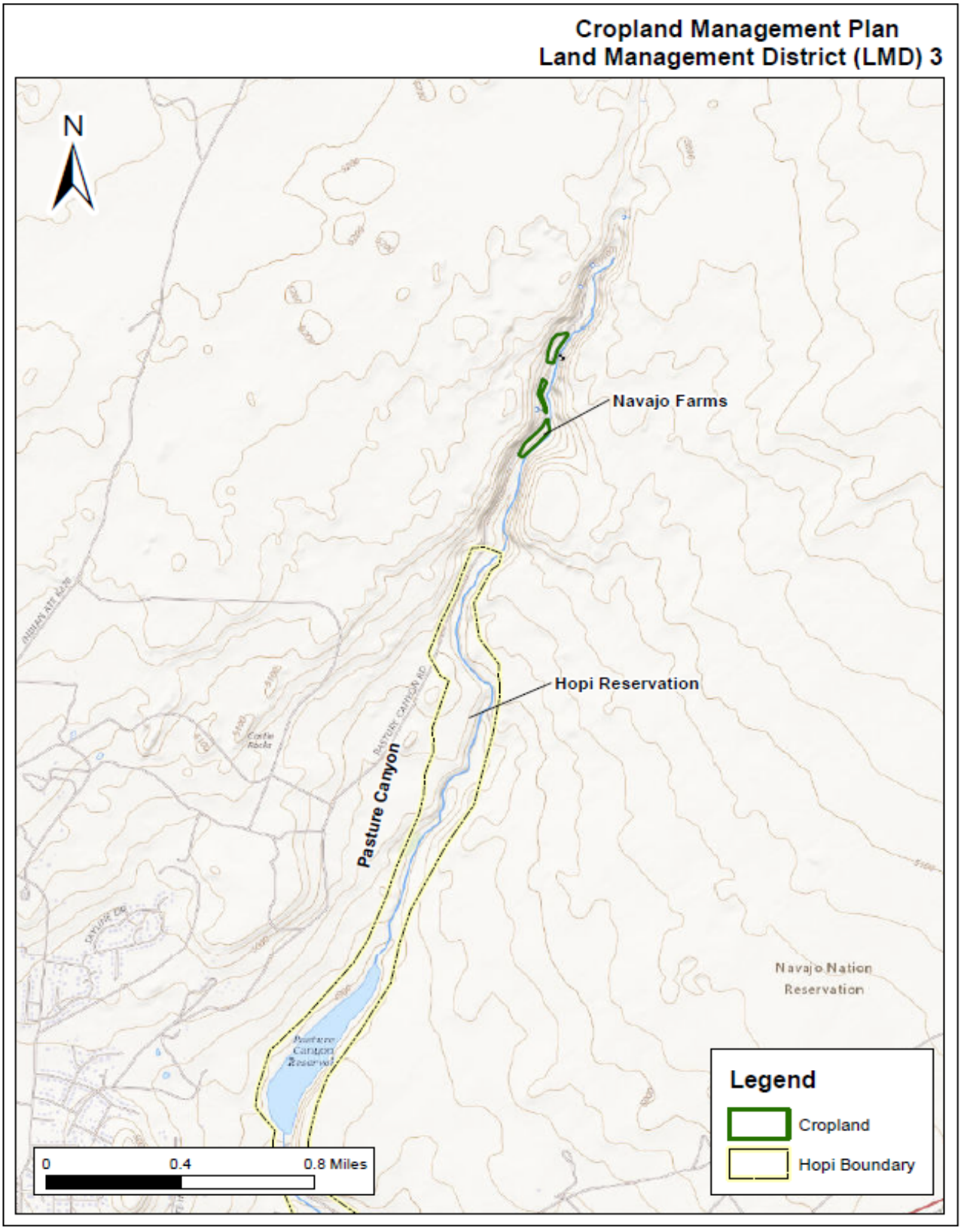
5.7.1 Pasture Canyon Irrigation System

The Pasture Canyon Irrigation System is also referred to as the Reservoir Canyon Project, shown on Figure 4. Though there are an estimated eight plots in the canyon watering 14 acres, the BIA spreadsheet only lists one farm plot totaling 2.4 acres used by Navajo farmers, with the other farms used by Hopi farmers. The soil type is Endoaqueous-Haplofibrist-Psammaqunts complex on flood plain alluvium. Soil is loamy fine sand/fine sand with irrigation use as 4w and non-irrigation 7w (Web Soil Survey).

The irrigated land receives water primarily from springs in Pasture Canyon and from direct pumping out of the wash. The average annual water supply is approximately 300 acre-feet (AF) per year, with most water stored in three reservoirs with an estimated active storage capacity of 333 AF. In 1939, this system provided ditch water to up to 300 acres of farms downstream in Moenkopi Wash, delivered by a 5.25-mile-long pipe system with a 7 cubic ft per second capacity. The three dams need major rehabilitation to pass flood safety standards, and the pipeline needs repair (NNDWR, 2000). Stormwater from Tuba City is in danger of flooding into Pasture Canyon (Cody, 2022).

It is recommended that a hydrologic analysis be completed for the canyon and springs, and an assessment of water rights between the Hopi and Navajo be done to determine if some water flow capacity is available for Kerley Valley farms via a pipeline in the canyon bottom, or by pumping out of the canyon through a new 5-mile pipeline to be located strictly on Navajo lands. Right of way details, permitting, and use monitoring will be administered by the Agricultural Technical Center.

Figure 4. Pasture Canyon Irrigated Farms East of Tuba City



5.7.2 Kerley Valley Irrigation System

The Kerley Valley Irrigation System is also referred to as the Upper Moenkopi Irrigation System and Moenkopi-Tuba Irrigation Project. Historical records provided in the Water Management and Conservation Plan (NNDWR, 2000) show average irrigated acres from 1937-1958 as 530 acres, with a high of 626 acres in 1940, low of 304 acres in 1948, and 282 acres in 1958. The soil type on the main flood plain area is Jocity sandy clay loam with under 2% slope and well drained. The narrow-incised river corridor is Ives-River Wash Association (Web Soil Survey).

A 1983 report titled "Watershed Development Irrigation Rehabilitation and Conservation Needs in the Navajo Nation, Preliminary Report" (Navajo Nation Water Resources Division, 1983) listed this Tuba-Moenkopi irrigation project as needing improvements, including the increase of the diversion dam height with 100 cubic yards of masonry, headgate repairs, 2,000 ft of cement lining on the main canal, and 4,000 cubic yards of sediment removal. This would increase water use up to 3,000 AF and allow a potential expansion of the current 250 acres in production to 1,000 acres.

The comprehensive 2000 Water Management and Conservation Plan (NNDWR, 2000) shows detailed maps of 110 farm plots (588 acres) served by a ditch system on the north side of Moenkopi Wash. Water is supplied by the seasonal surface flow of Moenkopi Wash.

Moenkopi Wash flows create huge challenges for irrigators because they are dominated by a few very large events of short duration, and there are extended periods with little or no flow. Historical surface water flow is over 6,000 AF per year with average flow of 8.8 cubic ft per second. The diversion capacity of the dam is about 15 cubic ft per second. However, peak flows can exceed 1,900 cubic ft per second during summer monsoon storms. There are extended periods of little or no flow during the growing season; average no-flow days are 22 for June, 21 for July, and 14 for August. In July, one out of five water flow periods have no recorded flow at all, which is deadly for corn crops. One farmer has built 3-foot earth berms around his fields and floods them in May to ensure water sinks deep, so his corn can attain 6-foot heights, even as water flows dry up over the summer (Williams, 2022).

There has been a downward trend in water flows over the past 100 years, with 22.6 cubic ft per second from the late 1920s through 1940, 8.8 cubic ft per second during the late 1970s through the 1990s, and 6.2 cubic ft per second in early 2000s. The current water supply is less than 45% efficient, with compromised diversion structure capacity. Another issue is that as the flow regime is dominated by large events; they carry large sediment loads and water cannot be efficiently diverted to the fields. The overall conclusion is floodwaters may only serve 320 acres of irrigated land, or half the historically irrigated acreage. Recommendations from the 2000 comprehensive plan (NNDWR, 2000) include:

1. Improve irrigation efficiency from 45% to 60 or 75%
2. Modify the cropping pattern to include crops that better match the natural stream hydrograph
3. Increase the irrigation season by pre-irrigating
4. Reduce the active command area served by irrigation
5. Restore the diversion capacity to 15 or 30 cubic ft per second
6. Perform engineering hydrologic reviews of the diversion structure, the conveyance system, and riparian system health

An important consideration is that putting more money behind the status quo system is not a good idea. The 2000 Water Management and Conservation Plan documents that tens-of-millions of dollars in repair costs to the existing upper and lower Kerley Valley flood-irrigation systems for 110+ farm plots are way out of line in benefit/cost terms with production results to be achieved. In our current era of climate change-induced drought and water fluctuations, along with historical wash level downgrading of about 20 ft (and continuing), CMP goals of greening the valley for year-long production will not be achieved. Siltation, increasing salinity, washouts and sinkhole issues will only increase. The solution is to resort to traditional low-intensity, low-input farming methods, to introduce quality clean water from springs, wells, collection aprons, and pipelines, and to use water conservation or "water-thrifty" farming methods—including drip systems and large greenhouses. These new alternative water sources are presented in the following section. Planting traditional drought-resistant crops will reduce water needs. Water use policy will need continued development to determine caps on how much water can be taken from water sources for domestic use, livestock use, and farming use. A key purpose of forming a KVFA is to work with the ATC as a Water Users Group to monitor water supplies and decide on best uses.

Alternative water sources for Kerley Valley Farms

The best groundwater for use in the Kerley Valley area is from the N Aquifer, which is up to 430 ft thick, with static water level from 20 to 150 ft below the surface, providing high quality and dependable water (NNDWR, 2000). According to long-time farmer Dan Williams, the Coconino Sandstone underlies the N Aquifer, with more abundant quantity; however, it is not of good quality (Williams, 2022). A recommendation of this CMP is to do a thorough groundwater study guided by the U.S. Geological Survey. According to the 2000 NNDWR report, the N Aquifer is the primary water bearing formation in the Kerley Valley and Tuba City areas. This aquifer provides high quality and dependable municipal water, with 1,260 AF withdrawn in 1998 for Tuba City and Moenkopi public water systems. According to Section 4.1.2.2 of the FBFA IRMP, the ground water supply for the N aquifer storage is estimated at 526-million-AF, with the C aquifer having 413 million AF. Under high efficiency drip systems, providing water to 300 acres of Kerley Valley (the remainder acreage being fallowed and rotated) would take 2 AF of water per acre for a half-year growing season to grow vegetables for a total of 300 AF needed per year.

According to the 2000 NNDWR report, farm areas at the head of Kerley Valley historically received water from Pasture Canyon through about 200 ft of metal corrugated pipe transferring it from the canyon ditch to the Kerley Valley ditch system. Former records show Pasture Canyon did produce the 300 AF of water annually, which is enough for the 300 acres of Kerley Valley. Kerley Valley also received water from John Etsitty Spring north of the highway. Water rights for continued use of this water for Kerley Valley Farms should be investigated. The University of Arizona had a demonstration farm here, which used Navajo Tribal Utility Authority (NTUA) municipal water for a time due to unreliable surface water supply (NNDWR, 2000).

More water could be obtained from pumping shallow wells from the Moenkopi Wash alluvium (as many Hopi farmers do upstream from Kerley Valley). Large gabion structures placed across the wash could decrease channel downcutting and increase alluvium water storage capacity. The Western Navajo Pipeline is now under construction to bring water from Lake Powell to

Cameron, with a side pipeline taking water to Moenkopi Village, but not to Tuba City. It is a goal #1 of section 5.2 of the FBFA IRMP to "Provide a dependable, safe, and sustainable water supply for agriculture, livestock, wildlife, and domestic use to ensure future water security," with Objective #1 to "Design local domestic and agricultural water projects." Management Action #10 for this section 5.2 on water is to "Establish secure water source from the Colorado River for livestock and irritated farmlands" (FBFA IRMP, 2020).

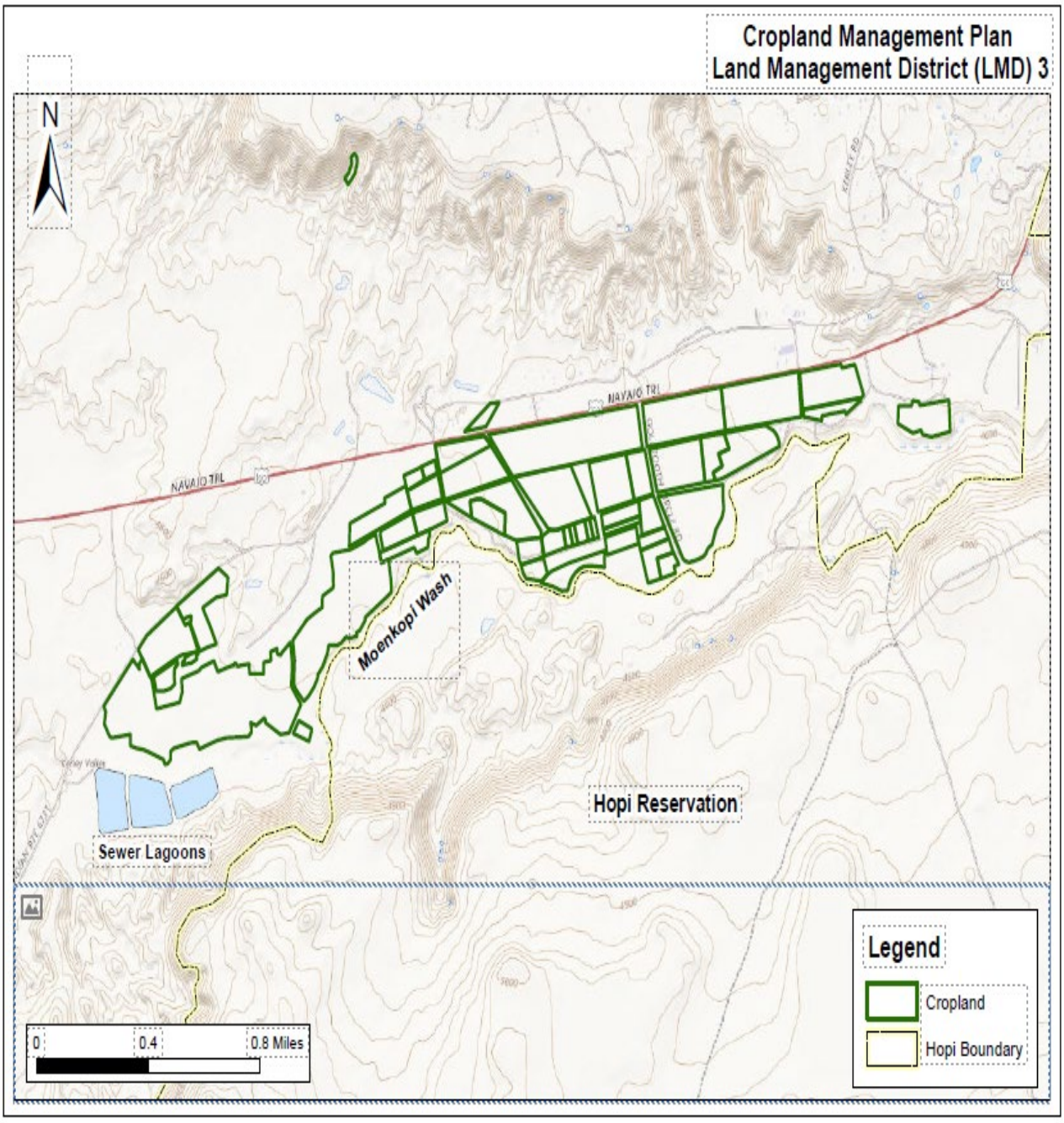
Treated effluent from the NTUA wastewater lagoon is a potential source of year-round cropland water. Potentially, the lagoons could produce 1,000-AF per year according to 1999 figures (NNDWR report, 2000). Assuming an irrigation water efficiency of 45% to 60% this water supply could irrigate 60-80 acres of alfalfa. A 10-foot pumping lift could supply farms at the west end of Kerley Valley or be sent by gravity flow 9 miles west to fields on the Lower Moenkopi Irrigation farm area. Any proposal to use reclaimed water on food crops will need to consider adequately disinfecting the effluent (NNDWR, 2000). This idea is not considered cost effective at this time.

The Peabody Black Mesa Mine slurry line is 18 inches in diameter, and it pumped clean N Aquifer water at 3 million gallons per day (9.2 AF/day) until it closed in 2005. At that pumping rate, Kerley Valley farm water needs (of only half a million gallons a day for the growing season) would be met with 33 days of pumping. This current pipeline could be tapped into at a location 10 miles to the east upstream of Tuba City and brought overland for use both at Tuba City (which needs a new source of domestic water) with a portion used for agriculture. It is likely this old pipeline may not be useable as coal slurry wears the inside of pipes out and it was abandoned 17 years ago.

A Tuba City Chapter Planner (personal communication Nelson Cody, September 22, 2022) has recommended directing the storm water off of the Tuba City plateau into 50,000-gallon steel tanks at the head of Kerley Valley to be used for greenhouses and farms. One tank would water a greenhouse for 50 days or 1 acre of drip irrigated farmland for 30 days. Several tanks would be needed. An issue will be the engineering design at the head of the valley of a huge catchment pond to capture the mud-filled surge of runoff and safely channel it into the steel tanks for use. In addition, the tanks would need to be cleaned yearly of mud, with human safety in mind for the structure location and design.

Several Kerley Valley farmers have held many meetings to start forming the KVFA, making plans to manage all surface waters and control additional sources of piped in water from wells, springs, reservoirs, or Western Navajo Pipeline (personal communication with Rosemarie Williams, R., August 11, 2022). This will optimize year-round production, which is to include diversifying crops and greenhouse use. Only eight farms are in use this year.

Figure 5. Kerley Valley Irrigated Farmlands



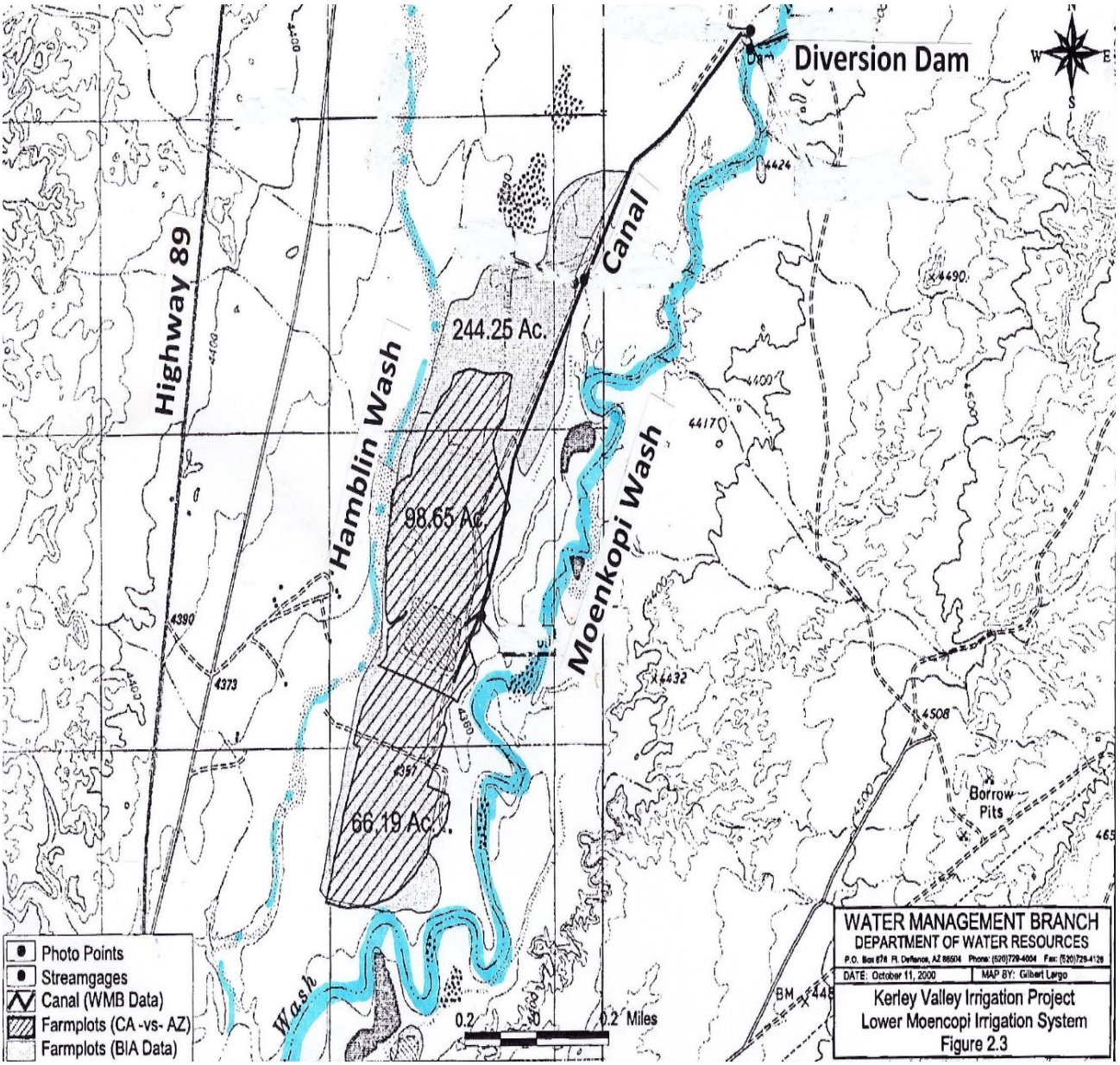
5.7.3 Lower Moenkopi Irrigation System

The Lower Moenkopi Irrigation System is also referred to as the Lower Kerley Valley Irrigation Project. The irrigated land is located 9 miles downstream from the Upper Kerley Valley Project (southeast of the Hwy 89 and Hwy 160 junction), which was constructed between 1933 and 1935 by the Public Works Administration. Originally, 65 acres were cleared with an additional

95 acres proposed to be farmed for a total of 160 acres. Figure 6, a map created in 2000 by NNDWR, shows a farming area of 164.84 acres of a total project site area of 244.25 acres. BIA Excel sheet records show historically there were 10 plots on 47 acres. Soils are on a flood plain and are of the Jocity Tuba complex of are loam to fine sandy loam with irrigation use as 3s and non-irrigation 7c (Web Soil Survey).

According to the NNDWR 2000 report, by 1995 no land was being farmed, as severe head cutting from floods in the 1970s undercut 200 feet of the original masonry diversion structure, leaving the bottom of the wash 20 ft below the 3-foot diameter intake pipe, with 90% of the original structure washed away. Based on 2000 engineering estimates it would cost $10.4 million (in 2023 dollars) to build a 30-foot tall by 500 foot long rolled concrete structure to restore water to this site. However, this would not be cost effective, as it would soon wash out again. An option is to use treated effluent from the NTUA wastewater lagoon as a source of year-round agriculture water. The potential of 1,000 AF of recalimed water per year from the lagoons could irrigate 60-80 acres of non-edible crops, such as alfalfa and grass hay, and be supplied by gravity flow from 9 miles of pipeline. If this reclaimed water is used, the 2000 report suggests the fields be located closer to the wastewater lagoons, but this would still require 6 miles of pipe to find reasonably level lands for growing non-edible crops.

Figure 6. Lower Moenkopi Farms SE of Highway 89 & 160 Junction



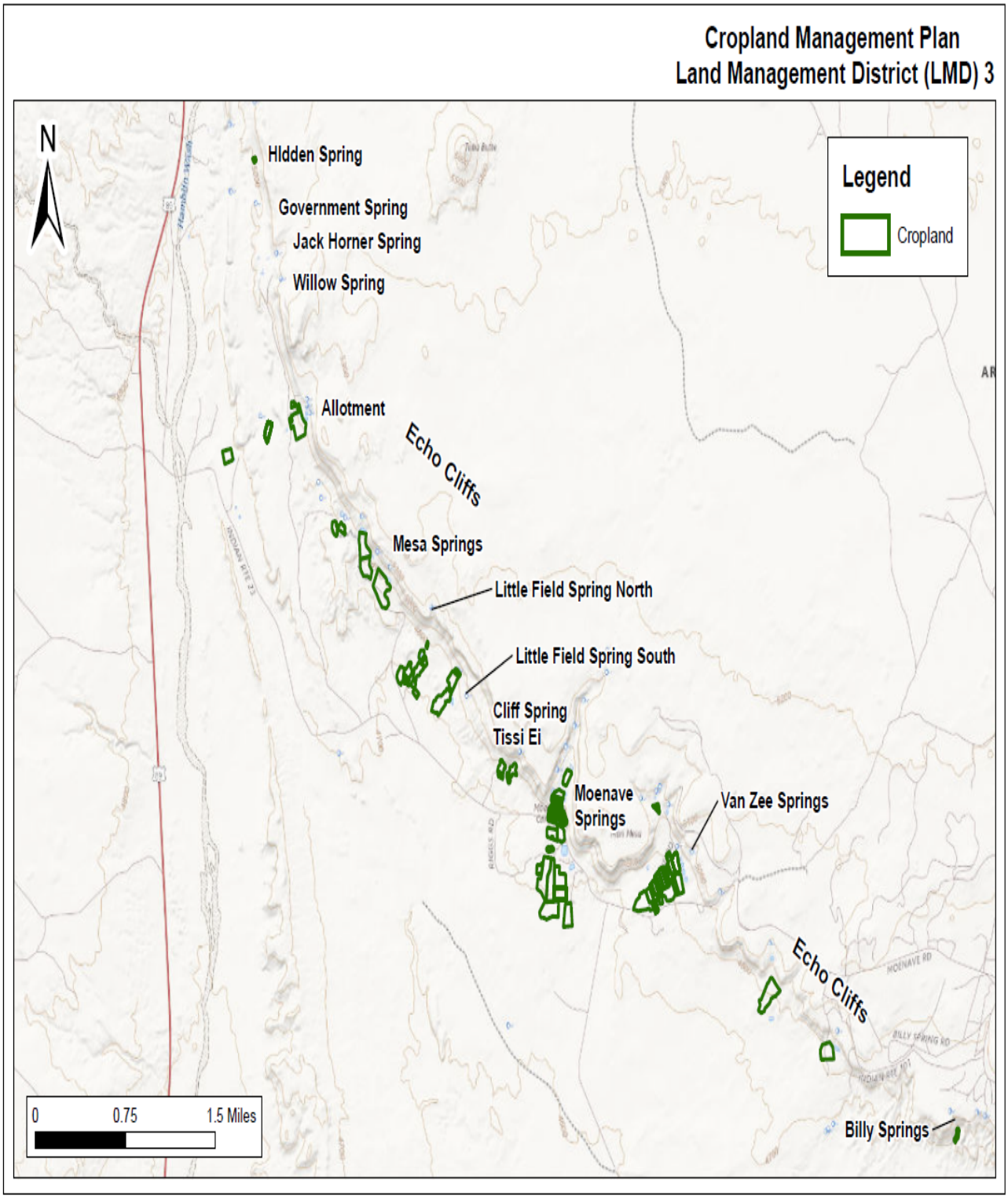
5.7.4 Echo Cliffs Springs Irrigated Farms

Sixty irrigated farms, or 46% of all irrigated farms on LMD-3, are found near the springs coming out from the Echo Cliffs formation for 12 miles between Tuba City and Willow Springs to the northwest (Figure 6). This area is known as “To’Nanees’Dizi” or “scattered and tangled waters,” which gives Tuba City its Navajo name. These can be considered the best farms in the district because good clean water flows constantly from the springs year-round.

Soils are on flood plain alluvium and classified as Ives-Jocity complex of well-drained loamy fine sand with land capability class 3w for irrigation and 7w for non-irrigation (Web Soil

Survey). An increasingly profitable crop grown in all these farm areas is grapes, which can be sold for winemaking (Kaibetoni, 2022).

Figure 7 Springs and Farm Areas along the Echo Cliffs NW of Tuba City



5.7.4.1 Moenave South VanZee Irrigation System

The Moenave South canyon alluvial fan area, also known as Van Zee, has 29 irrigated plots covering 50 acres. Van Zee Spring feeds into two ponds at the base of the eastern hill of the valley. Water is diverted westward in three ditch systems to orchard trees and terraced farm plots on the south of the ditches and to terraced farm plots on the north of the ditches. The contractor estimated that only about 20% of the acreage was in production in 2022.

5.7.4.2 Moenave North Irrigation System

The Moenave North canyon alluvial fan area has nine irrigated plots covering 40 acres. Several springs feed into an irrigation ditch on the west side of the valley. Local farmers maintain the system for farming. Currently, the irrigation water systems are in dilapidated condition and need repairs, which will require equipment use. In a personal communication with local farmer Wayland Riggs (W. Riggs, September 23), Mr. Riggs said that the old farm permit system is broken by disputes causing land not to be used over a long span of time. The solution is to do away with the old permitting system and allow others to start farming this area, as several younger people have requested. However, for the system to work, rules must be enforced. Soil fertility on the alluvial fan area is better than average and would be very productive if using a rotation method of planting. Mr. Riggs said only 7 of the 17 farm permittees (including four dry farms) are still living.

5.7.4.3 Tissi Eli/Cliff Spring Irrigation System

The Cliff Springs area has four irrigated plots on 7 acres. One large extended family has active farms in this spring area just to the west of North Moenave (personal communication with Wayland Riggs, September 23,2022).

5.7.4.4 Littlefield and Mesa Spring Irrigation Systems

According to the BIA spreadsheet, 13 irrigated plots on 50 acres are represented in three separate areas from South Littlefield to North Littlefield and Mesa Spring, located ¾ miles to the north of North Littlefield. North Littlefield has two recently built steel water tanks to hold irrigation water. Grapes are a feature crop in this area. Mesa Spring has fields downhill to the south, as well as one to the west of the spring. Active farming occurred in parts of each area in 2022. Roads are in poor condition from washouts making access difficult.

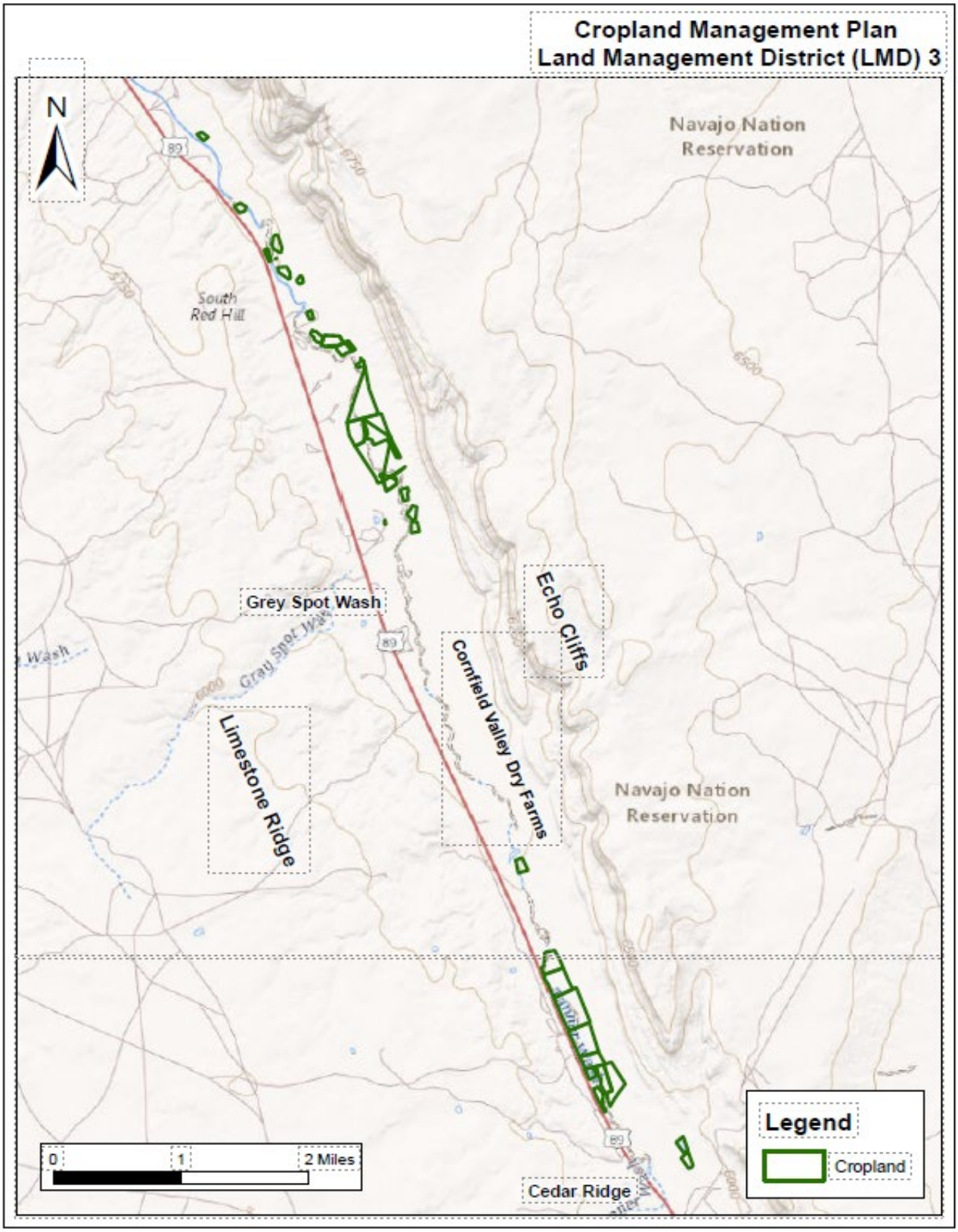
5.7.4.5 Allotment and Willow Spring Irrigation System

The Allotment has one irrigated plot on 9.5 acres and is located 1 mile north of Mesa Spring on an approximately 160-acre Indian Allotment parcel with some farmland on and adjacent to it. There are three homes there in good condition. One-half mile to the north is Willow Springs farm area, which is located on the designated San Juan Southern Paiute Indian Reservation.

5.7.4.6 Cedar Ridge Dry Farm Area

Seven miles north of Gap Chapter is located a series of 41 dry farm plots on 284 acres located just east of U.S. Highway 89 in an area called Cornfield Valley in the community of Cedar Ridge (Figure 8). Soils are on flood plain alluvium and classified as Radnik-EskaVada Riverwash complex of loamy sand with land capability class 4e for irrigation and 6c for non-irrigation (Web Soil Survey).

Figure 8. Cedar Ridge Area Dry Farms along Highway 89



5.7.5 Proposed Little Colorado River Farmlands

Six large farm areas on over 4,000 acres have been proposed along the LCR upstream from Cameron, Arizona. On March 7, 2018, the Cameron Farm Enterprise Plan, authored by Tolani Lake Enterprises, was authorized for a two-phased commercial farming operation to create jobs and food and water security. This commercial-scale farming will require land withdrawals from the Navajo Nation.

1) The Tolani Lake Enterprise is initially requesting $2,242,680 from the Navajo Nation Council Sihasin Fund to establish and operate a 133-acre community-based demonstration market-oriented Cameron Farm Enterprise on the LCR (Tolani Lake Enterprises, 2018). Funds are to pay for land and water development, water delivery and irrigation systems, crop production and marketing, water quality monitoring, and related technical assistance and training support needs. Initial cropping is to involve 50 acres of alfalfa-grass pasture/hay as a foundation for soil-building and livestock quality improvement; 10 acres of blue corn; 10 acres of white corn; 5 acres each of potatoes, onions, dry beans, melons, green chili, and peaches; 5 acres for youth and farmer training; and up to 15 acres for irrigated family gardens. Net sales of produce will be reinvested into the farm.
2) The second phase involves development of 4,000+ acres of the over 5,250 inventoried acres of deep productive irrigatable soils within 1 mile of the LCR south of Cameron on the alluvial food plains, mostly to the east of the river. Water is to come from 20,000-AF of LCR surface flows, tapped from wells under 150 ft deep. In 1980, five 10-inch cased wells were drilled at the Old Cameron Farm location. Two of the wells irrigated 20 acres, steadily pumping 250 gpm with drawdowns of under 25 ft. The Navajo Thaw Chapter Plan for Cameron listed $110 million for this farm development (Navajo Thaw, 2020). However, the Coalmine Canyon Chapter planners, who oversee this LCR area, say there is no authorization for this, and a great deal of testing must be done, as most of these sites have issues with uranium contamination, either from old mines or windblown soils high in uranium, thus an EA needs to be done that considers the Uranium Gamma Ray Radiation Study results (B. Begaye, 2022).

Soils are on flood plains classified as Jocity-Joraibi-Navajo-River Wash complex of stratified clay loams to silt loams with land capability class 3w for irrigation and 7w for non-irrigation. An exception to this is the Tonahakaad Farms and Tohatchi Wash sections, which involve soils of Clay-Springs-Huerfano-Tuba complex on 2-5% slopes on structural benches of clay loam to 6 inches over bedrock (Web Soil Survey).

Though the BIA spreadsheet records show no dry or irrigated farms in the Cameron Chapter area, there are two historical irrigated farms on the east bank of the LCR south of Cameron (technically in Coalmine Chapter but not on the BIA spreadsheet). One is called Old Cameron Farm located 2.5 miles southeast upriver of Cameron on the east side of the LCR, and one is called Black Falls Farm located 22 miles upriver from Cameron (Figure 9). Both had new wells redrilled through the 2021 federal Coronavirus Aid, Relief, and Economic Security (CARES) Act. On both farms, the NGO Choice Humanitarian installed diesel pumping systems to 22,000-gallon storage tanks with 100 foot by 16-foot hoop houses using drip systems inside as well as to outside plots (Choice Humanitarian, 2022).

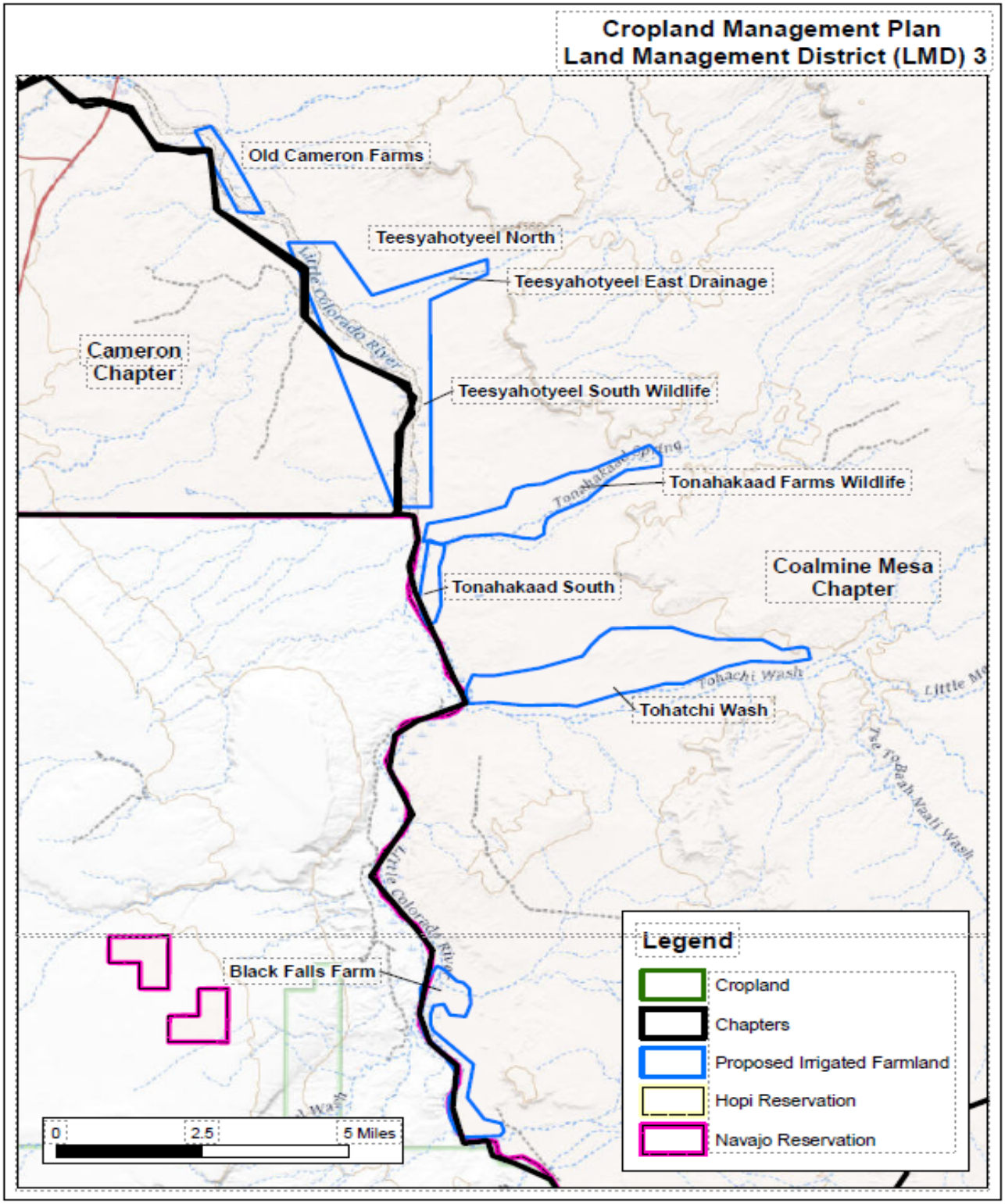
The Cameron Farm has five fenced acres, whose manager, Mae Franklin, is working with Diné College and plans to include Cameron community members in expanding farming and include

more fruit tree planting. Mrs. Franklin is very concerned by the active threat of the huge sloped alluvial flood fan extending to the east of the farm, which threatens major flooding events (personal communication with Mae Franklin, September 6, 2022). Detailed uranium contamination mapping is also needed to determine which areas to avoid and where mitigation is needed. From personal communication with Ilene Tohannie, manager of the Black Falls Well Farm, this farm has three fenced acres used by five families (I. Tohannie, September 6, 2022). Mrs. Tohannie said Diné College has advised them on planting cherry, peach, and apple trees. There is a concern for water contamination, so testing is needed. Both the Cameron Farm and Black Falls Farm, in their second year with hoophouses, are still less than 20% developed needing much more planting, mulching, and drip irrigation work. The hoophouses, in addition to 70% sun fabric, need some sort of plastic covering for plants to survive into the cold season.

There is also a 1,080-acre area, 3 miles north of the Black Falls Well Farm on the east side of the LCR designated as a proposed farm for the Cameron Farm Enterprise Plan, discussed below. The 1983 *Watershed Development Irrigation Rehabilitation and Conservation Needs in the Navajo Nation, Preliminary Report* (Navajo Nation Water Resources Division, 1983) listed this Black Falls irrigation project as an old project that required rebuilding the river water diversion dam, installing 2 miles of concrete lining along the main canal, performing canal dressing work, and removing 15,000 cubic yards of sediment and 10,000 cubic yards of compacted earth for flood protection—all to increase water use by 4,000 AF. As noted below, the Cameron Farm Enterprise plans to develop this land using water pumped from new big wells.

Most of the proposed farm acreages are located on such steep and baren outwash slopes (coming off of Painted Desert badlands) that flood control will be a major issue and expense in developing and sustaining crop production. In a personal communication, farm consultant Jacques Seronde recommended that 20,000+ acre livestock Range Units be established to use planned rotation grazing to restore and maintain grass cover on these extensive areas upslope from proposed farms (J. Seronde, June 6, 2022). According to Section 4.1.2.2 of the FBFA IRMP, N Aquifer and C aquifer groundwater supplies are dry for this southwest portion of the LMD-3, so only LCR alluvial water is available. It is recommended to eliminate tamarisk and Russian olive trees on the LCR corridor to increase water available for agriculture.

Figure 9. Proposed Little Colorado River Farmlands



SECTION 6.0 ALUP ISSUANCE AND MANAGEMENT

6.1 ALUP Issuance to Match AIARMA Objectives and Goals

According to the provisions outlined in the Navajo Nation Treaty of 1868, Article V, an individual or head of family belonging to the Tribe who shall desire to commence farming shall have the privilege to select a tract of land within the reservation to be held in the possession of the person selecting it, and of his family, so long as he or she may continue to cultivate it. Note that "continue" does not specify the ability to allow fields to rest/fallow, an important management activity. For the purposes of the CMP, fallowing that includes monitoring for eventual replanting is considered a management activity, compared to abandonment. NNC Title 3 defines the permitting process on lands generally over 1 acre in size, and often growing crops for commercial production and sales.

This section addresses recommendations for irrigated farms and dryland farms that require an ALUP, which also answers AIARMA Section 101's requirement to establish management objectives for the resources, including defining critical farming values of interest to Tribal members and providing holistic management objectives [AIARMA Section 4 (10)].

As stated in the 1868 Treaty, holding farmland is a privilege that is dependent on continuous land cultivation. To meet this requirement and the six AIARMA objectives outlined in Section 5 of this document, this CMP requires ALUPs be issued directly to farmers' associations on irrigated systems, allowing practical administration, monitoring, and enforcement.

AIARMA Objective 1 is to Provided Farmland Management with Goal #1 to Improve Enforcement. While the historical ALUP issuance in individual names has not accomplished this outcome, farmers' associations provide needed leadership for perpetual farmland area management, including fallowing and rotation of farm plots.

AIARMA Objective 2 is to Maintain High Agricultural Production with Goal #2 to Increase Food Production. While the historical ALUP issuance in individual names has not accomplished this outcome, farmers' associations provide needed leadership and advanced technology application for greatly increasing production while better caring for healthy land needs.

AIARMA Objective 3 is for Production, Product diversity, Farm income, and Jobs with Goal #3 to Improve Farm Revenue and Employment. While the historical ALUP issuance in individual names has not accomplished this outcome, farmer's associations provide needed leadership for increasing production, crop diversity, farm income, and employment.

AIARMA Objective 4 is to Protect Multiple Resource Values with Goal #4 to Increase Culturally Vital Farming Lifeway, and Goal #5 to Protect Multiple Resources Values. While the historical ALUP issuance in individual names has not accomplished this outcome, farmers' associations provide needed leadership for cooperating between farmers, agency staff, and NGOs to achieve goals and objectives.

AIARMA Objective 5 is to Provide Technical Assistance, Training, and Education with Goal #6 to Increase Water Availability and Goal #7 to Provide Education, Training, and Demonstration Farms. While the historical ALUP issuance in individual names has not accomplished this outcome, farmers' associations provide a needed group forum and leadership to ensure education, training, and demonstrations are achieved.

AIARMA Objective 6 is to Develop Value-added Industries with Goal #8 to Establish a Food Hub at an Agricultural Technical Center. Farmers' associations provide needed group forums and leadership for implementing value added programs.

The FBFA IRMP acknowledges the fact that successful farming, at all scales, depends on the structure of range units and customary use areas and planning for water needs. The IRMP commits to make available government funding for BMPs to address the adverse legacy effects of the Bennett Freeze. Issuing ALUPs directly to farmers' associations is a sure way to get funding on the ground with the least controversy and delay, while meeting FBFA IRMP Section 4.2.1.1 directive of "Promoting accurate agricultural production and land management record keeping" (FBFA IRMP. 2020).

6.2 Create LMD-3 Agricultural Technical Center

To implement this CMP, BIA, Navajo Nation and FBFA program managers will coordinate in establishing a local LMD-3 ATC for the common purpose of meeting AIARMA objectives (see Section 10 for funding resources). This Navajo Nation ATC concept has a precedent in the Range Office established in 1988 on the 352,000-acre Navajo New Lands by the Office of Navajo and Hopi Indian Relocation to work with grazing permittees relocating from Hopi Partitioned Lands (located directly to the east of LMD-3) onto the New Lands. The CMP contractor has direct experience with the New Lands Range Office and believes it is a good cost-effective model to use for the LMD-3/FBFA situation. The Range Office was so effective because it had its own standalone office and ware yard location with credentialled and experienced professional staff for 25 years, until the retirement of its last Conservationist. During this time it efficiently: 1) Performed a thorough inventory and mapping of all agricultural lands, 2) Developed regulations, policies, conservation plans and procedures for effective conservation management of all acreage — through hundreds of meetings directly with agriculture permittees, 3) Did state-of-the-art construction and maintenance of hundreds of land improvements, 4) Did extensive workshops, newsletters, and site-specific trainings to educate ranchers and farmers on BMPs, and 5) Performed constant monitoring, reporting, and stakeholder collaboration to ensure both production and conservation goals were being met. These Range Office tasks fit well with the objectives and outcomes the AIARMA stipulates for this CMP for LMD-3.

The Navajo Nation's Navajo-Hopi Land Commission (NHLC) has had oversight of New Lands, just as they have of the FBFA planning, including the FBFA IRMP and Navajo Thaw program. Navajo New Lands is one of the nine chapters involved in Navajo Thaw planning. Therefore, the NHLC could support this same concept for the FBFA to achieve the high level of land management achieved on Navajo New Lands. As with the New Lands Range Office, the ATC will require full-time certified agricultural extension experts on staff authorized and directed to assist the farmer and rancher associations in LMD-3. This ATC program is a new strategy, not provided by any current agency, with the specific purpose to fill an essential missing "capacity building" with staff who are to be constantly engaged in assisting localized associations and individual farmers on their exact on-site community-based farms to actively develop all six AIARMA objectives through consultation, education, equipment assistance, and ensuring water flows to project areas to ensure timely delivery of ditch, spring, and pipeline water. The essential element is that all farmers must work as part of their local CFA (covered below in section 6.4), with their own local leadership to ensure work and development happens on schedule.

This LMD-3 ATC will be a costly new program but will be the most cost-effective means of achieving the AIARMA objectives. The Navajo Nation ATC office, demonstration farm, and ware yard are best placed on a major highway to best serve as many farmers and ranchers as possible and to give good public access for volunteer programs and farmers market sales. Because Kerley Valley has historically been designated a special farming district area used by farmers from several chapters, it is a logical location for the ATC along Highway 160. Fresh irrigation water can be developed and brought to storage tanks at the ATC site, used there for greenhouses, and routed from there for controlled distribution to area farms. The ATC is an ideal location for greenhouses and demonstration gardens for training farmers as well as producing seed sets and heirloom seeds for farmer use — as directed in section 4.4.1.1 of the FBFA IRMP. The ATC can also coordinate specific area demonstration projects at CFA irrigation projects and do demonstration tours to provide training for outside farmers.

This CMP includes the establishment of an AFHF at the ATC location, as covered below in Section 6.5. The purpose of the AFHF is 1) doing value-added preparation and branding of bulk foods produced by farmers, 2) having a Farmers Market on location for individual farmers to cooperate on marketing to the public, and 3) assisting with formation and operation of a Marketing Cooperative to optimize marketing effect. NRCS, University Extension, Navajo Nation Agriculture Department, and many other agencies will readily join in to leverage both education and technical assistance needs, using the ATC and Food Hub as a base location.

The concept of the Western Navajo LMD-3 ATC is to be a non-political structure able to consistently provide yearly services established in its legal charter. Each CFA must file their charter papers with the LMD-3 ATC and annually file a progress report, including listing current association leaders, association sub-permittees, development completed, and crop production results, as directed in Section 4.4.1.1 of the FBFA IRMP. The reports will be a requirement by the government entities providing the grant funding. BIA and Navajo Nation will also receive copies of reports. The LMD-3 ATC will employ professional farming-credentialled staff to assist all forms of agriculture, including rangeland grazing associations, farmers associations, and individual farmers and home gardeners. Staff must also oversee water surveys and water acquisition projects in coordination with agencies to ensure a constant supply of quality farm water for farmable acreage.

Aspects that will contribute to the success of the ATC include:

- Local leaders will be encouraged to work with the Navajo Thaw program to fund this LMD-3 ATC program. As 98% of LMD-3 and the FBFA acreage is open-lands rangeland and farmlands, this program is the best way to ensure IRMP goals will be met. If this program is not implemented, it is doubtful that the AIARMA objectives will be met.
- As reliable year-round water is the biggest challenge for year-round farming, the LMD-3 ATC will focus on the big picture of securing the physical infrastructure and legal process to ensure water from stream, spring, well and pipeline sources is applied to the best applications on farmlands, to gardens and to greenhouses.
- It would be practical if staff worked out of a permanent office located on Highway 160 in Kerley Valley, where half of LMD-3 farms and several local greenhouses will be located. Staff would be available full-time with duties spanning: 1) providing education and service to farmers to ensure optimized production; 2) monitoring and facilitating water delivery from multiple sources, doing coordination between affected agencies; 3)

monitoring high-cost infrastructure conditions and repair contracts; 4) coordinating large equipment purchase, maintenance, and storage; 5) facilitating value-added production efforts; and 6) providing a full-circle plan, act, monitor, control, and replan feedback loop by gathering and sharing information throughout the year in reports to agricultural stakeholders.

6.3 Enact an Irrigation Permit System

The BIA Navajo Region has sole authority to issue grazing and ALUPs on the Navajo Nation, based on the recommendation of the local Navajo Nation Grazing Committee and Farm Board (Section 4.2.1 FBFA IRMP, 2020). As stated in the IRMP Section 4.2.1.1, the ALUPs were established for the purpose of:

- Demonstration methods of agricultural production, farm management and crop marketing, irrigation management, and other measures;
- Promoting accurate agricultural product and land management record keeping;
- Monitoring and preventing plant disease;
- Protecting the Navajo Nation's food supply and agricultural markets.

A key role of a newly instituted LMD-3 ATC will be to inventory farmland to sort out water rights for each of the irrigation systems and give guidance to CFAs in developing and sustaining their farms through normal and drought years. As all water resources on the Navajo Nation are subject to the Navajo Nation Water Code (22 NNC Section 1101 et seq.) and managed by the NNDWR, the NNDWR and NTUA will provide base information and coordinate in developing ATC objectives in meeting AIARMA outcomes for farmers. The Navajo Nation Water Code process can be used for water users to establish local management areas, irrigation districts, and/or irrigation ditch companies. This is to ensure agriculture water use does not impact availability of water to residents.

The LMD-3 ATC will be responsible for an accurate mapping of all springs, irrigation systems, and access needs. Historical alluvial fans useful to agriculture need to be mapped, including data on structures, fences, and historical users. The following lists clarification or documentation that will be required to effectively allocate water rights:

- Clear policy from NNDWR and NTUA on limitations for homesite garden use of water, and irrigation system limitations on water use and transfer.
- Data needs to be acquired on diversion dams and maintenance responsibility, including Hopi Tribal information concerning Moenkopi Wash and Pasture Canyon water and land management.
- Issues with piping Pasture Canyon water to Kerley Valley.
- Opportunities and issues with drilling wells to tap riverbed alluvial aquifers.
- Extensive mapping of N Aquifer springs, wells, surface rights and transport permits need documentation. This will be costly and should be done in conjunction with Tuba City and Moenkopi future water needs planning.
- Western Navajo Pipeline schedule, allowed garden and farm uses, process for use, and costs.
- LCR water rights and allowable farm usage for Cameron Farms.
- Issues with water transfers, right of ways, and use rights.

- Treated wastewater use policy and limitations.

The 2000 NNDWR report noted "the effectiveness of an irrigation project is a function of the organization that rehabilitates, operates, and maintains the facilities, and resolves conflicts … which includes the acceptance of obligations, and accountable leadership." The NNDWR recommends a self-governing non-profit association for an irrigation project, which is approved by the Farm Board, and thus qualified for support from federal agencies.

This CMP requires that irrigated farm plots be managed under an organized CFA, which is issued a single ALUP for all lands under one irrigation system from a common water source. It is the responsibility of the association leadership to form a list of current able farmers and interested farmers to decide who will actually help with farming needs. The Navajo Nation Western Farm Board is available to assist in the process. A conservation management plan, to include a list of BMPs, is to be included with each association permit. For the 10% or so of irrigating farmers not falling within an irrigation system, BIA will issue three-year permits based on being on a list of farmers with ability to farm at farm site locations. It is a TK "use it or lose it" situation where both the farmer and BIA will monitor to ensure permits are renewed and actually used. The Farm Board will approve applications. Permits automatically expire if not renewed by the farmer.

The irrigated farmer's association ALUP's Conservation Plan will be aggressive in seeking funding and engineering expertise to optimize water delivery from the best sources to sustain year-round food production. A focus will be clean water delivery and storage—from pipelines from springs, wells, reservoirs, and outside sources, such as the Western Navajo Pipeline.

6.4 Establish Localized Community Farmer Associations

To establish localized watershed CFAs, the goal will be to get 90% of LMD-3 farmers who are part of irrigation water systems to incorporate each system for effective local uniform management. This is a new strategy to have the local farmers, typically living on a historical alluvial fan area that needs to be kept in perpetuity as farmland, form a self-governing association with bylaws and a farm plan, to oversee all aspects of keeping farmlands in production.

In the process of ATC formation, the BIA will cancel existing ALUPs, notifying all existing ALUP holders, historical farmers without ALUPs, and farmers without permits but currently farming. The ATC will inventory farmlands and irrigation systems then coordinate the formation of farmers' associations. BIA will issue single association permits, referring to models such as used on other reservations, which will ensure whole-system farmland leadership that allows government to easily monitor permit and conservation plan performance. Elected association leadership will then select qualified persons to farm under sub-permits that the association issues and monitors. The association will have the authority to fence the entire farmland area to exclude livestock and maintain fencing in perpetuity. Homesite lease regulations do not allow housing on farmlands, except by special approval, and it is best to create buffer zones against conflicting uses. The CMP contractor held dozens of interviews with farmers and planners on LMD-3 individually and at meetings, which confirms they support such a change to transparent enforcement of fair regulation changes as this CMP proposes—including allowing only able-bodied farmers to hold permits, and cancelation for non-use of farmland.

The BIA will issue one ALUP in the name of each CFA association, which requires (1) elected leadership; (2) legal association formation that can handle money and property; (3) one comprehensive Conservation Plan developed to include management of all farm plots—ensuring all farmlands are in annual production, with flexibility to rest and fallow areas as needed for productivity and soil health; (4) a watermaster who ensures the use of multiple water sources are well coordinated to optimize farm production throughout the year; and (5) a coherent "feedback loop" ensuring timely plan formation; plan actions; land, water, plant production and produce sales monitoring; timely corrective control actions to noted problems; and periodic and annual reports to members, financers, and government agencies indicating goal responsibilities are being met.

This table, from the FBFA IRMP Table 4, lists current farmland project areas:

Table 2. Number of LMD-3 Farmers and Acres by Project Area

Project area name	# of Farmers	Acreage	Type of Farm
Moenkopi/Tuba (Kerley Valley) includes Pasture Canyon	57	299.60	Irrigated
Lower Moenkopi	10	47.50	Dry
Van Zee (Moenave S.)	29	49.40	Irrigated
Moenave (Moenave N.)	13	53.52	Irrigated
Tissi Ei (Cliff Spring)	5	6.75	Irrigated
Little Field (includes Mesa Spr)	16	55.03	Irrigated
Cedar Ridge	41	284.00	Dry
Willow Springs	8	48.90	Irrigated
TOTALS	179	1,000.80	128/ 623.20 Irr 51/ 377.60 Dry

Add to this Proposed LCR Farms: Six large farm areas; up to 5,070 acres total, though most are identified with some uranium contamination. Individual farmers have not been identified.

An example of this is the recently formed KVFA, which will control all irrigation waters for the historical 110 plots on maps from seasonal flow of Moenkopi Wash waters, piped in water from wells, springs, reservoirs or Western Navajo Pipeline, etc.; and, also optimized production via diversifying crops and greenhouse use.

Individual farmers within the association will be selected by an open/transparent process based on an application list the association keeps, with prioritization based on who can meet the association's annual work and production needs. The list would require the following:

- Start with the association leadership contacting farmers who have evidence of being on BIA's permit list. Persons must indicate their physical ability to do the required farm work "to keep farm plots managed and productive," and they must indicate the minimum and maximum acres they could farm.
- Also include those actually doing farming now, but not on the BIA list. The NNDA's Agriculture Infrastructure Fund's Farm and Garden Crop Report may be referenced.
- Next, include young people committed to a farm-work lifestyle, including providing leadership within the association.

- Last, include other local area residents committed to a farm-work lifestyle who can show capacity to farm every year to keep land in green production.

The farmers' association is not required to do probate or conduct extensive research on all persons who farmed in the past. Rather, they are responsible to keep all lands well-managed for production based on selecting farmers from a list of qualified farmers who actively work with them. According to ATC's guidelines, association leadership shall be accessible and shall maintain a publicly accessible listing of able farmers, and that they will post public notice of the process and a timeline for application to the list and conduct outreach to all community membersin the area of their irrigation system who are active farmers or who have historically been involved in farming. The ATC will keep a current list of active farmers and share it publicly.

The previous BIA permitting system deteriorated into conflict and resulted in loss of production over time. This newly revitalized ALUP method relies on Navajo Nation Fundamental Law and TK practice making beneficial use of farmland to ensure farm acres are active (including fallowed for management reasons) and support the food, nutrition, and economic needs of families. Guidelines of farm assistance agencies will be followed to meet farmers' needs. A key role of the elected Western Navajo Farm Board is to moderate the balance of written law and policy with Fundamental Law, fair practice, and reasonable time limits.

The farmers' association leadership will select farmers and assign acreage to them, based on fair criteria they select. The association will issue farm sub-permits to chosen farmers with a number system indicating their Association, such as KV-5, for Kerley Valley sub-permit #5. Permits will be reviewed annually by association leadership to determine if 1) the farmer will farm this year, and 2) what adjustments are needed to meet annual production goals. Farmers' association leadership has the right to fallow plots and/or have cover crops planted to improve soils, thus the farmer can be assigned to farm in another location with the association acreage when needed.

Farmers' associations are a most-widely used method of managing non-private common area farmlands around the world. Mormon settlers used farmers' association when they originally set up the Moenkopi and Kerley Valley irrigation systems, which they ran for 30 years (Smallcanyon, 2010) and was used in the acequia systems of northern New Mexico. They are a best hope for highest production by:

1. Keeping the most land in production each year,
2. Using effective water bosses,
3. Using common machinery,
4. Marketing together for best prices,
5. Ensuring farmers are educated and assisted, and
6. Ensuring farmers of all ages are involved; they also are best for qualifying for participation in NRCS Environmental Quality Incentive Program (EQIP) programs.

6.5 Create An Agriculture Food Hub Facility

AIARMA Objective 6 is to Develop Value-added Industries with Goal #8 to Establish an Agriculture Food Hub Facility at an ATC with a food processing area and kitchen, using seasonal staffing and volunteer workers to help farmers market product, handle large volumes of seasonal produce, perform canning and packaging, and perform special branding to increase sale

value. This can multiply the efforts of farmers in achieving self-sustaining local communities reaching to achieve food sovereignty.

This AFHF concept has a precedent in the Food Hub established by the Taos Pueblo in New Mexico. The CMP contractor has direct experience with planning the Food Hub facility in the Taos Pueblo ARMP and believes it is a good cost-effective model to use for the LMD-3/FBFA situation (Martinez, Cameron, 2021). This facility may be built in conjunction with the full-time LMD-3 ATC, to optimize resources effectiveness and create a one-stop resource base for farmers and customers buying products. Localized irrigation associations backed by the LMD-3 ATC staffing will provide a perpetual place-based arrangement, which keeps green growth on the land, stabilizes soil, improves water quality, increases wildlife habitat and species diversity, and creates new recreation and cultural legacies. It may take three or more years to coordinate with NGOs in recruiting farmers and volunteers to get the AFHF going.

6.6 Technical Assistance

Good farming methods are needed to optimize water use and produce production. Farmers need local real-time assistance in building capacity for meeting the challenges of farming. Soils have degraded, and production lessened from lack of BMPs as recommended by the NRCS and other farming experts. Current-day farming challenges require new technology applications. Typical farmers do not have the education, tools, or resources to apply most BMPs. The CMP addresses this through the establishment of a LMD-3 ATC whose staffing will help form many irrigation associations. The ATC will provide a perpetual place-based arrangement offering constant local education and assistance to farmers throughout the farming tasks throughout the year. This will maximize potential benefits from technical assistance, training, education, and marketing. This arrangement will accomplish “farm scaping” by land leveling on contours, tree planting, no-till planting, cover-cropping, weed control, fencing, etc.

Technical assistance includes water development:

1. In improving water from the Moenkopi Wash ditch system,
2. From springs and wells,
3. From reclaimed wastewater for alfalfa fields (such as Lower Moenkopi abandoned fields),
4. From localized rainwater harvesting and storage, and
5. From big pipeline sources, such as from the LCR and Western Navajo Pipeline.

LMD-3 ATC staffing provides a perpetual place-based arrangement to regularly inventory, observe and test soil stability and fertility, and to add amendments. This will also influence planting and cropping methods (including no-till planting and cover cropping) that maintain water holding capacity and maximize production, while supporting soil sustainability.

SECTION 7.0 HOME SCALE GARDEN BMPs

This section explains recommendations for small home-scale gardening of under 1 acre on home sites that do not require ALUPs—gardening done within the home, or near the house on small plots, in raised beds, cold frames, hoop houses, or small greenhouses; i.e., growing crops for "personal consumption, subsistence, or sold for commercial benefit" as stated in AIARMA 4.(2)(A). The ATC and Food Hub will play an important role in increasing local production to help nutrition needs by helping home gardeners. Conversely, dozens to hundreds of home producers can add a great deal of vegetables and fruits they grow into the farmers market and Food Hub sponsored by the ATC to make the whole system work better, providing more food and income to the community.

This home scale garden furthers many of the AIARMA objectives: Objective 2 to Maintain High Agricultural Production; Objective 3 to Increase Production, Product Diversity, Income, and Employment; Objective 4 to Increase Culturally Vital Farming Lifeway; Objective 5 to Provide Technical Assistance, Training, Education and Demonstrations; and Objective 6 to Develop Value-added Industries. The FBFA IRMP goals will be boosted by home gardening to address the adverse legacy effects of the Bennett Freeze. This is the level of growing food that should be taught to all school children and area residents.

BASIC GARDEN CROPS

Types of garden plants typically grown on Western Navajo include core crops of corn, squash of different kinds, beans, potatoes, melons, cantaloupes, and watermelon; a second garden layer of tomatoes, cucumbers, sweet corn, onions, radishes, pinto beans, and pumpkins; and a third garden layer of cabbages, chili peppers, carrots, and lettuce (Frisbie, 2018).

SCALES of GARDENING

Personal and family gardening on a homesite lease needs to be the most common form of gardening in LMD-3 to reach food availability goals for families and area residents. Crops can be grown indoors and outdoors in containers, raised bed frames, garden plots, greenhouses, and small dryland plots on homesite lease areas. Section 7.1 discusses several indoor gardening options, with and without soil, and section 7.2 discusses several outdoor gardening options.

7.1 Indoor Container Gardening

7.1.1 Types of indoor soil-based systems

The simplest form of crop production is to grow herbs and vegetables in pots and planters inside the house, using purchased planting mixed soils. Vegetable seedlings can be purchased at a nursery or grown from seeds started in seed trays or pots. Plants can be grown and harvested in the home year around. Plants are hand watered, or optionally can be drip irrigated from a simple timer attached either to the house water system (connected under a sink) or a gravity tank supplied by piped water or roof-harvested water. Small pots and planters can be placed on a window ledge. For greater production, trays can be stacked on a tower stand, placed on a hard surface floor, such as in a kitchen, by a window. Using LED grow lights is an economical option for increasing production and use where there is not enough natural light from windows.

7.1.2 Types of indoor water-based systems without-soil

The reason some people choose to use water-based systems, which do not use potting soil, is that much greater production can be obtained in the same space, and it is cleaner not to have soil in the house. Water-based systems use little water and have little nutrient loss compared with outdoor growing. LED grow lights are an economical option for increased production.

Systems can be: 1) an aeroponic system where a kit is purchased that has tiered trays or planters that have slots to hold plants. Water tubes are placed in the trays so that a mist of water sprays on the plant roots and regular intervals determined by a timer. Water needs to be under pressure from a household water source or small pump on the unit. Liquid fertilizers are added as needed into the spray units; 2) a hydroponic system where a kit is purchased that has tiered trays with slots to hold plants. Trays are kept full of water, so plant roots are always wet. A small electric pump keeps water circulating. Liquid fertilizers are added to the water to provide all needed nutrients; 3) an aquaponic system, which is like the hydroponic system, but larger, with live edible fish added. The fish are fed fish food, and the fish excrement, plus some added minerals, provide the nutrients the plants need. Fish can be eaten as a protein source. This system uses the fewest nutrients, and the least amount of water.

7.2 Types of outdoor Gardening

Options for gardening just outside of homes include large pots, raised bed gardens, cold frames, hoop houses and greenhouses, small dryland garden plots, and fruit trees. It is advisable to use woven fencing or hardware cloth to protect plants from animals or insects, which may damage them. Some plants may benefit from sunshade cloth structures over them.

1) Containers next to the house, which involves purchasing large containers or flower-type pots, filling them with potting mix, and planting either seeds or already established seedlings. Pots are hand watered. Pots may be placed on planter saucers and moved indoors under a window to extend the spring or fall season by protecting from frost and wind.
2) Lasagna Bed known as “sheet mulching,” which is a no-dig, no-till garden bed that results in nutrient rich soil with very little work from the gardener. The garden is built by laying down thin layers of organic matter (even newspapers) like lasagna. The layers “cook down” over time resulting in nutrient-rich soil that helps plants thrive while preventing weeds.
3) Raised bed gardening. Because typical soils on LMD-3 are too alkaline for typical vegetable plants, it is recommended gardens totaling from 50 square ft to 500 square ft in size use wood sides raised above the native soil. Eight- to 12-inch-tall sides are built up from soil level and the boxes filled with purchased garden soil, planting mixes, and loamy soil found locally. This is based on the fact that most all native soils need to be avoided as they have negative characteristics, such as poor pH, nutrient value, or toxins. Much better production occurs by not using or even mixing in amendments to local soils. One needs to get advice on soil requirements for native corn, squash, and beans that may grow on native soils. It is important to use locally adapted heirloom seeds. Hand watering and drip irrigation is the most water efficient way to water these gardens.

4) Keyhole Garden is a 4-to-6-foot square raised bed garden with solid sides and with a 6-inch diameter standpipe in the center (perforated below ground) as an access point to add water, food, compost, and manure. The compost then nourishes the plants for high productivity. Colton Gardens at the Museum of Northern Arizona has a demonstration of this method.
5) Wicking Bed design uses a large container of water in the base of the garden bed with a layer of sand between the mulch rooting medium and water source. This design can double produce growth using half the water, requiring water tank filling only twice a week.
6) Guard Tunnel is a way to garden with vines over a ¾ inch polyvinyl chloride (PVC) pipe structure and wire fencing, which saves space and protects the gourds, melons, or squash.
7) A Potato Tire Tower is an easy way to grow and harvest potatoes, by starting with one tire with soil medium and then adding tires and additional layers on top as they grow. At harvest time simply knock the tires over to find all the buried tubers.
8) Cold frames, hoop houses, and greenhouse gardens. Because the growing season is short on LMD-3, it is advisable to do gardening under glass or plastic covering that protect plants from frost and wind, allowing for a longer growing season as well as denser plant clustering for greater production per square foot of soil. Care needs to be taken to prevent wind damage to the structures, and structures need to be well ventilated on hot days to prevent heat damage to plants. Season Extenders: Without artificial heat inside the structures, they will still freeze at night in winter, so it is desirable to have some dense heat holding mass in low walls next to rows of plants. One method is to cut 12-inch diameter PVC or culvert pipe into lengths, put caps on the ends (with water fill bungs), fill them with water, and lay them alongside rows of plants. Another common method is to use 1- to 5-gallon jugs filled with water placed between plants.
9) Small dryland farm plots can be developed on homesite areas for native corn and squash if the right sandy wash areas are present. Hand watering is needed to get plants started and during dry periods. Plots need to be fenced, preferably with woven wire around the base to prevent livestock, rodent or bird entry.
10) Fruit Trees can be planted in yards and watered by hand or with drip irrigation. It is important to get trees from a reputable native plant nursery to ensure the tree is adapted to local climate, soils, and water quality. Fruit tree growers should follow expert advice on soil mixtures for rooting areas. It is often advisable to plant several trees near each other to ensure proper pollination and better care. Farmers' associations can ensure plants are pruned and replaced to sustain long-term production.
11) Grapes. Several varieties of grapes are currently being grown on LMD-3, particularly on the Echo Cliff Springs farming areas. Demand for grapes for wine making is at an all-time high in Arizona, with Yavapai College in the Verde Valley having the state-wide academic authorization to teach viticulture and vinification. Some local farmers are now marketing local wines, and there is great potential to do more, with high value-added marketing potential.

7.3 School or community gardens

Since it is very important to teach youth about gardening, and they may have no examples near home to learn from, school and community gardens are a good way to teach both gardening

practices and food preparation techniques. Typically, these gardens are under 1,000 square feet and should also use raised beds. They can be planted on school property or on an agreeable community resident's property who can ensure responsible access and care. A group leader can ensure crop care chores are accomplished and a fair distribution of harvested produce occurs.

SECTION 8.0 AGRICULTURAL BEST MANAGEMENT PRACTICES

In the early stages of this CMP development process, the contractor met with BIA and professional staff from multiple agencies who agreed that BMPs used across the several agencies should be included in this CMP. BMPs are a Management Action directive of the FBFA IRMP Section 5.2, which states, "Evaluate soil properties and determine best management practices and functions based on NRCS Ecological Site Descriptions." BMPs result from an approach to farming that honors the three-part holistic goal of enhancing Quality of Life of food producers and consumers through sustainable production methods, which build a productive and stable landscape resource base. Though these practices are critical for sustaining large farm and commercial operations, they should also be considered for use at the home and community garden scale. Tribes can also develop their own field guides for best practices.

The USDA NRCS office provides guidance for BMPs that apply to local resources and conditions. The following list of BMPs are from the 2013 Wyoming Department of Environmental Quality (DEQ) Cropland Best Management Practice Manual (Wyoming DEQ, 2013):

- Use cooperative/association farming options for planning, labor, and machinery sharing.
- Develop ALUP plans based on CFAs and their irrigation water system. Do a complete Plan of Operations to include Organization and Leadership, Partnerships and Collaborations, Market analysis and Marketing cash flow, Money sources and use, Ecological and financial sustainability over time, and Monitoring of goals.
- Complete a favorable farm site map for the area, excluding incompatible areas such as areas that are urbanized, contain uranium or arsenic contamination, are too steep or erosive, and have unsuitable soils (dunes, clays, saline, etc.). Refer to FBFA IRMP PEA for abandoned mine lands buffer zone guidelines. Create sewer pond buffer zones.
- Locate garden and farm fields for legal and practical access, protection/fencing, optimum sun, gravity water, good drainage, minimum erosion, and efficient equipment usage.
- Do a geomorphological site selection process (aspect, slope, drainage) and do Soil Testing (structure, texture, organic matter, fertility, and chemistry balance). Use Web Soil Survey information and management recommendations (per FBFA IRMP Section 5.2, Action #20).
- Do a water assessment map for potential irrigation, including flood water, pond water, shallow alluvium water, spring water, and horizontal drill options for gravity water. List quality criteria, quantity limits, affordability, and legal access. Calculate benefit cost for sizeable projects.
- Make a vandalism prevention plan, including trash and waste removal response.
- Pre-irrigate and stagger planting of corn and other crops to match water projected delivery.
- Map riparian buffers for all irrigation systems and mark on ground.
- Include consideration for wildlife habitat in plans.
- Apply technology to improve irrigation efficiency, including gated pipe; drip, surge, and micro irrigation; and land leveling.
- Apply contour farming, terracing, and runoff control.

- Build water diversion structures for farm protection and rainwater harvesting.
- Practice strip cropping, intercropping, and windbreak tree planting.
- Practice no-till (carbon-saving regenerative agriculture) options over till options for planting and soil management, low fossil fuel dependency, lower water use.
- Practice off-season cover cropping to hold and build soil, fertility, and water holding capacity.
- Practice mulching, composting, and soil amendments with no-till methods.
- Get creative on composting materials, sources, and preparation.
- Consider nutrient management and non-chemical fertilizer options.
- Practice conservation crop rotation for soil enhancement.
- Address silt and salt build up mitigation.
- Do crop residue management, including advantageous use of grazing animals and manure.
- Do smart weed management with cover crop considerations and roller crimping. Refer to BIA's Navajo Nation Integrated Weed Management Plan and FPEIS guidelines.
- Do creative pest management with non-chemical options strongly considered.
- Do monitoring of land, crops, and goals on proper schedules and share with others.
- Do smart seed procurement, heirloom source, planting, and saving; use seed banks and exchanges.
- Use appropriate tools and machinery sharing with others to cut costs; time planting and harvesting to optimize machinery use and costs.
- Improve water system engineering and installation standards:
    - Engineer it right: Field inspection of old as well as new waterlines must be completed to ensure low maintenance and avoid early systems failure, which leads to lower crop production. CMP contractor noted that currently many pipes are exposed, pipeline trenches not filled in, and random insulation used.
    - When properly designed and installed no insulation should be used, as soil is the best most reliable insulation. The recommendations in Table 3 have been proven on the 62 well and pipeline systems on Navajo New Lands, resulting in high performance and very low maintenance. It may cost a bit more at installation, but is still affordable in contract funding, and definitely pays for itself in deferred maintenance and increased crop production over many years use.

Table 3 Well and Pipeline System Recommendations

Irrigation Tools	Issues	Solution
Valves	1. Quality 2. Correct size 3. Freezing	1. Should be of high quality (Robert Mfg) 2. Large enough for proper flow 3. Install in steel boxes with hinged lids below soil surface level

Irrigation Tools	Issues	Solution
Spring-fed water tanks	Freezing/Frost	Brass float valve (Robert Mfg) assemblies (in shallow buried steel box) uphill of the tank (level with water at top of tank) for frost free reliable water in the tank year-round
Pipelines from springs to tanks and fields	1. Correct size 2. Freezing	1. Large diameter PE pipe for problem-free longevity 2. Pipes should be buried over 2 ft deep for frost-free reliable water. Cover and mark ditches.
Tank setup	1.Steel box placement 2. Correct box size	1. One big steel box built at the side of the tank, with all pipelines (from spring to tank bottom, from tank bottom to outlet value, and from multiple outlet valves out to fields). This way, one box is opened to make sure all valves are turned correctly. 2. Make sure the box is large enough to fit all valves, plus room for pipe-tool use, plus room for 2 inches of insulation board on all sides and lid—but not on the ground side (so earth heat keeps box from ever freezing).

SECTION 9.0 MARKETING CROPS

The AIARMA Objective 3 is to Improve Farm Revenue and Employment achieved through creating many jobs for growing as well as marketing a diversity of farm products.

Most of this CMP concerns the production side of farming. However, to achieve the holistic Three-Part Goals of this CMP, locally grown food from gardens and farms must reach thousands of LMD-3 residents, and this will require structuring marketing systems. Currently, an outdoor flea market is held in Tuba City where people sell farm products. Successful agriculture is a two-way street where demand drives and balances supply and where farmers have sufficient incentives to respond to demand. Marketing issues involve public awareness of how to get into farming and making sales, public awareness of local food availability, knowing what products to grow, knowing how much to grow of which products, how to provide quality produce year-round, how to be cost-competitive on the open market, and how government can boost marketing.

The LMD-3 ATC will facilitate this by structuring farming and farm permitting to open the doors to many more and younger farmers to start farming. ATC staff will be highly qualified and motivated in organizing CFAs, with each receiving an ALUP with a Conservation Plan to assign plots to dozens of farmers. Each CFA's leadership will organize workdays to get maximum water flowing to farm plots for growing the proper mix of vegetables and fruits for profitable sales. ATC staff will produce publicly available literature on growing and marketing crops. Staff will work with all levels of gardening and farming, including assisting home gardeners. A key component of the ATC is to have a publicly accessible location where a farmers' market, with booths and parking, is available for seasonal use by farmers, to include produce grown in greenhouses right at the ATC site. The ATC can assist farmers in forming a Marketing Cooperative.

The ATC site will include an AHFH for the explicit purpose of boosting marketing. This will be done by on-site greenhouse plantings to augment a balance of types of produce to come on the market at the right times, and to sell heirloom seeds and starter plants. An indoor/outdoor kitchen facility will accommodate large gatherings of farmers to process and package food in bulk to maximize sales potential. Special branding and messaging protocol will be used to optimize value-added income. As this AFHF is part of the full-time LMD-3 ATC, this location will be a one-stop resource for farmers as well as local customers and tourists who stop by to make purchases.

The ATC staff will do research on which farm products are in demand and help gardeners and farmers produce the right plants in the right seasons for profitability. The staff will work with public health programs, as well as local grocers, to explain the value-added nature of buying local foods; while they may cost more, they are worth it for the health benefits and support of the local economy. Staff will coordinate with CFAs and other regional producers across Arizona to ensure surplus produce can be sold for a profit off of LMD-3, and so produce from other regions can be marketed in the LMD-3 area during winter or when local produce quantities are not sufficient to meet demand. A Community Supported Agriculture program can be started to boost sales and healthy food consumption across LMD-3.

SECTION 10.0 FUNDING RESOURCES

According to the FBFA IRMP, "following the approval of the IRMP, the Navajo Nation and BIA will prepare and implement appropriate management alternatives and actions consistent with the IRMP…including conservation plans" such as a CMP. The IRMP was approved in December 2022. Also stated is "Successful implementation of the IRMP has the potential to create a shift in philosophy withing organizations that starts with buy-in of this IRMP and a commitment to cooperation and collaboration" (FBFA IRMP, 2020).

Realization of AIARMA objectives, goals of this CMP, and FBFA IRMP directives require significant funding. The process of implementing this CMP will require several million dollars in federal funding to contract the formation of the LMD-3 ATC, conduct water surveys, build pipeline and distribution systems, and establish a new farm permitting system involving localized farmer irrigation associations. This CMP recommends that the ATC's scope be expanded from the LMD-3's 1.4-million-acre area to include all the 1.6-million-acre FBFA area to fulfill the needs of the FBFA IRMP. The AIARMA regulatory process funding this 10-year CMP program also funds the Navajo Thaw program being developed for each of the chapters on the FBFA. This CMP program and the Range Management Program involve the administration of 98% of LMD-3's 1.4 million acres (estimating 50 square miles of fenced right of ways and housing areas). Therefore, these programs should be included in the Navajo Thaw funding to better coordinate stakeholder efforts and avoid potential conflicts with large infrastructure projects that are designed and funded under Navajo Thaw. Details of the Navajo Thaw program and draft chapter plans can be found at http//navajothaw.com.

The CMP contractor believes the key stakeholders in the LMD-3 agricultural community support the programs and permitting changes recommended in this CMP, and therefore are willing to support a new transparent program to revive the declining agriculture situation. The recently formed KVFA is seeking funding and government assistance. Currently no agency or program within the federal or Navajo Nation government is set up to handle the full scope of implementation of this CMP. The Office of Navajo and Hopi Indian Relocation (ONHIR) was established in 1974 under Public Law 93-531 to operate under the executive branch of the U.S. government to administer issues relevant to Navajo and Hopi lands. The NHLC operates under the Navajo Nation and is federally funded through AIARMA to oversee the work of ONHIR and also administer the Navajo Thaw program for the FBFA area. The U.S. Secretary of the Interior could create a task force to direct both the CMP and RMP program implementation and funding.

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APPENDIX

Crop Inventory Form

Navajo Nation Department of Agriculture CROP INVENTORY REPORT
Please return to your Major Irrigation Farm Board * Thank you!

20_____ CROP INVENTORY

Permittee Name: _____
Address: _____
City: _____
Census#: _____
LUP# _____
District#: _____ Unit#: _____
Chapter: _____
Farmboard: _____

Total LUP Acres: _____

HARVEST INVENTORY

Did You Plant This Year Yes/No (Circle One) YES NO
TTL No. of Acres Planted: _____
No. of Acres Unseeded (Natural): _____

HAY CROP

Hay Crop Type	Acres/Bales
Alfalfa	
Alfalfa/Grass Mix	
Grass	
Oat	
Wheat	
Sorghum	
Other	

VEGETABLES CROP

Vegetable Name	Acres/Bushels
Corn (kind)	
Squash (kind)	
Squash (kind)	
Potatoes	
Beans	
Other (name)	
Other (name)	
Other (name)	
Other (name)	
Other (name)	

MELON CROP

Melon Name	Acres
Watermelon	
Honeydew	
Cantalope	
Other (name)	
Other (name)	

FRUIT CROP

Fruit Name	Acres/Bushels
Apples	
Peaches	
Apricots	
Pears	
Cherries	
Grapes	
Strawberries	
Other (name)	
Other (name)	

OTHER CROP

Name of Crop	Acres/Bushels
(name)	
(name)	
(name)	
(name)	
(name)	

Did you Fertilize Crop: Yes No
Type of Fertilizer Yes No
Was Irrigation Water Available: Yes No
Was Rain Sufficient: Yes No
Did Weeds Cause Problems (Circle 1): Yes No

WEEDS

Weed Name	Color

Did you control weeds: Yes/No (Circle one)

WEED CONTROL

Type of Control	Time of Year
Mechanical	
Chemical	
Other	

I certify all information is correct.

_____
Land Use Permittee

_____
Major Irrigation Farm Board / DGCM

2017

APPENDIX B. AVERAGE CLIMATE MEASURES FOR EACH LMD-3 UNIT AND THE GRAZING COMPARTMENTS WITHIN THEM, 1981-2010

Unit [1]	Compartment	Annual Precipitation (inches)	Mean Annual Temperature (°F)	Maximum Annual Temperature (°F)
3-1	1	7.35	54.72	69.04
	2	7.89	53.80	68.39
	3	7.70	54.03	68.80
	4	7.68	54.20	69.02
	5	5.36	57.78	72.37
	6	5.79	57.45	72.30
	7	6.32	57.16	72.22
	8	6.89	56.09	70.88
	9	6.16	58.34	73.67
	10	5.63	58.39	73.65
	11	6.20	58.98	74.46
	12	5.49	58.86	74.27
3-2	1	6.56	55.63	69.98
	2	7.28	54.64	68.90
	3	5.67	57.10	71.52
3-3	1	7.19	59.34	72.00
	2	7.09	58.90	71.52
	3	8.79	54.39	67.69
	4	9.19	53.48	67.20
	5	6.72	55.58	69.49
	6	6.60	56.93	71.00
	7	7.20	58.24	72.29
	8	6.72	55.79	70.05
	9	7.72	54.53	68.32
	10	8.44	54.72	68.08

Unit [1]	Compartment	Annual Precipitation (inches)	Mean Annual Temperature (°F)	Maximum Annual Temperature (°F)
3-4	1	9.10	53.49	67.87
	2	8.44	54.36	68.84
	3	5.92	58.12	72.85
	4	8.65	53.59	68.34
	5	5.96	56.78	71.50
	6	11.72	49.43	64.86
	7	7.76	53.83	68.74
	8	5.52	58.34	73.50

[1] Values are averages of all 800-meter cells within each compartment. Data are from www.prism.osu.edu (Accessed July 25, 2017).

APPENDIX C. CHARACTERISTICS OF SOILS FOUND IN LAND MANAGEMENT DISTRICT 3, NAVAJO NATION, COCONINO COUNTY, AZ

Map Symbol	Map Unit Name	Order	%Sand[1]	%Silt[1]	%Clay[1]	Hydrologic Group	kf	WEG	WEI tons/ac/yr	Forage Production (lb/acre)
1	Arches-Rock outcrop-Mido complex, 2% to 15% slopes	Entisols	95	0.5-2.4	3-4	A/D	0.02-0.05	1	220	250/400/600
3	Begay-Mido-Milelok complex, 1% to 5% slopes	Aridisols	82-93	1.4-9.5	5-8	A	0.1-0.28	2/1/2	134/220/134	300/650/1000
4	Berto-Nepalto family-Lava flows complex, 4% to 35% slopes	Aridisols	43-68	22-38	10-18	B	0.32-0.37	8	0	200/200/300
5	Cataract-Tsaya-Typic Calciargids complex, 4% to 15% slopes	Aridisols	40-97	1-38	8-35	A/C/D	0.05-0.37	1/6/6	250/48/48	75/250/500
6	Claysprings-Huerfano-Tuba complex, 2% to 15% slopes	Entisols	40-96	1.5-25	3-35	A/D	0.02-0.32	4L/5/1	56/220/134	NA
7	Endoaquolls-Haplofibrists-Psammaquents complex, 0% to 3% slopes	Entisols, Mollisols, Histosols	78-96	4-16	1-6	A/D	0.05-0.32	1/2/1	220/134/220	NA
8	Epikom-Leupp complex, 2% to 15% slopes	Entisols	55-90	8-23	2-22	D	0.2-0.37	1/4L	220/86	NA
9	Gladel family-Arabrab complex, 4% to 35% slopes	Inceptisols, Alfisols	55-65	21-27	14-18	D	0.2-0.24	5	56	NA

Map Symbol	Map Unit Name	Order	%Sand[1]	%Silt[1]	%Clay[1]	Hydrologic Group	kf	WEG	WEI tons/ac/yr	Forage Production (lb/acre)
10	Grieta extremely gravelly fine sandy loam, 0% to 3% slopes	Aridisols	68	22	10	C	0.37	8	0	300/475/700
11	Hajisho-Cataract family-Shinume complex, 4% to 15% slopes	Aridisols	62-81	17-34	2-4	D	0.43-0.64	5/8/3	56/0/86	50/250/500
12	Hajisho-Seeg complex, 2% to 15% slopes	Aridisols	64	30	6	B/D	0.43-0.64	3/6	86/46	350/450/700
13	Hajisho-Seeg complex, 15% to 35% slopes	Aridisols	55-66	29-40	5	B/D	0.43-0.64	6/5	48/56	150/300700
14	Hatknoll-Lithic Haplargids complex, 2% to 8% slopes	Aridisols	52-62	8-12	30-36	C	0.2	5/4L	56/86	NA
15	Hoskinnini-Moenkopie complex, 2% to 8% slopes	Aridisols, Entisols	40-55	35-43	10-17	D	0.43-0.49	3/4L	86/86	100/200/300
16	Ives-Bebeevar family-Oxyaquic Torripsamments complex, 0% to 3% slopes	Entisols	78	16	6	A/B	0.24-0.32	3/2	86/134	800/1000/1200
17	Ives-Jocity complex, 1% to 4% slopes	Entisols	67-84	10-19	7-14	A/C	0.17-0.24	2/3	86/134	NA

Map Symbol	Map Unit Name	Order	%Sand[1]	%Silt[1]	%Clay[1]	Hydrologic Group	kf	WEG	WEI tons/ac/yr	Forage Production (lb/acre)
18	Ives-Riverwash association, 0% to 2% slopes	Entisols	94	1	5	A	0.02	1	250	NA
20	Jocity sandy clay loam, 0% to 2% slopes	Entisols	55	17	28	B	0.24-0.32	5	56	300/550/700
21	Jocity-Joraibi-Navajo-Riverwash complex, 0% to 2% slopes	Entisols	15-40	15-40	17-45	C	0.15-0.32	4L/3/4	86/86/86	1150/1600/2000
22	Jocity-Tuba, complex, 1% to 3% slopes	Entisols	78	16	6	A/C	0.2-0.28	2/2	134/134	400/600/800
23	Lava Flows	NA								NA
24	Leupp-Hoskinnini complex, 2% to 15% slopes	Aridisols	68-80	17-20	3-12	D	0.32-0.37	3/2	86/134	100/250/400
25	Mellenthin gravelly sandy loam, 0% to 8% slopes	Aridisols	55	40	5	D	0.49	5	56	500/650/800
26	Mellenthin-Placitas-Mellenthin, extremely stony, complex, 4% to 35% slopes	Aridisols	66-69	22-27	7-10	C/D	0.32-0.55	6/6/8	48/48/0	300/475/700

Map Symbol	Map Unit Name	Order	%Sand[1]	%Silt[1]	%Clay[1]	Hydrologic Group	kf	WEG	WEI tons/ac/yr	Forage Production (lb/acre)
27	Mellenthin-Rock outcrop complex, 15% to 30% slopes	Aridisols	60	25	15	D	0.2	6	48	500/700/950
28	Mellenthin-Rock outcrop complex, 30% to 70% slopes	NA	70	14	16	D	0.15	6	48	NA
29	Meriwhitica-Wayneco-Tassi family, complex, 5% to 30% slopes	Aridisols	45-70	17-32	12-23	D	0.37	6/5/4L	48/56/86	NA
30	Mespun-Councelor-Mespun, limy substratum complex, 0% to 10% slopes	Entisols	96	1	3	A	0.05-0.15	1	250	NA
31	Mido-Arches-Rock outcrop complex, 4% to 35% slopes	Entisols	95	1	4	A/D	0.05-0.1	1	220	300/650/1000
32	Mido-Arches-Ustic Haplocalcids complex, 2% to 10% slopes	Entisols	93	2	5	A/D	0.02-0.05	1	220	NA
33	Moffat-Monue complex, 1% to 6% slopes	Aridisols	85	8	7	B	0.28-0.43	2	134	NA

Map Symbol	Map Unit Name	Order	%Sand[1]	%Silt[1]	%Clay[1]	Hydrologic Group	kf	WEG	WEI tons/ac/yr	Forage Production (lb/acre)
34	Moffat-Sheppard complex, 1% to 6% slopes	Aridisols	86-96	2-8	2-6	A	0.02-0.28	2	134	300/500/700
36	Needle-Rock outcrop-Sheppard complex, 2% to 15% slopes	Entisols	87-92	5-8	3-5	A/D	0.05-0.32	2	134	200/400/600
37	Nepalto family-Tsaya-Rock outcrop complex, 35% to 70% slopes	Entisols	80	17	3	A/D	0.37-0.43	6	48	100/100/100
38	Persayo-Hanksville complex, 4% to 60% slopes	Entisols	18-55	21-50	24-32	C/D	0.28-0.43	4L/5	86/56	NA
39	Progresso-Skos complex, 2% to 15% slopes	Aridisols	43-80	17-39	3-18	C/D	0.37-0.43	2/8	134/0	600/850/1200
40	Puertecito very cobbly loam, 15% to 35% slopes	Aridisols	43	39	18	D	0.49	7	38	350/475/600
41	Radnik-Escavada-Riverwash complex, 0% to 3% slopes	Entisols	83-95	1-9	4-8	A	0.1-0.17	2/1	134/250	400/650/1000

Map Symbol	Map Unit Name	Order	%Sand[1]	%Silt[1]	%Clay[1]	Hydrologic Group	kf	WEG	WEI tons/ac/yr	Forage Production (lb/acre)
42	Reef-Progresso family complex, 8% to 35% slopes	Entisols	48-70	16-45	7-14	C/D	0.32-0.43	8/6	0/48	250/300/350
43	Reef-Rock outcrop complex, 4% to 35% slopes	Entisols	47	45	8	D	0-0.55	1	7	300/475/650
44	Rock outcrop-Lithic Torriorthents complex, Kaibab, Toroweap, and Coconino Formations, 15% to 60% slopes	NA				D		1	8	250/325/450
45	Rock outcrop-Lithic Torriorthents complex, Supai Group, 15% to 60% slopes	NA				D	0-0.37	1	6	250/325/450
46	Rock outcrop-Mathis-Nalcase complex, 10% to 50% slopes	Entisols	96	2	2	A/D	0-0.1	5/1	56/250	NA

Map Symbol	Map Unit Name	Order	%Sand[1]	%Silt[1]	%Clay[1]	Hydrologic Group	kf	WEG	WEI tons/ac/yr	Forage Production (lb/acre)
47	Rock outcrop-Typic Torriorthents complex, Hermilet Formation, 15% to 60% slopes	Entisols	0-60	0-28	0-12	B	0-0.32	8	0	250/325/450
48	Rock outcrop-Typic Torriorthents complex, Tonto Group and Redwall Formation, 15% to 60% slopes	Entisols	0-80	0-15	0-5	B	0-0.55	6	48	250/325/450
49	Santrick-Nalcase-Rock outcrop complex, 1% to 15% slopes	Entisols	95	1	4	B	0-0.05	1	250	NA

[1] Values for sand, silt, and clay and water erosion factors (kf) are ranges of values for all components of each type. Hydrologic Groups represent runoff potential: A = High infiltration, low runoff, mostly sand and gravel; B = moderate infiltration, fine to moderately course texture; C = slow infiltration, layer that impedes downward movement, fine to moderately fine texture; D = very slow infiltration, high runoff potential, shallow soils over an impervious layer. KF range from 0.02-0.69 with higher values representing higher potential for water erosion. Values of the Wind Erosion Group represent potential for each component of a soil unit. Increasing values represent decreasing potential for erosion. Wind Erosion Index is the amount of soil potentially lost in a given year. Forage production values are the highest amounts of all components of each soil mapping unit for low, reasonable (i.e., average), and high values.

APPENDIX D. ACRES ENCOMPASSED BY EACH SOIL MAP UNIT WITHIN THE FOUR UNITS OF LAND MANAGEMENT DISTRICT 3, NAVAJO NATION, COCONINO COUNTY, AZ

Map Symbol	Map Unit Name	Order	3-1	3-2	3-3	3-4	Totals
1	Arches-Rock outcrop-Mido complex, 2% to 15% slopes	Entisols		53,877	12		53,889
3	Begay-Mido-Milelok complex, 1% to 5% slopes	Aridisols			1,763		1,763
4	Berto-Nepalto family-Lava flows complex, 4% to 35% slopes	Aridisols			4,394	66	4,460
5	Cataract-Tsaya-Typic Calciargids complex, 4% to 15% slopes	Aridisols			5,073		5,073
6	Claysprings-Huerfano-Tuba complex, 2% to 15% slopes	Entisols	69,405	2,431	2,826	6,174	80,836
7	Endoaquolls-Haplofibrists-Psammaquents complex, 0% to 3% slopes	Entisols, Mollisols, Histosols		62			62
8	Epikom-Leupp complex, 2% to 15% slopes	Entisols	7,300			23,725	31,025
9	Gladel family-Arabrab complex, 4% to 35% slopes	Inceptisols, Alfisols				9,826	9,826
10	Grieta extremely gravelly fine sandy loam, 0% to 3% slopes	Aridisols				16,455	16,455
11	Hajisho-Cataract family-Shinume complex, 4% to 15% slopes	Aridisols			61,479	622	62,101
12	Hajisho-Seeg complex, 2% to 15% slopes	Aridisols			1	30,311	30,312

Map Symbol	Map Unit Name	Order	3-1	3-2	3-3	3-4	Totals
13	Hajisho-Seeg complex, 15% to 35% slopes	Aridisols			62,751		6,2751
14	Hatknoll-Lithic Haplargids complex, 2% to 8% slopes	Aridisols			27,050		27,050
15	Hoskinnini-Moenkopie complex, 2% to 8% slopes	Aridisols, Entisols			13,851	7,306	21,157
16	Ives-Bebeevar family-Oxyaquic Torripsamments complex, 0% to 3% slopes	Entisols		3			3
17	Ives-Jocity complex, 1% to 4% slopes	Entisols		387			387
18	Ives-Riverwash association, 0% to 2% percent slopes	Entisols	7,000	1,563	3,100		11,663
20	Jocity sandy clay loam, 0% to 2% slopes	Entisols	4	28			32
21	Jocity-Joraibi-Navajo-Riverwash complex, 0% to 2% slopes	Entisols	7,355		211	51	7,617
22	Jocity-Tuba, complex, 1% to 3% slopes	Entisols	963				963
23	Lava Flows	NA				104	104
24	Leupp-Hoskinnini complex, 2% to 15% slopes	Aridisols	797	22	72,834		73,653
25	Mellenthin gravelly sandy loam, 0% to 8% slopes	Aridisols				1,312	1,312

Map Symbol	Map Unit Name	Order	3-1	3-2	3-3	3-4	Totals
26	Mellenthin-Placitas-Mellenthin, extremely stony, complex, 4% to 35% slopes	Aridisols			56,409		56,409
27	Mellenthin-Rock outcrop complex, 15% to 30% slopes	Aridisols				9,797	9,797
28	Mellenthin-Rock outcrop complex, 30% to 70% slopes	NA				13,811	13,811
29	Meriwhitica-Wayneco-Tassi family, complex, 5% to 30% slopes	Aridisols			40,757	68,710	109,467
30	Mespun-Councelor-Mespun, limy substratum complex, 0% to 10% slopes	Entisols		24,362			24,362
31	Mido-Arches-Rock outcrop complex, 4% to 35% slopes	Entisols		4,568			4,568
32	Mido-Arches-Ustic Haplocalcids complex, 2% to 10% slopes	Entisols		2,333			2,333
33	Moffat-Monue complex, 1% to 6% slopes	Aridisols	35,377				35,377
34	Moffat-Sheppard complex, 1% to 6% slopes	Aridisols	2,800		3,922		6,722
35	Navajo-Jocity complex, 1% to 3% slopes	Entisols					

Map Symbol	Map Unit Name	Order	3-1	3-2	3-3	3-4	Totals
36	Needle-Rock outcrop-Sheppard complex, 2% to 15% slopes	Entisols		4,003			4,003
37	Nepalto family-Tsaya-Rock outcrop complex, 35% to 70% slopes	Entisols	14,110	3,500	12,700	5,247	35,557
38	Persayo-Hanksville complex, 4% to 60% slopes	Entisols	24,541	1,961	5,682	6,670	38,854
39	Progresso-Skos complex, 2% to 15% slopes	Aridisols			25,417		25,417
40	Puertecito very cobbly loam, 15% to 35% slopes	Aridisols				1,378	1,378
41	Radnik-Escavada-Riverwash complex, 0% to 3% slopes	Entisols			1,314		1,314

APPENDIX E. ACRES OF EACH LANDCOVER TYPE BY UNIT AND COMPARTMENT IN LMD-3, NAVAJO NATION, COCONINO COUNTY, AZ

Landcover and Vegetation Types														
Unit	**Compartment**	**Barren**	**Cliff, Scree, Rock**	**Developed**	**Non-Native**	**Shrub and Grass**	**Saltbush**	**Dwarf Sagebrush**	**Tall Sagebrush**	**Pinyon-Juniper**	**Ponderosa Pine**	**Desert Riparian**	**Saline Wetland**	**Water**
3-1	1	21042	2700			3693	2332	35		107			1511	
	2	20217	943	220	7	17848	462		3359	345			42	25
	3	18778	203		15	5534	1000	9	535	157			182	
	4	25432	53		37	11283	283		42	65			20	
	5	3227	2685	5	356	4178	638						664	
	6	33909	11318		4	22530	7496	124	54	6			28	21
	7	12244	3853		9	27751	6711	12	36	23			97	8
	8	4721	296		10	12948	2967	20	158	158			32	2
	9	14489	15753			15810	1903	129	2				7217	7
	10	6248	15479	30	203	4481	1748		1				11625	4
	11	227	525		1739	628	215	23				5	567	
	12	2	31		2041	11	387						990	
	Sub-Total	**160536**	**53839**	**255**	**4421**	**126695**	**26142**	**352**	**4187**	**861**		**5**	**22975**	**67**
3-2	1	12332	4861	112	3	2682	452		13	91			122	39
	2	81980	21260	135	36	89166	1658	3	630	8680			613	2
	3	4248	968		21	6979		8	1811	12			5	4
	Sub-Total	**98560**	**27089**	**247**	**60**	**98827**	**2110**	**11**	**2454**	**8783**			**740**	**45**

Unit	Compartment	Barren	Cliff, Scree, Rock	Developed	Non-Native	Shrub and Grass	Saltbush	Dwarf Sagebrush	Tall Sagebrush	Pinyon-Juniper	Ponderosa Pine	Desert Riparian	Saline Wetland	Water
3-3	1	144	3784		156	6650	2457	80	571	316	1		380	2
	2		332			8620	4857	9	4	27			1321	
	3	6365	2843		163	66199	39518	99	9016	12920			44	33
	4	4166	1523		269	45695	12530	23	50615	13528			35	63
	5	5631	907			62163	15730	531	744	5941			10	11
	6	9260	12719		565	75031	26146	964	545	1152			3879	33
	7	255	6498		2030	11228	4628	29	97	107		264	226	223
	8	278	49			1474	472		21	2				
	9	285	538			2554	122		402	561				
	10		1669		1	3503	314		827	415			5	
	Sub-Total	**26384**	**30862**		**3184**	**283117**	**106774**	**1735**	**62842**	**34969**	**1**	**264**	**5900**	**365**
3-4	1	212	922		3	8502	11487	1	9321	4222			46	
	2	159	314			1485	1105	148	691	1072				
	3	762	2071		36	8280				3			213	
	4	43	1307			1982	708	1	611	2381	5			
	5	1726	917		39	20969	7492	194	1400	942			521	8
	6	247			45	28366	2218	2	661	805	3		21	3
	7	340	231		42	34910	5299	11	4209	2554			1726	28
	8	629	5840		342	12031	217	142	8				6015	10
	Sub-Total	**4118**	**11602**		**507**	**116525**	**28526**	**499**	**16901**	**11979**	**8**		**8542**	**49**
		289595	**123392**	**502**	**8172**	**625165**	**163552**	**2597**	**86384**	**56592**	**9**	**269**	**38383**	**526**

APPENDIX F. LETTER FROM THE NAVAJO NATION DEPARTMENT OF FISH AND WILDLIFE LISTING SPECIES OF CONCERN FOR LMD-3

NNHP
Navajo Natural Heritage Program

PO BOX 1480
Window Rock, AZ 86515

P 928.871.6472
F 928.871.7603

www.nndfw.org

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07-February-2023

William Youmans
Sundance Consulting, Inc.
10400 Academy Rd. NE, Suite 200
Albuquerque, NM 87111
505-478-0444
byoumans@sundance-inc.org

SUBJECT: Cropland Management Plan (CMP) for Land Management District 3 (LM3)

William Youmans,

NNHP has performed an analysis of your project in comparison to known biological resources of the Navajo Nation and has included the findings in this letter. The letter is composed of seven parts. The sections as they appear in the letter are:

1. **Known Species** – a list of all species within relative proximity to the project
2. **Potential Species** – a list of potential species based on project proximity to respective suitable habitat
3. **Quadrangles** – an exhaustive list of quads containing the project
4. **Project Summary** – a categorized list of biological resources within relative proximity to the project grouped by individual project site(s) or quads
5. **Conditional Criteria Notes** – additional details concerning various species, habitat, etc.
6. **Personnel Contacts** – a list of employee contacts
7. **Resources** – identifies sources for further information

Known Species lists "species of concern" known to occur within proximity to the project area. Planning for avoidance of these species is expected. If no species are displayed then based upon the records of the Navajo Nation Department of Fish and Wildlife (NNDFW) there are no "species of concern" within proximity to the project. Refer to the Navajo Endangered Species List (NESL) Species Accounts for recommended avoidance measures, biology, and distribution of NESL species on the Navajo Nation (https://www.nndfw.org/nnhp/sp_account.htm).

Potential Species lists species that are potentially within proximity to the project area and need to be evaluated for presence/absence. If no species are found within the Known or Potential Species lists, the project is not expected to affect any federally listed species, nor significantly impact any tribally listed species or other species of concern. Potential for species has been determined primarily on habitat characteristics and species range information. A thorough habitat analysis, and if necessary, species specific surveys, are required to determine the potential for each species.

Species of concern include protected, candidate, and other rare or otherwise sensitive species, including certain native species and species of economic or cultural significance. For legally protected species, the

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following tribal and federal statuses are indicated: NESL, federal Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA), and Eagle Protection Act (EPA). No legal protection is afforded species with only ESA candidate, NESL group 4 status, and species listed on the Sensitive Species List. Please be aware of these species during surveys and inform the NNDFW of observations. Reported observations of these species and documenting them in project planning and management is important for conservation and may contribute to ensuring they will not be up listed in the future.

In any and all correspondence with NNDFW or NNHP concerning this project please cite the Data Request Code associated with this document. It can be found in this report on the top right corner of every page. Additionally please cite this code in any biological evaluation documents returned to our office.

1. Known Species *(NESL=Navajo Endangered Species List, FE=Federally Endangered, FT=Federally Threatened, FC=Federal Candidate)*

Species

AQCH = Aquila chrysaetos / Golden Eagle NESL G3
LIPI = Lithobates pipiens / Northern Leopard Frog NESL G2
PEAMCI = Perognathus amplus cineris / Wupatki Pocket Mouse NESL G4
PEPEFI = Pediocactus peeblesianus var. fickeiseniae / Fickeisen Plains Cactus NESL G3 FE
**All or parts of this project currently are within areas protected by the Golden and Bald Eagle Nest Protection Regulations; consult with NNDFW zoologist or EA Reviewer for more information and recommendations.

2. Potential Species

Species

AQCH = Aquila chrysaetos / Golden Eagle NESL G3
ATCU = Athene cunicularia / Burrowing Owl NESL G4
BURE = Buteo regalis / Ferruginous Hawk NESL G3
CIME = Cinclus mexicanus / American Dipper NESL G3
COAM = Coccyzus americanus / Yellow-billed Cuckoo NESL G2 FT
DEPE = Dendroica petechia / Yellow Warbler NESL G4
EMTREX = Empidonax traillii extimus / Southwestern Willow Flycatcher NESL G2 FE
ERRO = Errazurizia rotundata / Round Dunebroom NESL G3
LIPI = Lithobates pipiens / Northern Leopard Frog NESL G2
PEAMCI = Perognathus amplus cineris / Wupatki Pocket Mouse NESL G4
PEPEFI = Pediocactus peeblesianus var. fickeiseniae / Fickeisen Plains Cactus NESL G3 FE

3. Quadrangles (7.5 Minute)

Quadrangles

Badger Spring (35111-F2) / AZ
Cameron SE (35111-G3) / AZ
Cameron South (35111-G4) / AZ
The Landmark (35111-G2) / AZ
Wupatki NE (35111-F3) / AZ
Wupatki SE (35111-E3) / AZ

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4. Project Summary *(EO1 Mile/EO 3 Miles=elements occuring within 1 & 3 miles., MSO=mexican spotted owl PACs, POTS=potential species, RCP=Biological Areas)*

SITE	EO1MI	EO3MI	QUAD	MSO	POTS	RCP
Project Area	None	AQCH	Badger Spring (35111-F2) / AZ	None	AQCH, ATCU, BURE, EMTREX, ERRO, PEAMCI	Area 3
Project Area	None	LIPI, PEAMCI	Cameron SE (35111-G3) / AZ	None	AQCH, BURE, COAM, DEPE, EMTREX, ERRO, LIPI, PEAMCI	Area 1, Area 3
Project Area	LIPI, PEAMCI	LIPI, PEAMCI	Cameron South (35111-G4) / AZ	None	AQCH, BURE, CIME, COAM, DEPE, EMTREX, LIPI, PEAMCI, PEPEFI	Area 1, Area 3
Project Area	None	None	The Landmark (35111-G2) / AZ	None	AQCH, BURE, EMTREX, ERRO, PEAMCI	Area 3
Project Area	None	AQCH, PEPEFI	Wupatki NE (35111-F3) / AZ	None	AQCH, ATCU, BURE, COAM, DEPE, EMTREX, LIPI, PEAMCI, PEPEFI	Area 1, Area 3
Project Area	None	None	Wupatki SE (35111-E3) / AZ	None	AQCH, ATCU, BURE, COAM, DEPE, EMTREX, ERRO, LIPI, PEAMCI	Area 1, Area 3

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5. Conditional Criteria Notes *(Recent revisions made please read thoroughly. For certain species, and/or circumstances, please read and comply)*

A. Biological Resource Land Use Clearance Policies and Procedures (RCP) - The purpose of the RCP is to assist the Navajo Nation government and chapters ensure compliance with federal and Navajo laws which protect, wildlife resources, including plants, and their habitat resulting in an expedited land use clearance process. After years of research and study, the NNDFW has identified and mapped wildlife habitat and sensitive areas that cover the entire Navajo Nation.
The following is a brief summary of six (6) wildlife areas:
1. **Highly Sensitive Area** – recommended no development with few exceptions.
2. **Moderately Sensitive Area** – moderate restrictions on development to avoid sensitive species/habitats.
3. **Less Sensitive Area** – fewest restrictions on development.
4. **Community Development Area** – areas in and around towns with few or no restrictions on development.
5. **Biological Preserve** – no development unless compatible with the purpose of this area.
6. **Recreation Area** – no development unless compatible with the purpose of this area.
None - outside the boundaries of the Navajo Nation
This is not intended to be a full description of the RCP please refer to the our website for additional information at https://www.nndfw.org/clup.htm.

B. Raptors – If raptors are known to occur within 1 mile of project location: Contact the NNHP zoologist at 871-7070 regarding your evaluation of potential impacts and mitigation.
Golden and Bald Eagles- If Golden or Bald Eagle are known to occur within 1 mile of the project, decision makers need to ensure that they are not in violation of the *Golden and Bald Eagle Nest Protection Regulations* found at https://www.nndfw.org/nnhp/docs_reps/gben.pdf.
Ferruginous Hawks – Refer to *Navajo Nation Department of Fish and Wildlife's Ferruginous Hawk Management Guidelines for Nest Protection* (https://www.nndfw.org/nnhp/docs_reps.htm) for relevant information on avoiding impacts to Ferruginous Hawks within 1 mile of project location.
Mexican Spotted Owl - Please refer to the *Navajo Nation Mexican Spotted Owl Management Plan* (https://www.nndfw.org/nnhp/docs_reps.htm) for relevant information on proper project planning near/within spotted owl protected activity centers and habitat.

C. Surveys – Biological surveys need to be conducted during the appropriate season to ensure they are complete and accurate please refer to NN Species Accounts https://www.nndfw.org/nnhp/sp_account.htm. Surveyors on the Navajo Nation must be permitted by the Director, NNDFW. Contact Jeff Cole at (928) 871-6450 for permitting procedures. Questions pertaining to surveys should be directed to the NNDFW the NNHP Zoologist for animals, and the NNHP Botanist for plants. Questions regarding biological evaluation should be directed to Jeff Cole at 871-6450.

D. Oil/Gas Lease Sales – Any settling or evaporation pits that could hold contaminants should be lined and covered. Covering pits, with a net or other material, will deter waterfowl and other migratory bird use. Lining pits will protect ground water quality.

E. Power line Projects – These projects need to ensure that they do not violate the regulations set forth in the *Navajo Nation Raptor Electrocution Prevention Regulations* found at https://www.nndfw.org/nnhp/docs_reps/repr.pdf.

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F. Guy Wires – Does the project design include guy wires for structural support? If so, and if bird species may occur in relatively high concentrations in the project area, then guy wires should be equipped with highly visual markers to reduce the potential mortality due to bird-guy wire collisions. Examples of visual markers include aviation balls and bird flight diverters. Birds can be expected to occur in relatively high concentrations along migration routes (e.g., rivers, ridges or other distinctive linear topographic features) or where important habitat for breeding, feeding, roosting, etc. occurs. The U.S. Fish and Wildlife Service recommends marking guy wires with at least one marker per 100 meters of wire.

G. San Juan River – On 21 March 1994 (Federal Register, Vol. 59, No. 54), the U.S. Fish and Wildlife Service designated portions of the San Juan River (SJR) as critical habitat for Ptychocheilus lucius (Colorado pikeminnow) and Xyrauchen texanus (Razorback sucker). Colorado pikeminnow critical habitat includes the SJR and its 100-year floodplain from the State Route 371 Bridge in T29N, R13W, sec. 17 (New Mexico Meridian) to Neskahai Canyon in the San Juan arm of Lake Powell in T41S, R11E, sec. 26 (Salt Lake Meridian) up to the full pool elevation. Razorback sucker critical habitat includes the SJR and its 100-year floodplain from the Hogback Diversion in T29N, R16W, sec. 9 (New Mexico Meridian) to the full pool elevation at the mouth of Neskahai Canyon on the San Juan arm of Lake Powell in T41S, R11E, sec. 26 (Salt Lake Meridian). All actions carried out, funded or authorized by a federal agency which may alter the constituent elements of critical habitat must undergo section 7 consultation under the Endangered Species Act of 1973, as amended. Constituent elements are those physical and biological attributes essential to a species conservation and include, but are not limited to, water, physical habitat, and biological environment as required for each particular life stage of a species.

H. Little Colorado River - On 21 March 1994 (Federal Register, Vol. 59, No. 54) the U.S. Fish and Wildlife Service designated Critical Habitat along portions of the Colorado and Little Colorado Rivers (LCR) for Gila cypha (humpback chub). Within or adjacent to the Navajo Nation this critical habitat includes the LCR and its 100-year floodplain from river mile 8 in T32N R6E, sec. 12 (Salt and Gila River Meridian) to its confluence with the Colorado River in T32N R5E sec. 1 (S&GRM) and the Colorado River and 100-year floodplain from Nautuloid Canyon (River Mile 34) T36N R5E sec. 35 (S&GRM) to its confluence with the LCR. All actions carried out, funded or authorized by a federal agency which may alter the constituent elements of Critical Habitat must undergo section 7 consultation under the Endangered Species Act of 1973, as amended. Constituent elements are those physical and biological attributes essential to a species conservation and include, but are not limited to, water, physical habitat, and biological environment as required for each particular life stage of a species.

I. Wetlands – In Arizona and New Mexico, potential impacts to wetlands should also be evaluated. The U.S. Fish & Wildlife Service's National Wetlands Inventory (NWI) maps should be examined to determine whether areas classified as wetlands are located close enough to the project site(s) to be impacted. In cases where the maps are inconclusive (e.g., due to their small scale), field surveys must be completed. For field surveys, wetlands identification and delineation methodology contained in the "Corps of Engineers Wetlands Delineation Manual" (Technical Report Y-87-1) should be used. When wetlands are present, potential impacts must be addressed in an environmental assessment and the Army Corps of Engineers, Phoenix office, must be contacted. NWI maps are available for examination at the Navajo Natural Heritage Program (NNHP) office, or may be purchased through the U.S. Geological Survey (order forms are available through the NNHP). The NNHP has complete coverage of the Navajo Nation, excluding Utah, at 1:100,000 scale; and coverage at 1:24,000 scale in the southwestern portion of the Navajo Nation. In Utah, the U.S. Fish & Wildlife Service's National Wetlands Inventory maps are not yet available for the Utah portion of the Navajo Nation, therefore, field surveys should be completed to determine whether wetlands are located close enough to the project site(s) to be impacted. For field surveys, wetlands identification and delineation methodology contained in the "Corps of Engineers Wetlands Delineation Manual" (Technical Report Y-87-1) should be used. When wetlands are present, potential impacts must be addressed in an environmental assessment and the Army Corps of Engineers, Phoenix office, must be contacted. For more information contact the Navajo Environmental Protection

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Agency's Water Quality Program.

J. Life Length of Data Request – The information in this report was identified by the NNHP and NNDFW's biologists and computerized database, and is based on data available at the time of this response. If project planning takes more than two (02) years from the date of this response, verification of the information provided herein is necessary. It should not be regarded as the final statement on the occurrence of any species, nor should it substitute for on-site surveys. Also, because the NNDFW information is continually updated, any given information response is only wholly appropriate for its respective request.

K. Ground Water Pumping - Projects involving the ground water pumping for mining operations, agricultural projects or commercial wells (including municipal wells) will have to provide an analysis on the effects to surface water and address potential impacts on all aquatic and/or wetlands species listed below. NESL Species potentially impacted by ground water pumping: Carex specuicola (Navajo Sedge), Cirsium rydbergii (Rydberg's Thistle), Primula specuicola (Cave Primrose), Platanthera zothecina (Alcove Bog Orchid), Puccinellia parishii (Parish Alkali Grass), Zigadenus vaginatus (Alcove Death Camas), Perityle specuicola (Alcove Rock Daisy), Symphyotrichum welshii (Welsh's American-aster), Coccyzus americanus (Yellow-billed Cuckoo), Empidonax traillii extimus (Southwestern Willow Flycatcher), Rana pipiens (Northern Leopard Frog), Gila cypha (Humpback Chub), Gila robusta (Roundtail Chub), Ptychocheilus lucius (Colorado Pikeminnow), Xyrauchen texanus (Razorback Sucker), Cinclus mexicanus (American Dipper), Speyeria nokomis (Western Seep Fritillary), Aechmophorus clarkia (Clark's Grebe), Ceryle alcyon (Belted Kingfisher), Dendroica petechia (Yellow Warbler), Porzana carolina (Sora), Catostomus discobolus (Bluehead Sucker), Cottus bairdi (Mottled Sculpin), Oxyloma kanabense (Kanab Ambersnail)

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6. Personnel Contacts

Wildlife Manager
Leanna Begay
928.871.6450
lbegay@nndfw.org

Zoologist
Brent Powers
928.871.7070
bpowers@nndfw.org

Botanist
Nora Ventrella
928.523.1526
nventrella@nndfw.org

Biological Reviewer
Vacant
928.871.6450
reviews@nndfw.org

GIS Supervisor
Dexter D Prall
928.660.9169
prall@nndfw.org

Dexter D Prall

Digitally signed by Dexter D Prall
DN: cn=Dexter D Prall, o=Navajo Natural Heritage Program, ou=Navajo Nation Department of Fish and Wildlife, email=prall@nndfw.org, c=US
Date: 2023.02.07 09:14:39 -07'00'

Dexter D Prall, GIS Supervisor - Natural Heritage Program
Navajo Nation Department of Fish and Wildlife

7. Resources

Navajo Endangered Species List:
https://www.nndfw.org/nnhp/endangered.htm

Species Accounts:
https://www.nndfw.org/nnhp/sp_account.htm

Biological Investigation Permit Application
https://www.nndfw.org/nnhp/study_permit.htm

Navajo Nation Sensitive Species List
https://www.nndfw.org/nnhp/trackinglist.htm

Various Species Management and/or Document and Reports
https://www.nndfw.org/nnhp/docs_reps.htm

Consultant List
https://www.nndfw.org/bi_consult_list_2022.pdf

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