N A A K A I I T O

Mexican WATER CHAPTER

COMMUNITY-BASED LAND USE PLAN

Mexican Water, Arizona/Utah
DECEMBER 2007

MEXICAN WATER CHAPTER

Red Mesa TP#1019, HC 61 Box 38 • Teec Nos Pos, AZ 86514 • (928) 674-3641

Mexican Water Chapter

MWC071207-80011

RESOLUTION OF MEXICAN WATER CHAPTER

Approving the Mexican Water Chapter Community-Based Land Use Plan and Requesting The Transportation and Community Development Committee to grant Local Governance Certification

WHEREAS,

1. The Mexican Water Chapter is officially recognized and certified as a political unit of the Navajo Tribal Government pursuant to Navajo Tribe Council Resolution No. CJ-20-55;

2. Pursuant to Resolution No. CAP-34-98, the Navajo Nation Council adopted the Navajo Nation Local Governance Act (LGA);

3. Pursuant to the LGA, all chapters shall develop and implement Community-Based Land Plan in accordance with 26 N.N.C. § 2004;

4. Pursuant to the LGA, the Mexican Water Chapter established a Community Land Use Planning Committee, which was renamed to the Planning & Zoning Commission to oversee all land use planning activities under Resolution No. MWC070830-113;

5. Pursuant to the LGA, the Planning & Zoning Commission approved a Community Participation Plan on August 01, 2007 to ensure local community members were given the opportunity to participate in the planning process;

6. Pursuant to the LGA, a 60-day comment period was opened with a public hearing on October 5, 2007 and closed on December 5, 2007;

7. The Mexican Water Chapter developed the community-based land use plan in the best interest of the community and in accordance with all applicable laws, attached hereto as Exhibit "A";

8. The Planning & Zoning Commission reviewed and recommended to the Chapter approval of the community-based land use plan, attached hereto as Exhibit "B".

NOW THEREFORE BE IT RESOLVED THAT;

1. The Mexican Water Chapter hereby approves the Community-Based Land Use Plan in accordance with the requirements of the LGA, attached hereto as Exhibit "A".

2. The Mexican Water Chapter further hereby requests the Transportation and Community Development Committee of the Navajo Nation Council to grant certification of their Community-Based Land Use Plan.

CERTIFICATION

We hereby certify the foregoing resolution was considered by Mexican Water Chapter, (Navajo Nation), Arizona at a duly called Chapter Meeting, at which a quorum was present and the same approved this resolution by a vote of 25 in favor, 0 opposed and 0 abstained on this **7th** day of **December 2007**.

Jerry Tsosie, President

David L. John Sr., Vice-President

Cassandra Beletso, Secretary/Treasurer



Mexican WATER CHAPTER

ACKNOWLEDGEMENTS

Mexican Water Chapter • Naakaii To
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Renae Keith, Member
All Community Grazing Permittees

CONTRIBUTORS

Navajo Tribal Utility Authority (NTUA), Navajo Nation Land Department, Navajo Nation Historic Preservation (NNHPD), Navajo Nation Department of Fish & Wildlife (NNDFWL), Navajo Nation, Soil and Water Conservation, Utah Trust Fund, Navajo Revitalization, Bureau of Indian Affairs (BIA) Department of Roads, BIA Natural Resources, Navajo Nation Department of Agriculture, Red Mesa Express, Navajo Natural Resource Committee, Resolute, Navajo Nation Oil and Gas, Navajo Nation Department of Water Resources, Pacific Corp Power Company and Apache County Department of Roads.

Mexican WATER CHAPTER

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INTRODUCTION

This Community-Based Land Use Plan (CB-LUP) is an official public document approved by the Mexican Water Chapter (hereafter interchangeably referred to as the Chapter) membership through Chapter Resolution MWC071207-80011 (a copy of the resolution is inserted at the beginning of this document). The CB-LUP serves as a guide for future development and provides a foundation for zoning ordinances. It also allows the Chapter to evaluate potential development projects while balancing the diverse needs of the community with concerns cultural traditions and natural resources. The Mexican Water Chapter recognizes that to build a self sustaining community, perseverance and a solid land development plan are needed. Equally important to the success of the CB-LUP is the community's commitment and their participation throughout the process. Such a plan is provided here that directly reflects the effort of the Mexican Water Chapter and its members who came together and voiced their wants, needs, and desires for a better future.

PURPOSE

The purpose of the Community Based Land Use Plan is to develop a plan as part of the *Local Governance Act of 1998* (LGA) in which Mexican Water Chapter can take control of its own destiny and plan for their futures. The CB-LUP satisfies the land use certification process under the LGA, as amended, and moves the Chapter closer to managing and making decisions regarding local matters pertaining to land use and thereafter administering the land use process.

The immediate goal is to develop a CB-LUP for the Chapter that assures that all voices in the community are heard. Much of the CB-LUP flows from the voices of the community's members and its chapter leadership including the elected officials and the members of the planning commission. Such a plan binds the Chapter and its membership to a contract that assures the

community's future growth and stability. Essentially, it functions as an action list and provides a baseline against which progress can be measured.

With a unique cultural perspective, the plan incorporates the traditions and customs of the past and articulates the community's overarching goals, objectives, and strategies to guide and coordinate land uses.

AUTHORIZATION

TITLE 26 NAVAJO NATION LOCAL GOVERNANCE ACT

Land use planning has been an option for Navajo Nation chapters since the LGA passed into law in 1998. If Chapters choose to administer land within their community, a CB-LUP must be developed and implemented, pursuant to the law, and updated every five years.

The purpose of the LGA is to recognize governance at the local level. Through adoption of this Act, the Navajo Nation Council delegates its authority, with respect to local matters consistent with Navajo law including custom and tradition, to the individual Chapters. This authority will improve community decision making, allow communities to excel and flourish, enable Navajo leaders to move towards a more prosperous future, and improve the strength and sovereignty of the Navajo Nation in the long run. The LGA compels Chapters to govern with responsibility and accountability to the local citizens.

Chapters wanting to administer land, pursuant to LGA, are required to develop a CB-LUP based upon results of a community assessment. Chapters who complete a CB-LUP must then receive certification from the Transportation and Community Development Committee. Once certified, Chapter can then administer land pursuant to the LGA. The Mexican Water Chapter has exercised this option and developed a CB-LUP.

LAND USE PLANNING & ZONING COMMISSION

In conformance with the LGA, Mexican Water Chapter established a Community Based Land Use Committee (CLUPC) comprised of community members that operate according to an approved plan of operation under Chapter Resolution MWC-991305-001. The CLUPC was established to approve the community-based land use planning processes and oversee community-based land use planning activities. The responsibilities of the CLUPC include attending periodic

meetings to discuss the development and implementation of the CB-LUP. Members advise, review, and make recommendations related to land use to the Mexican Water Chapter's membership at duly called chapter meetings.

The current CLUPC members were confirmed via Chapter Resolution MWC071209-80024. In order to better represent the mission of the Community-Based Land Use Committee and the growth and development of the community, the Chapter recently changed the CLUPC name to Mexican Water Land Use Planning & Zoning Commission per Resolution MWC 070814-113.

Copies of the above mentioned resolutions are provided in **APPENDIX A**.

PREVIOUS LAND USE PLAN

Miller, Arviso & Associates, Inc. (2001) prepared a land use plan that specifically focused on housing. The purpose of that plan was to identify land available for the development of affordable housing. A Native American Housing Assistance and Self-Determination (NAHASDA) grant funded the plan under the Office of Navajo Government Development.

COMMUNITY INVOLVEMENT AND PUBLIC PARTICIPATION

In accordance with the LGA, the Planning Commission initially developed, approved, and adhered to a Community Involvement and Participation Plan (August 1, 2007) to guide community members through the land use planning process by giving all interested parties the greatest possible opportunity to learn and actively participate in developing the CB-LUP. In this way, community members were strongly encouraged to participate in every step of the planning process to develop the CB-LUP.

The objective of the Community Involvement and Participation Plan was to provide opportunities for the maximum level of chapter community involvement throughout the planning process. The Community Involvement and Participation Plan offered participation processes that build on social interaction between the community members and the Chapter government. The Community Involvement and Participation Plan also fostered community education and active participation that ultimately allow the membership to substantially contribute to the back bone of CB-LUP.

The education component of the planning process relied on public meetings, work sessions, and public hearings. The approach of each session type is defined below:

- Public meetings informed, updated and recommended the land use planning activities of the Chapter community.
- Work sessions offered the community a more informal and hands-on approach to participating in the planning process.
- Public hearings were meetings that were held in a more formal setting to obtain views and comments of community members and typically include a wider public audience regarding the project.

These sessions were used to educate, inform, and involve the community in the project at various stages along the way. During these times, community members received feedback about assessments, helped prioritize land use plan objectives, and further defined goals. Local community members were encouraged and urged to attend and participate in any and all of the education and communication sessions. Information pertaining to the land use plan was available to the public.

The meetings conducted were as follows:

TABLE 1. COMMUNITY INVOLVEMENT MEETINGS

Activity	Purpose	Date
Public Meeting	Regular Planning & Zoning Meeting – Approval of Community Involvement and Participation Plan	August 1, 2007
Work Session	Obtain Goals and Objectives from Community Members	August 5, 2007
Work Session	Identify Existing Conditions	September 13, 2007
Work Session	Designate Future Land Use	September 13, 2007
Work Session	Review Land Use Planning Maps	September 19, 2007
Public Meeting	Review Draft CB-LUP	September 28, 2007
Public Hearing	Present Draft CB-LUP (start of 60-day comment Period)	October 5, 2007
Public Meeting	Regular Planning & Zoning Meeting – Review CB-LUP Comments	October 19, 2007
Public Meeting	Regular Planning & Zoning Meeting – Review CB-LUP Comments	November 28, 2007
Public Hearing	Present Final CB-LUP (end of 60-day comment Period)	December 5, 2007
Planning Meeting	Recommend to the Chapter for approval and adoption via Chapter Resolution	December 5, 2007
Chapter Meeting	Approval and Adoption of CB-LUP	December 7, 2007

AMENDMENTS

The amendment process provided an opportunity for community members, groups, organizations, departments, entities, businesses and the general public to propose changes to the CB-LUP. Proposed amendments included changes that addressed changing social, economic and environmental conditions.

Changes also reflected on-going work or new information. Proposed amendments may include changes to policies, maps, appendices or other components of the CB-LUP.

FIVE -YEAR UPDATE

Mexican Water Chapter anticipates that the CB-LUP will function well for some time to come; however, to assure that the plan is meeting the needs of the community, the CB-LUP will be completely reviewed, revised and updated by the Planning & Zoning Commission, as appropriate, every five years pursuant to LGA regulations.

AS NEEDED AMENDMENT

In between the five-year updates, amendments can be made on an as needed basis. Community members, groups, organizations, departments, entities, businesses and/or the general public can propose an amendment(s) in accordance with the process described herein. When the Planning & Zoning Commission approves an amendment, it shall become part of this CB-LUP as an addendum. All addendums will be reviewed and incorporated, as appropriate, into the CB-LUP during the Five-Year Update.

PROCESS FOR PROPOSING AN AMENDMENT

Request for amendments should be in writing to the attention of the Planning & Zoning Commission. Appropriate support material, if any, should be included along with the request for the amendment.

CRITERIA FOR CONSIDERING AN AMENDMENT

If an amendment is proposed to the CB-LUP, specific questions will be considered asked as part of the evaluation process. Such questions included but are not limited to the following:

- Is the proposed amendment appropriate for the CB-LUP?
- Do proposed changes pertain to the CB-LUP? For example, some proposed amendments suggest changes to regulations or budgets while others request specific assistance, which are more appropriately addressed at Chapter planning meetings and Chapter meetings.
- Is the proposed amendment legal? Consider whether the proposed amendment meets existing relevant laws.

APPROVAL/DISAPPROVAL OF AN AMENDMENT

The Planning & Zoning Commission shall conduct a public hearing for all proposed amendments determined to be appropriate to the CB-LUP. After the public hearing, the Planning & Zoning Commission shall vote to accept or reject the proposed amendment. If the proposed amendment is accepted, the Planning & Zoning Commission shall recommend adoption, via a resolution, of the proposed amendment to the Mexican Water Chapter. Mexican Water Chapter membership then shall vote on the resolution at a duly called chapter meeting. Pursuant to the LGA, Chapter approved amendments or modifications shall be approved by the TCDC of the Navajo Nation Council. The approval by the TCDC is the formal acknowledgement of Mexican Water Chapter amending its CB-LUP.

2

COMMUNITY VISION

INTRODUCTION

The initial step in developing a future land use plan for the Mexican Water Chapter is to identify the values of the community members, what is important to them. Such visioning and planning are important particularly considering the potential for future growth and development. To this end, community members within the planning area gave their input through public meetings and work sessions. Subsequent public hearings were held for the purpose of identifying a vision for the community that would reflect the desired end uses for the area.

MISSION

To provide a great local government that serves members across two states while creating a healthy, culturally-rich community with a good economy.

VISION

Mexican Water Chapter will be instilled with self sustaining strength and stability enriching the lives of all community members while embracing the four elements of life at its highest level:

- *Nitsahakees*: Thinking
- *Nahata*: Planning
- *Iina*: Living
- *Sii hasin*: Fulfillment

TEN GUIDING PRINCIPLES

1. The CB-LUP shall be forward looking: five to fifty-year time frame.
2. The CB-LUP shall be developed through a process of extensive community involvement and participation.
3. The CB-LUP shall have widespread community support.
4. The CB-LUP shall be based upon and adequately reflect community values, beliefs and expectations.
5. The CB-LUP shall be used to guide community decisions.
6. The CB-LUP shall be a community document that is amended from time to time reflecting community changes.
7. The CB-LUP shall be carried out within applicable common standards for land use development and adherence to all applicable laws, mandates, rules and regulations.
8. All land use planning meetings shall be open to anyone who wishes to attend.
9. Every reasonable effort shall be made to listen to and consider issues or concerns raised by community members and the general public.
10. The Planning and Zoning Commission shall develop and approve a Community Involvement and Participation Plan to facilitate the orderly development of the plan.

3.

COMMUNITY SETTING

LOCATION

The Mexican Water Chapter is a dual state community with its chapter house and lower third in Apache County, Arizona and the remainder in San Juan County, Utah **(MAP 1).** Kayenta and Dennehotso lie immediately west, Red Mesa is to the east, and Mexican Water and Sweetwater are to the south. The junction of Highways 160 and 191 are just southeast of the chapter house.

BRIEF CHAPTER HISTORY

BACKGROUND

For many centuries, Navajos lived peacefully all over the four corners area where they interacted and traded ideas with Pueblo and Plains Indian groups. It was not until the Spanish arrived and later U.S. soldiers and citizens that Navajo lives and traditions were threatened. Skirmishes, slave raids, and massacres occurred with increasing frequency. New alliances upset the balance of power among the native groups causing the Navajo to move out of Dinetah to avoid the hostilities. They moved into areas such as Bear's Ear in Utah, Canyon de Chelly, Mount Taylor, Navajo Mountain, and as far west as the Grand Canyon.

Most Navajos who remained in these areas were forced to relocate at Fort Sumner as part of the U.S. Government's "Long Walk" where unbearable conditions further decimated the population. Although many of the original families from the Mexican Water area such as Lee Jim's were able to avoid the initial round up by hiding in the nearby canyons of Monument Valley, some family members were tricked into going to Fort Defiance, New Mexico, for food where they were captured and then sent to Fort Sumner.

Years after the Long Walk when the Navajo people returned to their homeland, they discovered and fed many hungry Utes who were roaming the Mexican Water area. Family clans reestablished their homes in their area and eventually more clans moved into the community. One prominent tribal member in the Mexican Water area, Lester White, lived at "Dog Down Wash" and was an interpreter at the time of the Spanish battles. Another, Man Etsitty, who originally established three homes, moved around the community all the way up to Bluff after coming back from the Long Walk. Another resident, "Hole in the Rock Woman" resided in the area near Bluff along the San Juan River. She used to recall a Mormon family passing thru the area and asking to stay the night and never leaving.

After the Long Walk, the United States Government's Indian Policy determined the administration of the reservation. Appointed federal individuals (Indian Agents) essentially ruled the reservation, sometimes relying on the counsel of traditional Navajo methods of government. The current tribal government was established and recognized by the federal government in 1923 (http://en.wikipedia.org/wiki/Navajo_Nation accessed September 30, 2007).

BOUNDARY OF ORIGINAL NAVAJO RESERVATION OF 1868

Boundary Butte, one of about 300 diatremes in the Four Corners is 543 feet high. The name of this feature has nothing to do with its proximity to Four Corners of the state boundaries; it marked the northeastern corner of the original Navajo Reservation of 1868 **(MAP 2)**. The Navajo name for it translates as "Rabbit Ears." This name must have been applied by someone viewing it from the west (http://fourcornerssw.com/mexwater.html accessed September 29, 2007).

LOCAL GOVERNMENT

The Navajo Tribal Council certified the Mexican Water Chapter on August 15, 1955 pursuant to CJ-20-55 (LRS Innovations 2004). Under the Bureau of Indian Affairs (BIA), the Chapter is in grazing district and is one of 20 chapters that makes up the Northern Navajo Agency. The earliest chapter meetings were held under trees next to the original Mexican Water Trading Post, which was directly west of the modern-day Chapter house. During the winter months, chapter meetings were held in the Trading Post Warehouse or a stone hogan, northwest of the Chapter house that was also used for lodging.

Within a year of certification, the newly chosen chapter officials chose a site directly east of the old Trading Post near a water well as the location for the new chapter house. Construction ran from May through November, 1956, and was done by local community members: Hugh Poyer, Chiscilly Benally; Saggboy Bellison; Charley Sagg; Robert James; Wallace Tsosie; Leonard Hernandez; Dirty

Bedoni; Frank Lameman; Chester Betsuie; Keith Francis; Council Delegate Dorsey Bellison; Jess White; Gover Bellison; Tom Poyer; and John Lameman. Other individuals present included Samuel Bellison, Dillion Platero, Anna Wauneka, Raymond Nakai, Paul Jones, Norma Collins, and James Etsitty. Colors were posted during the dedication of the Chapter house on Thanksgiving holiday. The Navajo Nation Band was present during the dedication, which was held with a large feast prepared by local community members: Susie Cly; Evelyn White; Bessie Sagg; Edith Lameman; Eileen Lameman; Bertha James; Lena Poyer; and Martha Naljahih. Today, the Mexican Water Chapter is one of the 110 chapters on the Navajo Nation.

CHAPTER NAME

The community eventually embraced the name Mexican Water based on oral histories that were passed down from generation to generation. Three main stories regarding the origins of the name differ slightly. One such story holds that a Mexican came to the area along with a mule; the Mexican is said to have dug a well behind the present location of the chapter house and church and stayed there. Another account chronicles the life a Mexican who was passing through the area and stopping for a rest and a drink of water under a shady tree before continuing on his way. In this narrative, the Mexican was involved in local battles with Spanish explorers of earlier time. In the third accounting of events of the times, the story speaks to how Mexicans traveled from Bluff to Chinle on burros. As they traveled, the burros needed water so the Mexicans watered their burrow at a pool of water located near what is now the Baptist Church. The local Navajos referred to these travelers as Nakai to hi ye nili (Mexican's take out water). These three rich stores provide some insight as to the origins of this community and its name.

Regardless of the originals of its name, the Navajo community began to flourish again as members reestablished themselves in this "Mexican water" area. In particular, three traders, "Bear Rolled Up," "Tail Squashed," and later Don Reeves, moved in and ran a trading post. In addition, Lester White was an interpreter, and Lee Robert James was one of the first Council Delegates to represent the area. Today, the community cherishes its past and is still very traditional.

LOCAL LEADERSHIP

Since the Mexican Water Chapter was formed and its first officials were elected in 1955, outstanding leadership has been the norm. Since that time, the Chapter has had 12 terms with officials serving as President, Vice-President, Secretary/Treasurer, and Council Delegate. The current incumbents include Jerry Tsosie as President, David L. John, Sr. as Vice-President, Cassandra Beletso as Secretary/Treasurer, and Davis Filfred and Kenneth Maryboy as Council Delegates. **TABLE 2** lists the Chapter's previous officials going back to 1955.

TABLE 2. CHAPTER LEADERSHIP

Year	Council Delegate	President	Vice-President	Secretary/Treasurer
1955	Robert James	Chris E. Begay	Sagg Boy Bellison	Lawrence Big
1959	Little Pouch	Robert James	Charley Saggboy	John Lamemen
1963	Evans Holly	Robert James	Charley Saggboy	William Bill Scott/ George Tohtsoni
1967	Evans Holly	Robert James	Charley Saggboy	Roselyn Jim
1971	Evans Holly	Robert James	Charley Saggboy	Roselyn Jim
1975	Jonas Mustache	Louis Patterson	Tom Poyer	Thomas Poyer
1979	Jonas Mustache	Louis Patterson	James Tsosie	Margaret Buck
1983	Jonas Mustache	James Naljahih	Dan A. Jones	Annie L. Gillwood
1988	Dean Paul, Sr.	David Yanito, Sr.	David L. John	James Tsosie
1991	David L. John	David Yanito, Sr.	Francis Haskan, Sr.	Margaret Buck
1993	David L. John	Marlin Saggboy	Francis Haskan, Sr.	Martha Nahkai
1994	David L. John	Marlin Saggboy	Francis Haskan, Sr.	James Tsosie
1996	David L. John	Curtis D. Yanito	Francis Haskan, Sr.	James Tsosie
1997	David L. John	Curtis D. Yanito	Esther Askan	Carmelita L. Sagg
1999	David L. John Mark Maryboy Robert B. Whitehorse	Curtis Yanito	Esther Askan	Carmelita L. Sagg
2000	David L. John/ Kenneth Maryboy Mark Maryboy	Kenneth Maryboy/ Amelia Black	Alvin Tohtsoni	Carmelita L. Sagg
2004	Davis Filred Kenneth Maryboy	Jerry Tsosie	Annie L. Gillwood/ David L. John, Sr.	Cassandra Beletso

PLANNING AREA

During planning meetings and public work sessions, the Mexican Water community members identified the planning area as the land on which they live and practice their traditional life ways such as farming and grazing livestock. The Mexican Water planning area is shown in **MAP 3.** The San Juan River forms the northern edge of the planning area. The eastern edge of the planning area generally follows Navajo Route 5089 and follows the top of the mesas and ridges as it meets the San Juan River. The Southern edge lies south of Highway 160. It follows a fence

south of Hummingbird Spring and ties back into the Chinle Wash and crosses over to the west of Chinle Wash. The western edge generally follows the ridge west of the Chinle Wash.

Five chapters are adjacent to Mexican Water. These include Red Mesa to the east, Sweetwater and Rock Point to the south, and Dennehotso and Kayenta chapters to the west.

GRAZING DISTRICT

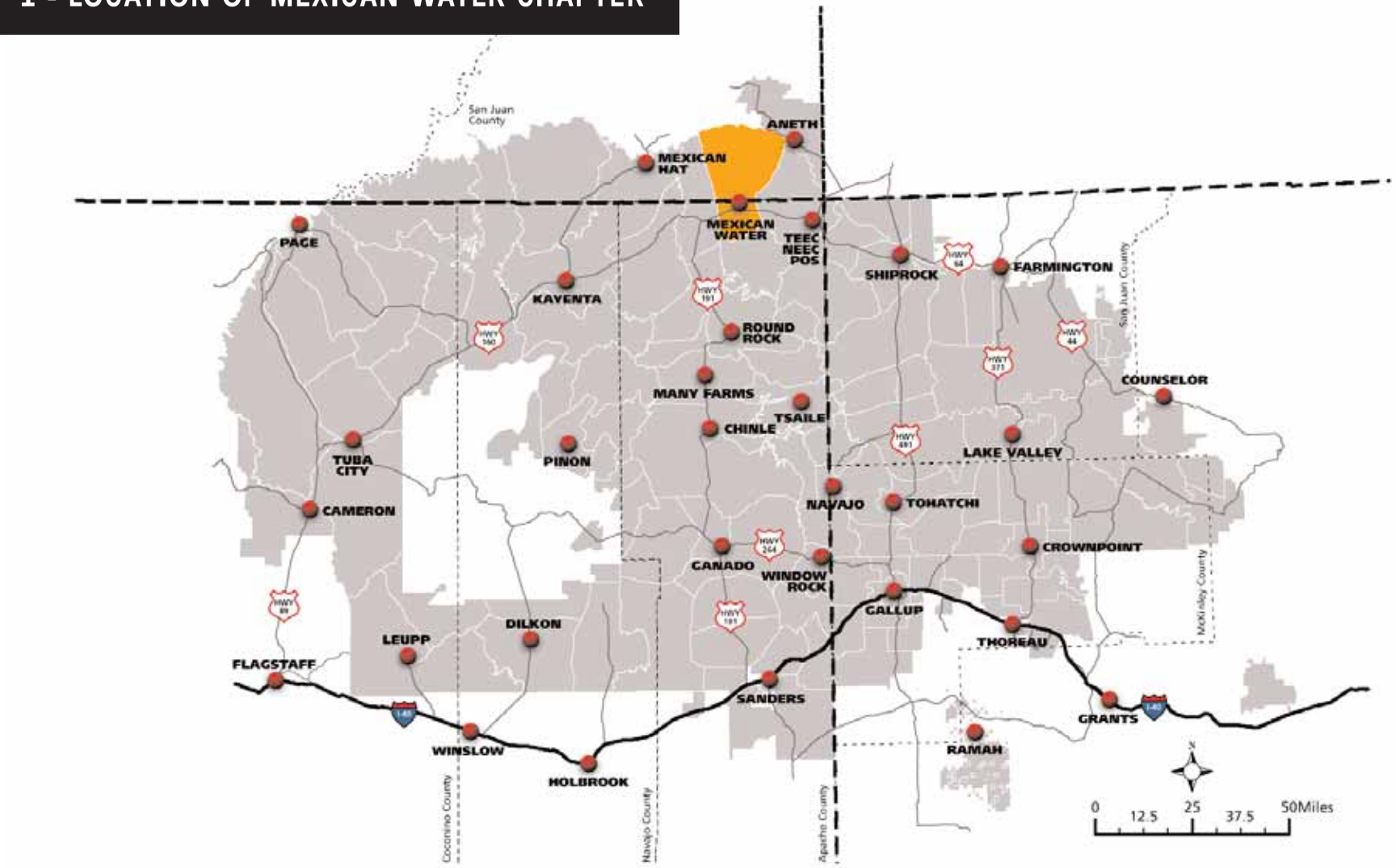
Generations of herding and grazing on the Navajo Nation led the federal government to form grazing districts over 70 years ago. The Bureau of Land Management (BLM) and the Bureau of Indian Affairs (BIA) developed Navajo Nation grazing districts in 1935. They based the districts on soil and range inventories, which they used to determine animal unit capacities. As these agencies performed their studies, they also kept track of their research areas with what they called grazing district lines that were based on natural topography such as mountain ranges and washes. Between 1937 and 1938, the BIA issued grazing permits based on the units' capacities, and although the district boundaries have never been legally surveyed, they have had many uses over the years.

Once created, the BIA grouped three individual grazing districts into the Shiprock Agency: 9, 12 and13. The Mexican Water Chapter is mostly within Grazing District 9 **(MAP 4)**. A small portion on the western edge of the planning area extends into Grazing District 8 which is held in the Chinle Agency.

LAND STATUS

The vast majority of the Chapter's planning area is located on Navajo Tribal Trust Land as shown in **MAP 5**. There are two narrow strips along the San Juan River that are withdrawn as Native American and Navajo Indian Power Sites.

MAP 1 - LOCATION OF MEXICAN WATER CHAPTER



Mexican Water Chapter
Community-Based Land Use Plan
December 2007

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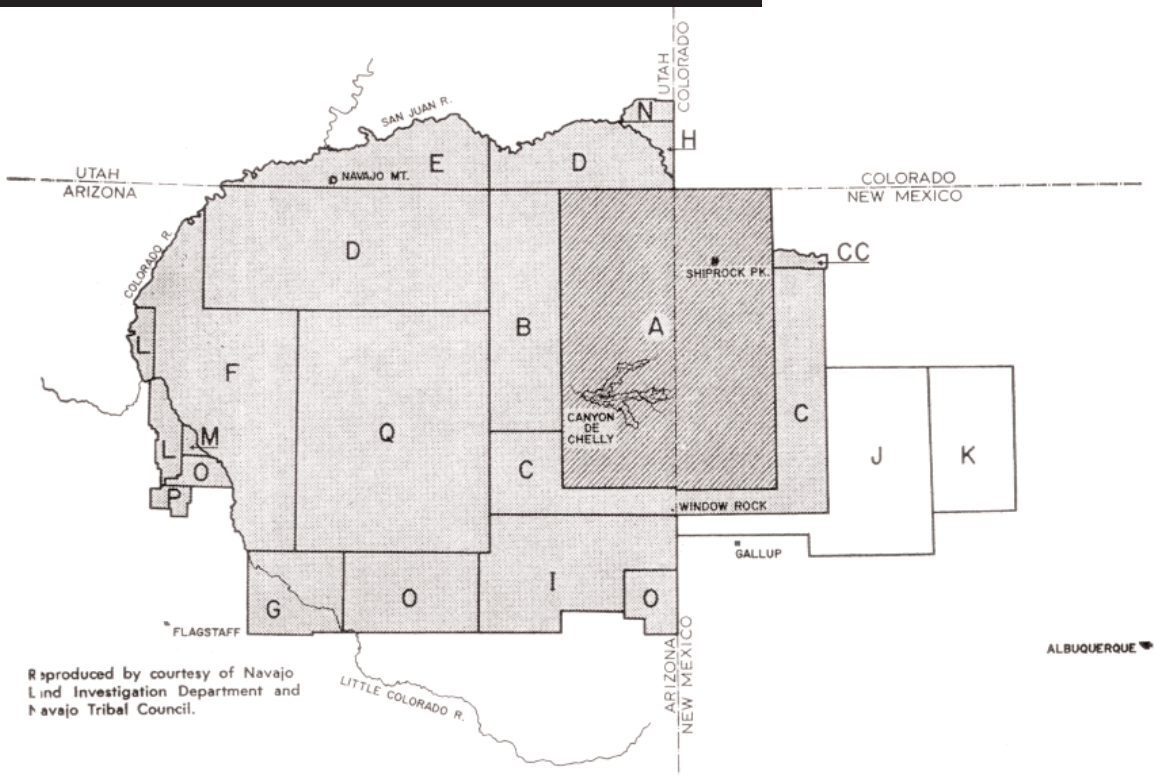
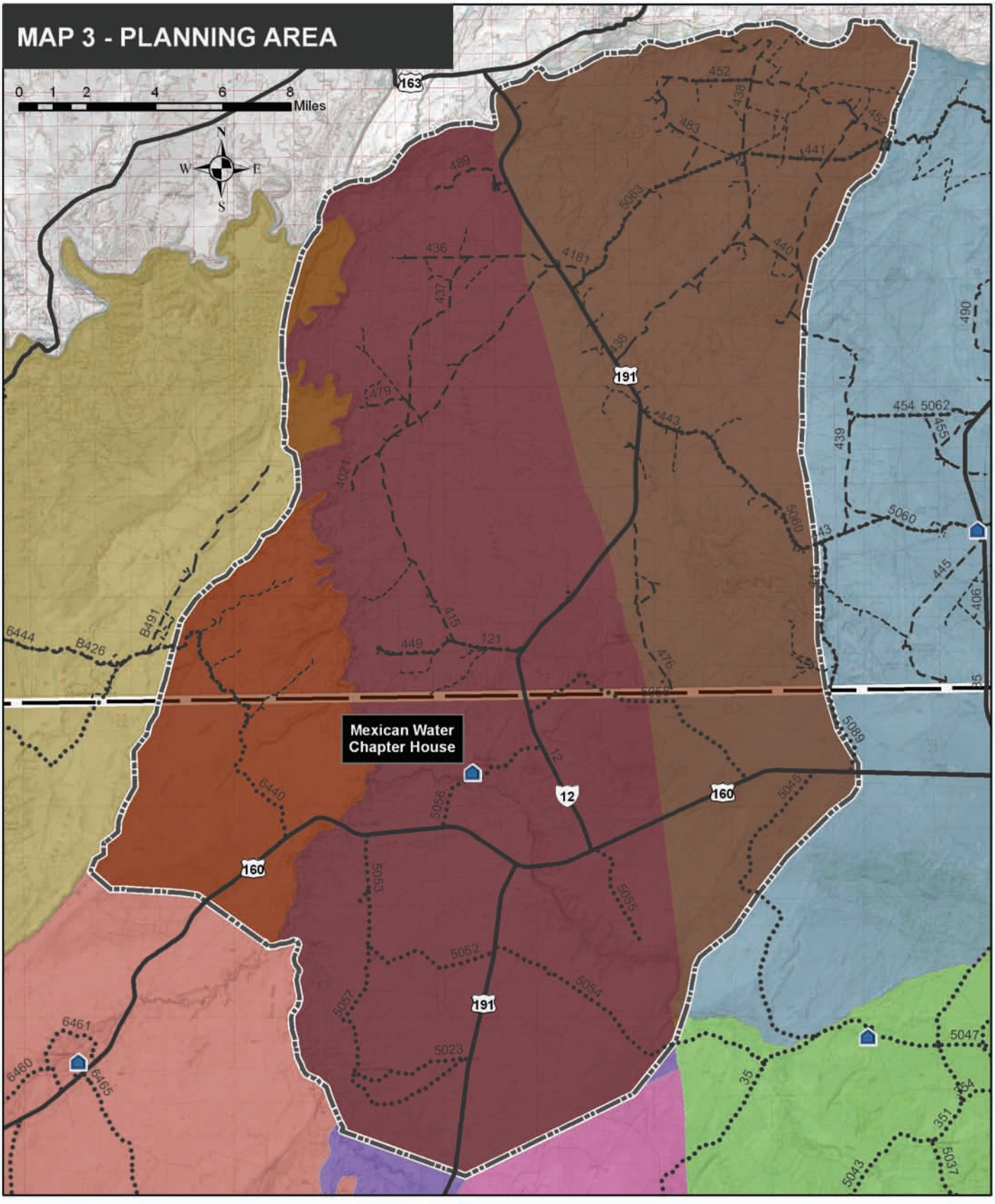
Sources: NDOT
Navajo Land Department

MAP 2 - ORIGINAL NAVAJO RESERVATION OF 1868



A	Original treaty reservation. June 1, 1868.
B	Executive-order addition. October 29, 1878.
C	Executive-order addition. January 6, 1880.
CC	Originally a part of **"C"**; withdrawn from the reservation by executive order, May 17, 1884; restored by executive order, April 24, 1886.
D (two parts)	Executive-order addition. May 17, 1884.
E	The Paiute Strip. Originally a part of **"D"**; in 1872 restored to the public domain; in 1908 withdrawn for the use of various Indians; restored to public domain in 1922; in 1929 again withdrawn from entry; 1933 transferred permanently to the Navajo reservation.
F	Executive-order addition. January 8, 1900.
G	Executive-order addition. November 14, 1901.
H	Executive-order addition. March 10, 1905.
I	Executive-order addition. November 9, 1907.
J	Executive-order addition. November 9, 1907; restored to public domain by executive order of January 16, 1911.
K	Executive-order addition. November 9, 1907; restored to public domain by executive order of December 30, 1908.
L	Tusayan Forest addition. Act of May 23, 1930.
M	Executive-order addition. May 7, 1917.
N	Act of March 1, 1933.
O (three parts)	Arizona Boundary Act of June 14, 1934.
P	Tusayan Forest addition. Act of February 21, 1933.
Q	Hopi reservation. Executive-order reservation created on December 16, 1882.

MAP 3 - PLANNING AREA



Legend

- Chapter House
- Planning Area
- Stateline

Roads

- Navajo Route (unpaved)
- Navajo Route (Paved)
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Chapter Areas

- Dennehotso
- Kayenta
- Mexican Water
- Red Mesa
- Rock Point
- Sweetwater

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Community-Based Land Use Plan
December 2007

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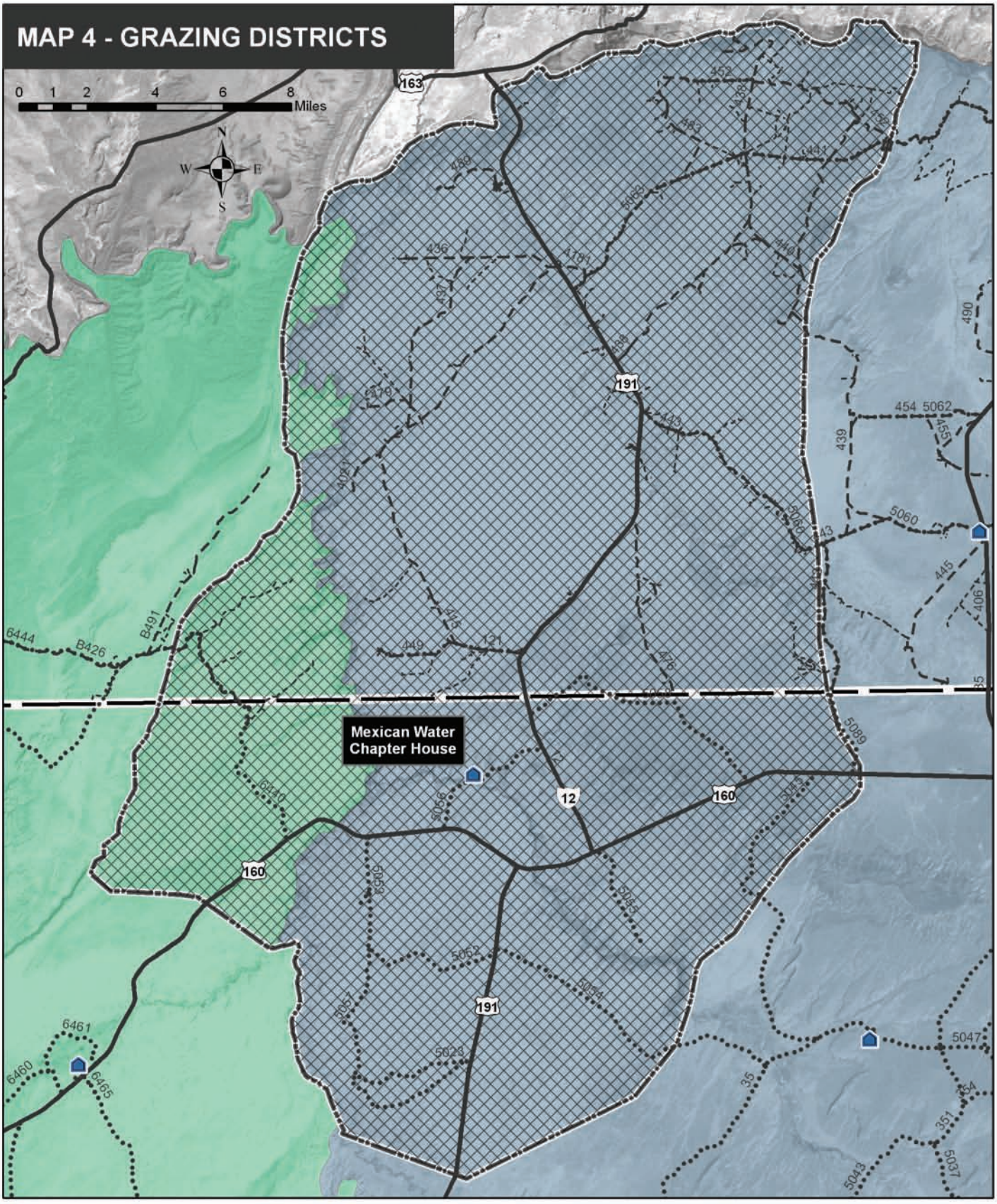
NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (image)

MAP 4 - GRAZING DISTRICTS



Legend

- Chapter House
- Planning Area
- Stateline

Roads

- Navajo Route (unpaved)
- Navajo Route (Paved)
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Grazing District

- Grazing District 8
- Grazing District 9

Mexican Water Chapter Community-Based Land Use Plan December 2007

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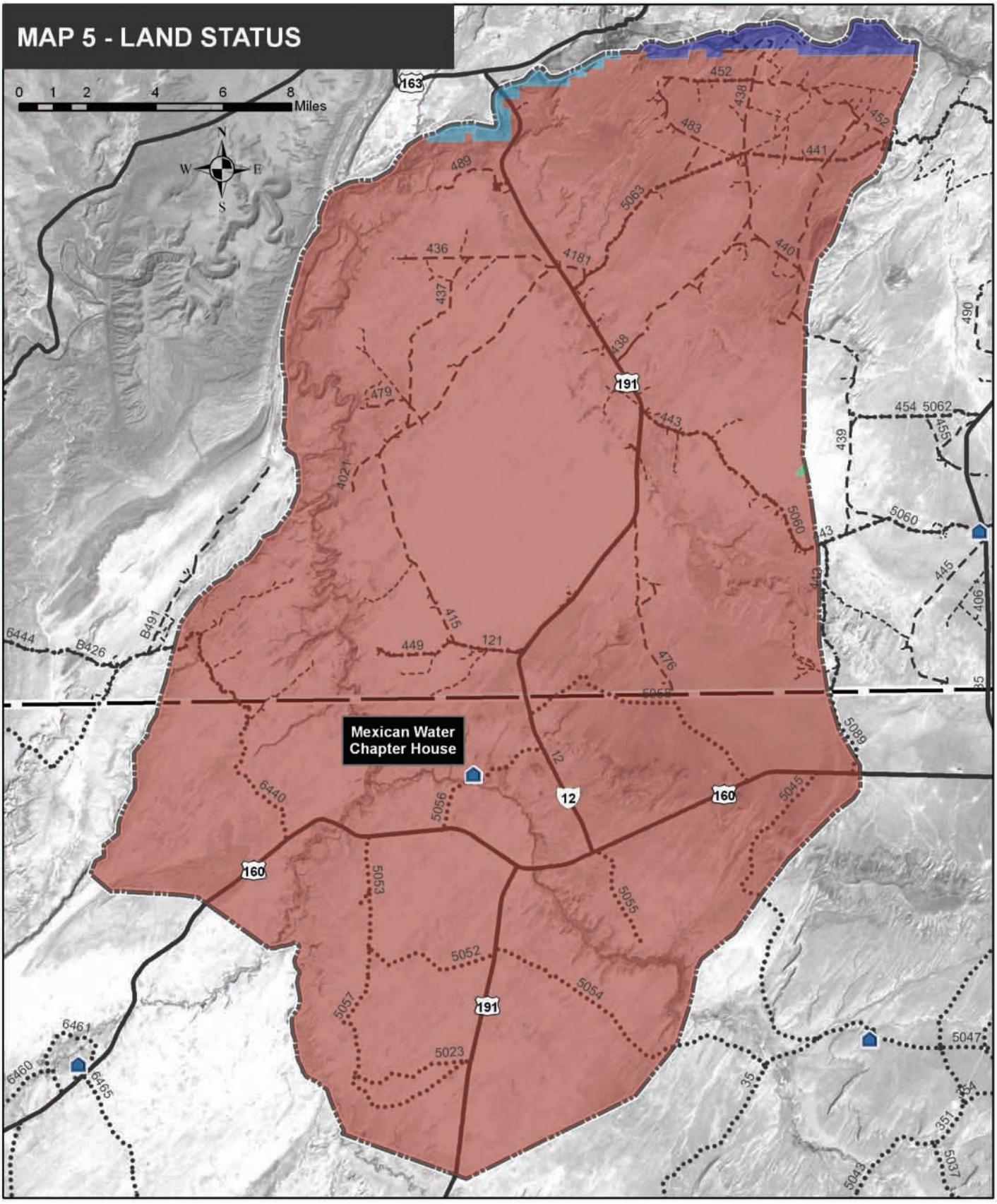
NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (image)

MAP 5 - LAND STATUS



Legend

- Chapter House
- Planning Area
- Stateline

Roads

- Navajo Route (unpaved)
- Navajo Route (Paved)
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Land Status

- Native Amer/Power Wdrawal
- Navajo Tribal Trust
- Navajo Indian/Power Sites
- Private

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Community-Based Land Use Plan
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NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (image)

4

NATURAL CONDITIONS

TOPOGRAPHY

The local landscape consists of low, broad mesas, high plateaus and wide valleys with gently rolling desert grasslands, sand dunes, and hills (H. Sandoval 2002) **(MAP 6)**.

Within Utah, the Chapter is situated in portions of the following United States Geological Survey (USGS) 7.5' quadrangles: Bluff; Recapture Pocket; Mexican Hat; San Juan Hill; White Mexican Water; Hogan Mesa; Moses Rock; Boundary Butte; and Gray Spot Rock. In Arizona, the quadrangles include: Garnet Ridge; Mexican Water; Walker Creek Reservoir; Toh Atin Mesa West; Mexican Water SW; and Hogansaani Spring.

GEOLOGY

Describing the geology of the planning area is not straight forward. The map symbols presented in **TABLE 3** for Arizona and Utah are not consistent. Consequently, information is described separately for the Utah and Arizona portions of the planning unit.

The planning unit's Arizona section holds four major geological entities. These include the Glen Canyon Group, the Morrison Formation, the San Rafael Group, and various dikes, silts, and plugs. Surficial alluvium, colluvium, and eolian deposits characterize the Utah portion; however, the Glen Canyon Group noted above also covers a large area along the western side in the units Utah section. The Morrison Formation also presents itself in Utah. Formations that are unique to the Utah side are the Cedar Mesa/Diamond Creek Arc, the Chinle Ankareh Formations, Dakota and Cedar Mountain, Moenkopi Dinwoody Woodside, Morgan Round Valley, Oquirrh Group, Wells, Weber, Summerville Entrada Carmel, and various intrusive tertiary rocks **(MAP 7)**.

The geological age of the planning unit's deposits are extensive (Hintze et al 2000) **(FIGURE 1)**. The oldest, Moenkopi and the Glen Canyon Group, formed during the Triassic Period 248 to 206 millions years ago. Barnes (2000:41) describes the Moenkopi Formation:

> "The Moenkopi Formation consists of shale, siltstone, sandstone and limestone, of inter-layered shallow marine, tideland and mudflat origin. Deposits are predominantly red and brown, with layers of gray limestone toward the western part of the region. When exposed to weathering, the harder layers of the formation erode into strangely convoluted walls, columns and figures, while the softer shales form gentle slopes ledged by thin harder layers.
>
> Geologists separate this formation into several different members in various areas of canyon country, but such distinctions have little meaning to non-professionals. The whole formation is eight hundred feet thick at its maximum in most places, but exceeds two thousand feet thick in some sunken areas adjacent to salt valleys and in some areas to the west of the canyon country region.
>
> The Moenkopi Formation is exposed throughout canyon country, with huge areas of the reddish rock along the flanks of the ancient Monument Uplift, in the San Rafael Swell and to the west of the Waterpocket Fold. Utah 24 goes through one beautiful area between the visitor center in Capital Reef National Park and Torrey to the west. The red slopes above the White Rim off-road vehicle trail in Canyonlands National Park are Moenkopi, as are the red, sloping hills in lower Castle and Professor valleys along Utah 128, upriver of Moab."

TABLE 3.
PLANNING AREA GEOLOGIC FORMATIONS

State	Geologic Formation
AZ	JTRgc – Glen Canyon Group
AZ	Jm – Morrison Formation
AZ	Jsr – San Rafael Group
AZ	Ti - Dikes, Sills and Plugs
UT	P1 - Cedar Mesa, Diamond Creek, Arcturus and other Fms
UT	Tr2 - Chinle, Ankareh Fms
UT	K1 - Dakota, Cedar Mountain, Kelvin and other Fms
UT	Jg - Glen Canyon Group (Navajo, Kayenta, Wingate, Moenave Fms)
UT	Tr1 - Moenkopi, Dinwoody, Woodside, Thaynes and other Fms
UT	P - Morgan, Round Valley, Honaker Trail, Paradox, Ely and other Fms
UT	J2 - Morrison Fm
UT	PP - Oquirrh Group, Wells, Weber Ely, Callville and other Fms
UT	J1 - Summerville, entrada, Carmel, Arapien, Twin Creek and other Fms
UT	QT - High-level alluvial deposits
UT	Tl - Intrusive rock - Tertiary
UT	Qa -Surficial alluvium and colluvium
UT	Qe -Surficial eolian deposits
UT	Qao - Surficial older alluvium and colluvium

The Glen Canyon Group consists of the Kayenta Formation, Navajo Sandstone, Wingate Sandstone, and the Carmel Formation, which is transitional to the Jurassic Period. Other major formations that date to the Jurassic Period are the Morrison, Summerville, and the Entrada Sandstone date to 206 to 144 millions years ago or the Jurassic Period. Barnes (2007:47–53) describes these as:

> "The Summerville formation is interlayered sandstone, siltstone, mudstone, shale and gypsum, of a coastal-marine mudflat and tidal basin origin. This formation is predominantly red or red-brown in color, with some light tan or greenish layers, and is up to 330 feet thick. The lower part of the formation interlayers into the intruding Curtis Formation and Entrada Moab tongue, but the upper formation occurs throughout canyon country. It formed in the tidal basins and mudflats of the retreating Curtis Sea.
>
> The Morrison Formation consists of four members. The two main members together covered the eastern half of Utah, including virtually all of canyon country, plus all of Colorado and Wyoming, major parts of Montana, Nebraska, New Mexico and the Dakotas, and bits of Arizona, Texas, Oklahoma and Kansas.
>
> The immense freshwater lake and stream region that deposited the Morrison Formation was ideal habitat for the many dinosaur species that dominated the land at that time. Fossilized dinosaur bones are fairly common in Morrison de¬posits. There are outstanding

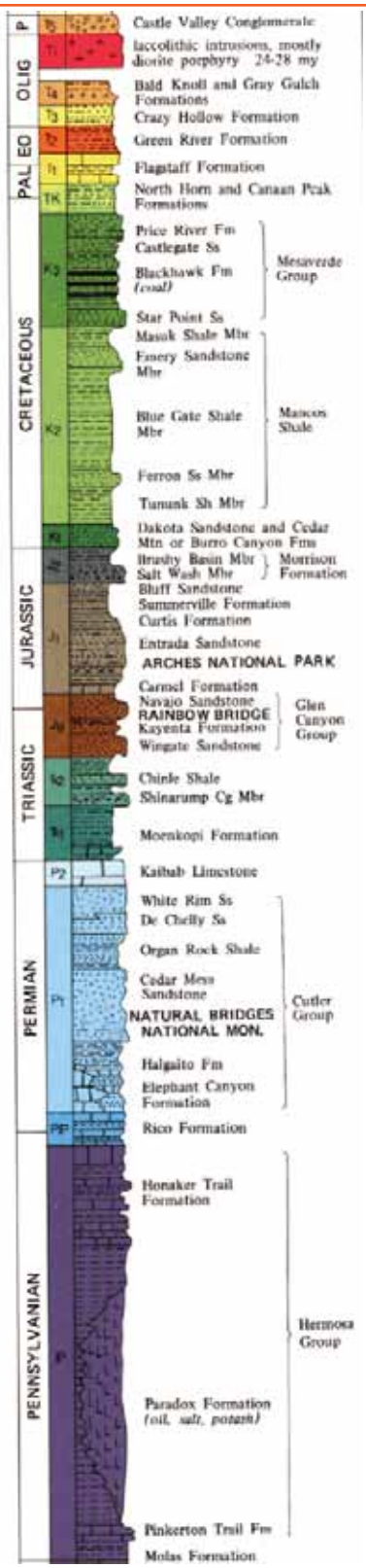


FIGURE 1. GEOLOGIC TIMETABLE

examples of petrified bone accumulations at Dinosaur National Monument and at the Cleveland Lloyd Dinosaur Quarry south of Price.

Entrada Sandstone consists of three distinct tongues or members. These are the Entrada/Dewey Bridge member from marginal marine mudflats, the Entrada/Slickrock member consisting of sandstone and siltstone from desert-dune and marine tidal-flats, and the Entrada/Moab tongue, which consists of white dune-sand from coastal seas."

The earliest rock structure laid was in the Permian, which is divided into three plates and primarily consists of Plate 1, the Cutler group. Unlike the later formations, the Cutler group is a heterogeneous conglomerate. As a whole, the formation is dark red and purple with some ranging from gray to green. The material is poorly sorted and ranges in size from sand size to boulders as large as 25ft (Shults 1984 in Condon 1997) Rock in the Cutler group are from nearly Proterozoic rocks originally part of debris flow and braided stream deposits.

SOILS

Although many soil variations are present in the planning area, Hendricks (1985) generally defines them as Mesic Arid Soils, which are those that have a mean annual temperature of eight to 15 degrees Celsius or 47–59 degrees Fahrenheit and six to10 inches annual precipitation. In particular, Hendrick's 1985 Arizona General Soil Map indicates the planning unit is in the Sheppard-Fruitland-Rock Outcrop Association, which is made up of "shallow and deep moderately coarse to moderately fine-textured, nearly level to rolling soils on sandstone and shale plateaus."

Other sources such as USDA, Natural Resources Conservation Service (2005; 2006) indicate that the soils throughout the planning unit mainly consist of loamy fine sand with Badlands, sandstone outcrops, and various associations **(MAP 8, TABLE 4)**. It is entirely likely that both these sources are correct. Because of the proximity of the San Juan River and its major tributary, the Chinle Wash, to the planning unit, flooding over many years may have mixed the soils requiring an update in both these sources.

Soil descriptions based on these sources are presented in **APPENDIX B**. Map Unit Text - Shiprock Area, Parts of San Juan County, New Mexico and Apache County, Arizona describes soils on the Arizona side. Component Text - San Juan County, Utah, Navajo Indian Reservation describes soils in Utah.

Additional tables indicating the severity of individual soil limitations are provided in **APPENDIX C.** Dwellings and Small Commercial Buildings Shiprock Area, Parts of San Juan County, New Mexico and Apache County, Arizona is for Arizona soils and Dwellings and Small Commercial Buildings - San Juan County, Utah, Navajo Indian Reservation is for Utah soils. The ratings range from 0.01 (the point at which the soil feature is not a limitation) to 1.00 (the soil feature has the greatest negative impact on the use). The information is not site specific and does not eliminate the need for onsite soil investigation by experienced experts.

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. The soil limitations tables show the degree and kind of soil limitations that affect dwellings and small commercial buildings. Information in these tables are intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a

depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

TABLE 4.
SOIL DESCRIPTIONS

Arizona

Map Symbol	Description
501	Escavada-Riverwash complex, 0 to 1 percent slopes
502	Sogzie loamy line sand, 1 to 5 percent slopes
505	Recapture-Shorthair-Aneth complex, 1 to 8 percent slopes
506	Blackston-Grazane association, 3 to 50 percent slopes
507	Sheppard loamy fine sand, 2 to 8 percent slopes, hummocky
508	Shalet-Rock outcrop complex, 8 to 45 percent slopes
509	Trail loamy fine sand, 1 to 3 percent slopes
510	Aneth loamy fine sand, 1 to 3 percent slopes
511	Redlands loamy fine sand, 1 to 3 percent slopes
512	Gotho fine sandy loam, O to 2 percent slopes
513	Sogzie-Aneth association, 2 to 8 percent slopes
514	Aneth loamy fine sand, 2 to 8 percent slopes, hummocky
515	Piute-Bluechief-Rock outcrop complex, 2 to 25 percent slopes
516	Kaito-Claysprings complex, 30 to 65 percent slopes
517	Moffat loamy fine sand, 1 to 12 percent slopes
518	Tohatin-Sheppard loamy fine sands, 5 to 35 percent slopes
519	Shumbegay loamy fine sand, 0 to 8 percent slopes
520	Rock outcrop-Needle complex, 2 to 20 percent slopes
521	Sandbench-Sheppard fine sands, 1 to 8 percent slopes
522	Pennell loamy fine sand, 1 to 6 percent slopes
523	Tyende-Aneth-Shumbegay loamy fine sands, 1 to 25 percent slopes
524	Uzaneva clay loam, 0 to 2 percent slopes
526	Sandbench-Rock outcrop-Piute, cool complex, 1 to 8 percent slopes

Utah

Map Symbol	Description
AmB	Aneth loamy fine sand, 1 to 8 percent slopes
AnA	Aneth loamjr fine sand, moderately afkafi, 0 to 3 percent slopes
AsA	Aneth sandy clay loam, 0 to 3 percent slopes
AV	Aquic Ustifluvents-Typic Fluvaquents association, gently sloping
BA	Badland
BD	Badland-Typic Torrifluvents association, steep
DeE	Deleco loamy fine sand, 12 to 55 percent slopes
GtA	Gotho soils, 0 to 3 percent slopes
LAG	Lithic Torriorthents-Typic Torriorthents-Rock outcrop association, steep
MbD	Moenkopie sandy loam, 3 to 8 percent slopes
McF	Moenkopie-Rock outcrop complex, 8 to 25 percent slopes
MoB	Mota loamy fine sand, 1 to 8 percent slopes
MRE	Mota-Moenkopie-Rock outcrop association, sloping
NnD	Neskahi fine sandy loam, 2 to 6 percent slopes
PY	Playas
RaE	Raplee very fine sandy loam, 2 to 12 percent slopes
RO	Rock outcrop
RRG	Rock outcrop, sandstone-Lithic Torriorthents, association, steep
ShD	Sheppard fine sand, hummocky
ShE	Sheppard fine sand, rolling
SME	Sheppard-Rock outcrop association, hummocky
W	Sheppard-Rock outcrop association, hummocky

GROUNDWATER

The Chapter is located in the San Juan River Basin where water-bearing rocks consist primarily of sandstone, limestone and other conglomerates. The Navajo, Coconino, Dakota, and Alluvial aquifers underlie the San Juan River Basin. The 103 wells in the Chapter's planning unit draw water from eight geologic formations held within these four hydrological systems, which are listed in **TABLE 5** and described below, beginning with the shallowest.

TABLE 5.
AQUIFERS LOCATED WITHIN THE PLANNING AREA

Map Unit	Aquifer
110ALVM	Alluvium (alluvial aquifer)
221RCPR	Recapture (D-aquifer)
221BLFF	Bluff (D-aquifer)
221ENRD	Entrada (N/D-aquifer)
220NVJO	Navajo (N-aquifer)
231LKCK	Lukachukai (N-aquifer)
231MNKP	Moenkopi (C-aquifer)
310DCLL	Chelly (C-aquifer)

ALLUVIAL AQUIFERS

Alluvial aquifers are generally characterized by high transmissivities and storage coefficients. Alluvial fills occur along existing rivers and streams where water is actively moving and depositing sand and gravel. The occurrence of alluvial aquifers in the basin is minimal with water-bearing depths of less than 200 feet in most areas. The largest and most developed alluvial aquifers are in Spanish Valley, Castle Valley and flood plains of the San Juan River near Bluff http://water.utah.gov/planning/SWP/seastcol/swp_sc19.pdf accessed September 30, 2007). Alluvial water quality is poor, and yield to wells is generally small except where significant gravel exists. The concentrations of dissolved solids make the water mainly suitable for livestock.

THE DAKOTA AQUIFER (D-AQUIFER SYSTEM)

The Dakota aquifer sits above the Navajo aquifer. The system includes the Entrada Sandstone, Summerville Formation, and the Cow Springs Sandstone members of the Morrison Formation and the Dakota Sandstone. The Entrada Sandstone and Summerville Formation both consist of a sandstone and silty sandstone facies. In both cases, the silty facies is well cemented. The Cow Springs Sandstone is well sorted, fine-grained quartz that is also firmly cemented. These deposits are extensive, encompassing the southern half and western portion of the region. The sandstone tongues are quite extensive and interfinger with members of the Morrison Formation.

The Morrison Formation is the uppermost Jurassic unit in the region, and is comprised of four members. These are from oldest to youngest: 1) the Salt Wash Member, which consists of fine to coarse-grained lenticular sandstone beds and mudstone; 2) the Recapture member, which consists of friable fine to medium–grained sandstone interstratified with shaly mudstone; 3) the Westwater Canyon Member, which consists of fine to coarse-grained sandstone and minor shaly mudstone; and 4) the Brushy Basin Member, which consists of shale interbedded with some mudstone and fine to medium-grained sandstone.

THE NAVAJO AQUIFER (N-AQUIFER)

The N-aquifer consists of consolidated water bearing rocks associated with Jurassic age formations of the Glen Canyon Group: the ingate, Kayenta, Navajo Carmel, and Entrada Formations. The N-aquifer generally ranges from 750-1,000 feet in thickness with the top of the aquifer averaging 550 feet below land surface. The aquifer is recharged along the flanks of the Abajo Mountains, Sleeping Ute Mountain, and the Carrizo Mountains. The water moves downgradient from these recharge areas and discharges into the San Juan River (Spangle et.al. 1996).

The quality of the water within this system is excellent. The Lukachukai member of the Wingate Sandstone, the Moenave Formation, the Kayenta Formation and the Navajo Sandstone comprise what is referred to as the N-aquifer system. The Lukachukai Member consists of a fine to very fine-grained quartz sandstone that is homogeneous throughout the region. The Moenave Formation consists of two sandstone members that include Dinosaur Canyon and the Springdale Members. These consist of coarse to very fine-grained quartz sandstone with a large percentage of silt and firm calcareous cement.

The Kayenta Formation consists of a sandstone facies and a silt facies of which the form is bonded with calcareous cement. The Navajo Sandstone is composed of medium to fine-grained quartz sandstone and is boded with weak calcareous cement. The sandstone contains many lenticular beds of cherty limestone. Because of their homogenous lithologies and loose cementation, the Navajo Sandstone and Lukachukai Member of the Wingate Sandstone are the primary water producing units in the N-aquifer system.

THE COCONINO SANDSTONE (C-AQUIFER SYSTEM)

The C-aquifer system yields water of good chemical quality except southwest of Leupp and in the northern part of the Black Mesa basin where excessive amounts of dissolved solids could render it unfit for use. The C-aquifer includes the Coconino Sandstone, the De Chelly Sandstone, the Moenkopi Formation and the Shinarump Member of the Chinle Formation.

The Coconino Sandstone is of very fine to medium-grained well sorted quartz grains. The grains are coarse near the southern extend of the unit along the Mogollon Rim and grade into a finer grain size to the north. The De Chelly Sandstone is a thick-bedded fine to medium grained sandstone and hydraulically connected with the Coconino and the Shinarump Member of the Chinle Formation. The Chinle and Moenkopi Formations consist primarily of mudstone and siltstone beds. The Chinle Formation and the De Chelly and Coconino Sandstones are the primary sources of ground water. The other members of Chinle Formation and the Moenkopi Formations are too fine grained and act as aquicludes. The C-aquifer system thins rapidly to the north and pinches out along the Utah-Arizona border.

The Cretaceous Dakota Formation is comprised of three lithologic types deposited under fluvial, lagoonal and shallow marine conditions. The lower fluvial member consists of well-cemented, medium to fine-grained quartz sandstone with a basal conglomerate in some places. The middle member consists of carbonaceous flat bedded mudstone and siltstones, coal and interbedded sandstone lenses. The upper shallow marine sandstone member differs somewhat in lithology from the lower because it has a greater amount of very fine sand and silt and in several areas forms alternating sandstone ledges and intercalated shaly beds.

The water quality is marginal to unsuitable for drinking due to sulfate and dissolved solids concentrations exceeding U.S. Public Health Service's recommended drinking water limits.

MAP 9 shows water well locations according to their aquifers. **TABLE 6** below lists all wells along with there operator and the aquifer that they draw water from.

TABLE 6. WELLS IN THE MEXICAN WATER CHAPTER PLANNING AREA

Well No.	Operator	Elevation	Depth	Aquifer	SWL
00-4034	BUTLER	4320.0	27.0	110ALVM	8.8
08-0646	UNKNOWN	4577.0	0.0		0.0
08-0647	NONE	4350.0	0.0	310DCLL	0.0
08A-290	UNKNOWN	4575.0	0.0	231MNKP	0.0
Q8T-52Q	TRIBE O&M.	4575.0	0.0		0.0
09-0634	DEPT OF AG	4780.0	340.0	220NVJO	0.0
09-0635	DEPT OF AG	4835.0	800.0	220NVJO	0.0
09-UNK-0001	UNKNOWN	5030.0	307.0	220NVJO	0.0
09-UNK-0002	UNKNOWN	4740.0	0.0	220NVJO	0.0
09-UNK-0003	UNKNOWN	4670.0	0.0	220NVJO	0.0
09-UNK-0004	UNKNOWN	4670.0	0.0	220NVJO	0.0
09-UNK-0005	UNKNOWN	4635.0	0.0	220NVJO	0.0
09-UNK-0010		0.0	0.0		0.0
09-UNK-0011	ARCO OIL	5180.0	331.0	220NVJO	0.0
09-UNK-0013	CARTER OIL	4950.0	530.0	221 ENRD	0.0
09-UNK-0019	NIELSON	4760.0	925.0	220NVJO	221.7
09-UNK-0020	UNKNOWN	4830.0	755.0	221 ENRD	315.2
09-UNK-0024	BIA	5097.0	380.0	220NVJO	0.0
09K-209	BIAv	4950.0	775.0	220NVJO	0.0
09K-210	NTUA	4840.0	85.6	220NVJO	0.0
09K-210A		4838.0	130.0	220NVJO	0.0
09K-210B	MEX WATER	4825.0	110.0	220NVJO	0.0
09K-214	TRIBE O&M	5110.0	590.0	220NVJO	332.6
09K-218	TRIBE O&M	5300.0	517.0	220NVJO	217.0
09K-220	TRIBE O&M	4600.0	405.0	220NVJO	47.8
09P-519	UNKNOWN	4750.0	105.0	220NVJO	0.0
09T-224	TRIBE O&M	5311.0	604.0	220NVJO	0.0
09T-506	TRIBE O&M	5042.0	0.0	220NVJO	230.2
09T-513	TRIBE O&M	5245.0	16.5	220NVJO	0.0
09T-514	TRIBE O&M	4930.0	25.3	220NVJO	0.0
09T-515	TRIBE O&M	4866.0	67.6	220NVJO	0.0
09T-516	TRIBE O&M	4964.0	217.0	220NVJO	41.3
09T-517	TRIBE O&M	5097.0	0.0	220NVJO	77.9
09T-518	UNKNOWN	5350.0	800.0		0.0
09T-524	UNKNOWN	4743.0	115.0		0.0
09T-530	TRIBE O&M	4635.0	93.0	220NVJO	0.0
09T-536	ODTL PETRO	0.0	0.0		0.0
09T-536*	ODTL PETRO	5310.0	2200.0		0.0
09T-542	TRIBE O&M	0.0	55.0	220NVJO	37.0
09T-543	UNKNOWN	4863.0	200.0		0.0
09T-544	TRIBE O&M	5004.0	50.0		0.0
09T-549	PAN AMER P	5300.0	110.0		0.0
09T-561		5340.0	0.0		0.0
09T-565	TRIBE O&M	4870.0	115.0	220NVJO	0.0
09T-568	TRIBE O&M	4810.0	140.0	220NVJO	6.2
09T-582	TRIBE O&M	4975.0	78.0	220NVJO	8.0
09T-602	TRiBE O&M	0.0	0.0		0.0
09T-603	TRIBE O&M	0.0	0.0		0.0
09T-606	NTUA	4660.0	480.0	220NVJO	20.0

TABLE 6. WELLS IN THE MEXICAN WATER CHAPTER PLANNING AREA [CONTINUED...]

Well No.	Operator	Elevation	Depth	Aquifer	SWL
09Y-12	TRIBE O&M	5165.0	592.0	221 ENRD	0.0
09Y-21	BIA	4760.0	0.0	220NVJO	0.0
09Y-25	BIA	4790.0	0.0	221BLFF	0.0
09Y-27	BIA	4755.0	0.0	221ENRD	0.0
09Y-29	BIA	4760.0	0.0	220NVJO	0.0
09Y-61	BIA	0.0	0.0	221RCPR	0.0
09Y-62	BIA	4810.0	0.0	221RCPR	0.0
09Y-65	BIA	4900.0	0.0	231LKCK	0.0
1 GOVT-NRW	BRITISH-AM	4744.0	5884.0		0.0
1N.BDYB	SHELL OIL	5028.0	5230.0		0.0
1 NAVAJ C	MIAMI PETR	4946.0	5781.0		0.0
1 NAVAJ-AE	TEXACO OIL	5050.0	6218.0		0.0
1 NAVAJO A	MIAMI PETR	4708.0	5970.0		0.0
1 NAVAJO35	CHAMPLIN	4457.0	6505.0		0.0
1-22 NAVAJ	BELCO PETR	4898.0	5681.0		0.0
1-33 CHNL	OHIO OIL	5086.0	5350.0		0.0
1-33 NAVAJ	SHENANODOA	4618.0	5590.0		0.0
1NAV MRTHOI*	MARATHON	5130.0	6944.0		0.0
1 NAVAJ B	MIAMI PETR	4598.0	5830.0		0.0
2N.BDYB	SHELL OIL	4934.0	5925.0		0.0
30-1 NAVAJ	CARTER OIL	5011.0	7098.0		0.0
40-1 NAVAJ	CARTER OIL	4816.0	5885.0		0.0
42-1 NAVAJ	CARTER OIL	4942.0	6336.0		0.0
43-28	SHELL OIL	4970.0	5586.0		0.0
50-1 NAVAJ	CARTER OIL	4818.0	5824.0		0.0
58-B-3 NAV	AZTEC OIL	4681.0	5660.0		0.0
8-8-13 231MNKP	UNKNOWN 4/7/1969 0.0		4519.0	0.0	
BOUNDARY BI		5403.0	0.0		0.0
DES CK-FED.1 DESERT CK-		4849.0	0.0		0.0
DZANEEZ 1	SHELL	4934.0	5558.0		0.0
ENGLISH 15	ENGLISH 15	4948.0	0.0		0.0
GOVT F-L 2	CARTER OIL	4535.0	6345.0		0.0
HANCK29-1	UNKNOWN	5670.0	6500.0		0.0
MEX WATER		4930.0	0.0		0.0
N. BOUND BU1N.		4920.0	0.0		0.0
N. BOUNDARY N.		4945.0	0.0		0.0
NA TRACT23-1	UNKNOWN	4665.0	0.0		0.0
NAV 1	UNKNOWN	5037.0	0.0		0.0
NAV 1-1 61	UNKNOWN	4580.0	0.0		0.0
NAV 1-22-28	UNKNOWN	4563.0	0.0		0.0
NAV 21 -1	UNKNOWN	4697.0	0.0		0.0
NAV 30-1	UNKNOWN	5000.0	0.0		0.0
NAV 40-1	UNKNOWN	4914.0	0.0		0.0
NAV 50-2	UNKNOWN	4965.0	0.0		0.0
NAV TRACT 4£	UNKNOWN	4604.0	0.0		0.0
NAVAJO 1 90	TEX PAC OL		5320.0	6424.0	0.0
NAVAJO B-1	UNKNOWN	4941 .0	0.0		0.0

TABLE 6. WELLS IN THE MEXICAN WATER CHAPTER PLANNING AREA [CONTINUED...]

Well No.	Operator	Elevation	Depth	Aquifer	
SWLNAVAJO-SAN	UNKNOWN	4925.0	0.0		0.0
PAN AM 1		5300.0	6598.0		0.0
TESNEZTP	LUMPKINLO	4745.0	170.0	220NVJO	0.0
TOHONADLA 1		4680.0	0.0		0.0
TOHONADLA 2		4817.0	0.0		0.0
UTAH-NAV 1	UTAH-NAVAJ	4803.0	0.0		0.0
WALKER CK1	GULF OIL	5197.0	6421.0		0.0

SURFACE WATER

The planning area is in the San Juan River Watershed, which takes in major portions of Arizona, Colorado, New Mexico, and Utah. Within this larger system, three smaller feed into the San Juan River and provide water to the Chapter's community **(MAP 10)**. The upper eastern third in Utah along Highways 191 and 515 is in the Lower San Juan-Four Corners watershed. The planning area's western half in both Utah and Arizona encompassing the chapter house and Highway 160 is in the Chinle Wash watershed. The Chinle Wash flows north into the Lower San Juan River. Only a small portion of the planning unit is in the Lower San Juan River-Kayenta watershed.

Much of the runoff from these systems is ephemeral, intermittent, and is in response to irregular precipitation. Down stream from large springs where the streambeds intersect the water table, streams are locally perennial. Maintained by groundwater discharge, perennial streams are restricted to the Navajo-Glen Canyon area, the lower Chinle Wash, and the Chuska Mountains-Defiance Plateau area among others. Tsaile, Wheatfields, Whiskey, and Coyote Creeks form a major stream system that drains much of the western escarpment of the Chuska Mountains. The dis¬charge from these streams funnels through Canyon de Chelly and eventually joins Chinle Wash. (Cooley et.al 1969).

VEGETATION

The Arizona section of the planning unit mainly has Great Basin Desert scrub vegetation zone. The Utah portion is mainly characterized by Southern Colorado Plateau Sand Shrubland, Colorado Plateau Blackbrush-Morman Tea Shrubland, and Colorado Plateau Mixed Bedrock Canyon and Tableland **(MAP 11, TABLE 7)** The riparian areas in both states likely include Fremont cottonwoods, Coyote willows, and invasive species such as salt cedar/tamarisk, Russian olive, and peach-leaf willow. Gambel oak forms dense thickets and even full grown trees in the upper reaches of the canyons. The side canyons have scattered specimens of western box elder, western chokecherry, and netleaf hackberry. Jimson weed, Rocky Mountain bee plant, and carrizo, the giant cane-like grass also grows in the canyons. More information regarding classifying natural vegetative communities can be found in **APPENDIX D**.

TABLE 7. VEGETATION

Map Unit	Vegetation
D04	Invasive Southwest Riparian Woodland and Shrubland
D08	Invasive Annual Grassland
N11	Open Water
N31	Barren Lands
S010	Colorado Plateau Mixed Bedrock Canyon and Tableland
S011	Inter-Mountain Basins Shale Badland
S012	Inter-Mountain Basins Active and Stabilized Dune
S014	Inter-Mountain Basins Wash
S039	Colorado Plateau Pinyon-Juniper Woodland
S045	Inter-Mountain Basins Mat Saltbush Shrubland
S053	Colorado Plateau Pinyon-Juniper Shrubland
S054	Inter-Mountain Basins Big Sagebrush Shrubland
S059	Colorado Plateau Blackbrush-Morman Tea Shrubland
S060	Mojave Mid-Elevation Mixed Desert Scrub
S065	Inter-Mountain Basins Mixed Salt Desert Scrub
S079	Inter-Mountain Basins Semi-Desert Shrub Steppe
S090	Inter-Mountain Basins Semi-Desert Grassland
S093	Rocky Mountain Lower Montane Riparian Woodland and Shrubland
S096	Inter-Mountain Basins Greasewood Flat
S136	Southern Colorado Plateau Sand Shrubland

WILDLIFE

The fauna of the region reflects the wide range of altitudes and plant zones. Coyote and kit fox are present on the Chinle plain. The black bear and the mule deer range through the forested areas as does mountain lion, bobcat, porcupine, raccoon, badger and spotted and striped skunks. Rodents are well represented with both jack rabbit and cottontail occurring in abundance along with several species of squirrels, including the handsome Albert's squirrel and the Colorado chipmunk.

Several large and economically important animals have been wiped out in recent times. These include grizzly, bighorn sheep, pronghorn antelope, Merriams's elk, and wolf. The bighorn sheep are protected within Mexican Water chapter.

Throughout the year, many birds, both resident and migratory, can be seen around Chinle and in Canyon de Chelly. Among the most conspicuous are the golden eagle, turkey vulture, raven, and great horned owl. Mallard and redhead ducks are winter visitors where there are ponds. Other birds often seen are the western mourning dove, red-shafted flicker, downy woodpecker,

desert sparrow hawk, pinyon jay, western nighthawk, and cliff swallow. Many of these birds were important to the prehistoric and Navajo people for feathers and/or food. The most highly prized of all was the wild turkey. Other residents of the canyon include numerous toad and frog species, a variety of lizard species (including a variety of horned lizard), and a number of snake species including the prairie rattlesnake.

Data from the Navajo Nation Fish and Wildlife Department (NFWD) indicate that four wildlife zones fall within the Chapters planning unit. The majority is Wildlife Zone 3. Wildlife Zone 1 follows the San Juan River and the Chinle Wash. Only one small section of Wildlife Zone 2 is present, and a very small amount of Wildlife zone 5, a biological preserve, is present along Chinle Wash in the southwest area of the planning unit **(MAP 12)**.

ZONE 1: HIGHLY SENSITIVE/RESTRICTIVE DEVELOPMENT

This zone contains the best habitat for endangered, rare and sensitive plant, animal, and game species, and the highest concentration of these species on the Navajo Nation. To protect the Navajo Nation's most sensitive habitats for plants and animals the NNDFWL advises no further business or residential development, permanent, temporary or seasonal.

Exceptions are not of concern if a biological evaluation determines the proposed development is within or adjacent to an area already developed and not close enough to habitat to cause long-term impacts. "Adjacency" will depend on the species and situation, but generally means within 1/8th of a mile (to existing development)

Any proposed development within Zone 1 shall be submitted to the NNDFWL for review and comment. The NNDFWL will evaluate each proposed project for appropriate environmental impact. The NNDFWL has the authority to reject any project in its entirety or approve with conditions.

ZONE 2: MEDIUM SENSITIVE/DEVELOPMENT WITH CAREFUL PLANNING

This zone has a concentration of rare, endangered, sensitive and game species occurrences or has a high potential for these species to occur throughout the landscape. To minimize impacts on these species and their habitats and to ensure the habitats in Zone 1 do not become fragmented, the NNDFWL recommends that no development be placed in Zone 2 to avoid species and their habitat.

Avoidance needs to include an adequate buffer to address long-term impacts. The buffer distance will depend on the species and the situation, and may be up to 1 mile.

As with Zone 1, any proposed development in Zone 2 shall be submitted to the NNDFWL for review and comment. The NNDFWL will evaluate each proposed project for appropriate environmental impact. The NNDFWL has the authority to reject any project in its entirety or approve with conditions.

ZONE 3: LOW SENSITIVITY

This zone has a low, fragmented or unknown concentration of species of concern. Species in this zone may be locally-abundant of "islands" of habitat; but islands are few and far between.

ZONE 5: HABITAT ENHANCEMENT/REFUGE/PRESERVE ZONES:
These areas contain excellent, or potentially excellent, wildlife and/or plant habitat and are recommended by the NNDFWL for protection from most human-related activities.

They will be identified for each chapter on a case-by-case basis. A variety of protection techniques are available, and the NNDFWL is interested in working with the chapter and land-user to protect/enhance these habitats by providing technical assistance and possibly materials and labor. The NNDFWL is also interested in receiving proposals from chapters and land-users for these types of zones.

ENERGY AND MINERALS

Rich natural resources exist within or cross the Chapter's planning area **(MAP 13)**. Near the existing chapter house, prospectors once searched for gold. A couple of uranium mines are noted in the Comb Ridge area. The extent or operation of these mines is unknown.

Oil and natural gas fields are present in the Utah portion. Although some are inactive, some are operational and run by Resolute Natural Resources Company, an independent energy corporation with offices in Colorado, California, Oklahoma, and New Jersey **(MAP 13)**. Although the company has offices across the county, their local base of operations is the Aneth Oil Fields, which they recently acquired in partnership with Navajo Nation Oil and Gas (http://www.lexdon.com/article/Resolute_Natural_Resources_Company_and/46845.html accessed October 2, 2007).

An APS 500-KV transmission line originates from the Four Corners Coal-Fired Generating Station located in the San Juan Chapter southwest of Farmington, NM, and parallels Highway 160 as it crosses the Chapter's planning area.

The Questar "Southern Trails" pipeline spans the southwestern part of the planning area generally following Highway 160. ARCO constructed the pipeline in 1957 move crude oil from the Four Corners area to California. In 1977, ARCO reversed the pipeline's direction and used it to transport oil from Southern California to the north. Questar purchased the pipeline in 2002, converted it to a natural gas pipeline and only activated the portion west of the Colorado River. It is again flowing in the southwesterly direction, carrying natural gas from San Juan basin in the Four Corners area to California.

CULTURAL RESOURCES

The original Navajo land of Dinetah, which the Chapter stills resides within, is geographically defined by four sacred mountains located in three states. The four sacred mountains are 1) the

east mountain Sisnaajini or Mt. Blanca located in south-central Colorado, 2) the south mountain Tsoodzil or Mt. Taylor located in northwestern New Mexico, 3) the west mountain Dook'o'oosliid or San Francisco Peaks located in northwestern Arizona, and 4) the north mountain Dibe Ntsaa or Mt. Hesperus located in southwestern Colorado. Ancient hogans, sweathouses, and fortresses that exist along side petroglyphs and pictographs comprise an abundance of archaeological evidence that supports Navajo oral history and their emergence into this world from the three previous worlds in the general vicinity (Maryboy and Begay 2007).

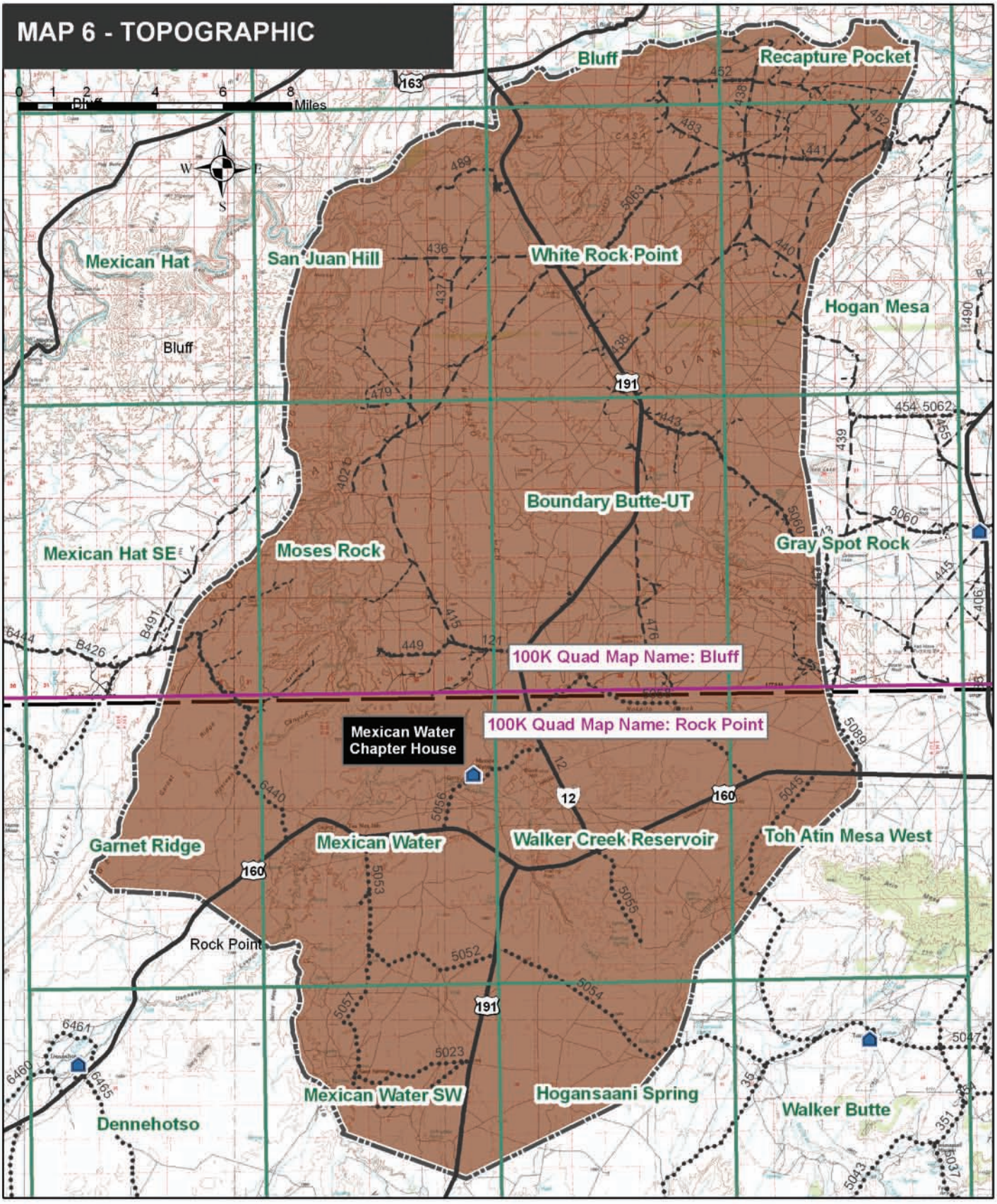
TRADITIONALLY SENSITIVE RESOURCES

Traditionally sensitive resources are considered important to retaining the culture of the community members. Traditionally sensitive sites are those areas most often used for ceremonies or those areas that have other traditional significance. These areas may be places where herbs are gathered or other resources are used for medicinal or ceremonial purposes. Often, such areas hold certain historic or traditional significance for community members.

These sites are protected under the NHPA, NAGPRA and Executive Order 13007.

Several traditionally sensitive sites are located throughout the planning area. Some of these have been indicated on the map while other sites have not been designated on maps so as to add an additional layer of protection for them.

MAP 6 - TOPOGRAPHIC



Legend

- Chapter House
- Planning Area
- Stateline

Roads

- Navajo Route (unpaved)
- Navajo Route (Paved)
- County Road (unpaved)
- Dirt Road
- U.S. Highway

USGS Quadangles

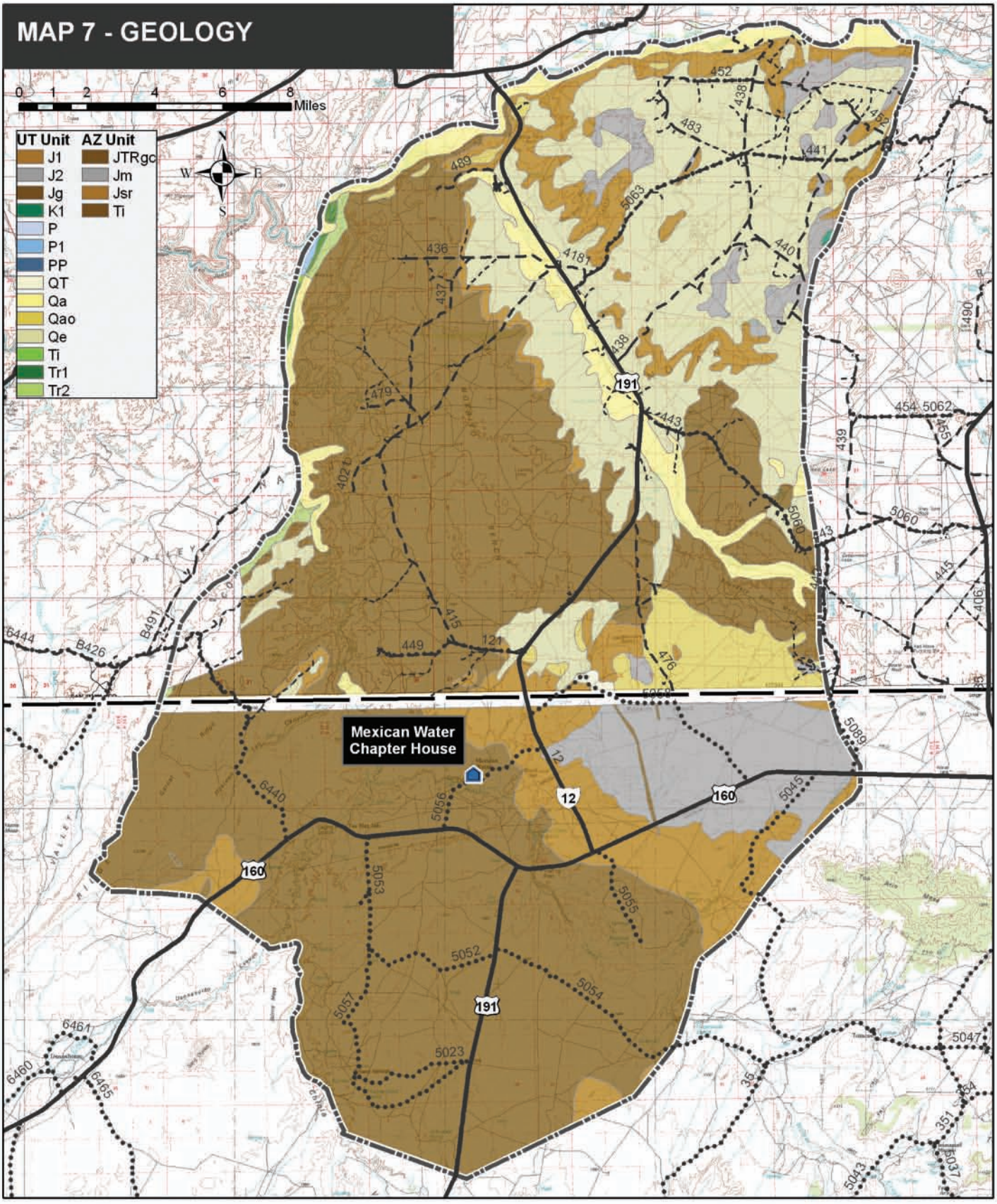
- 7.5 Min (1:24,000)
- 100K (1:100,000)

Mexican Water Chapter Community-Based Land Use Plan December 2007

JJ Clacs & Company

NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (100K)

MAP 7 - GEOLOGY



Legend

- Chapter House
- Planning Area
- Stateline

Roads

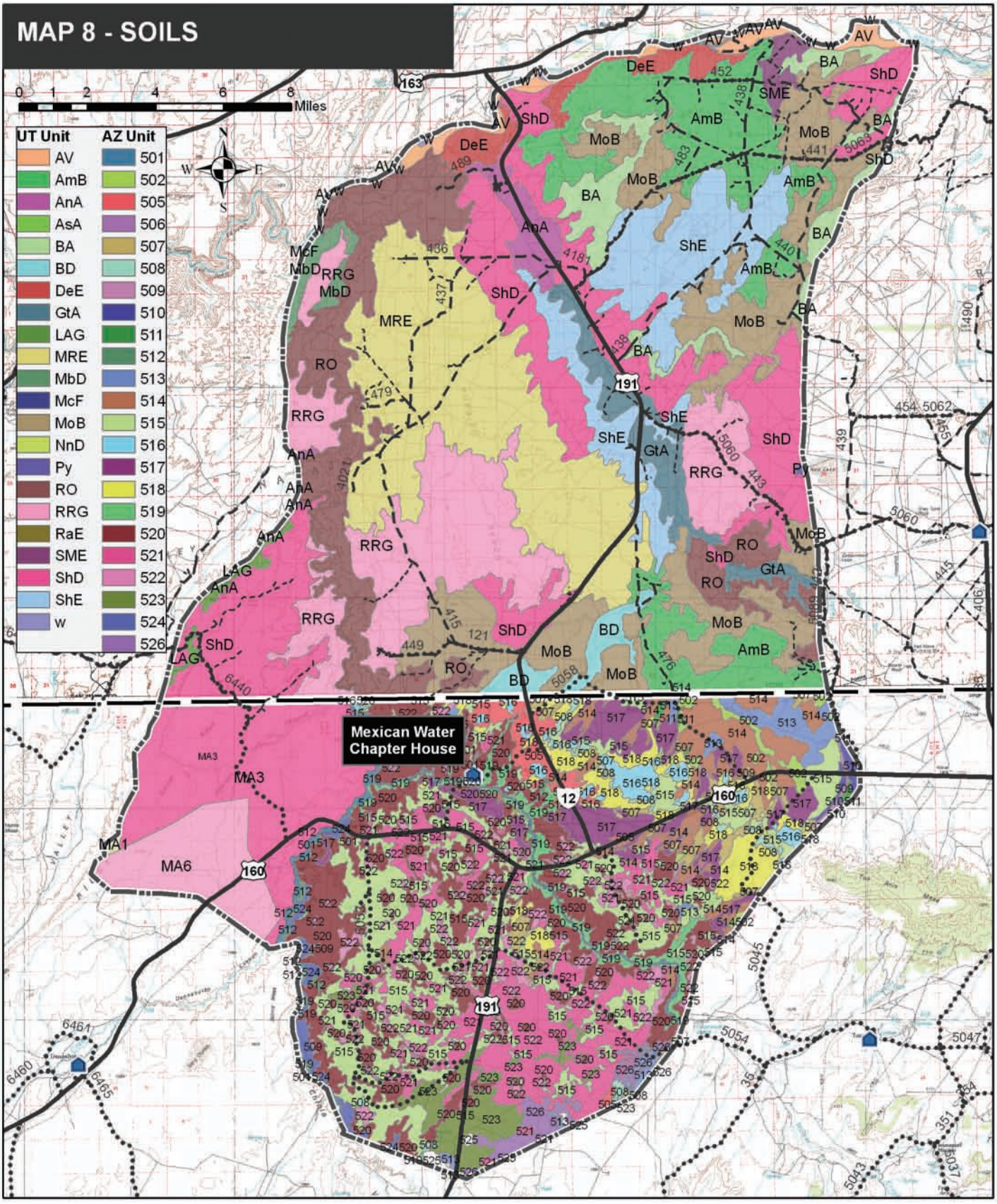
- Navajo Route (unpaved)
- Navajo Route (Paved)
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Mexican Water Chapter Community-Based Land Use Plan
December 2007

JJ Clacs & Company

NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (100K), Navajo Water Resources Dept.

MAP 8 - SOILS



Legend

- Chapter House
- Planning Area
- Stateline

Roads

- Navajo Route (unpaved)
- Navajo Route (Paved)
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Mexican Water Chapter
Community-Based Land Use Plan
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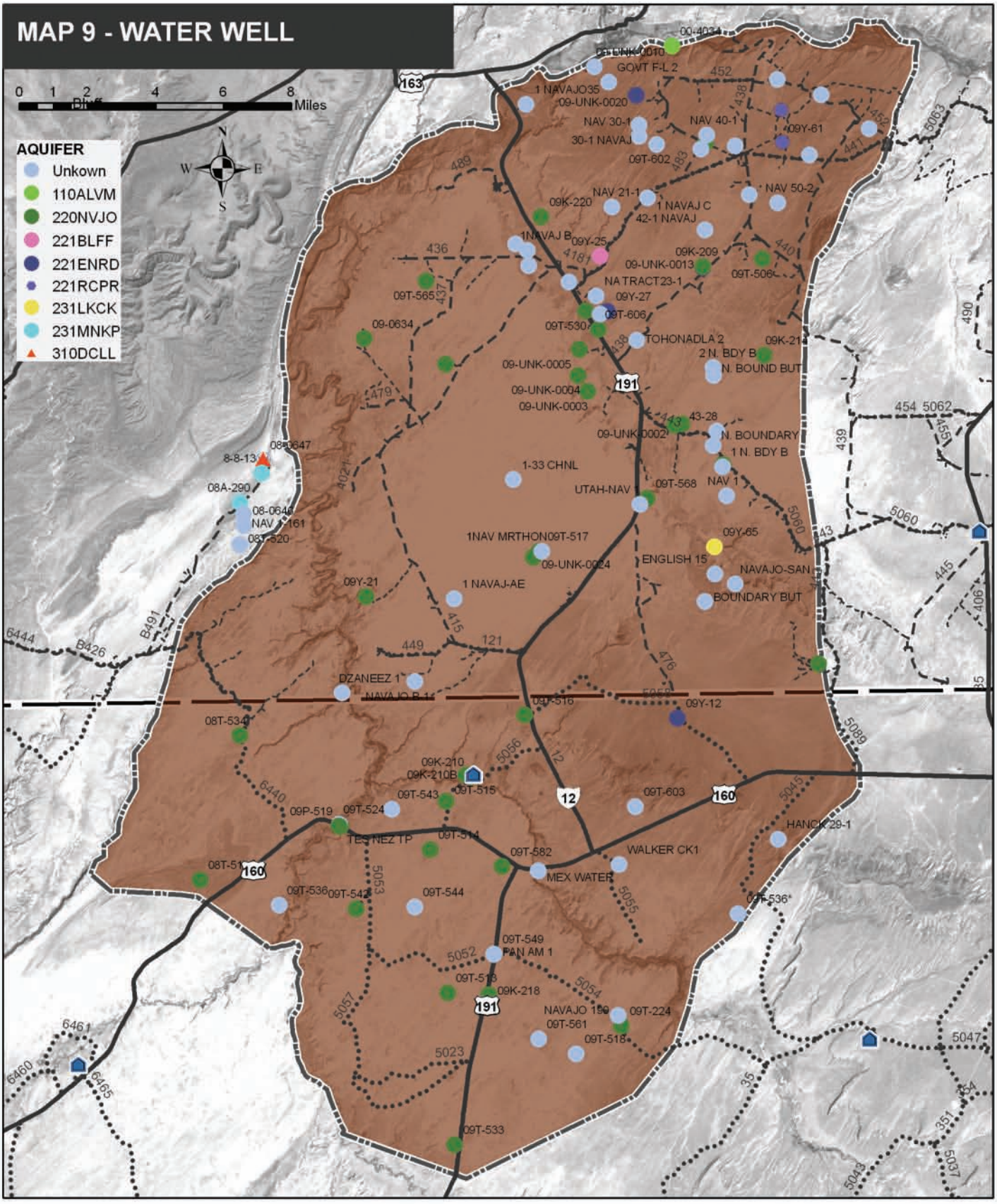
NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (100K), NRCS

MAP 9 - WATER WELL



Legend

- Chapter House
- Planning Area
- Stateline

Roads

- Navajo Route (unpaved)
- Navajo Route (Paved)
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Mexican Water Chapter
Community-Based Land Use Plan
December 2007

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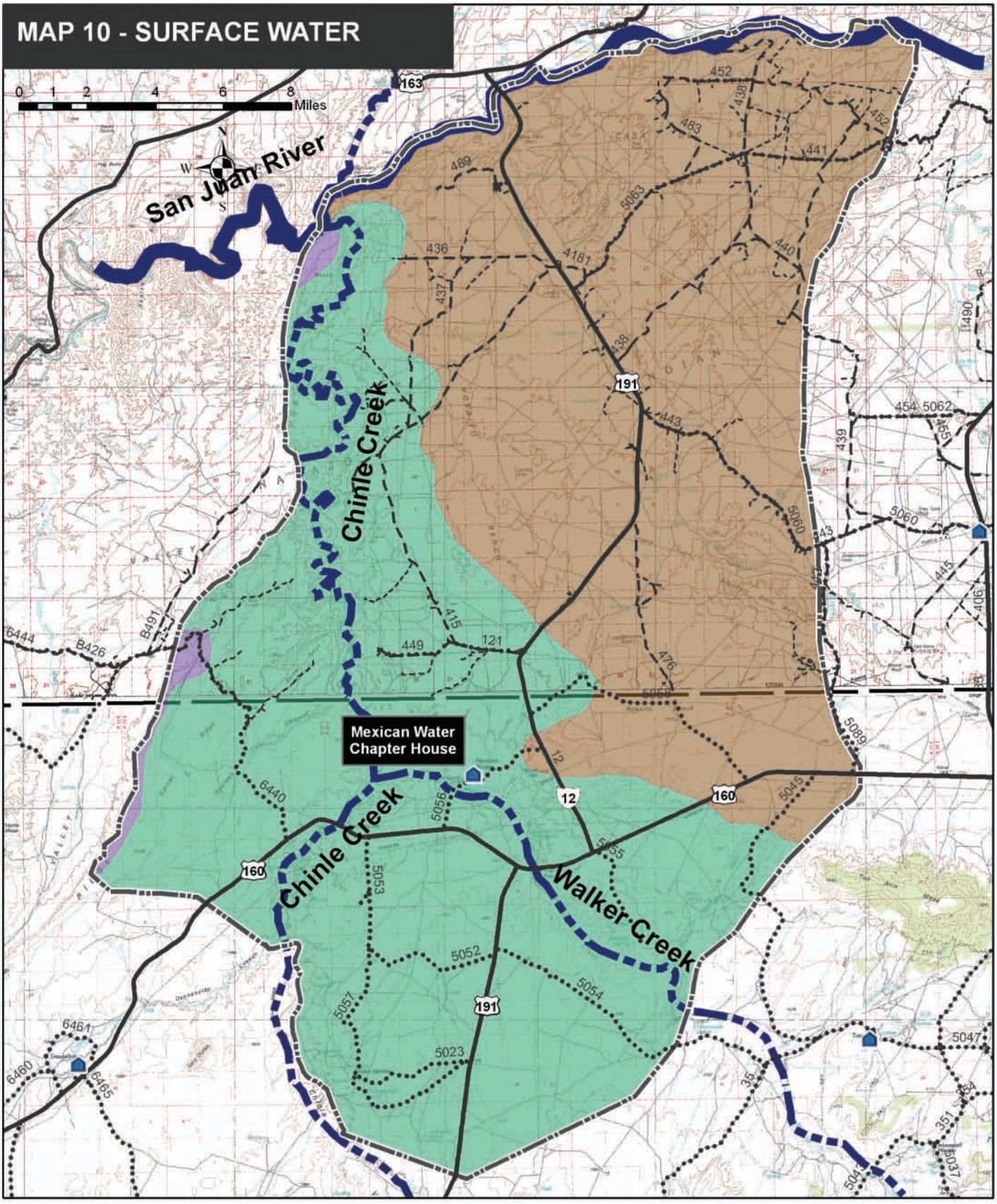
NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, Navajo Water Resources Dept., U.S. Geological Survey (image)

MAP 10 - SURFACE WATER



Legend

- Chapter House
- Planning Area
- Stateline

Roads

- Navajo Route (unpaved)
- Navajo Route (Paved)
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Watershed

- Chinle Wash
- Lower San Juan River
- Lower San Juan-Four Corners

FEATURE

- Stream
- Stream Intermittent

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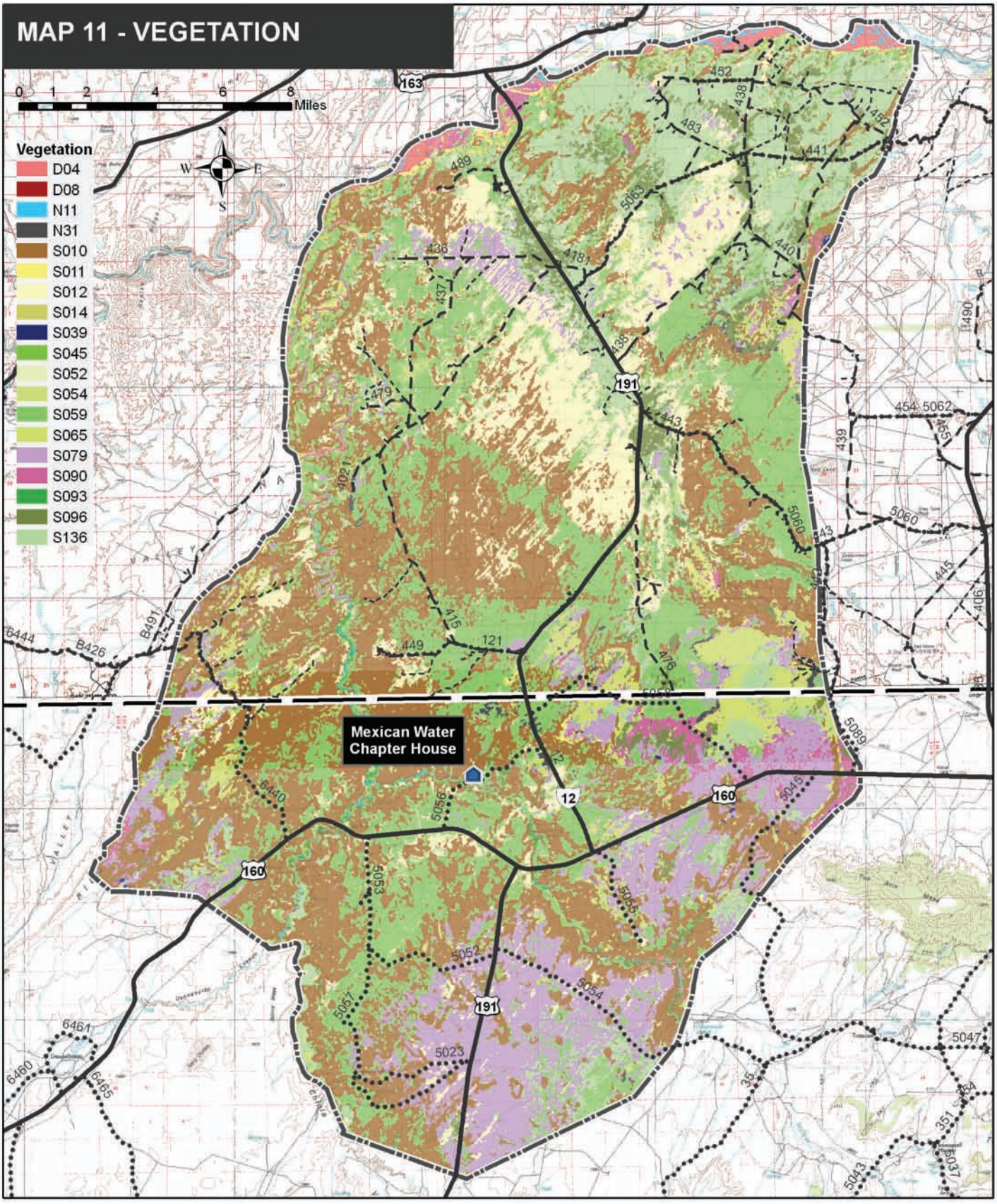
NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (100K), Navajo Water Resources Dept.

MAP 11 - VEGETATION



Legend

- Chapter House
- Planning Area
- Stateline

Roads

- Navajo Route (unpaved)
- Navajo Route (Paved)
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Mexican Water Chapter Community-Based Land Use Plan December 2007

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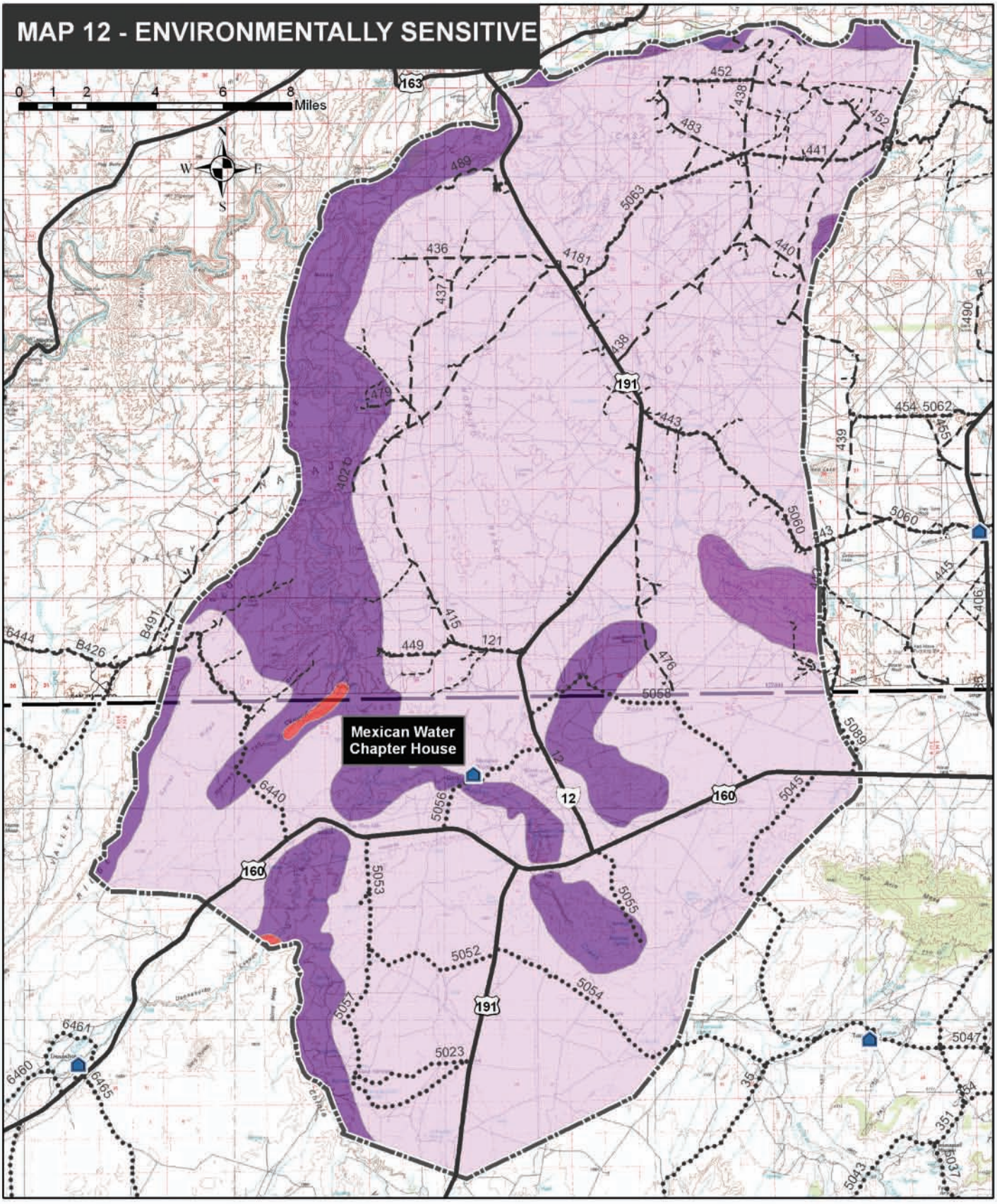
NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (100K), Navajo Water Resources Dept.

MAP 12 - ENVIRONMENTALLY SENSITIVE



Legend

- Chapter House
- Planning Area
- Stateline

Roads

- Navajo Route (unpaved)
- Navajo Route (Paved)
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Zone

- Zone 1 - HIgh
- Zone 2 - Moderate
- Zone 3 - Low
- Zone 5 - Biological Preserve

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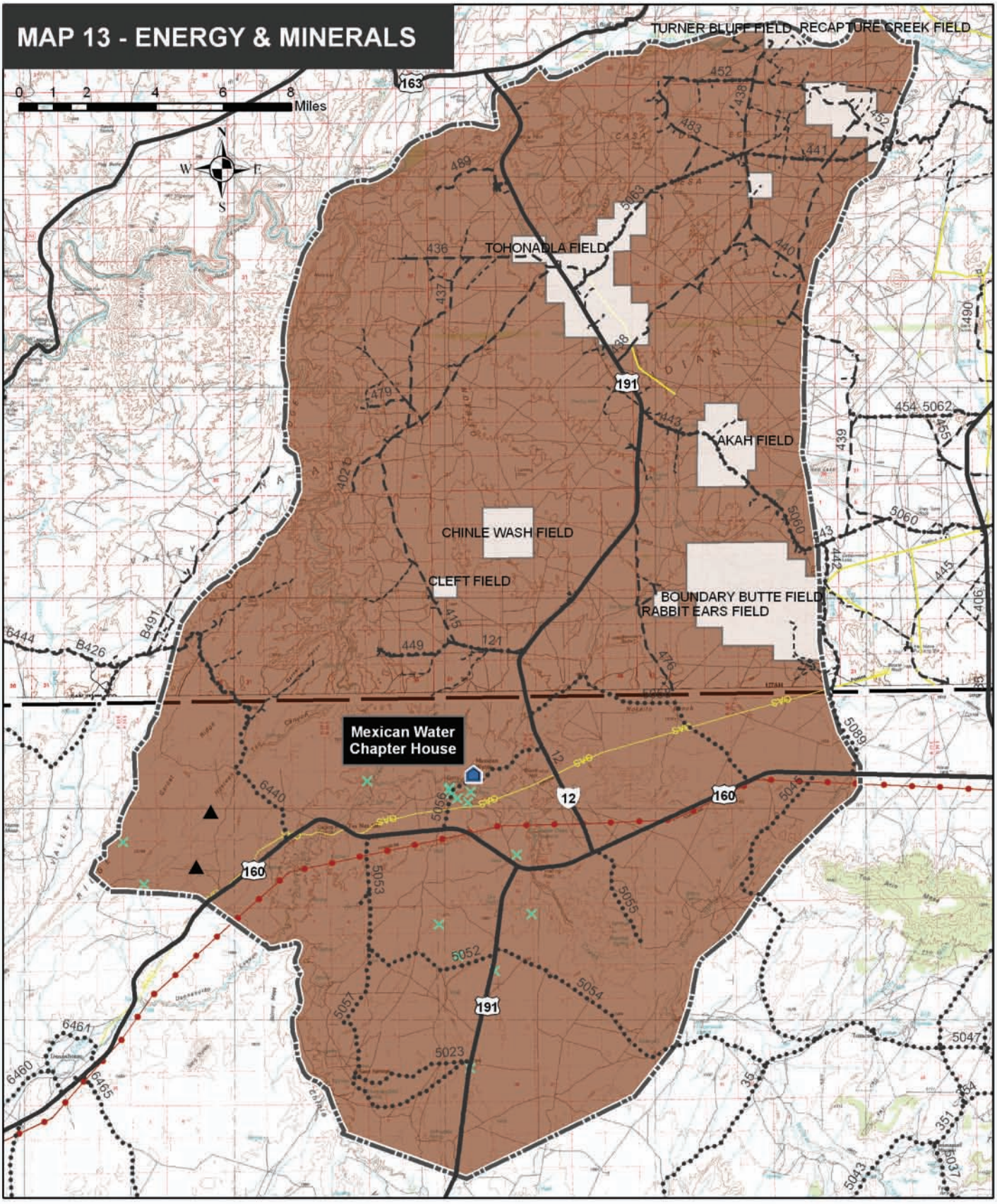
NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (100K), Navajo Water Resources Dept.

MAP 13 - ENERGY & MINERALS



Legend

- Chapter House
- Planning Area
- Stateline

Roads

- Navajo Route (unpaved)
- Navajo Route (Paved)
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Energy Minerals

- Oil & Gas Piplines
- Oil & Gas Fields
- Questar_Pipeline
- Power Transmission Line
- Abandoned Mining/Prospects
- Abandoned Uranium Mines

Mexican Water Chapter
Community-Based Land Use Plan
December 2007

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NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, Utah GIS Portal, ARIA, U.S. Geological Survey (100K)

5

POPULATION AND DEMOGRAPHICS

INTRODUCTION

Population growth brings demand for an expanded job base, retail and services business, residential development and essential community services. Changes in the Chapter's population are described below. Demographic information for this section comes from a variety of sources. Data from the 2000 U.S. Census provided data for Apache County, AZ and San Juan County, NM, Some information related to the Chapter was derived from Rodgers 2004. Data from the Arizona Department of Economic Security, the Utah Department of Workforce Development, the U.S. Department of Commerce, and the NNDED were also used. Interviews were also conducted with Chapter officials and Planning and Zoning Commission members.

POPULATION TRENDS AND FORECASTS

Although, the Chapter's population decreased 14.8 percent from 635 in 1980 to 541in 1990, it recovered by 2006. This temporary decline may have been partially due to inaccurate census data in 1990 and because many Chapter members may have moved to other areas where they would have blended in as part of a major growth center and enumerated at different chapters. Regardless, the population has grown substantially to just over 900 members in 2006 **(FIGURE 2)**. This is a major increase in a 20 year period (42.0 percent) especially considering that there was a population decline between 1980 and 1990.

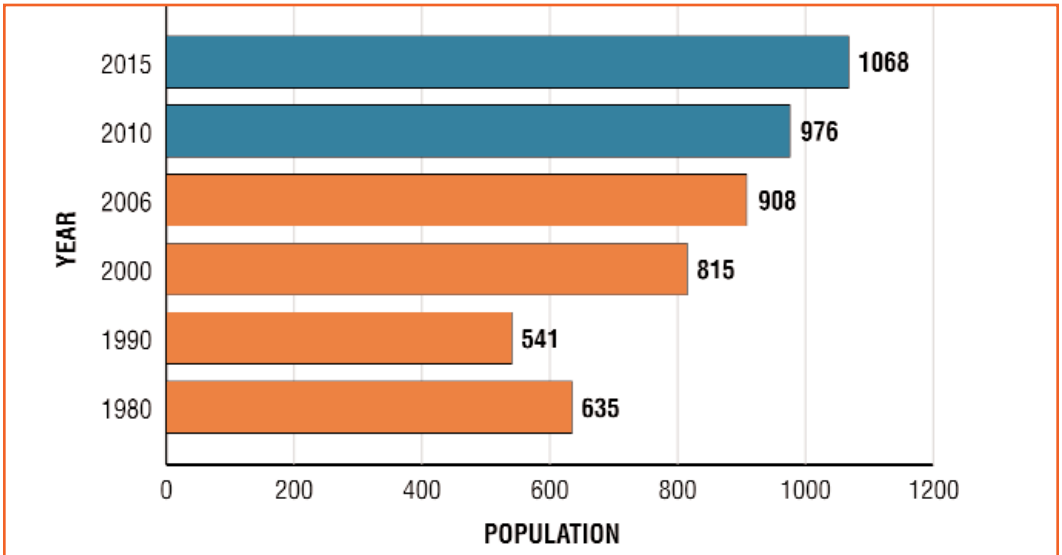


FIGURE 2. POPULATION AND FUTURE PROJECTION

In comparison, the Navajo Nation showed an overall 56.6 percent increase between 1990 and 2006. Apache County's population grew 21.0 percent during this time. The population in San Juan County Utah increased 16.0 percent where as the U.S. only increased 20.3 percent **(TABLE 8)**.

TABLE 8. POPULATION TRENDS

	Population (1990)	Population (2000)	Population (est. 2006)	Households (2000)(1)
United States	248,709,873	281,421,906	299,398,484	105,480,101
Arizona	3,665,228	5,130,632	6,305,210**	1,901,327
Utah	1,722,850	2,233,169	2,615,129***	701,281
Navajo Nation	128,356	155,214	201,060 *	47,603
Apache County	61,591	69,423	74,515	19,971
San Juan County	12,621	14,413	14,647***	4,089
Mexican Water Chapter	541	815	908*	218

Sources:
U.S. Census Bureau (2000)
* Navajo Nation: Chapter Images (2004)
** AZ Department of Economic Security (2007)
*** July 2000-2006: UT Population Estimates Committee
*** Navajo Nation Division of Economic Development (2005)

(1) A household includes all the people who occupy a housing unit as their usual place of residence.

AGE

The Navajo Nation has the youngest population of all jurisdictions shown in Table 9 followed by San Juan County, Apache County, and then Mexican Water. The U.S. and the states of Utah and Arizona have the lowest. The percent of the population over 65 years of age is lowest but steadily increases in the San Juan and Apache Counties and the state of Utah. Mexican Water's senior population is third behind the state of Arizona and the U.S.. Consistent with the Navajo Nation's high percentage of school-age children, they also have the lowest median age of all entities shown in **TABLE 9**.

TABLE 9. AGE CHARACTERISTICS: 2000

	Total Population	School Aged 5-19 (%)	Age 65 or older (%)	Median Age (Years)
United States	281,421,906	21.8	12.4	35.3
Arizona	5,130,632	22.1	13.0	34.2
Utah	2,233,169	26.9	8.5	27.1
Navajo Nation	155,214	34.9	7.0	24.1
Mexican Water Chapter	815	31.4	10.1	26.0
Apache County, AZ	69,423	32.8	8.3	27.0
San Juan County, UT	14,413	33.1	8.4	25.5

Source: U.S. Census Bureau (2000)

As shown in **FIGURE 3**, the age distribution for males and females in the chapter is similar, with a few small exceptions. For example, after a small decline in the number of girls between 5-10 years old, the number of teenage girls between 10–14 years jumps considerably higher than the boys of the same age range. Males between the ages of 50–54 outnumber the females in this age category, after which, the number of males declines in proportion to the women.

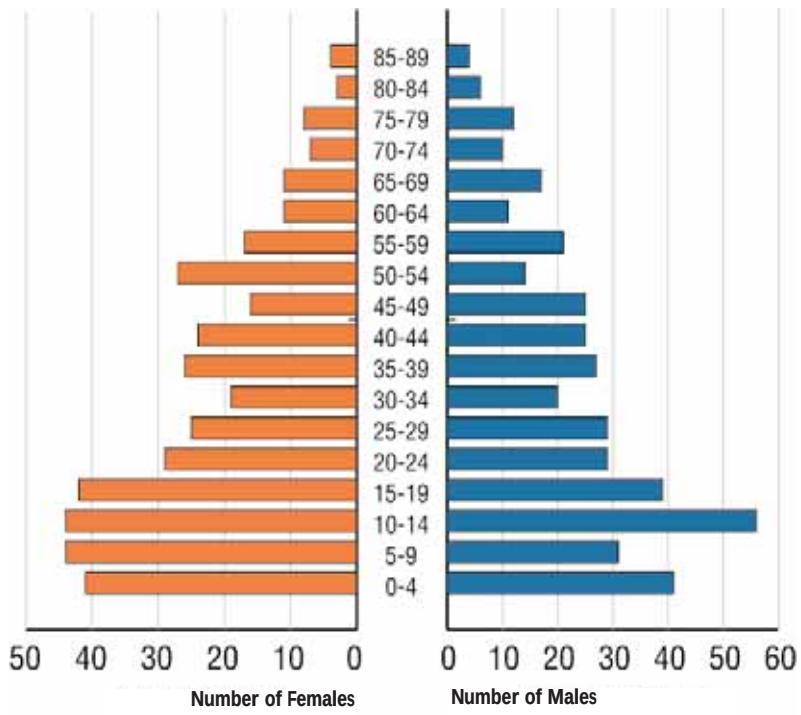


FIGURE 3. AGE DISTRIBUTION

VETERANS

Veterans within the Mexican Water community are honored for their efforts and the leadership they have shown through their service. According to the local veteran's association, at one time there were a total of 47 veterans. With time, eight have passed on leaving 39 with three being women vets. The remaining veterans are below the age of 60 and the community continues to take pleasure in having these treasures within the community where they play a significant role.

HOUSEHOLD SIZE

U.S. Census reported 218 households for the Chapter in the year 2000. The average household size is 3.74, which is slightly lower than the Navajo Nation but higher than the other regions listed in **TABLE 10.**

TABLE 10. HOUSEHOLD SIZE

	Mexican Water CHR	Navajo Nation	Apache County	San Juan County	Arizona	Utah	United States
Total Households	218	47,603	19,971	4,089	1,901,327	701,281	105,480,101
Persons per Household	3.74	3.77	3.41	3.46	2.64	3.13	2.59

Source: U.S. Census Bureau (2000)

SENIOR CITIZENS

According to the 2000 Census, 10.1 percent of the Chapter (82 persons) are over age 65. In addition, 14 households are comprised of persons 65 or older who are living alone. All elderly householders in the Chapter own their own home and do not rent.

SINGLE PARENT HOUSEHOLDS

According to the 2000 Census, approximately 21.1 percent of the 218 households in the Chapter are single parent households. This is compared to 62.4 percent for married couple families and 16.5 non-family households. **(FIGURE 4)**

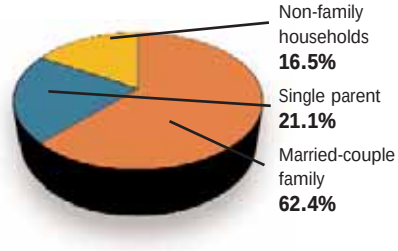


FIGURE 4. SINGLE PARENT HOUSEHOLDS

LARGE FAMILIES

Large family households have special housing needs due to the lack of adequately sized and affordably priced homes in the community, which results in overcrowding. Large family households are defined as households with five or more persons. A five-person household would typically need a three-bedroom unit while a seven-person household would need a five to six-bedroom unit. The Chapter has the highest percentage of large families followed by the Navajo Nation, San Juan County, Apache Counties, Utah, Arizona, and lastly, the U.S. **(FIGURE 5)**.

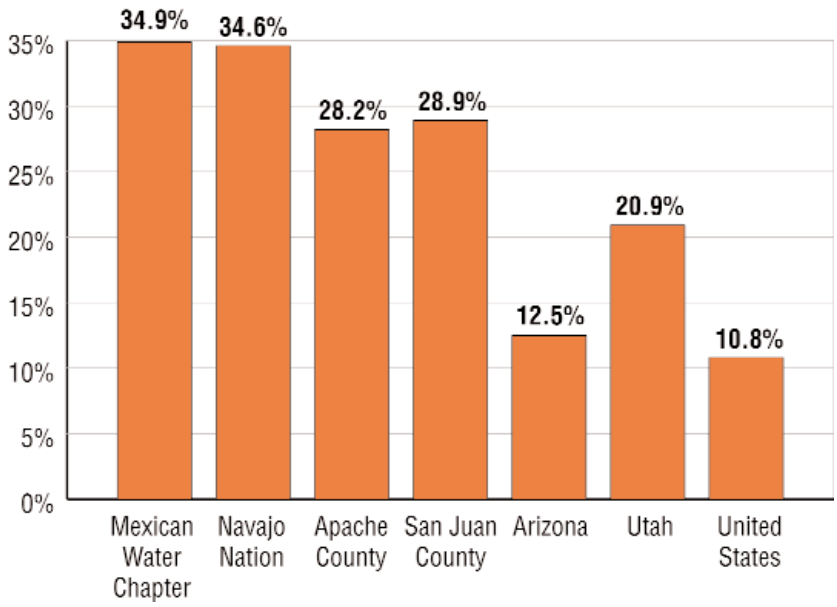


FIGURE 5. LARGE FAMILY HOUSEHOLDS

EDUCATIONAL ATTAINMENT

Within this community, there are significant numbers who have no formal education (approximately 28.2 percent). At the next level, some limited education was acquired with about 2.3 percent completing grades 5 through 8. Although approximately 25.2 percent of the population completed grades 9 through 12, this group did not obtain a diploma. Only a third (33.6 percent) of the Chapter's population over the age of 25 has completed high school. Roughly 1.4 percent have Master's degrees **(FIGURE 6)**.

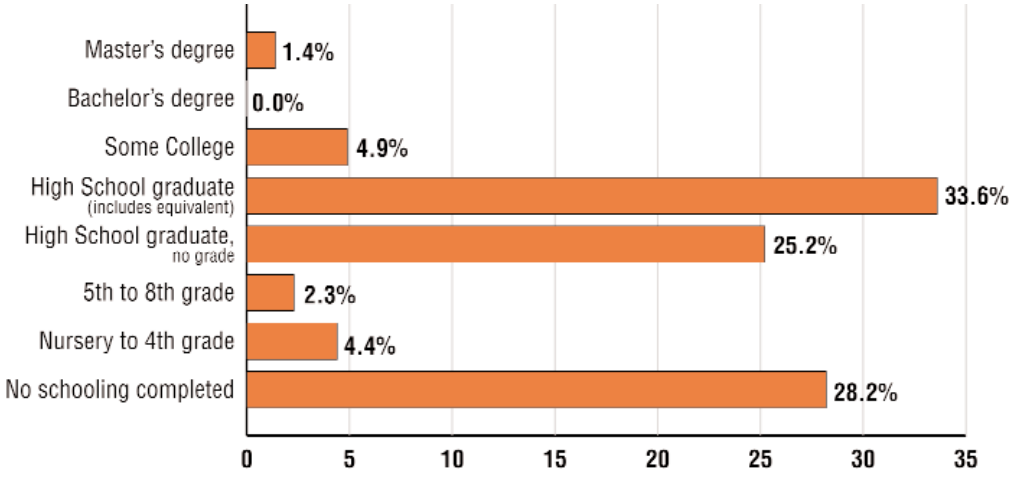


FIGURE 6. EDUCATIONAL ATTAINMENT

SPOKEN LANGUAGE CHARACTERISTICS

According to the 2000 Census, the majority of the Chapter's persons under 17 years old speak both English and Navajo (87.6 percent) while 8.3 percent only speak English **(FIGURE 7A)**. Among community members who are 18 to 64 years of age, 77.6 percent speak both Navajo and English, 14.9 percent only speak Navajo and 7.5 percent only speak English **(FIGURE 7B)**. Of those people who are 65 or older, 31.3 percent speak both languages and 53.6 percent only speak Navajo **(FIGURE 7C)**.

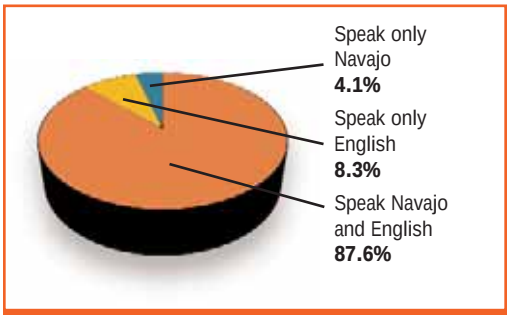


FIGURE 7A. UNDER 17 YEARS OLD

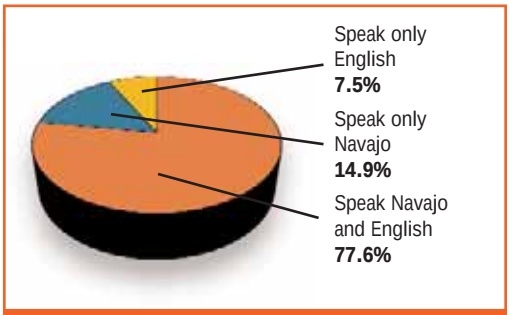


FIGURE 7B. 18-64 YEARS

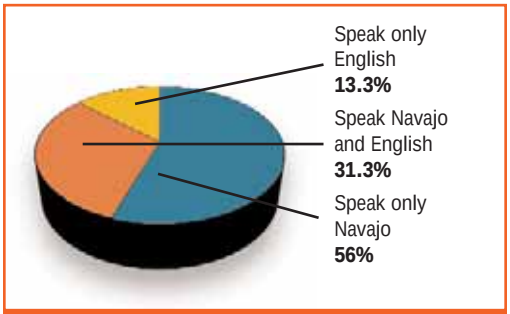


FIGURE 7C. 65 YEARS OR OLDER

6.

HOUSING ANALYSIS

PAGE 46

Scattered housing in the form of single family detached dwelling units is the predominant form of residential land use in the community. Housing areas are clustered based on family areas and typically include a home, Hogan and other structures. The majority of the homes are located in Utah. According to the Chapter's count, there are approximately 546 total housing units with approximately 339 units in Utah and about 207 in Arizona as shown on **MAP 14**. These figures differ from the 378 reported by Census 2000. The primary difference may be attributed to the difference in areas considered to be within the Mexican Water community.

HOUSING TYPE AND MEDIAN HOME PRICE

The median home value for the communities in the Chapter is far below all other jurisdictions examined in **TABLE 11**. It is likely that this is because the Chapter also has the highest number of mobile homes. The Navajo Nation and San Juan and Apache Counties have somewhat higher median home values and considerable fewer mobile homes. The trend continues in Utah, Arizona, and the U.S. The fewer mobile homes presents, the higher the median home price rises.

Mexican Water chapter shows the greatest percentage of mobile homes compared to the other areas shown in the previous table. Approximately one-third (32.8%) of the homes in Mexican Water are mobile homes **(FIGURE 8)**. The remaining 67.2 percent are single family units. Due to the remoteness of the community, mobile homes are easier to set up and cheaper than building a conventional type home.

FIGURE 9 shows the distribution of the housing units based on number of bedrooms. The majority of the houses within Mexican Water are two-bedroom units followed closely by homes with either one or no bedrooms. The homes without bedrooms are most likely hogans.

TABLE 11. HOUSING CHARACTERISTICS

	Total Housing Units		Type of Housing Units (2000)(1)		Median Home Value (2000)
	1990	2000	Single	Mobile Home	
United States	102,263,678	115,904,641	76,313,410	8,779,228 (7.6%)	$111,800
Arizona	1,659,430	2,189,189	1,375,489	302,575 (13.8%)	$109,400
Utah	598,388	768,594	558,003	39,267 (5.1%)	$142,600
Navajo Nation	48,385	59,498	45,576	11,118 (18.7%)	$23,800
Mexican Water Chapter	NA*	378	229	116 (32.8%)	$14,900
Apache County	26,731	31,621	22,993	6,317 (20.0%)	$39,200
San Juan County	4,650	5,449	3,850	1,238 (22.7)	$57,300

Sources:
U.S. Census Bureau (2000)(1)
A housing unit is a house, an apartment, a mobile home or trailer, a group of rooms, or a single room occupied as separate living quarters, or if vacant, intended for occupancy as separate living quarters.

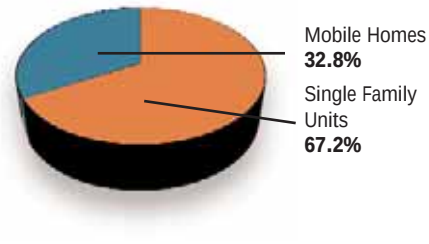


FIGURE 8. UNITS IN STRUCTURE

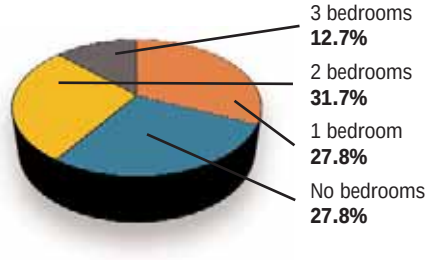


FIGURE 9. NUMBER OF BEDROOMS

HOUSING CONDITION

The condition of housing is generally characterized by the age of the homes and the availability of basic facilities, such as plumbing and heating. The majority of houses were built before 1980 and some much earlier than that **(FIGURE 10)**. Even the homes that are newer may be inadequate because they facilities so badly needed for their occupants. For example, complete plumbing facilities are defined as hot and cold piped water, a bathtub or shower, and a flush toilet. As shown in **FIGURE 11** and **TABLE 12**, the percent of the Chapter's homes lacking complete plumbing facilities is extremely high; it is much higher than all other jurisdictions including the Navajo Nation. Many of the residents in the area, as is typical throughout the Navajo Nation, depend upon cistern or well systems for water, often hauling significant distances on a weekly basis.

Energy needs among the Chapter's residents are also extensive. Although the NTUA and PacifiCorp provide electric service to the general area, only 8.2 percent (29) of the Chapter's residences have access to electricity. Most rely on wood for cooking and heating fuel but some use propane.

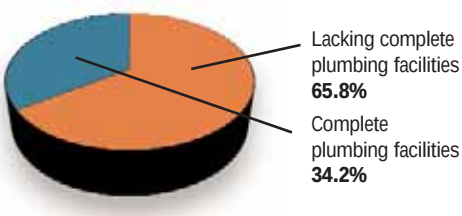


FIGURE 11. PLUMBING FACILITIES

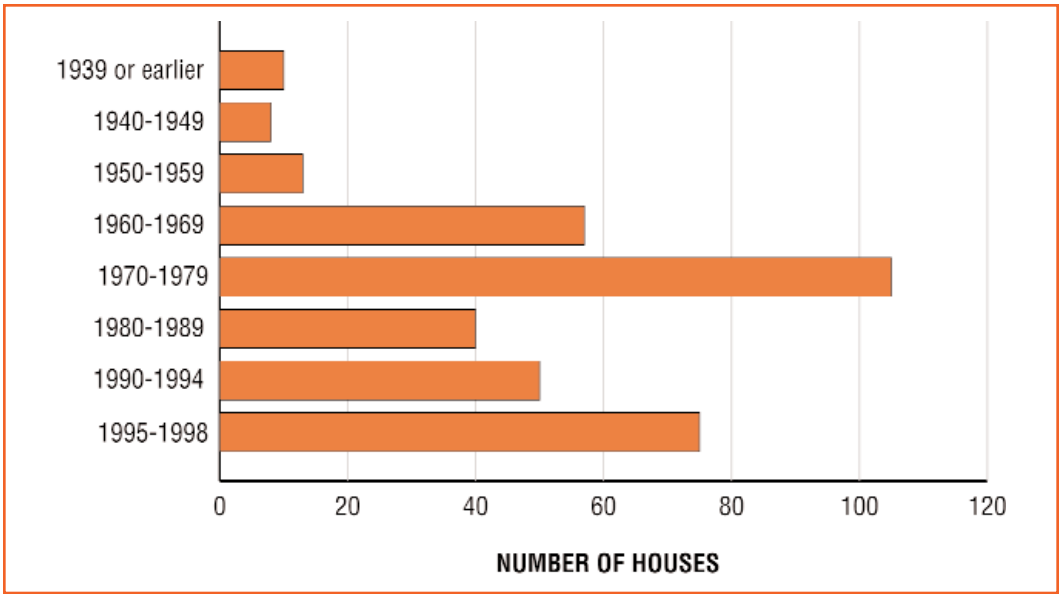


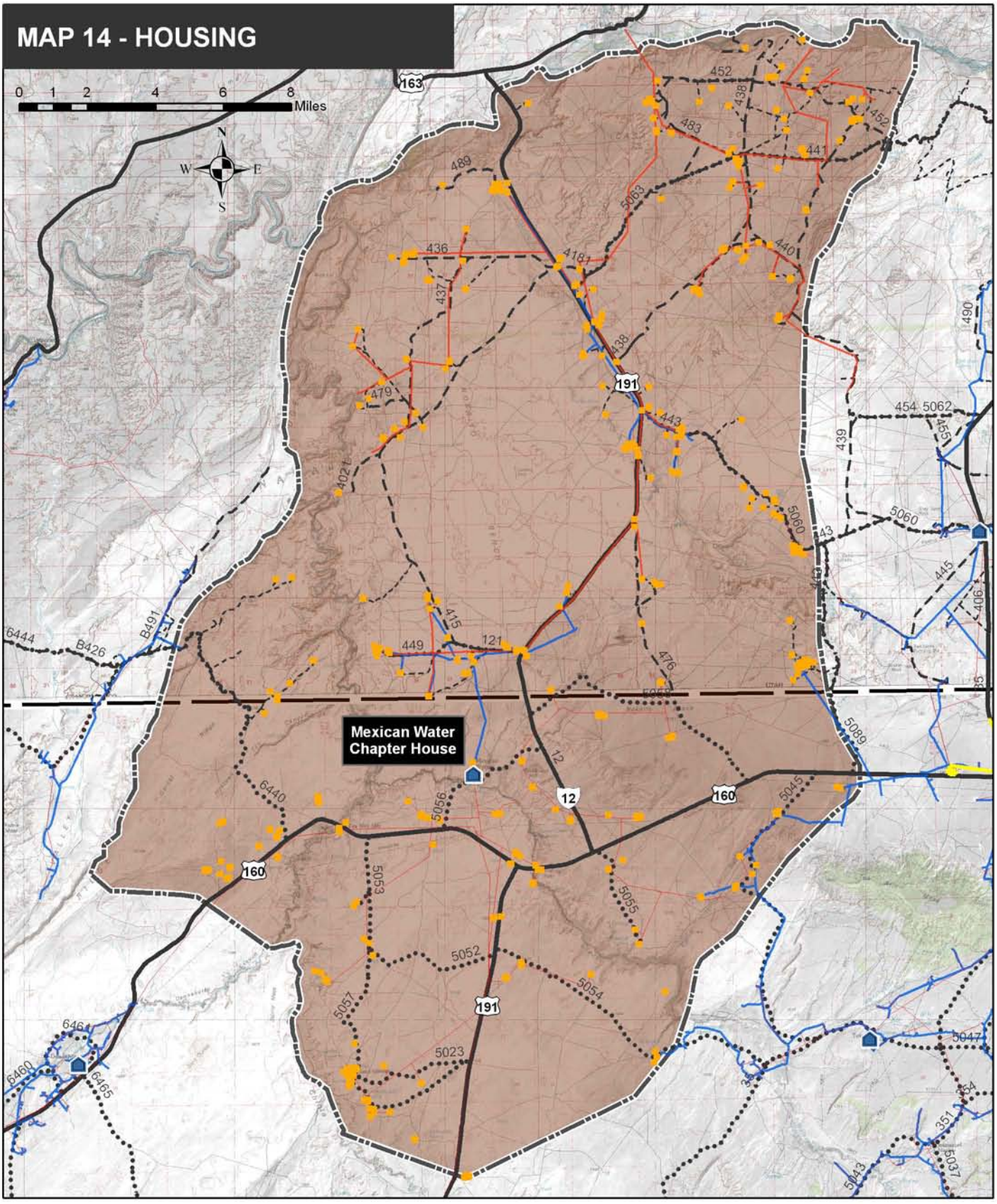
FIGURE 10. YEAR HOUSING UNIT BUILT

TABLE 12. HOUSING CONDITION: 2000

	Year Built		Type of Heating Fuel		Plumbing Facilities
	Prior to 1990	1990-2000	Electric	Wood or coal	Lacking Complete
United States	96,203,583	19,701,058	32,010,401(27.6%)	1,769,781 wood 142,876 coal	1,335,167 (1.2%)
Arizona	1,547,891	641,298	1,033,095 (47.2%)	39,842 wood 993 coal	39,632 (1.8%)
Utah	569,148	199,446	68,433 (8.9%)	7,756 wood 2,691 coal	7,519 (1.0%)
Navajo Nation	42,353	17,145	3,255 (5.5%)	20,896 wood 888 coal	26,930 (45.3%)
Mexican Water Chapter	230	124	29 (8.2%)	113 wood 0 coal	233 (65.8%)
Apache County, AZ	23,797	7,824	1,553 (4.9%)	10,085 wood 297 coal	11,759 (1.8%)
San Juan County, UT	4,117	1,332	569 (10.4%)	1.251wood 82 coal	1,462 (26.8%)

Source: U.S. Census Bureau (2000)

MAP 14 - HOUSING



Legend

- Chapter House
- Planning Area
- Stateline

Roads

- Navajo Route (unpaved)
- Navajo Route (Paved)
- County Road (unpaved)
- Dirt Road
- U.S. Highway

- Residential

Utilities

- Electric
- Water
- Natural Gas

Mexican Water Chapter Community-Based Land Use Plan December 2007

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NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (image)

7.

ECONOMIC BASE

DATA COLLECTION

Data were collected from available sources, particularly those that are part of public record from the Navajo Nation and the States of Arizona and Utah..

LABOR FORCE, EMPLOYMENT AND UNEMPLOYMENT

The total labor force, employment and unemployment figures for Arizona, Utah and the Navajo Nation are summarized in **TABLE 13**. The Arizona Department of Economic Security and the Utah Department of Workforce Services provide monthly data on unemployment and labor force for jurisdictions in each respective state. This data, however, does not consider the unemployed that are no longer eligible for unemployment benefits. The numbers do not accurately reflect the true number of unemployed on the Navajo Reservation. For example, the Arizona figures showed an unemployment rate of 23.5 percent in 2000 for the Navajo Nation. The Navajo Division of Economic Development (DED) also collects figures based upon more complete surveys of Navajo Nation residents that showed an unemployment rate of about 47.6 percent for the same period.

According to the "Comprehensive Economic Development Strategy of the Navajo Nation", prepared by the DED, there are several key characteristics of the Navajo Nation labor force. For example, the number of employees has changed very little since the DED began to collect data in 1991. The figure is generally in the area of 30,000 employees. On the other hand, more people are becoming eligible for the work force, resulting in a need to create up to 3,544 new jobs each year. It is estimated that about 200 jobs per year are created on the Navajo Nation.

TABLE 13. LABOR FORCE, EMPLOYMENT AND UNEMPLOYMENT CHARACTERISTICS

Arizona

Year	Labor Force	Employment	Unemployment	Unemployment Rate
2005	2,844,000	2,710,1000	133,900	4.7%
2004	2,762,612	2,630,988	131,614	4.8%
2003	2,690,294	2,593,359	150,935	5.6%
2002	2,667,477	2,502,720	164,757	6.2%
2001	2,577,933	2,456,515	121,418	4.7%
2000	2,489,348	2,390,899	98,449	4.0%
1990	1,806,323	1,707,287	99,036	5.5%

Source: Arizona Department of Economic Security (2005)

Utah

2005	1,263,774	1,211,803	51,971	4.1
2004	1,235,747	1,173,394	62,353	5
2003	1,205,599	1,137,566	68,033	5.6
2002	1,184,141	1,115,918	68,223	5.8
2001	1,159,433	1,108,547	50,886	4.4
2000	1,136,036	1,097,915	38,121	3.4
1990	820,436	784,050	36,386	4.4

Source: Utah Department of Workforce Services (2007)

Navajo Nation

2003	58,101	30,464	26.286	47.57%
2002	57,062	30,776	26.286	46.07%
2001	56,054	32,420	23.634	42.16%
2000	55,041	30,818	24.223	44.01%
1986*		40,742		40.6%

Source: Navajo Nation Department of Economic Development (2005)

EMPLOYMENT TRENDS

Employment estimates for 2004 for the broad sectors of the state economy are shown in **(TABLE 14)**. The primary industry for employment in Arizona and Utah is retail trade followed by health care and social assistance. The 'Other Services' category includes government, health care and educational services. Employment in government, health care and educational services on the Navajo Nation is considerably higher than the States of Arizona and Utah, most likely reflecting a lack of private sector jobs. Employment by the retail trade is the next highest for the Navajo Nation followed by Utilities and Mining.

TABLE 14. EMPLOYMENT BY SECTOR OF ECONOMY - 2004

	Sector of Economy	Arizona	Utah	Navajo Nation
22	Utilities	0.5%	0.5%	8.6%
23	Construction	9.1%	6.8%	2.9%
31	Manufacturing	8.2%	11.9%	1.3%
42	Wholesale trade	4.5%	4.8%	0.4%
44	Retail trade	14.5%	13.7%	11.1%
48	Transportation & warehousing	3.5%	4.8%	0.0%
51	Information	2.5%	3.2%	0.0%
52	Finance & insurance	5.9%	5.0%	2.3%
53	Real estate & rental & leasing	2.2%	1.7%	0.0%
54	Professional, scientific & technical services	5.7%	6.9%	0.0%
55	Management of companies & enterprises	2.9%	1.7%	0.0%
56	Admin, support, waste mgt, remediation services	9.5%	8.7%	0.0%
61	Educational services	1.8%	3.1%	0.0%
62	Health care and social assistance	11.8%	11.1%	0.0%
71	Arts, entertainment & recreation	2.1%	1.6%	0.0%
72	Accommodation & food services	10.9%	9.1%	0.0%
81	Other services (except public administration)	4.0%	4.8%	66.5%
99	Unclassified establishments	0.0%	0.0%	0.0%

Source: U.S. Census Bureau (2000)
Navajo Nation Division of Economic Development, Support Services Department

According to the DED, major employers on the Navajo Nation in 2002 were the Navajo Nation (8,000), the State of Arizona, including school districts (4,200); State of New Mexico including school districts (2,000), Navajo Area Indian Health Services (3,000), BIA Office of Indian Education (2,300), State of New Mexico (1,300) Peabody Energy (690) and McKinley Mine (300).

Further, the 2002 Navajo Nation Visitation and Economic Impact Study reported the tourism industry on the Navajo Nation has an economic impact of $100 million and supports 3,507 jobs.

According to Census 2000, there are 32 establishments within the local zip code areas comprising of the Teecnospos, Bluff and Mexican Hat that provide employment **(TABLE 15)**. The retail trade leads in the number o f establishments followed by the accommodations and food service industry. Education rounds out the top three industries in the local zip code areas.

TABLE 15. NUMBER OF ESTABLISHMENTS

Industry Code	Description	Teecnospos, AZ	Bluff, UT	Mexican Hat, UT
- -----	Total	10	19	3
23	Construction		2	
42	Wholesale trade		2	
44	Retail trade	6	3	1
48	Transportation & warehousing		2	
54	Professional, scientific & technical services		1	1
55	Management of companies & enterprises		1	
56	Admin, support, waste mgt, remediation services		1	
61	Educational services	1	3	
71	Arts, entertainment & recreation		1	
72	Accommodation & food services	1	3	1
81	Other services (except public administration)	2		

Source: U.S. Census Bureau (2000)
Navajo Nation Division of Economic Development, Support Services Department

Of the 32 establishments in local Census 2000 areas, two are located within Mexican Water. The Mexican Water Trading Post and restaurant are located near the southeast intersection of Highways 191 and 160 on Walker Creek **(MAP 15)**.

The trading post includes a convenience store and gas station. The restaurant is adjacent to the trading post, but is owned and operated by the Mexican Water Trading Post. A laundromat was also built to the west of the restaurant, however, it remains closed today due to low water pressure.

Before moving to its current location, the original trading post was located near the Baptist Church by the chapter house. Three traders "Bear Rolled Up," Tall "Squashed," and later Don Reeves ran the trading post in the earlier 1900's. In 1907, Hamblin Noel built the Mexican Water Trading Post at its present location (Linford, L. 2000).

Another commercial establishment comprising of a store and lodging facilities once existed in Tes Nez Lah which is located in Chinle Creek adjacent to the south side of Highway 160. After being in operations for some time, the establishments closed due to environmental hazardous conditions. Navajo EPA found leakage in the fuel storage container and ordered the area to be reclaimed and ensure soil and water conditions were within safety standards.

A majority of the working community members are employed outside the local area. Many travel long distances throughout all four states for employment.

In addition to the employment trends reported by Census 2000, an unknown number of community members are self employed or combine work to make a living. Entrepreneurs

typically are people operating art and crafts businesses where they make their products in their homes. They sell their products through various methods such as arts and craft shows, flea markets or through direct sales. Other entrepreneurs supplement their living via a cattle and/or sheep operation, farming business or other home-based businesses.

TOURISM

According to the 2002 Navajo Nation Visitation and Economic Impact Study, the tourism industry on the Navajo Nation has an economic impact of $100 million and supports 3,507 jobs.

Some of the major reasons that visitors come to the Navajo Nation are for its scenic attractions and to engage in outdoor activities. The seclusion of the Navajo Nation is ideal for visitors to get away for general sightseeing, hiking and boating, as well to shop for arts and crafts. While tourists are vacationing on the Navajo Nation and spending a great deal of time outdoors, 79 percent of lodging is taken in hotels.

According to the Travel Industry Association of American, domestic travel within the United States will increase with Americans traveling closer to home due to fears of anti-American sentiment overseas, which has increased the competition to attract the domestic traveler. In addition, consumer confidence is shaky with the lowest rating of the economy in 10 years. It is hoped that consumer spending, and therefore, tourism will slightly increase in the near future.

INCOME

The per capita income and median family income for residents within the planning area is shown in **TABLE 16**. The median family income for residents within the primary trade area is $24,530, which is comparable to that for the Navajo Nation, but still well below the median family income for Apache and San Juan Counties and the States of Arizona and Utah.

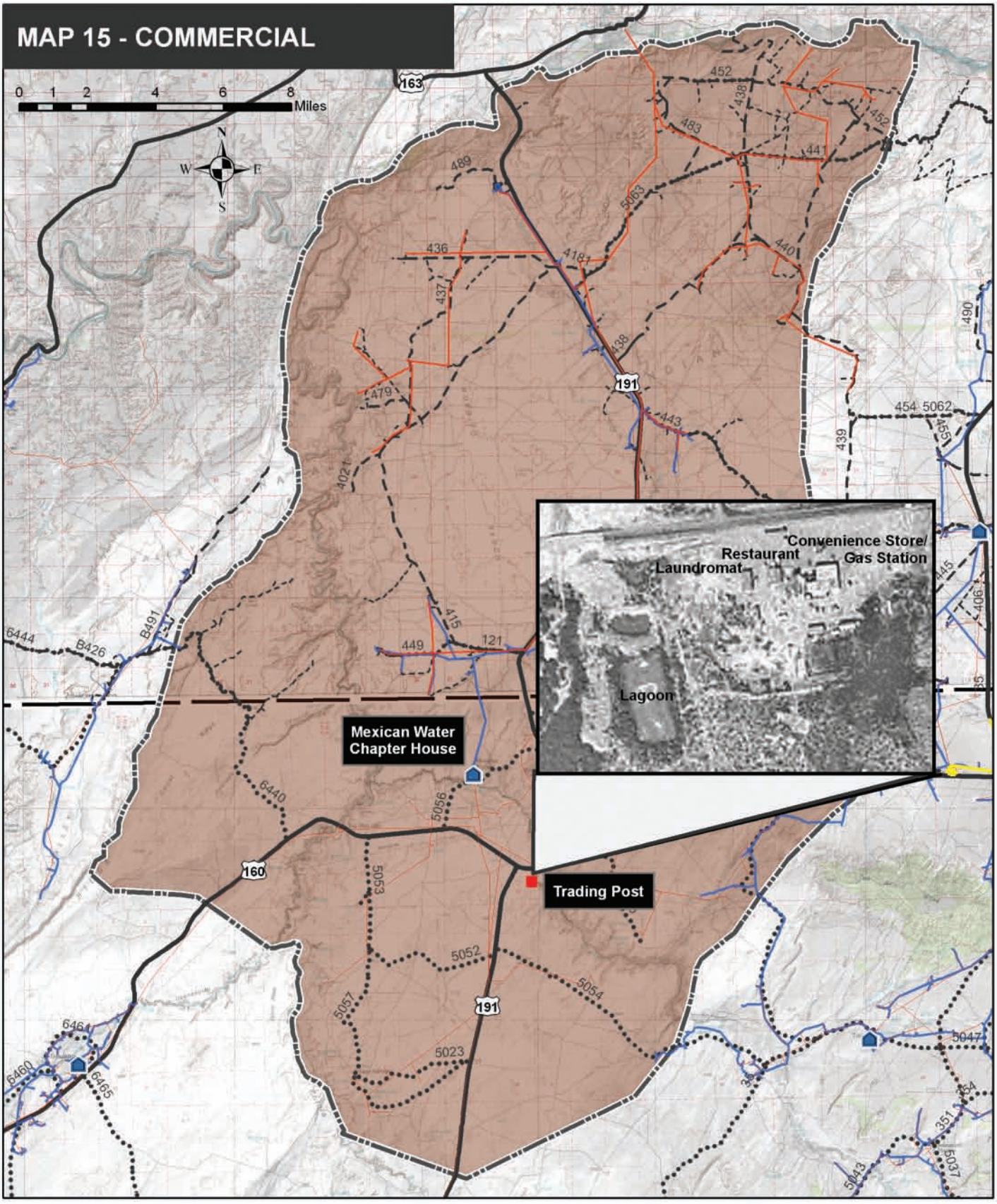
TABLE 16. INCOME CHARACTERISTICS

	Per Capita Income	Median Family Income	Persons Below Poverty Level	% Below Poverty Level
United States	$21,587	$50,046	33,899,812	12.4
Arizona	$20,275	$46,723	698,669	13.6 %
Utah	$18,185	$51,022	206,328	9.4%
Navajo Nation	$7,486	$23,209	65,001	41.9 %
Mexican Water Chapter	$7,235	$12,667	413	57.9%
Apache County, AZ	$8,986	$26,315	25,798	37.8%
San Juan County, UT	$10,229	$31,673	4,443	31.4%

Source: U.S. Census Bureau (2000)
Navajo Nation: Chapter Images (2004)

The percent of persons below poverty level, as defined by the U.S. Census Bureau, is very high for communities in the primary trade area, as well as for the Navajo Nation. This is consistent with the high unemployment rate found in the area. It is likely that the percent below poverty level is underestimated for the Navajo, as is the case with unemployment.

MAP 15 - COMMERCIAL



Legend

- Chapter House
- Planning Area
- Stateline

Roads

- Navajo Route (unpaved)
- Navajo Route (Paved)
- County Road (unpaved)
- Dirt Road
- U.S. Highway

- Mexian Water Trading Post

Utilities

- Electric
- Water
- Natural Gas

Mexican Water Chapter Community-Based Land Use Plan December 2007

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NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (image)

8

COMMUNITY FACILITIES & SERVICES

PAGE 56

This section examines the community facilities and services. It provides an inventory of the types of community facilities and services (police, fire, hospital, recreation), and infrastructure systems (sewer, solid waste, water, electric) within the Mexican Water Chapter **(MAP 16)**.

ELECTRIC

Several major electrical providers, including Arizona Public Service (APS), PacifiCorp and the Navajo Tribal Utility Authority (NTUA) own or operate transmission lines that traverse the Chapter's planning area, but only PacifiCorp and NTUA provide electricity to the community. PacifiCorp serves the Utah portion. NTUA serves the Arizona side. An APS 500-KV transmission line originates from the Four Corners Coal-Fired Generating Station located in the San Juan Chapter southwest of Farmington, NM, and parallels Highway 160 as it crosses the Chapter's planning area.

GAS

The Questar "Southern Trails" pipeline spans the southwestern part of the planning area generally following Highway 160. ARCO constructed the pipeline in 1957 move crude oil from the Four Corners area to California. In 1977, ARCO reversed the pipeline's direction and used it to transport oil from Southern California to the north. Questar purchased the pipeline in 2002, converted it to a natural gas pipeline and only activated the portion west of the Colorado River. It is again flowing in the southwesterly direction, carrying natural gas from San Juan basin in the

Four Corners area to California. Although NTUA is one of several companies that draw gas from Questar's pipeline they do not provide service to the Mexican Water community. Instead, the community widely relies on local propane distributors.

DOMESTIC WATER

Public water systems are limited. Those that do exist are owned and operated by the NTUA. Most families rely on individual wells for drinking water. Water hauling is common practice that can be difficult for some community members, particularly the elderly because it requires significant time and effort.

WASTEWATER FACILITIES

There are no public sewage lagoons in the planning area, however the Mexican Water Trading Post operates its own lagoon within its compound. Some homes throughout the community also have small lagoons. Most rely on individual septic systems.

SOLID WASTE DISPOSAL

The Chapter has an existing transfer station, but there are plans to remove it. Once this happens, community members will have to alternative ways to dispose of their waste. The nearest solid waste disposal is located in Bluff, Utah.

TECHNOLOGY AND COMMUNICATIONS

While the Chapter's communications do include telephone, radio, television, internet and newspaper, some of these services are extremely limited. For example, Mexican Water did not have any phone services until 1988 when they started renting a radio-phone. Now the chapter is on a satellite microwave telephone system. Although Citizens Communications is the primary provider of telephone service on the Navajo Nation, they do not serve the Mexican Water Chapter. The nearest phone lines are 15 miles from the chapter house (Rodger 2004). Growing coverage of cellular telephone service across the Navajo Nation has begun to replace the need for landline service in some cases; however, there is no cell-phone service in Mexican Water.

Clearly transmitted AM radio stations include KNDN, KTNN and KTUA from Farmington, NM, Window Rock, AZ, and Blanding, UT, respectively. Clear FM radio stations that can be readily heard include KISZ and KRTZ from Cortez, CO and KTRA from Farmington, NM and KFXR(KGLX) from Chinle, AZ (Rodgers 2004). Television channels that can be received include KNAZ from Flagstaff, AZ, KOBF from Farmington, NM and KUTV from Salt Lake City, UT. Some residents access satellite television.

Newspapers distributions include the Farmington Daily and Gallup Independent on a daily basis to the Mexican Water Trading Post. The Navajo Times and the Navajo/Hopi Observer are available on a weekly basis. Internet service is available via modem and satellite connections. Wireless internet service, made possible through the Bill and Melinda Gates Foundation, is available to the public at the Chapter house during regular working hours.

CHAPTER HOUSE

The Chapter House is located in the southern portion of the planning area near the Utah-Arizona state line. Built in 1956, the Chapter house serves as a local governance center for the community and conducts monthly meetings to address community needs and concerns. Office space within the Chapter house is also provided for a Community Health Representative (CHR). In addition to its community health program, the CHR oversees a wellness center consisting of exercise equipment currently located in the warehouse/maintenance shop.

The Chapter plans to build a new Chapter at a new location as discussed in the future plan section.

CEMETERY

The community cemetery is an approximately one acre tract located north of the Chapter House. Many of the graves are unmarked and as a result it is difficult to determine if the tract has reached its capacity. The Chapter is in need of a new site.

Several family cemeteries also exist throughout the community. These sites are located near the family homesteads and maintained by the respective families.

LAW ENFORCEMENT

The Navajo Nation provides law enforcement from Shiprock and Kayenta.

FIRE PROTECTION

There is no fire protection. The nearest fire station is located in Bluff, UT.

RESCUE AND AMBULANCE SERVICES

The nearest rescue and ambulance services are in Bluff, UT. The Health Care Center located in Red Mesa also provides ambulance and EMT services.

HOSPITAL AND HEALTH SERVICES

The Four Corner Health Care Facility is located in Red Mesa, Arizona, approximately 20 miles east along Highway 160. Community members also go the Utah Health Care Center located in Blanding.

PARKS AND RECREATION

Monument Valley is nearby some 40 miles to the west, but the mesas can be seen from certain areas within Mexican Water. Rafting occurs at the South Island launch site near Bluff, Utah.

There are no public parks within the planning area, however there are several areas known to local community members that are like parks. In addition, there is a shooting range east of Highway 191 across from the White Rock compound in the northern part of the community.

SCHOOLS AND EDUCATION

PRESCHOOL AND HEAD-START

The preschool is located within the Chapter house compound.

The Headstart is located in Todahaiddkani adjacent to 191 in the northern part of the community. The Headstart program was initially operated by the Utah Rural Education program before it was turned over to the Navajo Nation. Since the woes of the Navajo Headstart program begin in 2006, the facility has been closed.

ELEMENTARY EDUCATION

Students attend elementary schools in Red Mesa, Dennehotso, Bluff and Blanding.

MIDDLE SCHOOL EDUCATION

Students attend middle schools in Red Mesa, Rock Point, and Blanding.

HIGH SCHOOL EDUCATION

Students attend high schools in Red Mesa, Rock Point and Blanding.

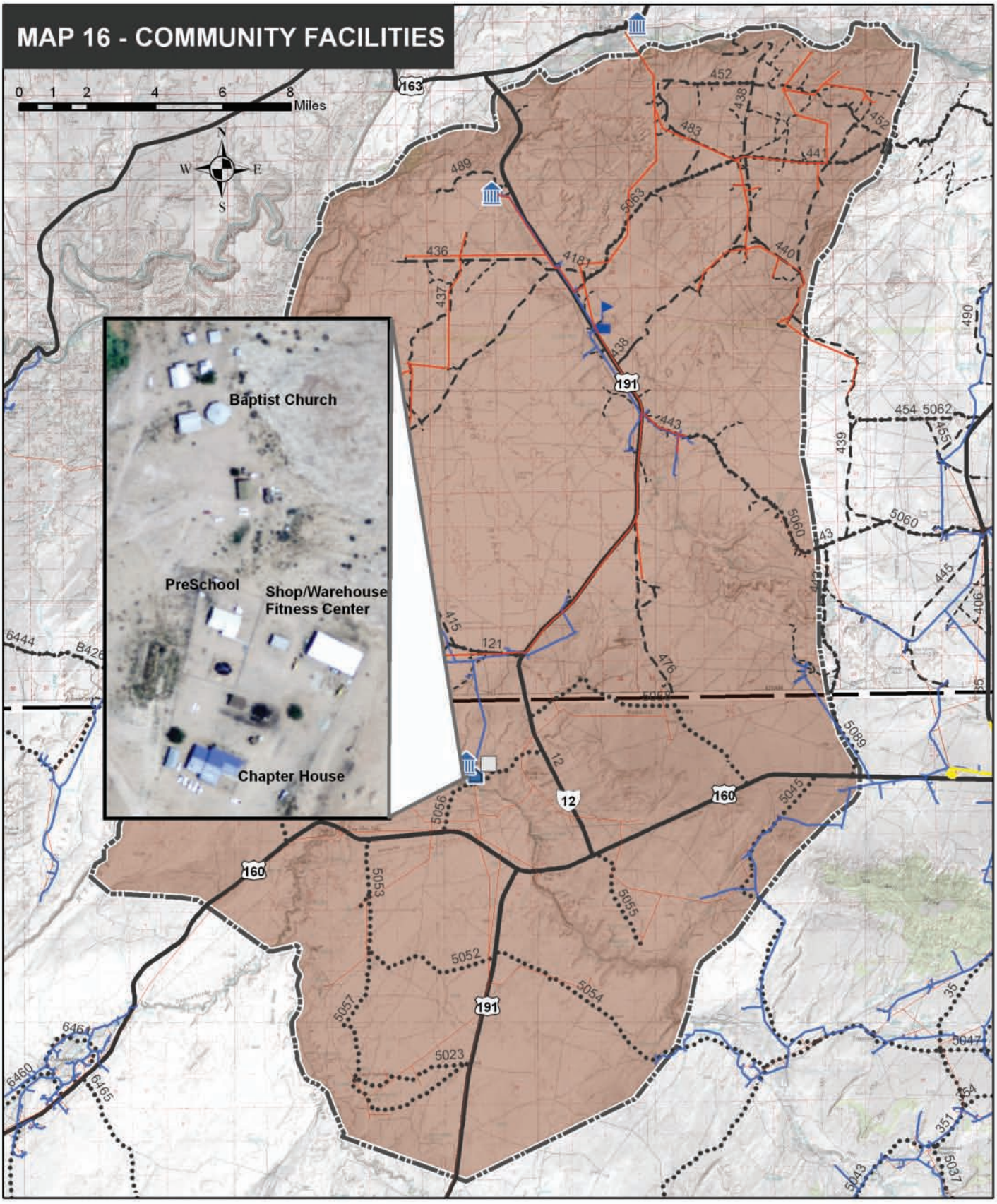
COLLEGES

Dine College is the nearest college in Tsaile, Arizona with a Branch in Shiprock, New Mexico. Off reservation colleges includes the College of Eastern Utah in Blanding, Utah.

CHURCHES

Mexican Water provides a variety of opportunities to worship, which include the following: Baptist Church located by the Chapter house and the White Rock Methodist Church. Several community members also practice the traditional Navajo religion and the Native American Church. These worship sites are located within or near existing developed homesteads.

MAP 16 - COMMUNITY FACILITIES



Legend

- Chapter House
- Planning Area
- Stateline

Utilities

- Electric
- Water

Roads

- Navajo Route (unpaved)
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Mexican Water Chapter
Community-Based Land Use Plan
December 2007

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NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (image)

9.

TRANSPORTATION NETWORK

Mexican Water's transportation network is vital as it provides the much needed safe convenient circulation within the community and links to nearby and adjacent communities.

ROADS

The major source of transportation through Mexican Water Chapter is serviced by U.S. highways 160 and 191 **(MAP 17)**. Highway 160 runs east and west in the lower southern portion of the chapter while highway 191 runs north and south. Highway 160 is located entirely within AZ and is under the jurisdiction of the Arizona Department of Transportation (ADOT). Highway 191 is divided into three segments. ADOT oversees the segment south of highway 160. The segment between highway 160 and the Arizona-Utah stateline is actually Navajo Route 12 and is under the jurisdiction of the Navajo Department of Transportation (NDOT). The segment in Utah is under the jurisdiction of the Utah State Department of Transportation (UDOT).

The UDOT roadways are divided into four distinct classes of which Class A are highways, Class C are municipalities and Class B and Class D are considered "county" roads. The Class B and C road system, with a funding program, was established by the Utah Legislature in 1937 as a means of providing assistance to counties and municipalities for the maintenance and improvement of roads and streets throughout the state. This system continues today under the regulations governing class B and C roads as administered by UDOT. Class D roads on the other hand are maintained by the County. These roads do not receive regular maintenance or the level of improvements as that provided the B roads. They are maintained as needs and financing dictates. The Utah portion of highway 191 is Class A. Other roads within the Utah

portion of Mexican Water Chapter are either Class B or D. The majority are Class B as shown on the transportation map.

Highways 160 is classified as a Rural Principal Other road under the ADOT classification system. The Rural Principal Other system consists of all nonInterstate principal arterials. Highway 191 is a Rural Major Collector road. The rural collector routes generally serve travel of primarily intracounty rather than statewide importance and constitute those routes on which (regardless of traffic volume) predominant travel distances are shorter than on arterial routes. Consequently, more moderate speeds may be typical, on the average.

The remaining named roads within Arizona are part of the greater Navajo Nation Indian Reservation Roads (IRR) program. The IRR program was established to provide for construction of public roads and bridges under the BIA administration. Its funding is authorized under the Federal Lands Highway Program and through the BIA-Division of Transportation. The Navajo IRR program is administered by the NDOT. The roads under the IRR program are referred to as Navajo routes.

NDOT classifies roads by their function. Functional road classification is the grouping of roads, streets and highways into integrated systems, each ranked by its relative importance and the function it is intended to serve, relative to mobility and land access. The classification also identifies the role each street or highway should play in channeling the flow of traffic in a logical and efficient manner. Navajo Route 12 (N12) is a Class 2 road. The Navajo-BIA Class 2 roads are major or minor arterials that provide an integrated network for serving traffic between population centers. They connect state highways and provide travel continuity among Navajo agencies. They collect traffic directly from Class 3 (streets) and Class 4 (local roads) roads onto state highways. Other Navajo routes within Mexican are considered Class 4 roads. The Navajo-BIA Class 4 roads are section line and/or stub-type roads collecting traffic for arterial roads and connecting with the grid of the Navajo IRR roads systems. They may serve areas

around Navajo population centers areas, farming areas, schools, tourist attractions or various small business enterprises. This class also includes roads and vehicular trails for administration of forest, grazing areas, mining, recreation, or other utilization purposes. The Navajo-BIA Class 4 encompasses roads not falling in either the Class 2 or 3 classifications.

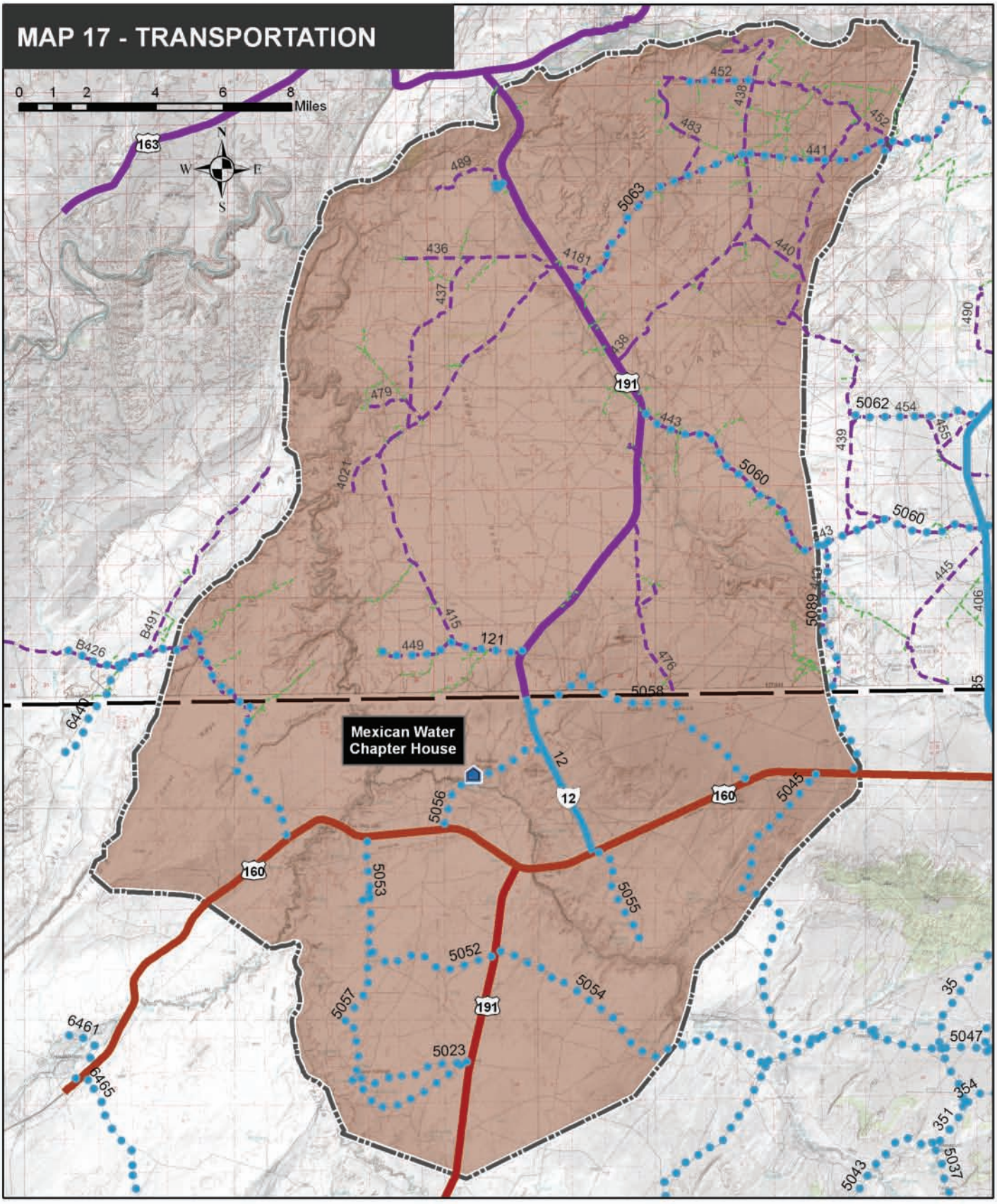
PUBLIC TRANSPORTATION

The Navajo Transit System does not service the Mexican Water community. The CHR, provides emergency medical transportation upon request. Other tribal and private services that provide public transportation to Navajos are: Navajo Aging Services Department providing service from Bluff; and Safe-Ride Services, which collects a fee for transportation.

AIR TRANSPORTATION

The nearest airstrip is located in Bluff, UT approximately 32 miles north from the Chapter house. A helipad is also located at the Four Corners Health Care Center in Red Mesa, Arizona approximately 16 miles east of the Mexican Water Chapter house.

MAP 17 - TRANSPORTATION



Legend

- Chapter House
- Planning Area
- Stateline

NDOT

- Navajo Route (unpaved)
- Navajo Route (paved)

ADOT

- 160, ADOT
- 191, ADOT

UDOT

- US Highway 163
- US Highway 191
- San Juan County
- dirt road

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NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, USGS

10.

FUTURE LAND USE

INTRODUCTION

The designation of future land uses for development are important to any community, especially for the Mexican Water Chapter as it moves towards local governance and sustainability. Decisions regarding how to design the landscape affect the way the community lives, works and spends its leisure time. Land-use decisions can also affect the way the community spends its money, potentially providing convenient locations for purchasing certain goods and services without the need for long-distance drives. Further, the way communities are planned has a direct impact on the community members' health, safety, general welfare, and emotional stability. Solid planning can lead to a stronger economic base, an efficient system of roads and utilities, and the protection of natural, cultural and traditional resources.

LAND USE DESIGNATION

Mexican Water's future land use plan **(MAP 18)** is designed to inspire ideas that provide a broad, yet clear picture of the community as its members, leaders, and the general public envision it to be. The CB-LUP is the community's general guide for managing growth in the location, type, scale and density of future land development.

The maps used in this plan indicate the intended predominate future function, density, and characteristic use of the land. They do not reflect the intended zoning of individual areas but rather generalizes desired future land uses. The maps suggest an overall mix of densities and should not be construed as tying individual projects to density designations. To achieve appropriate balance among the goals promoted by the land use plan, flexibility in specific decisions is required.

RESIDENTIAL HOUSING

Residential land use includes scattered housing and subdivisions. Scattered housing generally comprise of clusters of one-acre home sites. Within these clusters, homes may or may not be close together. Subdivisions on the other hand, provide a tighter, more organized housing arrangement with more houses per acre. Typically subdivisions on the reservation include housing built by the BIA, NHA, school or other entities.

COMMUNITY FACILITIES

This category designates public land uses, including schools, colleges, libraries, fire stations, police stations, convention centers, museums, governmental offices, utility stations, and hospitals. Community facilities provide a valuable service to the community, offering services to benefit and serve the entire community. Typically, these facilities on the Navajo Nation provide public amenities and include places like the Chapter house. The Chapter house provides a central location for meetings, meals and community gatherings. Other community facilities may include group-housing areas, health services facilities, police stations and fire departments. In addition, local schools are an important community facility that can provide children of the community with a suitable, conveniently located educational facility.

CULTURE, VISITOR AND TRIBUTE FACILITIES

This category is established to focus on culture, visitor and tribute facilities. The area is intended for community and public use for activities associated with maintaining and sharing the culture of the community within the community and with tourist. Further, the area will show how the community honors its people wherein it intends to establish a veterans' center which can serve multiple uses. The designated areas can be used for unique uses such as for museums and parks in addition to the visitor center and veterans' center. The spaces and facilities may be used by visitors wherein members can provide insights to the culture and history of the community. On special occasions, the community can pay tribute to and honor veterans and other honorable members of the community.

COMMERCIAL

The commercial categories are established to provide areas in which business may be conducted, goods sold and distributed, and services rendered. In addition, they are set up to provide for public activities and other activities which support retail and business functions. Such uses may include grocery stores, trading posts, or even areas for local vendors and artists to sell their wares to tourists and others.

This commercial land use is important to the economic development of the Chapter as it provides places for businesses to be developed and grow. Businesses can provide jobs and create an economic base, and potentially revenue for the

Chapter through sales tax or business leases. Local businesses can provide opportunities for local residents to shop locally versus commuting far away to shop; such activities bring money into "locally" owned business that can help spur other growth within the community.

INDUSTRIAL

Industrial development is another way to enhance economic development. Industrial development typically facilitates businesses connected with the production, manufacture, or construction of a product or a range of products. Typical industrial development may include mining, manufacturing or warehousing. Industrial development can provide jobs for the community and potentially bring revenue from user fees, sales tax, or other mechanisms.

RECREATION

Recreation facilities provide places for play and relaxation; activities at such facilities can encourage physical fitness among community members. The areas designated for recreation on this plan are intended to be more structural recreation facilities rather than those provided by trails in the open space. Such structural facilities may include both indoor and outdoor structures. Outdoor facilities may include parks, playgrounds, hiking and biking trails, ball fields, rodeo or equestrian facilities, or golf courses. Indoor facilities may include gymnasiums, fitness centers, or a multi-use recreation center.

OPEN SPACE

Areas designated as open space are those areas that the community has identified as having special significance, and are areas that should be preserved in their natural state without development. The designation as open space does not mean that people can not use the space for limited grazing, hiking, or other low impact activities, but it does protect the area from mining, building or other forms of development. Grazing in open space areas should not be intensive and should be carefully monitored to ensure that overgrazing does not occur in these areas. The intent of open space is to preserve areas of particular beauty, or natural or cultural significance for future generations to enjoy and respect.

GRAZING

As open space areas, grazing lands possess scenic values except when overgrazed. Areas designated for grazing should remain primarily undeveloped to ensure that grazing rights in

these areas are protected. The grazing areas will likely be managed by the grazing committee and should be regulated by the grazing management plan. Areas designated for grazing should not limit the use of these areas for other non-development related activities such as recreation or hunting with the understanding that the primary managed land use on this land is grazing. Traditionally, home sites and family clusters of homes are located within a grazing area. This type of home site development is compatible with areas designated for grazing.

FARMING

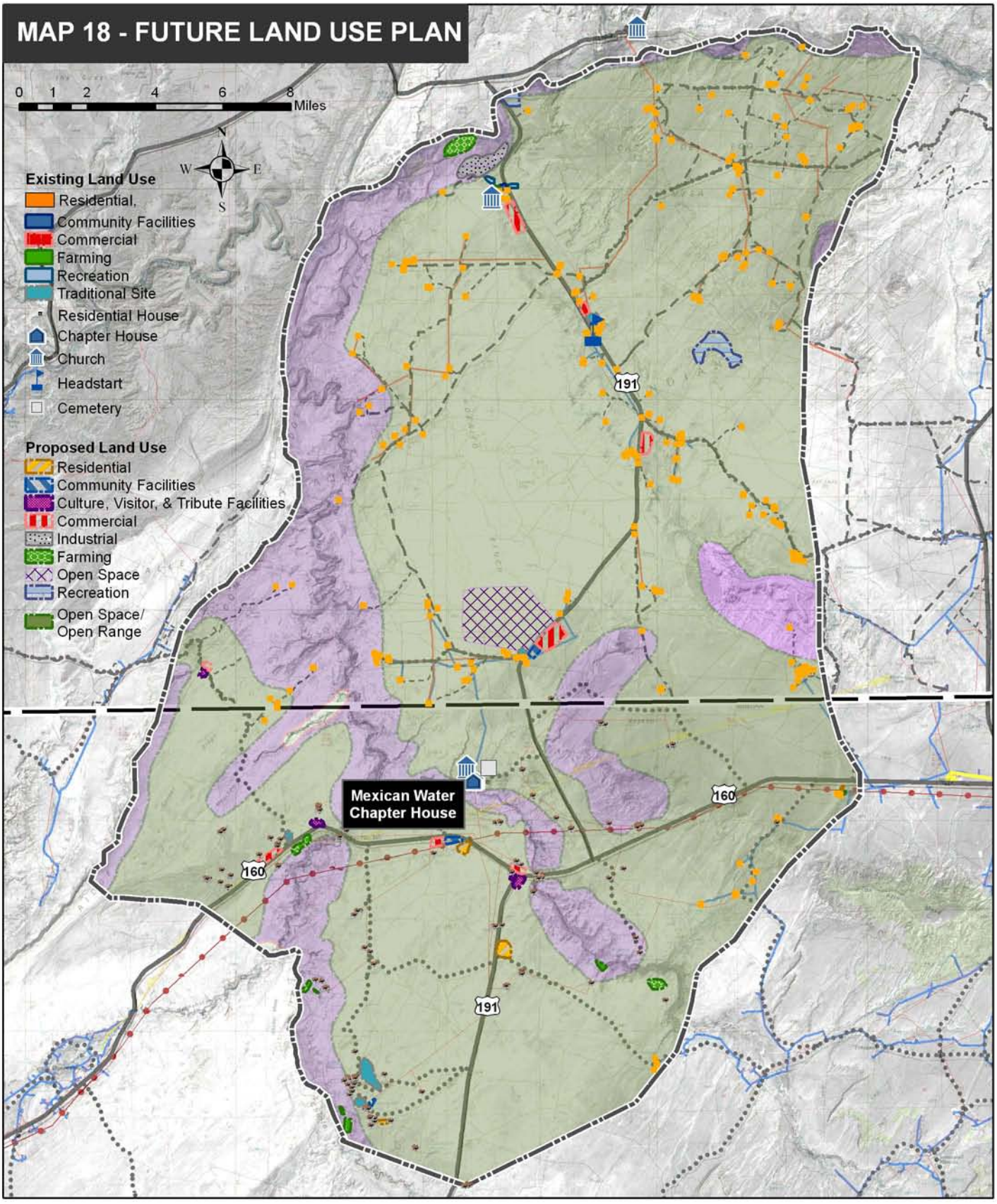
Farming is another important way of life for some community members, though on a smaller scale than grazing. Land that has been designated for farming should be used for raising crops, either for subsistence or for market. Soils and location are prime factors in determining the suitability of land for farming. Further, availability of adequate water is also a serious consideration and limits the amount of land capable of being brought into cultivation. Farming land is typically relatively flat with healthy, rich soils, and near a natural or irrigated water source.

TRADITIONALLY AND CULTURALLY SENSITIVE SITES

Traditionally and culturally sensitive sites are defined as those areas that have been designated by community members as areas that are either used for ceremonies, or have some cultural significance. These areas may be areas where herbs are gathered, areas of archeological importance, or they may be areas that hold other historic or cultural significance for members of the community. These areas should be treated with the greatest of respect and should not be subject to any sort of development (with the exception of building ceremonial structures, etc.). The purpose of designating these areas is to protect them for the use and respect of community members and future generations.

The extent and quality of the roads are an important determinant for local community development and economic development and growth. Future development in the leasehold area will be possible if the community is prepared to identify the existing infrastructure needs and plan for providing the infrastructure that will be needed to attract potential developments.

MAP 18 - FUTURE LAND USE PLAN



Legend

Planning Area

Stateline

Utilities

Electric

Water

Natural Gas

Roads

Navajo Route (unpaved)

Navajo Route (Paved)

County Road (unpaved)

Dirt Road

U.S. Highway

Questar Pipeline

Power Tranmission Line

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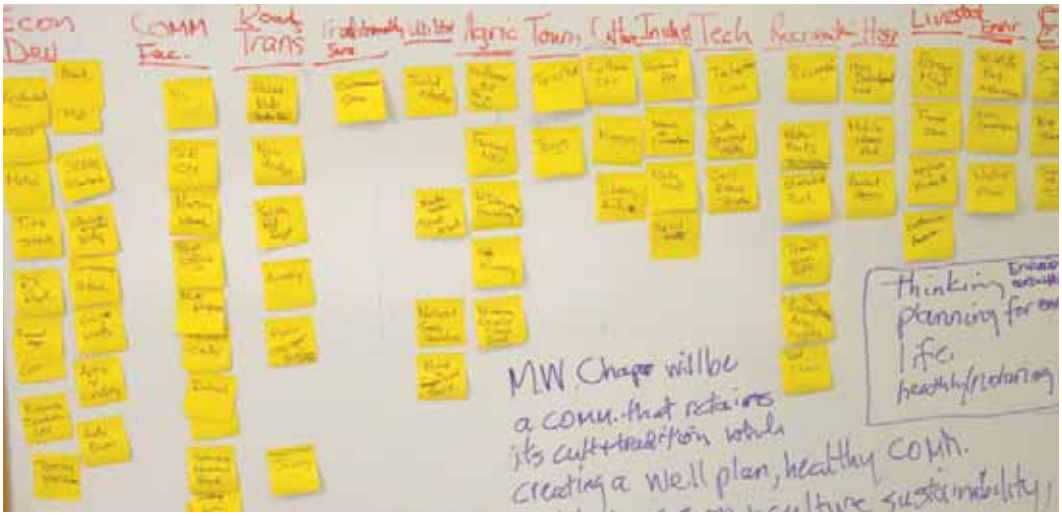
NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (image)



GOALS AND OBJECTIVES

The goals and objectives reflect the specific desires of the Mexican Water Chapter community – guiding how and where the community will grow.

ECONOMIC DEVELOPMENT

Commercial

Goal: Encourage economic development in balance with the needs of cultural and natural resources and long term business growth.

Objectives:

- Explore and support the development of retail businesses such as but not limited to a laundro-mat, a grocery store (e.g. Albertson's), restaurants, convenience stores, a gas station, a feed store, and outlets stores.
- Explore and support other service related businesses such as an auto shop, tire shop, copy shop, bank, towing services, septic service, insurance, funeral home, and a car wash.
- Provide access to resources that will help those who wish to develop and/or grow their businesses (i.e. business incubator center).
- Explore development of a storage and warehouse buildings.

Industrial

Goal: Encourage industrialization that supports sound development of local resources while reducing the impact on the environment.

Objectives:

- Analyze the economic, social, and environmental impacts of developing White Shell.
- Explore the manufacturing of natural spring water (i.e. Spirit Water).

Tourism

Goal: Create a respectful and balanced approach to tourism development.

Objectives:

- Study options to capitalize on tourism opportunities particularly along the San Juan River, Chinle Wash and others scenic areas.
- Explore innovative designs of tour packaging such as self-auto tours, scenic trails and historic sites.

Agriculture

Goal: Encourage sustainable agricultural development.

Objectives:

- Conduct feasibility study of a sunflower oil or farm bio-fuel program.
- Start a farmers market.
- Explore integrated farming methods that enhance productive farmland.
- Explore the development of a winery.
- Reintroduce churro sheep back into the local economy.

Cultural & Traditional Outreach

Goal: Develop related infrastructure to promote the sharing and use of information, including gathering, preserving, maintaining, educating, and facilitating sharing of our cultural and traditional oral history, teachings, and artifacts.

Objectives:

- Construct a cultural center where tourists as well as community members can gather for demonstrations, craft fairs, and shopping.
- Develop a museum where traditional objects can be preserved and exhibited for educational purposes.
- Create a library with archives for preserving language and literary works where native and non-native alike can conduct research as well leisure reading.

COMMUNITY FACILITIES

Public Use & Services

Goal: Provide adequate community facilities and services responsive to the safety and welfare of the general public.

Objectives:

- Provide a range of community facilities and services to meet existing and anticipated needs of the Chapter including but not limited to a new chapter house, cemetery, post office, senior center and a child care facility.
- Continue to work cooperatively with agencies to provide community facilities and services to the Chapter.
- Maintain facilities and programs to exemplify the highest standards for the Chapter.

Veterans

Goal: Establish facilities honoring our veterans.

Objectives:

- Develop a veteran's memorial park.

Wellness

Goal: Provide adequate community facilities and services ensuring the well-being of the community members and visitors.

Objectives:

- Provide community services to ensure each community member has a safe, healthful and attractive living environment such as a dialysis center, a wellness clinic, a nursing home and senior center.

Public Safety & Law Enforcement

Goal: Ensure a safe community by providing adequate safety and crime prevention services and facilities.

Objectives:

- Identify an area for development of facilities such as a fire station and law enforcement facilities.
- Build necessary facilities to ensure a safe community.

Education & Training

Goal: Support a range of educational and training opportunities.

Objectives:

- Build a strong working relationship with current school systems.
- Partner with surrounding communities to enhance educational opportunities.
- Provide areas for educational facilities (i.e. Elementary, Middle School, High School) and support its developments.
- Provide areas for training (vocational technology, business, agricultural) and support their development.

OPEN SPACE

Natural & Cultural Resources

Goal: Conserve, protect, and enhance natural, traditional, and cultural resources as well as provide sufficient parks and recreational areas that meet the needs and desires of the community members.

Objectives:

- Develop a management strategy that centers on protecting and conserving the areas identified for open space.
- Develop, preserve and enhance areas of scenic interest and determine methods to protect key scenic corridors and routes.
- Support a system of open spaces that enrich the lives of community members such as water parks, skateboard parks, horse and bike trails, hiking trails, and a fair ground (rodeo area, flea market).
- Protect the wildlife areas as open space.

Traditional Resources

Goal: Respect traditionally sensitive areas as an important land use while preserving the integrity of the locale.

Objectives:

- Protect and respect ceremonial sites.
- Protect and preserve herb gathering areas.
- Discourage development in and near traditionally sensitive areas.
- Interpret the significance of sites to add greater interest, preserve area history and educate visitors about the significance of various sites.
- Promote educational programs on cultural and historic areas of interest.

Water Resources

Goal: Consider multiple perspectives in the protection of our water resources/rights, including policy-making, short-to-long-term time frames, cross-generational perspectives, and local to regional to national jurisdictions.

Objective:

- Encourage water and energy conservation through land use controls.
- Protect the quality of groundwater.
- Request the Navajo Nation Water Resources Department to complete a Water Plan for the Chapter.
- Ensure the water rights are maintained and the Chapter receives its share.

Livestock

Goal: Preserve and enhance traditional livestock activities using effective and appropriate management techniques.

Objectives:

- Identify and provide resources to foster livestock and range management activities as well as other land conservation practices.
- Upgrade the existing windmills.
- Establish a Cattlemen Association.

Farming

Goal: Continue farming activities as essential to the traditional culture and the sustainability of the area.

Objectives

- Re-establish former farming areas
- Provide areas for future farm plots.
- Ensure water is made available for farming.

INFRASTRUCTURE DEVELOPMENT

Utilities

Goal: Provide adequate utilities to accommodate and stimulate community and economic growth while avoiding and/or mitigating (where necessary) adverse environmental effects.

Objectives:

- Coordinate the providers of power, gas, water, sewer, telecommunications and solid waste.
- Locate utility facilities to areas currently identified for future planned community and/or economic development.
- Encourage compatibility between utility facilities and adjacent land uses.
- Ensure adequate energy supplies for future growth.
- Promote reliable and cost-effective services for utilities.
- Develop a wastewater treatment plant.
- Obtain natural gas service to the community.

Solid Waste

Goal: Provide an adequate solid waste program to accommodate community and economic growth while avoiding and/or mitigating (where necessary) adverse environmental effects.

Objectives:

- Work with the Navajo Nation Solid Waste Program and the San Juan County in Utah and Apache County in Arizona to establish a solid waste program.

Transportation

Goal: Provide and maintain a transportation system that promotes the orderly and safe transportation of people, goods and service, and at the same time preserve the traditional character of the Chapter.

Objectives:

- Evaluate full range of local transportation modes and needs.
- Develop a new bridge.
- Review existing public transportation system and explore possibility of extending service to the Chapter (i.e. shuttle bus).
- Complete the road inventory request by NDOT and BIA Roads.

Technology

Goal: Provide innovative technology to accommodate and stimulate community and economic growth while avoiding and/or mitigating (where necessary) adverse environmental effects.

Objectives:

- Extend reliable telephone service throughout the Chapter.
- Explore possibility of establishing a central Data Storage Building for electronic data for the Navajo Nation.
- Explore possibility of establishing more Cell Phone Towers to provide better coverage and reception.

HOUSING

Types of Housing

Goal: Develop and maintain a pattern of residential land uses.

Objectives:

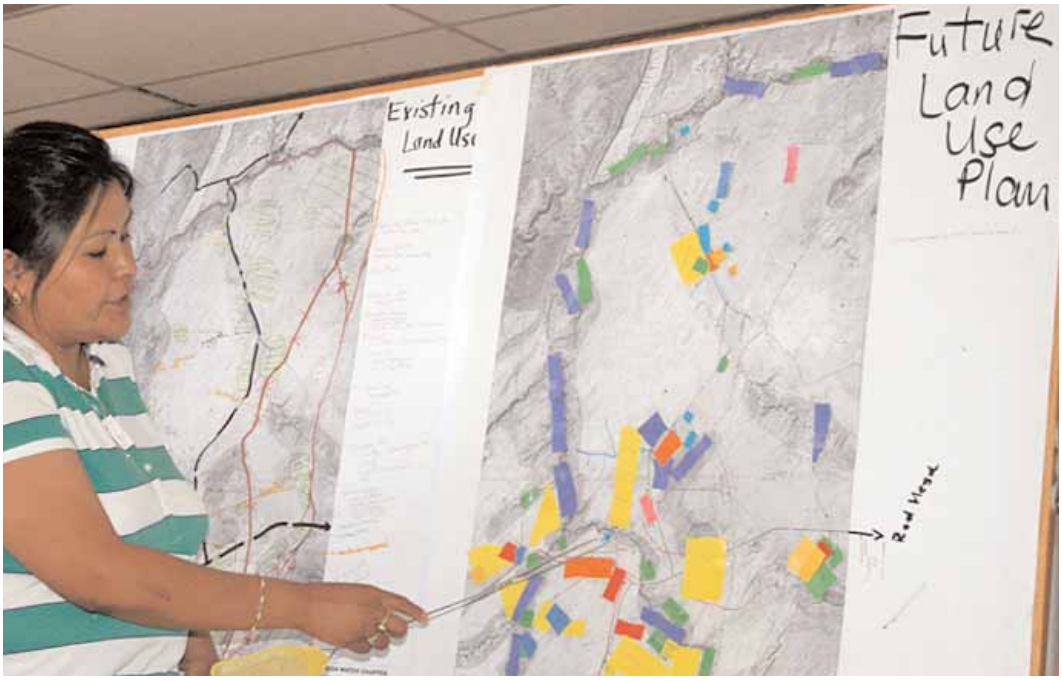
- Provide for a variety and balance of densities and opportunities for a mixture of different dwelling and tenure types (i.e. mobile home park, rentals, single-family homes, etc.)
- Continue to work cooperatively with agencies to provide infrastructure to the existing housing units.
- Provide adequate sites for the development of a wide range of housing types for all types of households.
- Continue to develop the positive aspects of the rural character of the Chapter.

Rental Homes

Goal: Provide rental homes for seasonal visitors and tourist.

Objective:

- Build homes that will attract visitors and tourist



FUTURE DEVELOPMENT AREAS

Land use and community development plans in the planning area as presented below are based on the wants, needs and desires of the community members.

The result of the community joining together has been extremely positive and immensely productive for all parties. The results of the collective efforts of community members with reference to land use and community development are discussed in the following sections. The information within these sections came directly from the written and spoken words of the families and community members as voiced during work sessions and in public meetings. Families and community members from all over the area came together to share their ideas, concerns, challenges and visions for the future. Their ideas were honored and captured as part of this project. People listened, they heard, and in some cases compromised, in order for this effort to be presented as one community voice. Because the people of the community worked together, this project has come together in this final form.

As a result of the community's work, their thinking and brainstorming about potential opportunities, the idea surfaced wherein Mexican Water envisions its area to be a central point of access to surround major spectacular gifts of Mother Nature. Studies indicate tourism plays a major part of the local and regional economy and Mexican Water sees a huge opportunity to capitalize on its location as a central focal point for tourism between Canyon de Chelly, Monument Valley or Mesa Verde or other interesting places in the Four Corners areas.

Some of the most beautiful areas are within easy driving distances from what could become the hub -- Mexican Water. Therefore, Mexican Water envisions providing services to accommodate thru-travelers, eco-tourists and other visitors to the area while also attracting more people to the area where they will stay and spend money within the communities.

As can be seen of the areas identified for development, the community generally supports development along the major thoroughfares. The community understands the importance of preserving other areas and has set those apart from areas of development. Further, the community desires to share some of the hidden treasures within the community whether they are natural resources to be shared and preserved or certain artifacts currently in storage.

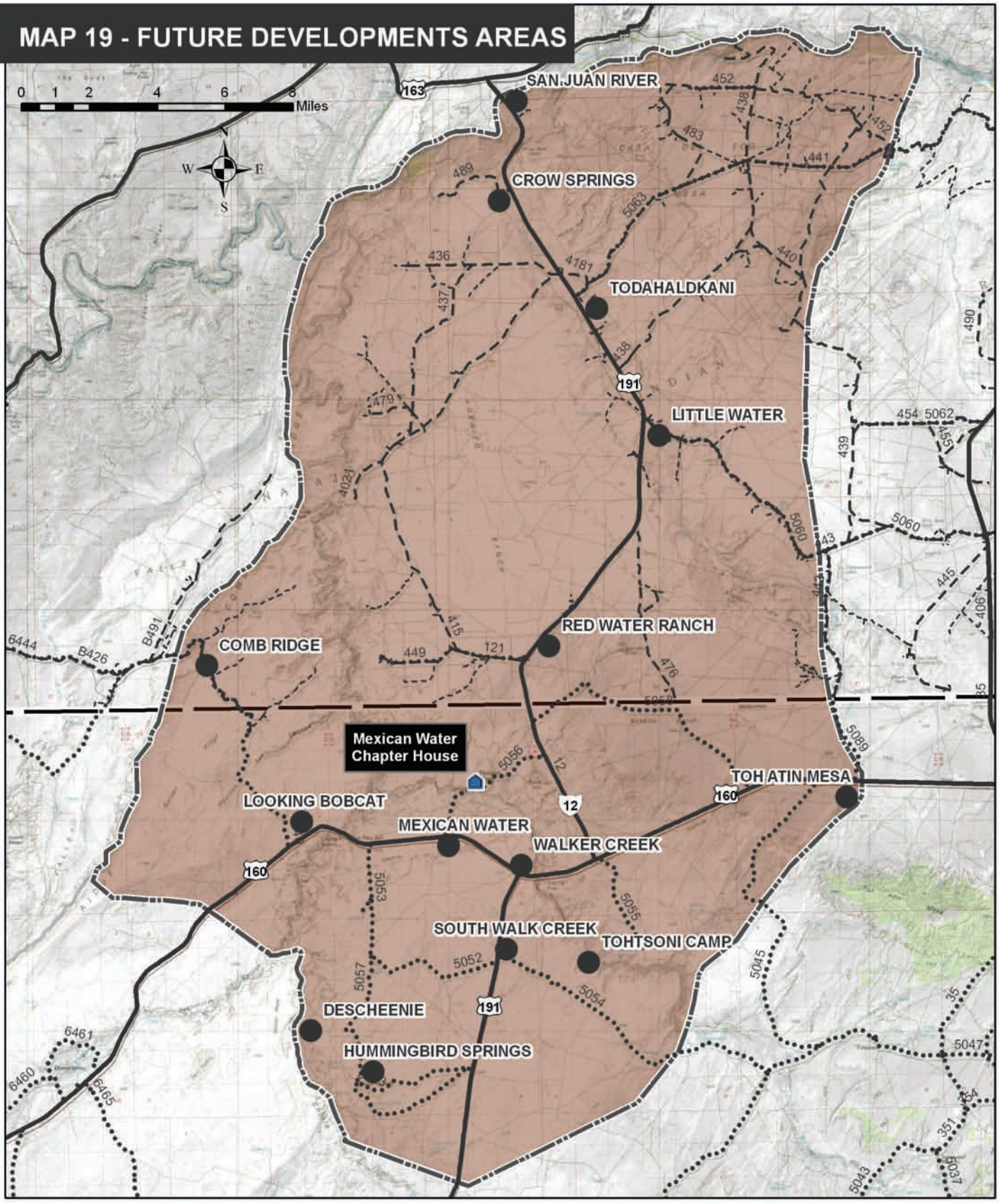
The planning work of the community has resulted in 14 different areas. These are listed in **TABLE 17** and graphically shown on **MAP 19**.

TABLE 17. FUTURE DEVELOPMENT AREAS

Number	Name	Development Type
1	San Juan River Development	Tourism & Recreation
2	Crow Springs Development	Farming, Recreation & Community Facilities
3	Todahaiddkani Development	Community Facilities & Commercial
4	Littlewater Development	Tourism
5	Red Water Ranch Development	Community Facilities, Commercial & Open Space
6	Toh Atin Mesa Development	Housing, Dam Installed & Traditional Site
7	Tohtsoni Camp Development	Farming
8	South Walker Spring Development	Housing
9	Hummingbird Springs Development	Housing, Farming & Community Facilities
10	Descheene Development	Farming & Tourism
11	Comb Ridge Development	Cultural & Tourism
12	Looking Bobcat Development	Commercial, Tourism, Farming & Museum
13	Mexican Water Development	Community Facilities & Commercial
14	Walker Creek Development	Commercial, Culture, Visitor & Tribute Facilities

The individual development areas and their proposed land uses are discussed below. Corresponding maps are also provided to help readers visualize the area being discussed.

MAP 19 - FUTURE DEVELOPMENTS AREAS



Legend

- Chapter House
- Planning Area
- Stateline

Roads

- Navajo Route (unpaved)
- Navajo Route (Paved)
- County Road (unpaved)
- Dirt Road
- U.S. Highway

- Future Development Areas

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JJ Clacs & Company

NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (image)

SAN JUAN RIVER DEVELOPMENT

Location

This development site is within the Bluff, 1:24,000 USGS quadrangle. It consists of one parcel along the south side of the San Juan River immediately east of Highway 191 in San Juan County, Utah **(MAP20-A)**.

Existing Conditions and Facilities

The area is currently undeveloped. Much of the nearby river bank is in Wildlife Zone 1, a highly sensitive animal and plant habitat, but only the development's northern edge overlaps into this zone. The development site is also in the Navajo Power site land designation. Uses in this area would be subject to regulations under this land status.

Immediately across the San Juan River lies a boat ramp and a picnic area that is part of the Sand Island campground and boat launching recreation areas administered by the Bureau of Land Management (BLM) along the San Juan River. The south side of the river is on the Navajo Nation. The Utah Department of Transportation (UDOT) right-of-way is a 250-foot corridor with 125 feet on each side of the bridge.

A housing area, an access road, and a water well are just south of the proposed development. There are no utilities on site, and access is directly off of Highway 191.

The site vicinity slopes downward to the north with elevations ranging from approximately 4420 to 4260 feet above mean sea level (amsl). **MAP 20-B** shows the site's soil regime, which primarily consists of Aquic Ustifluvents-Typic Fluvaquents association (AV) and Sheppard fine sand (ShD). The AV component is on the flood plain. Slopes are 0 to 3 percent. The parent material consists of mixed alluvium that is poorly drained. Water movement in the most restrictive layer is moderately high. Moderate amounts of water are available water to a depth of 60 inches. The ShD component is on dunes on structural benches. The parent

material consists of eolian deposits derived from sandstone, and they are excessively drained. Water movement in the most restrictive layer is high and available water is low to a depth of 60 inches. Shrink-swell potential is also low.

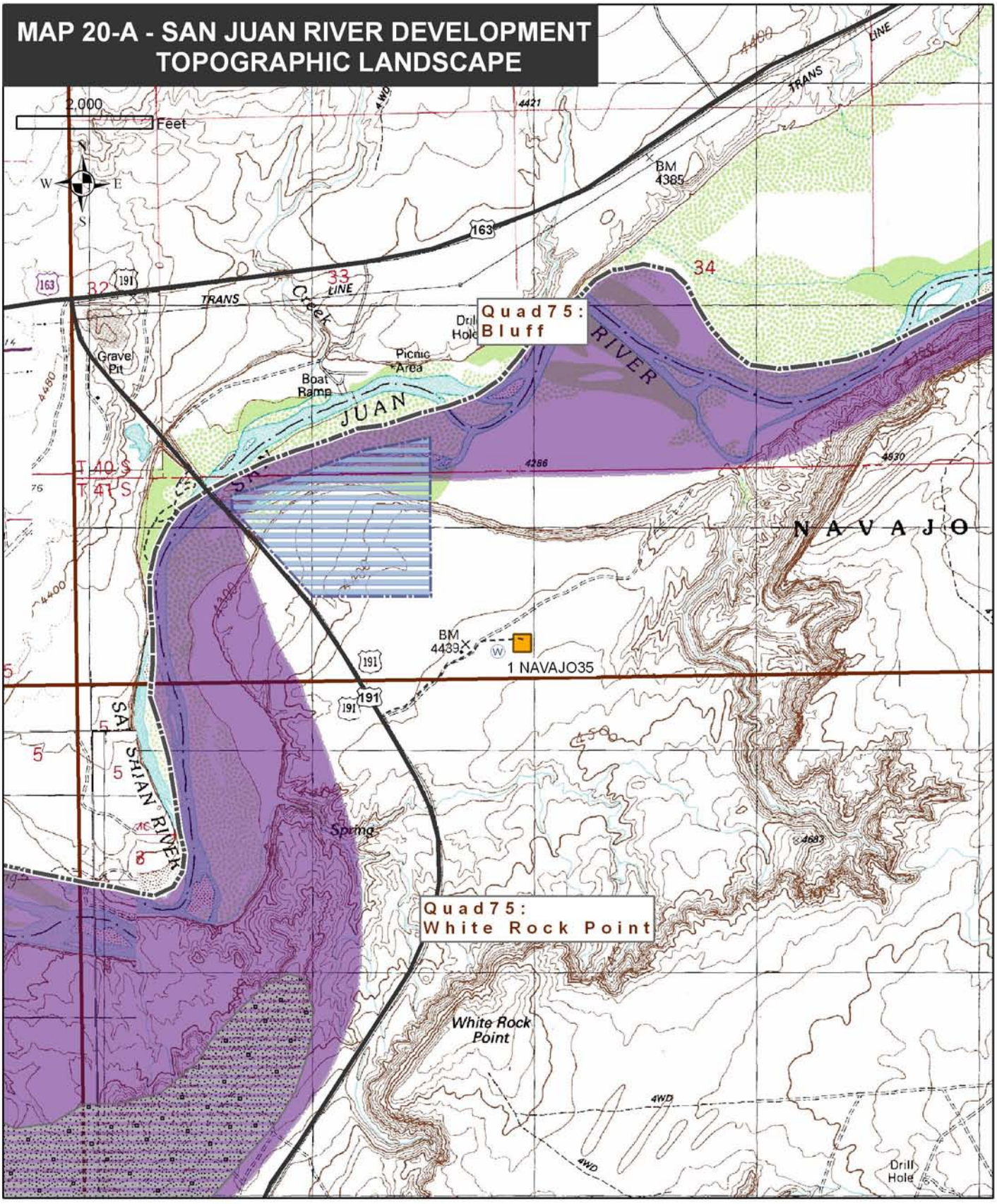
Opportunities

Recreation

A recreational facility such as additional campgrounds, a rafting launch pad, or a riverside park with trails would have a positive impact on the Nation's economy by generating tourist revenues. Costs for development would depend on the type of facilities proposed in a site design.

The site can be developed in such a way to incorporate the restrictions under the Zone 1 classification made by the NNDFWL.

MAP 20-A - SAN JUAN RIVER DEVELOPMENT TOPOGRAPHIC LANDSCAPE



Legend

Roads
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Water
- Electric

Existing Land_Use
- Residential
- Water Well

Proposed Land Use
- Recreation

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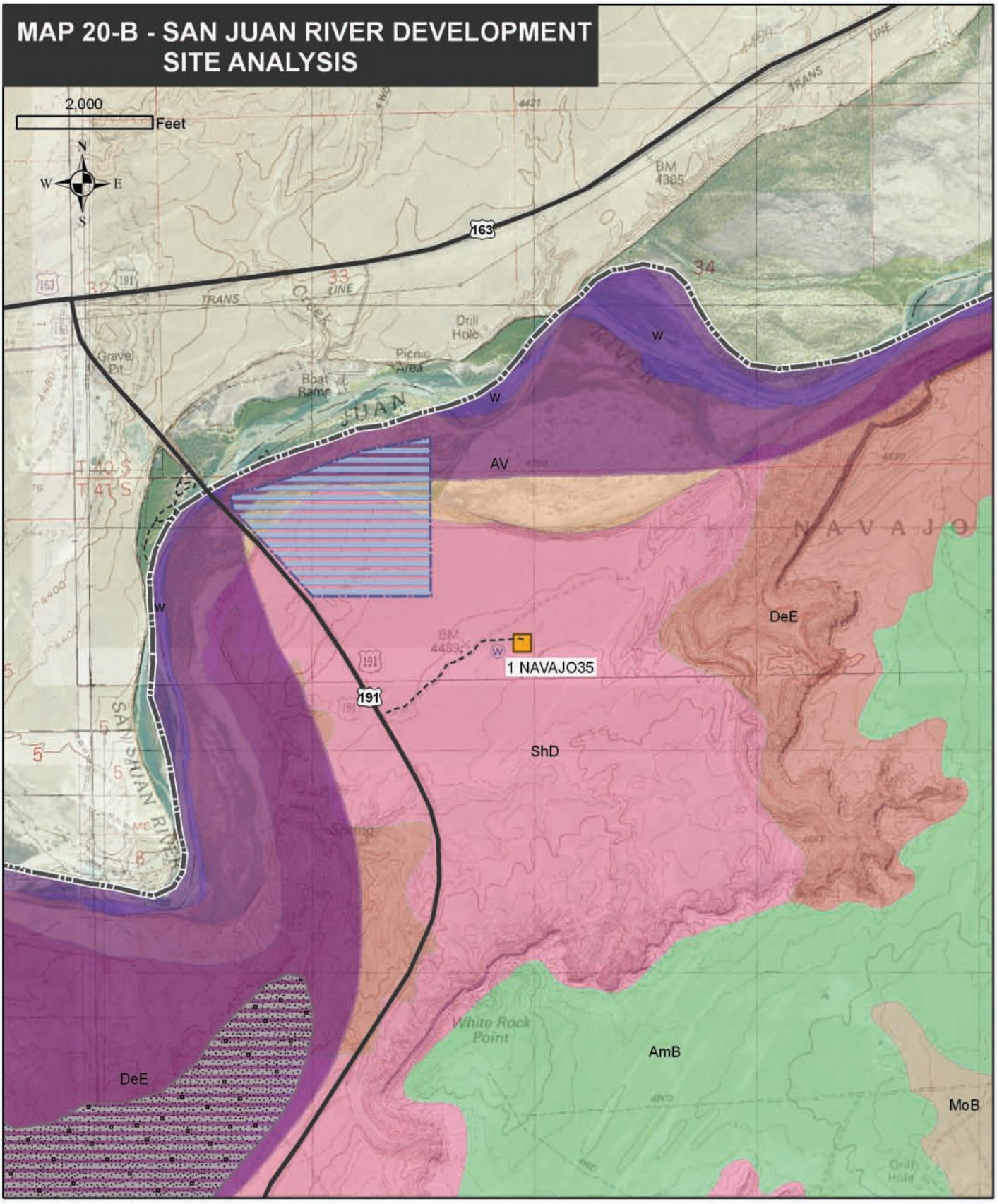
Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL, NRCS Pacificorp, Navajo Water Resources

MAP 20-B - SAN JUAN RIVER DEVELOPMENT SITE ANALYSIS



Legend

Roads
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Water
- Electric

Existing Land_Use
- Residential
- Water Well

Proposed Land Use
- Recreation

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Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL, NRCS Pacificorp, Navajo Water Resources

CROW SPRINGS DEVELOPMENT

Location

This site consists of five parcels on the San Juan Hill and White Rock Point 1:24,000 USGS quadrangles in San Juan County, Utah. Two of the parcels are large elongated areas immediately south of the San Juan River and west of Highway 191 **(MAP21-A)**. The other three parcels are to the south and situated around the White Rock compound

Existing Conditions and Facilities

Existing facilities within the White Rock compound is residential housing, White Rock Methodist Church, a spiritual retreat, shooting range and race track. The church is located at the west end while the spiritual retreat is along the highway. The shooting range is located on the east side of Highway 191 and the race track is located on the bend of County Road 489.

The area along the San Juan River is currently undeveloped and within Wildlife Zone 1, a highly sensitive animal and plant habitat. Additional locations proposed for development are south of the Wildlife Zone 1 along the highway. All areas of proposed development are easily accessed via Highway 191 and county and dirt roads. Existing power and water lines service residential housing and the White Rock Methodist Church just west of the highway. The development sites are within Navajo Trust land.

The San Juan River flanks the northern edge of the development site, and Gothic creek runs southeast along the western side of the existing church and housing facility. Numerous other small unnamed washes enter the area from the northeast and are likely to be dry most of the year.

Elevations in the vicinity range from approximately 4260 to 4600 amsl. **(MAP 21-B)** shows the site's soil regime, which primarily consists of Aneth (AnA) and Deleco loamy fine sands (DeE). These components are on flood plains. The parent material consists of eolian deposits derived from sandstone, and they are well drained. Water movement in the most restrictive layer is moderately high and is available water to a depth of 60 inches.

Opportunities

Community Facilities

A community facilities tract that supports the church and residences is proposed for the southwest corner of the compound.

Recreation

Two recreational areas are proposed for this area. One is north of the White Rock compound at the curve of county road 489. There is an existing BMX race track and the idea is to make this into a recreational park with a youth center and park.

Commercial

A 100 acre rectangular plot of land adjacent to the west side of Highway 191 will potentially provide an ideal location for the Utah Navajo Fair. There have been discussions about this so far.

Another commercial tract of land is located at the entrance into the compound. This tiny area is proposed for a gas station convenience store or a truck stop.

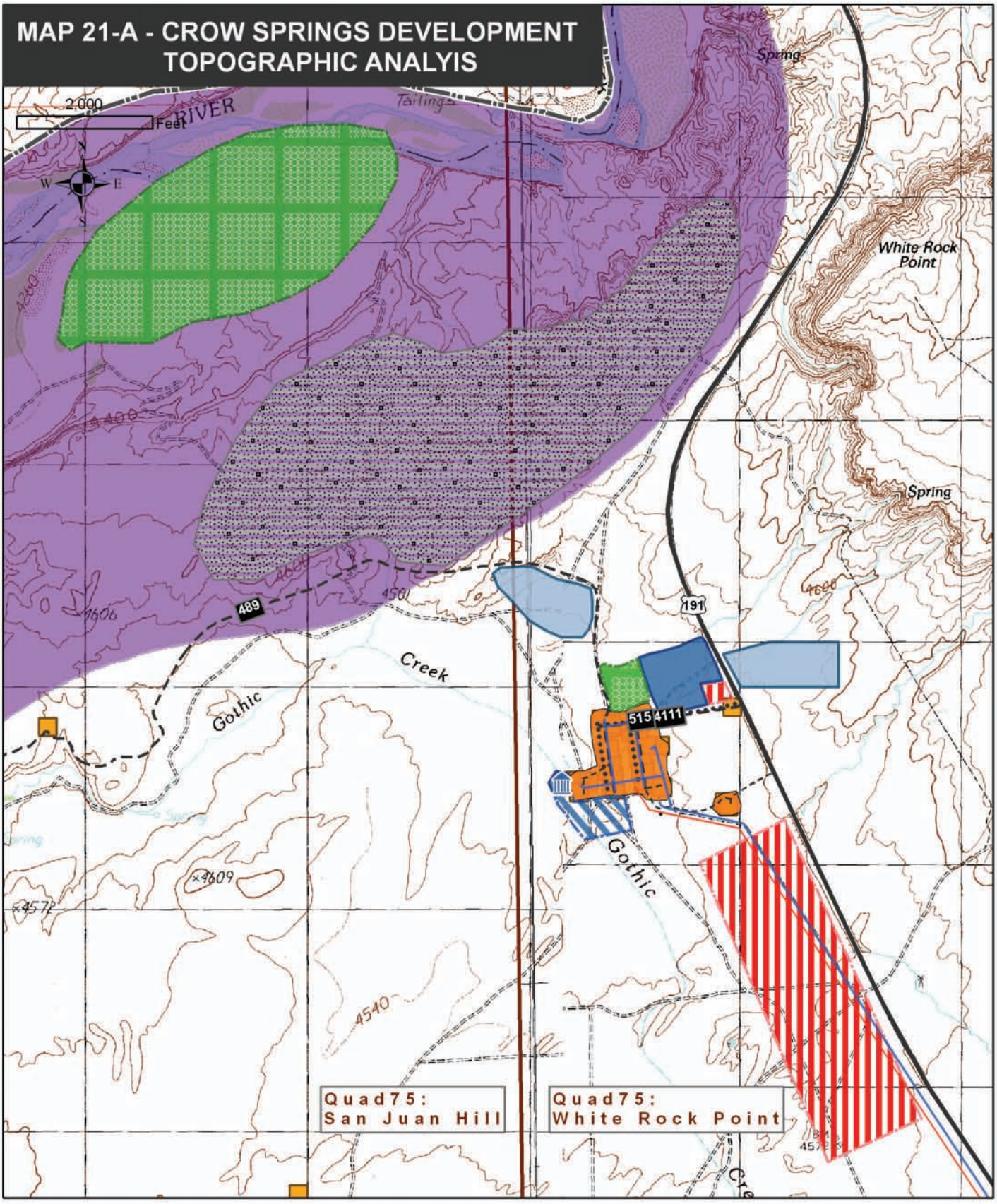
Farming

Two farming plots are proposed. One is located immediately south of the San Juan River and west of Highway 191. The other includes approximately 80 acres adjacent to the northern edge of the existing housing development. Farming will generate income from products that could be sold locally at markets and across the states. The investment to develop the farming area primarily lies in implementing traditional farming and sustainable practices.

Industrial

A gravel source is proposed for the area along the ridge. This area is within Wildlife Zone 1; however, steps have been taken to work with NDFWL. Some gravel has already been taken from this area in the past

MAP 21-A - CROW SPRINGS DEVELOPMENT TOPOGRAPHIC ANALYIS



Legend

Roads
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Water
- Electric

Existing Land_Use
- Residential
- Community Facilities
- Recreation

Proposed Land Use
- Community Facilities
- Commercial
- Industrial
- Farming

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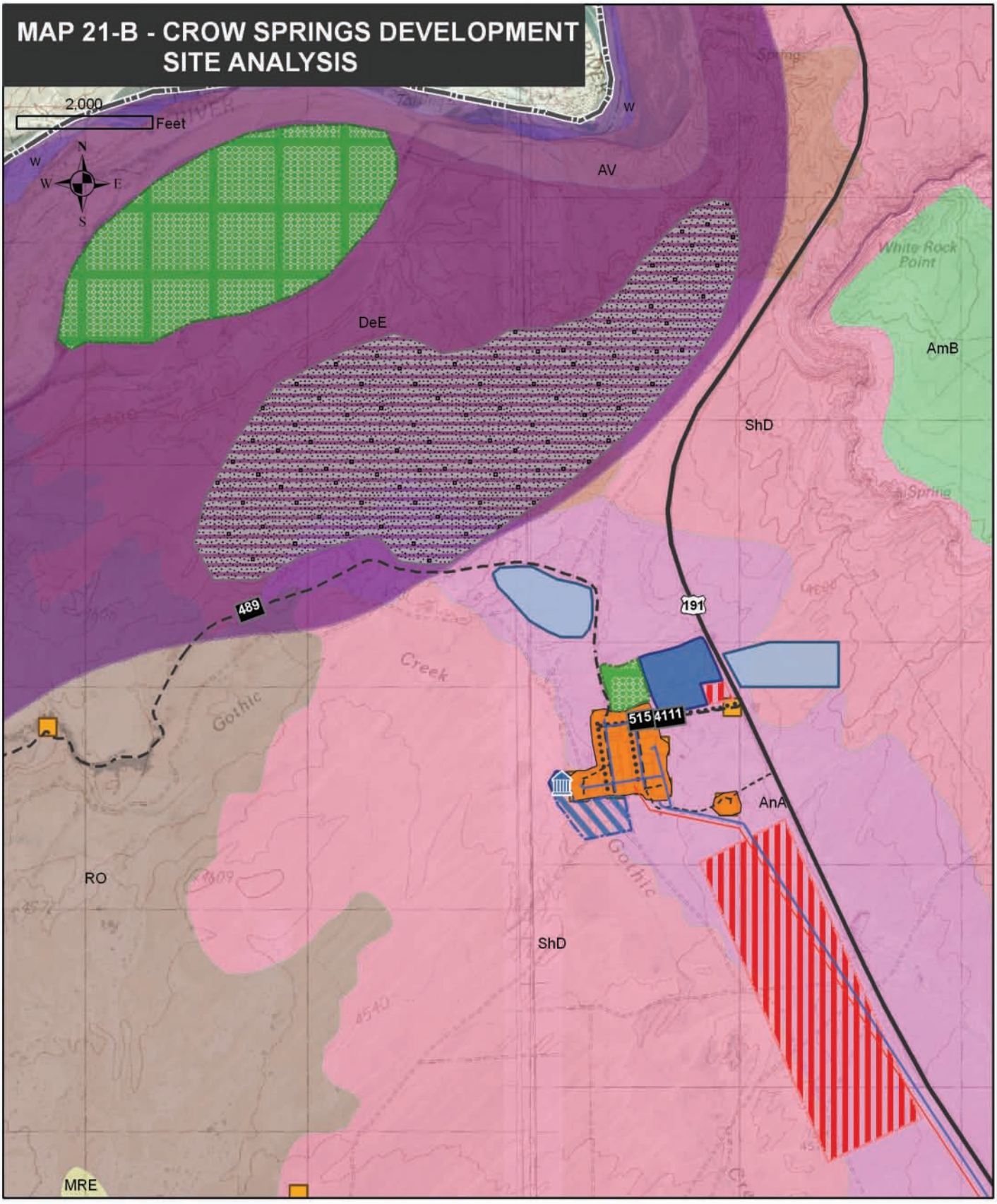
Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL, Pacificorp

MAP 21-B - CROW SPRINGS DEVELOPMENT SITE ANALYSIS



Legend

Roads
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Water
- Electric

Existing Land_Use
- Residential
- Community Facilities
- Recreation

Proposed Land Use
- Community Facilities
- Commercial
- Industrial
- Farming

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Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL, Pacificorp

TODAHAIDDKANI DEVELOPMENT

Location

This proposed development site consists of three parcels situated on the White Rock Point 1:24,000 USGS quadrangle adjacent to the east side Highway 191 and south of County Road #441 in San Juan County, Utah **(MAP 22-A)**.

Existing Conditions and Facilities

The three parcels are in an area with a considerable amount of existing development. Both water and power lines as well as ample transportation corridors provide infrastructure for many local families. A Head Start facility is currently adjacent to the southernmost parcel. A traditional site sits between the proposed commercial development and the community facility. The entire planned development is in the Tohonadla Oil Field. Although the oil field is considered active, it is not producing oil at this time, leaving the many oil and gas wells in the area still and the pipeline that parallels the highway empty.

Elevations in the vicinity range from approximately 4600 to 4700 amsl. **MAP 22-B** shows the site's soil regime, which primarily consists of Sheppard fine sand (ShD). This component is on dunes on structural benches. The parent material consists of eolian deposits derived from sandstone, and they are excessively drained. Water movement in the most restrictive layer is high and available water is low to a depth of 60 inches. Shrink-swell potential is also low.

Opportunities

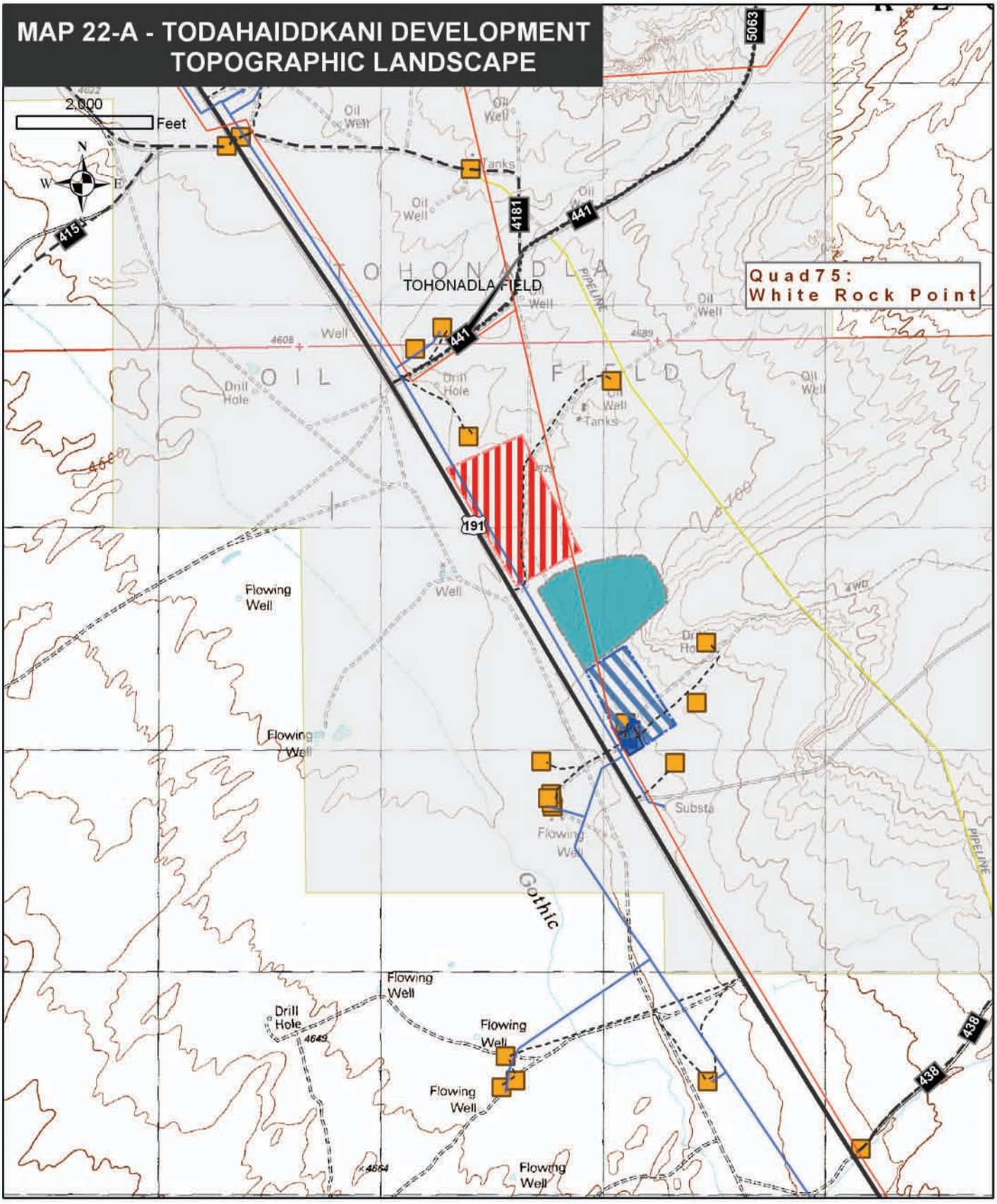
Commercial

This area has unlimited opportunities. This is also a potential site for a truck stop or other high power user. A three phase and single phase powerline extends into this area.

Community Facilities

This development site is actually part of an existing building that houses the Head Start program. Additional community facilities can be located within this area.

MAP 22-A - TODAHAIDDKANI DEVELOPMENT TOPOGRAPHIC LANDSCAPE



Legend

Roads
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Water
- Electric

Existing Land_Use
- Residential
- Community Facilities
- Traditional Site

Proposed Land Use
- Commercial

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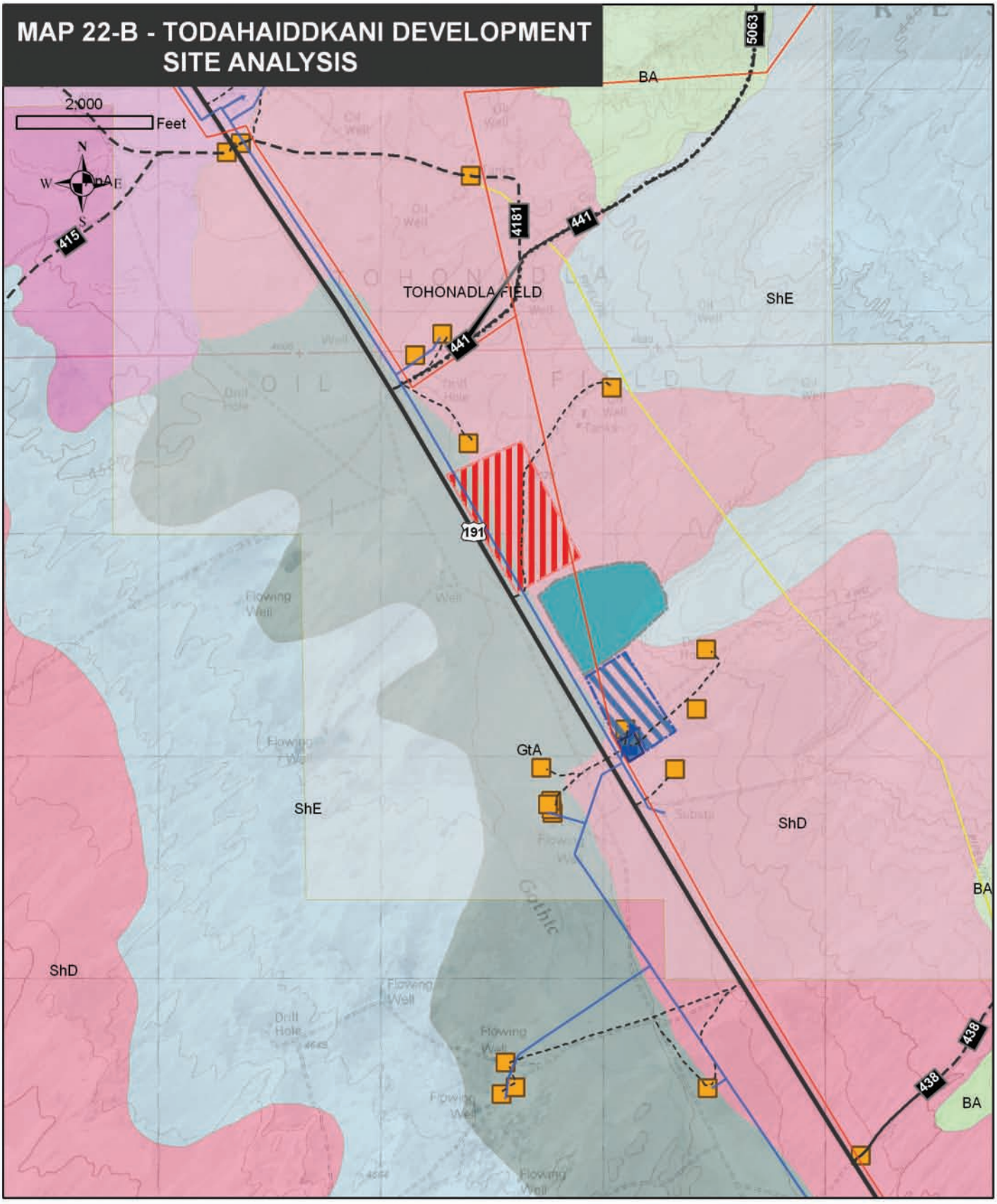
Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL, Pacificorp

MAP 22-B - TODAHAIDDKANI DEVELOPMENT SITE ANALYSIS



Legend

Roads
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Water
- Electric

Existing Land_Use
- Residential
- Community Facilities
- Traditional Site

Proposed Land Use
- Commercial

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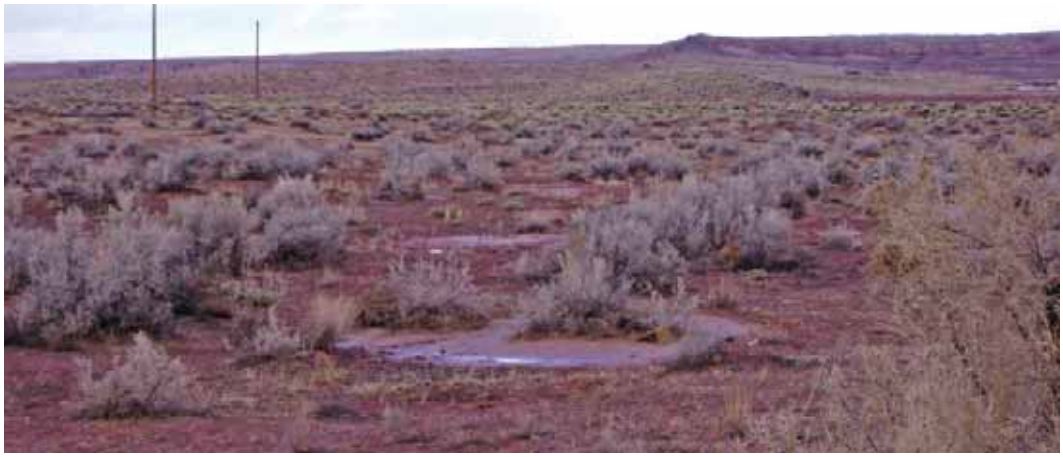
Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL, Pacificorp



LITTLEWATER DEVELOPMENT

Location

This prospective development consists of two separate parcels. One parcel spans the White Rock Point and Hogan Mesa (1:24,000) USGS quadrangles and the other parcel is on the Boundary Butte-UT (1:24,000) USGS quadrangle **(MAP 23-A)**. This development is located in San Juan County, Utah.

Existing Conditions and Facilities

Although currently accessible via a dirt road, the White Rock Point parcel is approximately three miles northeast of Highway 191 and County Road 443/5060 in a relatively remote area. The landscape within the parcel is well dissected with runoff channels that funnel water off a northwest-southeast trending escarpment.

The Boundary Butte-UT parcel is adjacent to the east side of Highway 191 and just south of the juncture of the highway and County road 443/5060. Many homes dot the landscape and are serviced by ample power and water lines. The parcel is easily accessible from Highway 191, the county road, and a dirt road to its southeast.

Elevations in the vicinity range from approximately 4500 to 5000 amsl. **MAP 23-B** shows the site's soil regime, which primarily consists of Gotho soils (GtA) along the highway and Mota loamy fine sand (MoB) at the base of Hogan Mesa. Gotho soils are on valleys and the parent material consists of alluvium derived from sedimentary rock. The natural drainage class for Gotho soils is well drained and water movement in the most restrictive layer is moderately low. Shrink-swell potential is moderate. Mota loamy fine sands are found on structural benches with parent material consisting of eolian deposits derived from sandstone. Mota sands are well drained and water movement in the most restrictive layer is high while available water to a depth of 60 inches is moderate. Shrink-swell potential is also low. The higher elevations of the mesa are badland (BA).

Opportunities

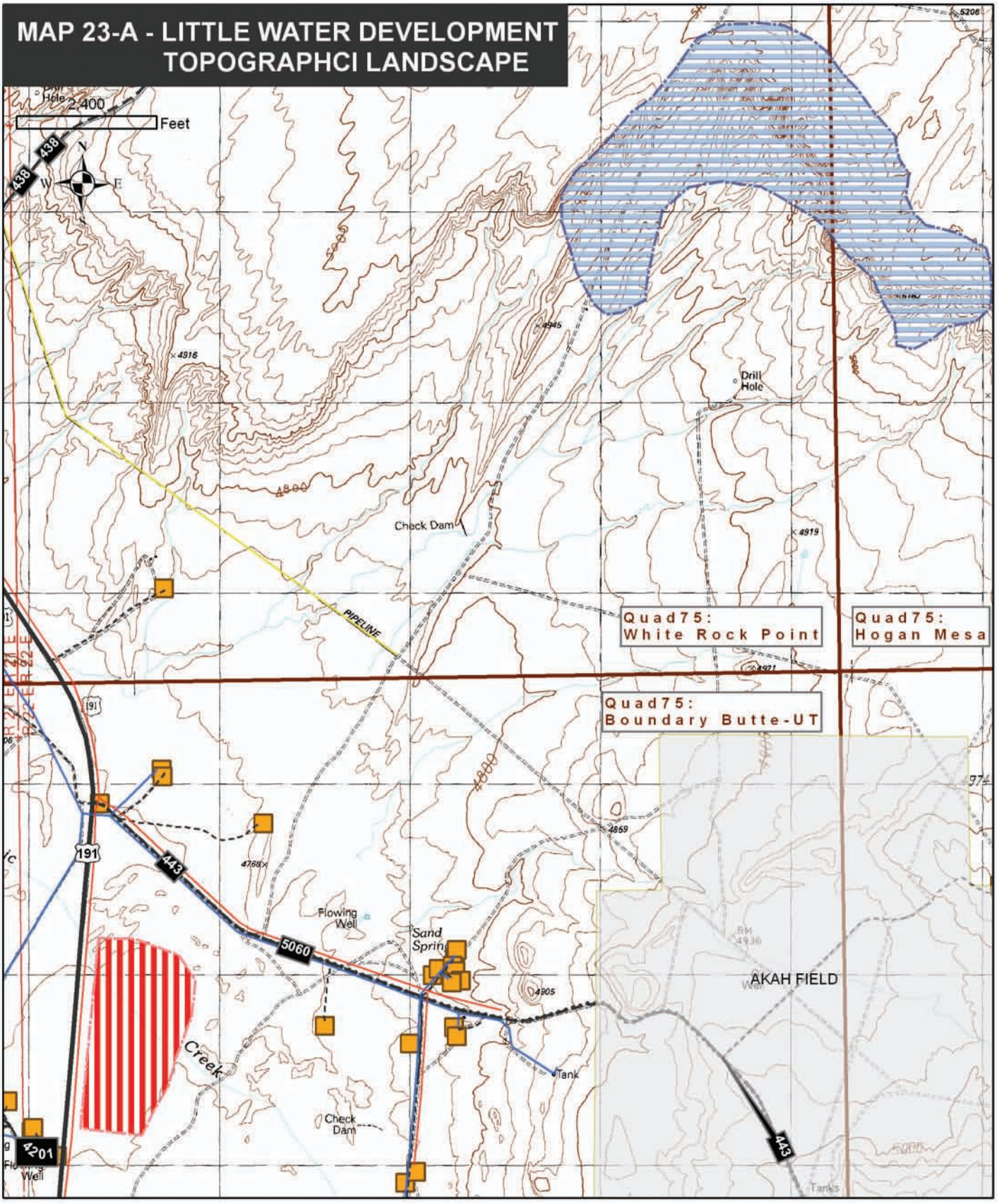
Commercial

Commercial development in the proposed areas is ideal because of the existing infrastructure and the prime location with beautiful natural resources and access to roads. Potential commercial uses include hiking trails in the White Rock Parcel and other tourist type businesses that support the trails. The community believes that the views and beauty of the area will be a strong attraction for tourism.

Recreation/Cultural

The community can enjoy and appreciate the treasures within its boundaries. In particular, in the Hogan Mesa are many beautiful sites and there are Anazazzi sites and dinosaur tracks to explore. Outside visitors will also be interested in visiting this special area.

MAP 23-A - LITTLE WATER DEVELOPMENT TOPOGRAPHCI LANDSCAPE



Legend

Roads
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Water
- Electric

Existing Land_Use
- Residential

Proposed Land Use
- Commercial
- Recreation

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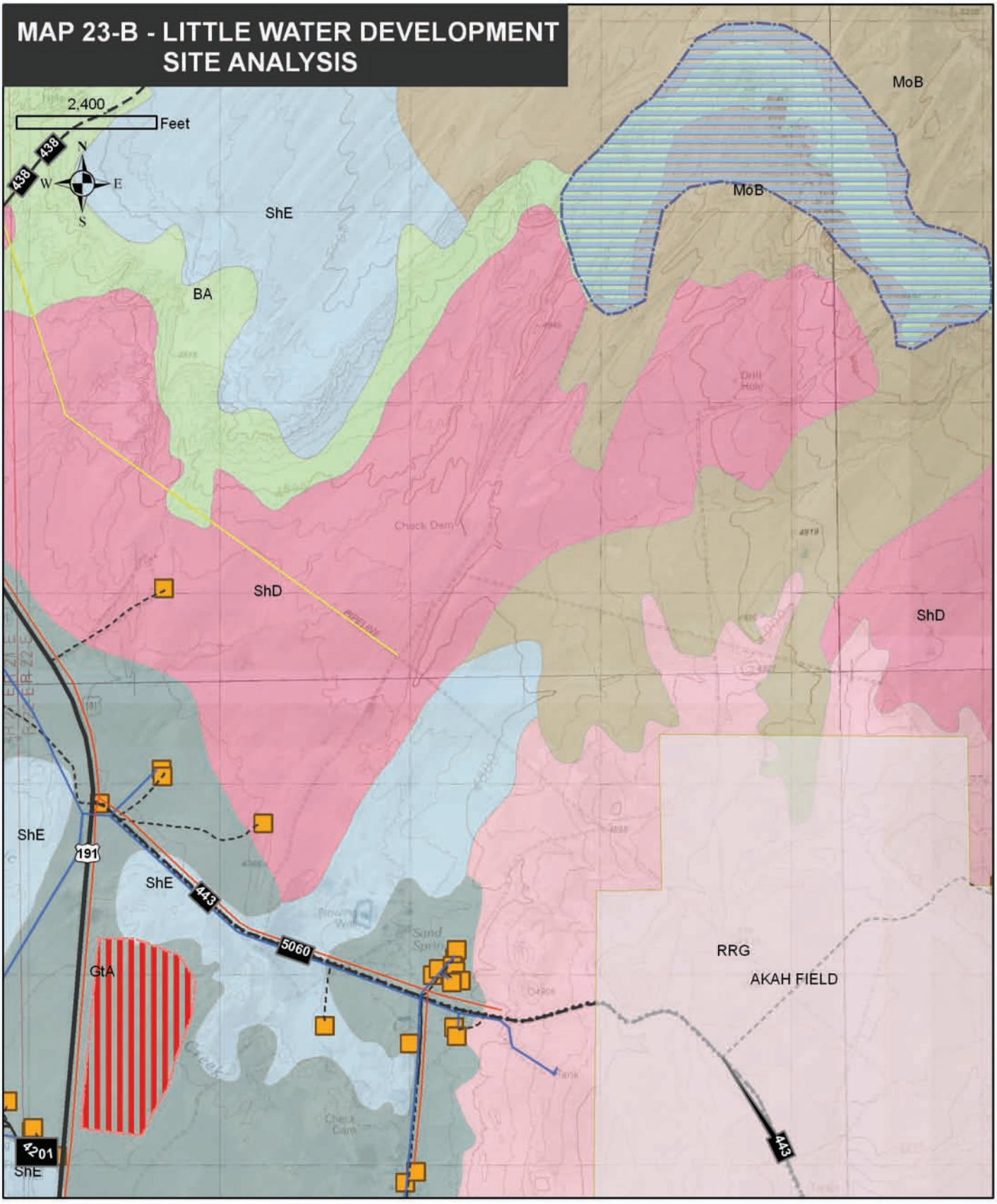
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL, Pacificorp

MAP 23-B - LITTLE WATER DEVELOPMENT SITE ANALYSIS



Legend

Roads
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Water
- Electric

Existing Land_Use
- Residential

Proposed Land Use
- Commercial
- Recreation

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Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL, Pacificorp

RED WATER RANCH DEVELOPMENT

Location

This development site is located on the Boundary Butte-UT (1:24,000) USGS quadrangle adjacent to the southern side of Highway 191 just north of County Road #449 **(MAP 24-A)**. This site is located in San Juan County in Utah.

Existing Conditions and Facilities

The proposed Red Water Ranch development area is situated in a well developed area with numerous homes serviced by both water and power lines. The area is also easily accessed via Highway 191. A traditional site is immediately north of the road across from the proposed development.

Elevations in the vicinity range from approximately 5100 to 5200 amsl. **MAP 24-B** shows the site's soil regime, which primarily consists of Mota loamy fine sand (MoB) in the proposed development on the east side of the highway. This component is on structural benches with parent material consisting of eolian deposits derived from sandstone. Mota sands are well drained and water movement in the most restrictive layer is high while available water to a depth of 60 inches is moderate. Shrink-swell potential is also low.

Opportunities

Community Facilities

The new chapter house is proposed within this 50 acre tract. The community has concepts regarding developing this into a multipurpose center where the facility could be used for a chapter house as well as a conference center. A conceptual drawing is presented in **MAP 24-C**. Further, meetings by other chapters could be held at this facility. By establishing this center with multi purposes in mind, it could be used for meetings and/or retreats by the Navajo Nation, other organizations, and outside companies. The site would be appealing not only because of the facility, but also because of the great views in the surround area.

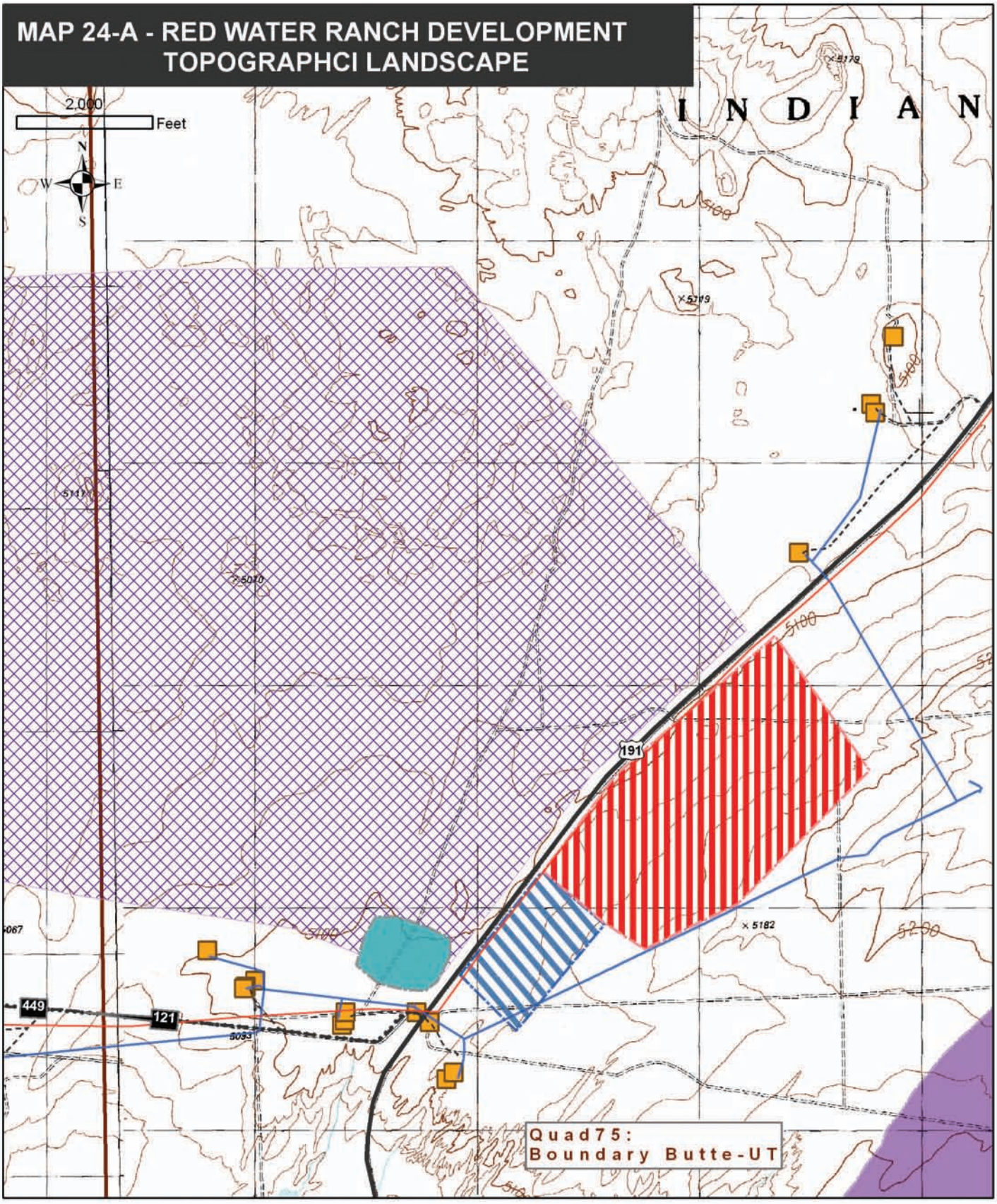
Commercial

Within the proposed area, the community believes that the commercial site could be used for supporting facilities such a bed and breakfast or other tourist related development.

Open Space

Open space is important to the well-being of communities. The families within this community recognize the value of such spaces and intend to preserve the designated area as open space to protect existing vegetation

MAP 24-A - RED WATER RANCH DEVELOPMENT TOPOGRAPHCI LANDSCAPE



Legend

Roads
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Water
- Electric

Existing Land_Use
- Residential,
- Traditional Site

Proposed Land Use
- Community Facilities
- Commercial
- Open Space

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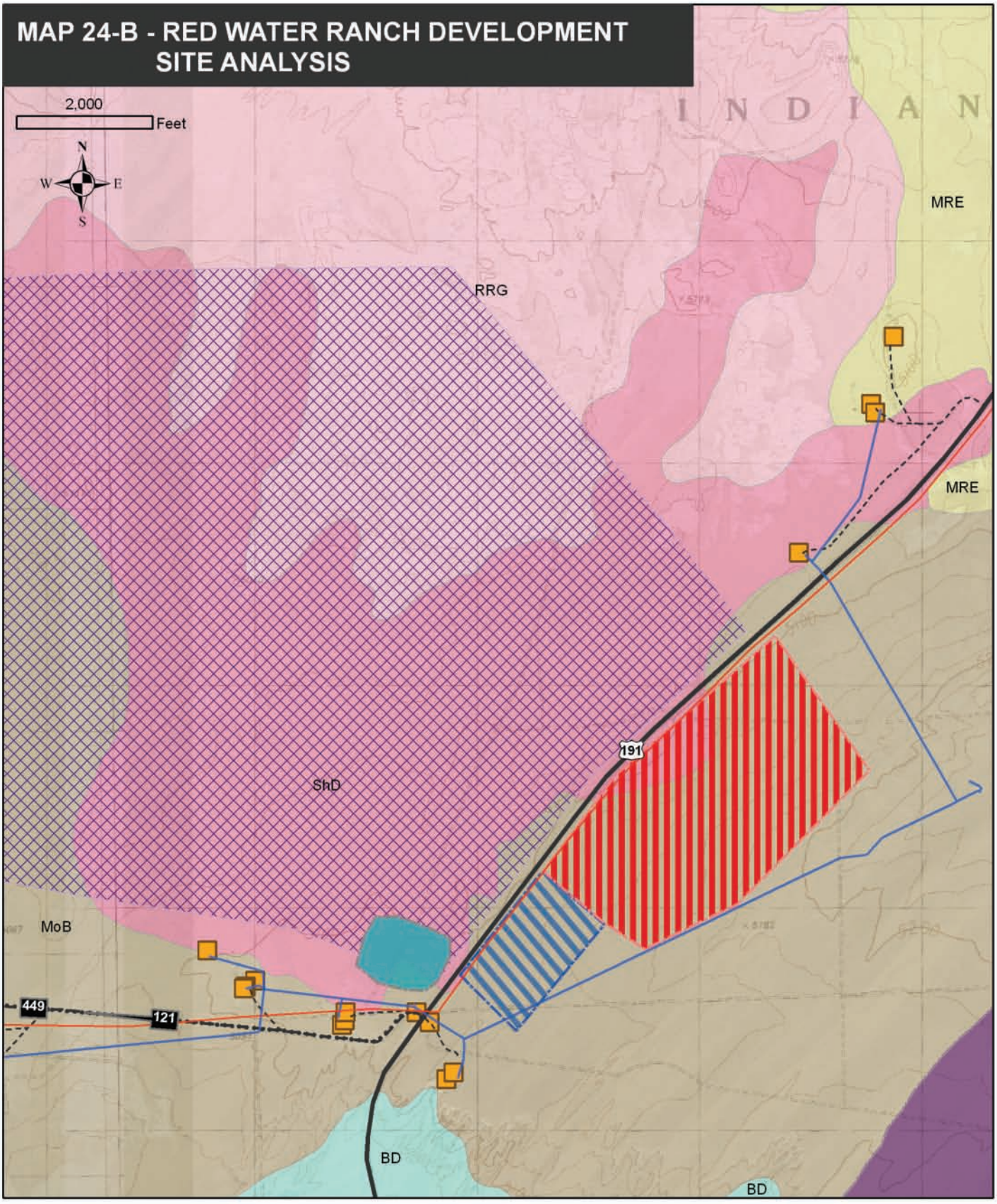
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL, Pacificorp

MAP 24-B - RED WATER RANCH DEVELOPMENT SITE ANALYSIS



Legend

Roads
- County Road (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Water
- Electric

Existing Land_Use
- Residential,
- Traditional Site

Proposed Land Use
- Community Facilities
- Commercial
- Open Space

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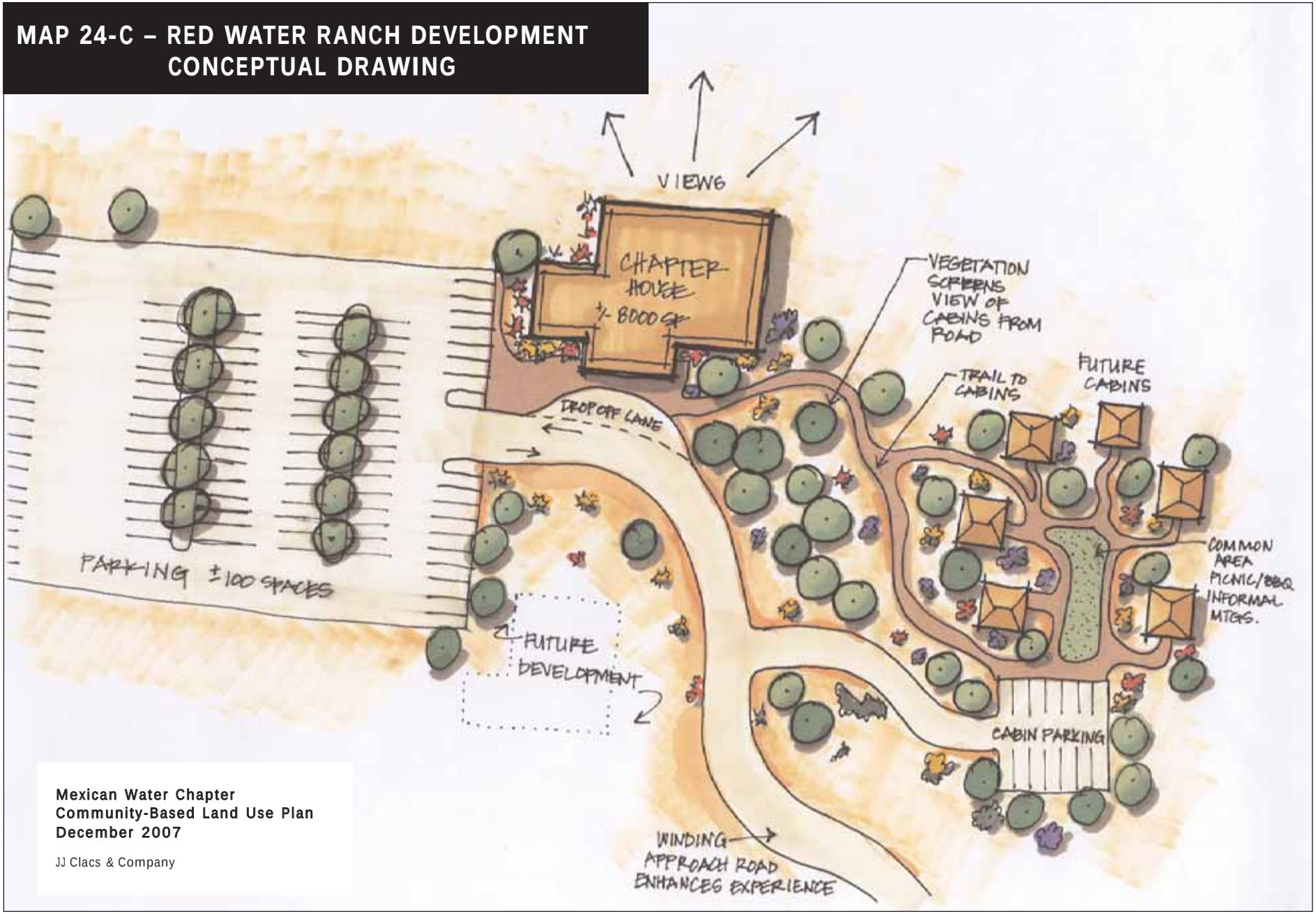
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL, Pacificorp

MAP 24-C – RED WATER RANCH DEVELOPMENT CONCEPTUAL DRAWING



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TOH ATIN MESA DEVELOPMENT

Location

Toh Atin Mesa development consists of three small parcels in the Toh Atin Mesa West (1:24,000) USGS quadrangle just south of Highway 160 along Navajo Route 5089 **(MAP 25-A)**. This site is located in Apache County in Arizona.

Existing Conditions and Facilities

This prospective planning unit is in an area that has some residential housing but is more strongly characterized by the presence of a 540 kv transmission line paralleling Highway 160. Water lines extend to the three homes near the planning parcels, and numerous dirt roads and county roads provide adequate access to the area. A windmill and a water tank are roughly one mile north, and a levee runs northeast-southwest past the planning units.

Sand Creek also runs through the area, which is characterized by floodplains to the north and elevation increase of 300-500 feet to the west, northwest, and southeast.

MAP 25-B shows the site's soil regime, which primarily consists of Aneth loamy fine sand (510) in the proposed housing development area. This soil is somewhat excessively drained. The depth to the restrictive layer is greater than 60 inches. Available water to a depth of 60 inches is moderate. Shrink-swell potential is also low.

Opportunities

Housing

The housing area is located in the eastern part of the planning area along Highway 191. Approximately 50 acres has been designated for community facilities. The families want to make their area more livable and safe.

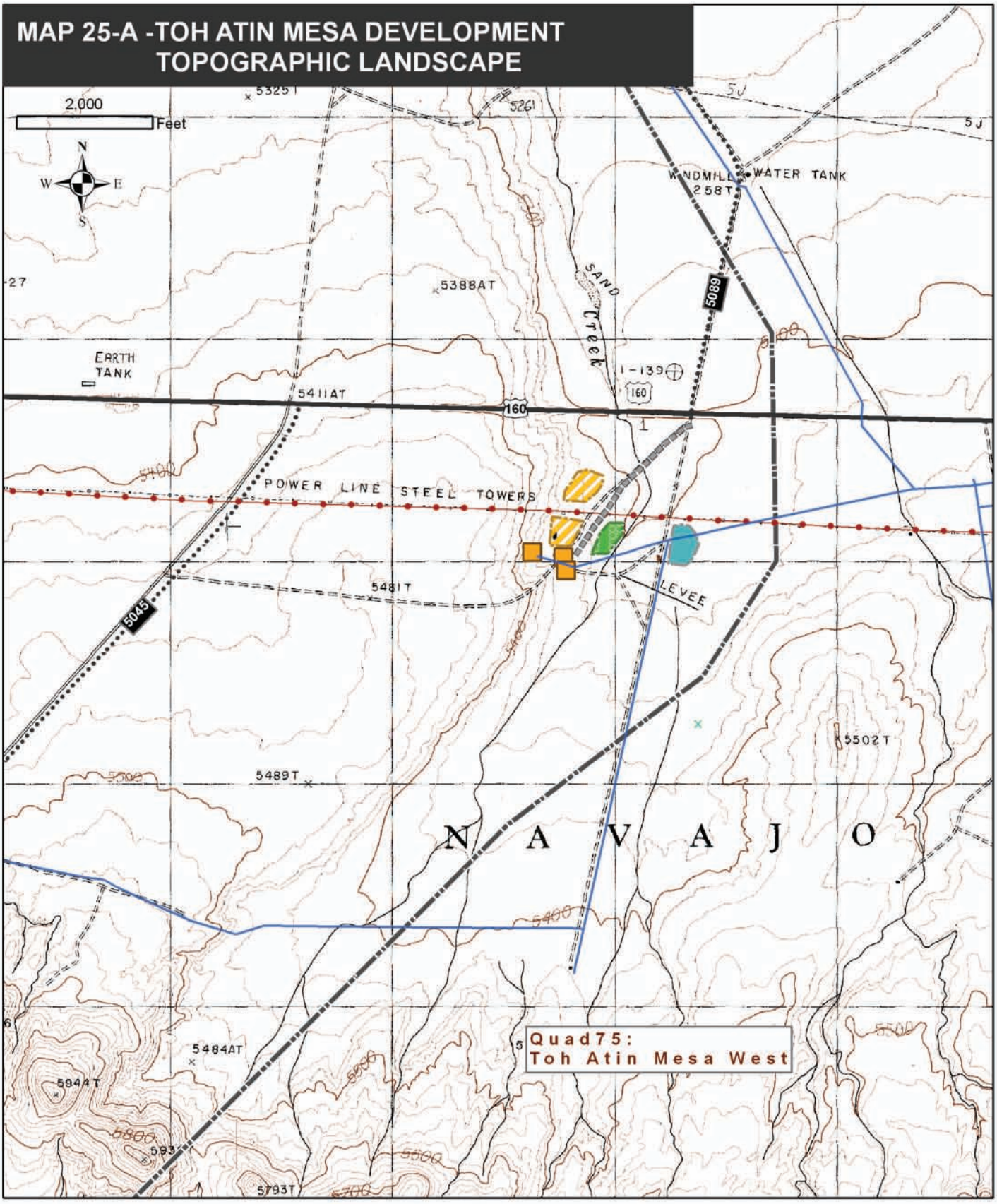
Dam Installed

Flooding during periods of high rain can occur in the area. A dam would help control the water flow and allow the families to access their home when there is excessive water run off in the area.

Traditional Site

To maintain the culture and traditions of the community, there is an area identified for traditional uses. The community intends to preserve this area.

MAP 25-A -TOH ATIN MESA DEVELOPMENT TOPOGRAPHIC LANDSCAPE



Legend

Roads
- Navajo Route (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Water

Existing Land_Use
- Residential,
- Traditional Site

Proposed Land Use
- Residential
- Farming
- Road Improvement

- Power Tranmission Line

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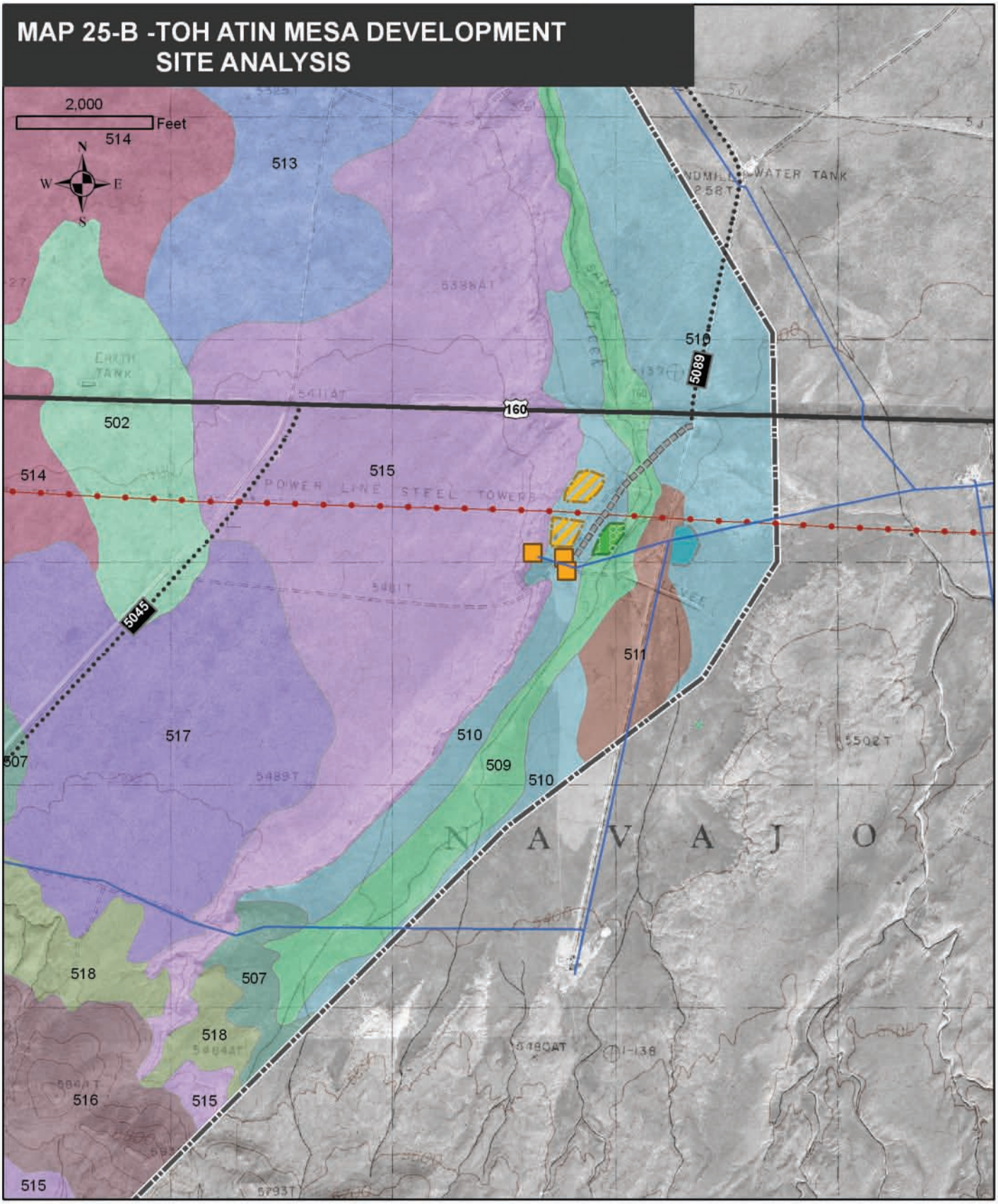
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL

MAP 25-B -TOH ATIN MESA DEVELOPMENT SITE ANALYSIS



Legend

Roads
- Navajo Route (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Water

Existing Land_Use
- Residential,
- Traditional Site

Proposed Land Use
- Residential
- Farming
- Road Improvement

- Power Tranmission Line

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Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL

TOHTSONI CAMP DEVELOPMENT

Location

Two irregular shaped parcels comprise this prospective development **(MAP 26-A)**. The northern most of these is entirely in the Walker Creek Reservation (1:24,000) USGS quadrangle. The other lies primarily in the Walker Creek Reservation quadrangle but slightly extends south into the Hogansaani Spring (1:24,000) USGS quadrangle. Tohtsoni Camp is located in Apache County, Arizona.

Existing Conditions and Facilities

The northern most parcel is within the NDFWL Wildlife Zone 1 just southwest of Walker Creek and south of Window Rock. Rugged terrain and steep slopes characterize the area, but the parcel lies in a low flat area next to the creek. A single home is southwest of the parcel and is accessed by a dirt road from the south. The southern most parcel that spans the Walker Creek Reservation and the Hogansaani Spring quadrangles is on a terrace overlooking the creek to the north, 200 feet below. A residence is located approximately 1.2 mile south, which is accessed via a dirt road.

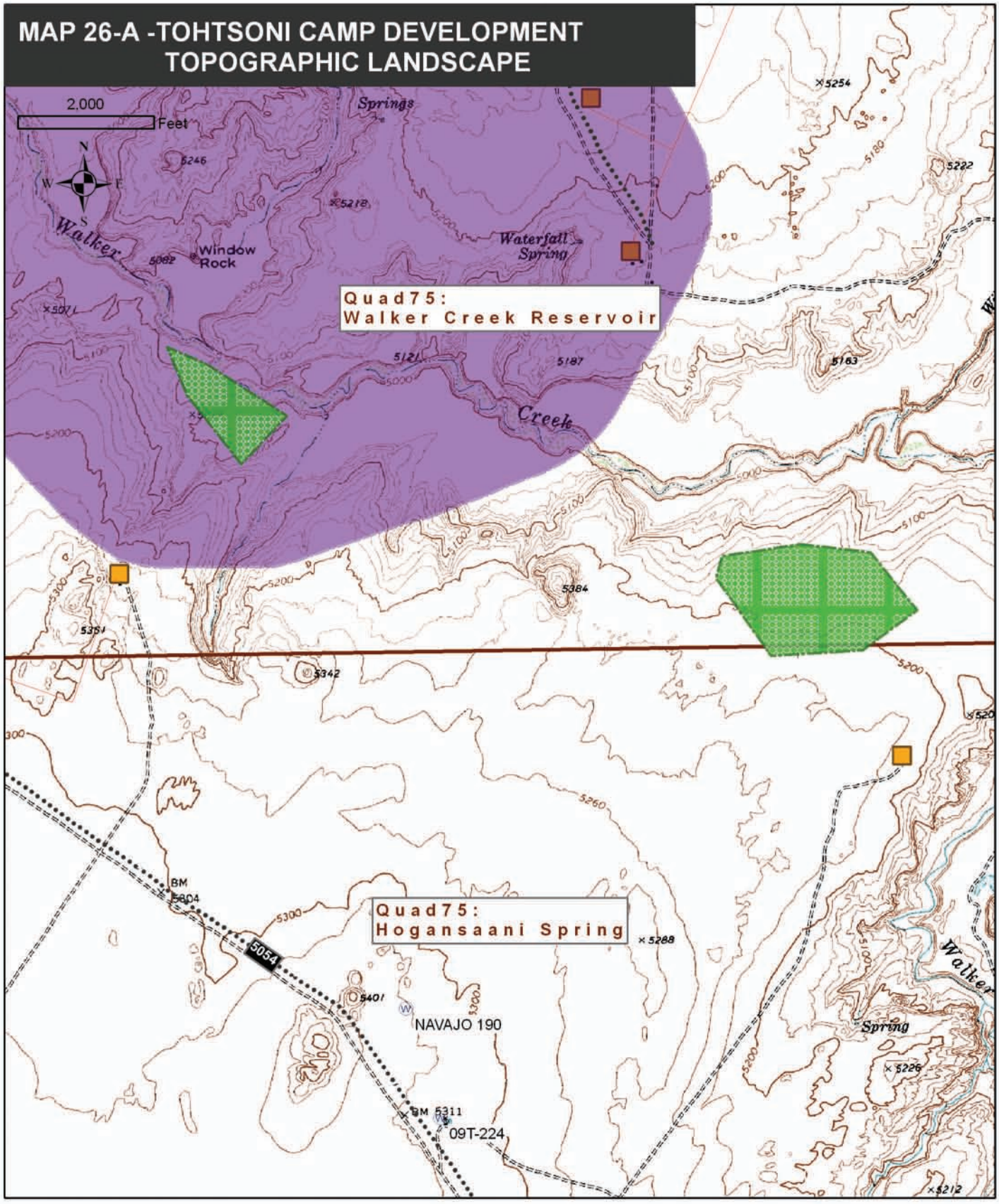
Elevations in the vicinity range from approximately 5000 to 5100 amsl. **MAP 26-B** shows the site's soil regime, which primarily consists of Shumbegay loamy fine sand (519) in the proposed farming development area. This soil is somewhat excessively drained. The depth to a restrictive feature is greater than 60 inches. Available water to a depth of 60 inches is low. Shrink-swell potential is also low.

Opportunities

Farming

The families within this area wish to reestablish farming. Farm products could be used to sustain the families and could also be sold at the local market

MAP 26-A -TOHTSONI CAMP DEVELOPMENT TOPOGRAPHIC LANDSCAPE



Legend

Roads
- Navajo Route (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Electric

Existing Land_Use
- Residential,
- Zone 1

Water Well

Proposed Land Use
- Farming

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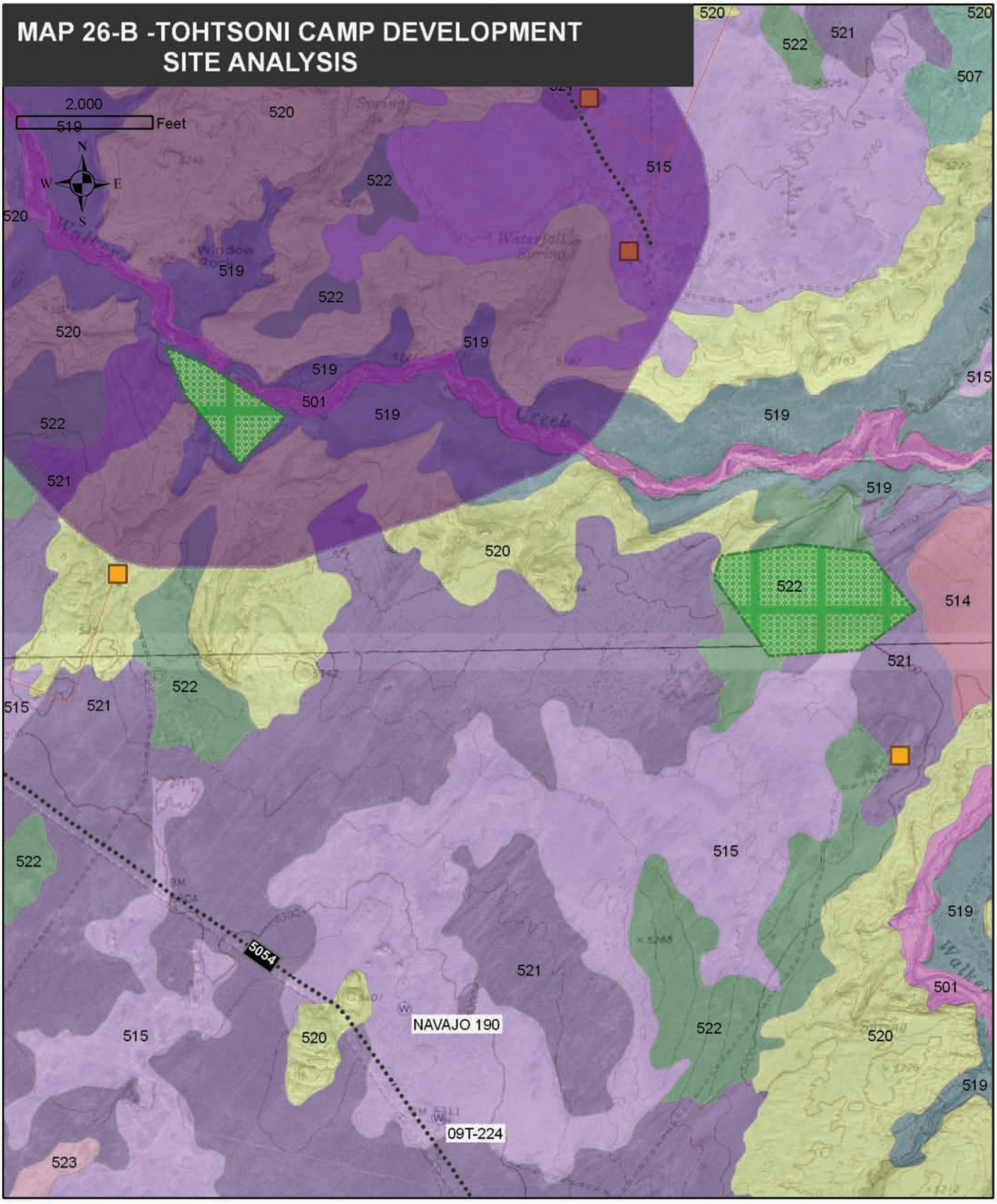
Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL

MAP 26-B -TOHTSONI CAMP DEVELOPMENT SITE ANALYSIS



Legend

Roads
- Navajo Route (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Electric

Existing Land_Use
- Residential,
- Zone 1

(W) Water Well

Proposed Land Use
- Farming

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Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL

SOUTH WALKER SPRING DEVELOPMENT

Location

This potential development is on the Walker Creek Reservoir and Mexican Water (1:24,000) USGS quadrangles in Apache County, Arizona **(MAP 27-A)**.

Existing Conditions and Facilities

Adjacent to the east side of Highway 191 and just north of County Roads 5052 and 5054, the planning area has several existing residential units both north and south. Powerlines traversing the area provide electricity to the homes, and they area easily accessed by a number of dirt and county roads as well as the highway. Gentle slopes characterize the terrain with elevation increasing to the south.

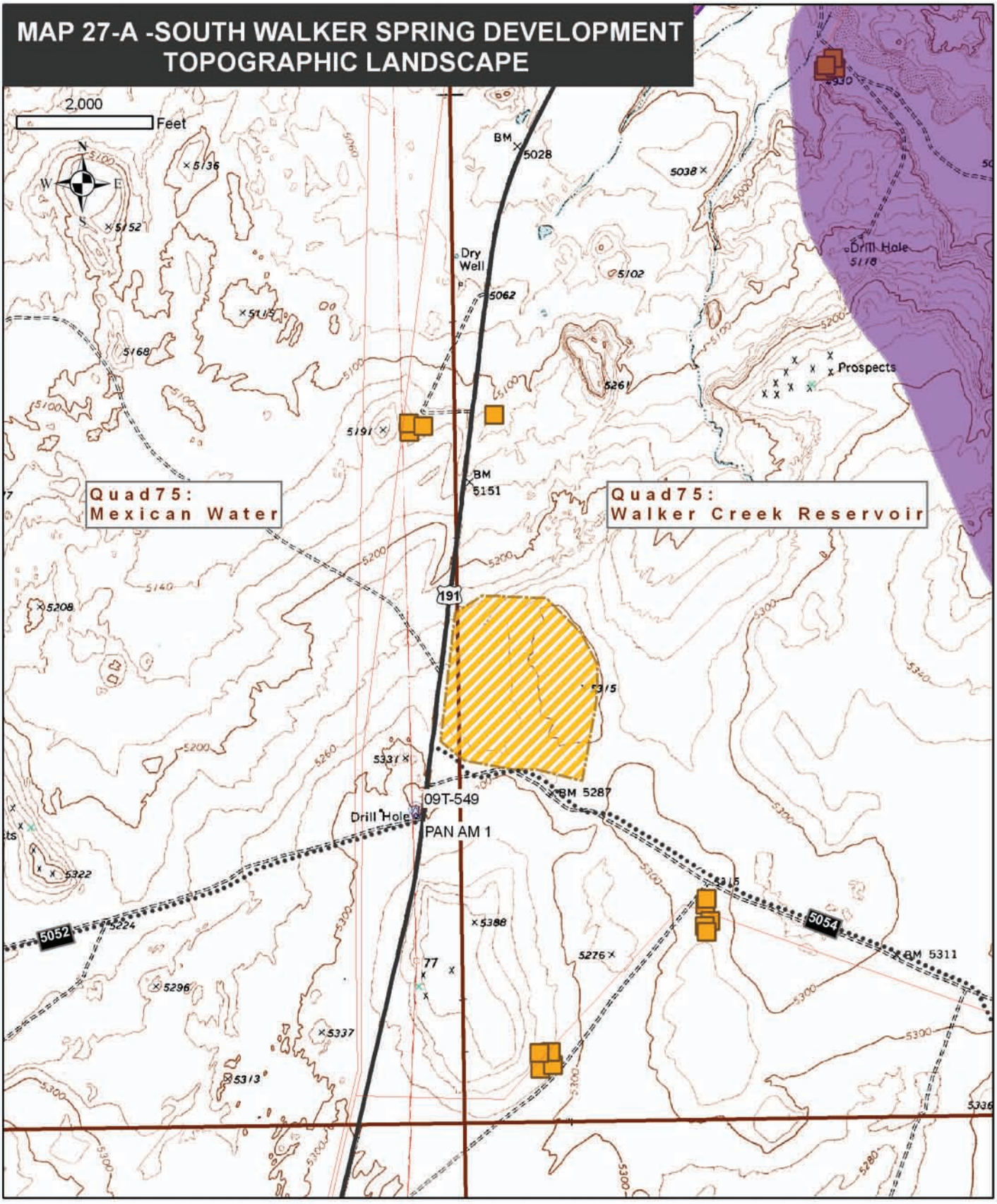
Elevations in the vicinity range from approximately 5220 to 5315 amsl. **MAP 27-B** shows the site's soil regime, which primarily consists of Piute-Bluechief-Rock outcrop complex (515) and Rock outcrop-Needle complex (520). The 515 complex is well drained and the depth to a restrictive layer is 4 to 6 inches to bedrock (lithic). Available water to a depth of 60 inches is very low and shrink-swell potential is also low. The 520 complex is excessively drained and available water capacity to a depth of 60 inches is very low, and shrink swell potential is low.

Opportunities

Housing

This area is located in the eastern part of the planning area along Highway 191. Approximately 30 acres has been designated for housing.

MAP 27-A -SOUTH WALKER SPRING DEVELOPMENT TOPOGRAPHIC LANDSCAPE



Legend

Roads

- Navajo Route (unpaved)
- Dirt Road
- U.S. Highway

Utilities

- Electric

Existing Land_Use

- Residential,
- Zone 1

Ⓦ Water Well

Proposed Land Use

- Residential

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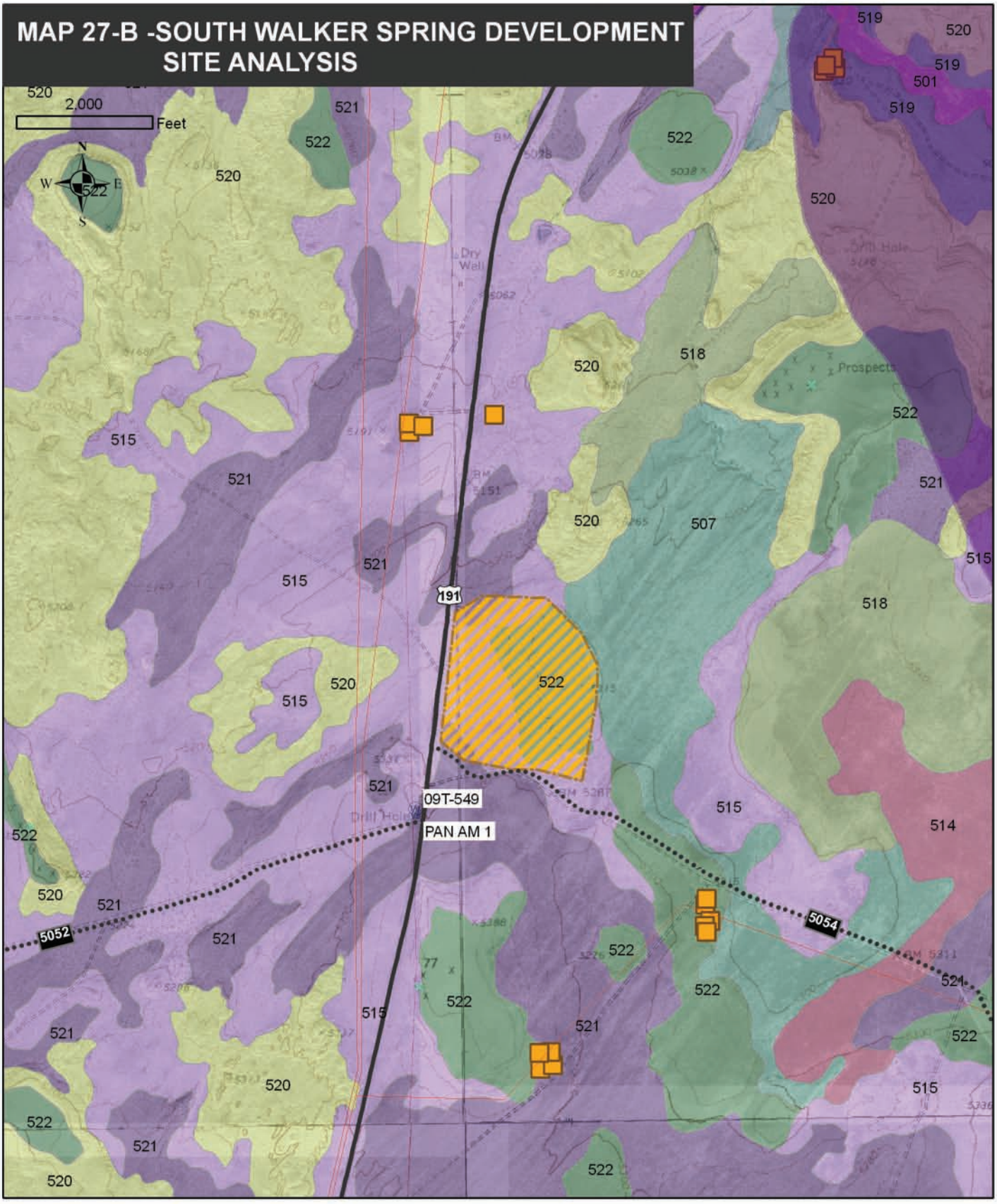
Sources: NDOT, Navajo Land Dept.,
NTUA, USGS, NDFWL

MAP 27-B -SOUTH WALKER SPRING DEVELOPMENT SITE ANALYSIS



Legend

Roads
- Navajo Route (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Electric

Existing Land_Use
- Residential,
- Zone 1

Water Well

Proposed Land Use
- Residential

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Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL

HUMMINGBIRD SPRINGS DEVELOPMENT

Location

The development includes four parcels: two agricultural; one residential; and one for community facilities. The sites are on the Mexican Water SW (1:24,000) USGS quadrangle, Apache County, Arizona **(MAP 28-A)**.

Existing Conditions and Facilities

The proposed sites are in a well developed area with many houses and ample access via dirt and county roads. Powerlines provide electricity but water is hauled from local wells and Hummingbird Spring, which is centrally located within the community. A traditional site surrounds Hummingbird Springs as well as an unnamed well and spring roughly 3,000 feet north.

The agricultural sites are within the NDFWL Wildlife Zone 1, a highly sensitive plant and animal habitat that flanks the southwestern edge of the planning area. This association consists of somewhat excessively drained and well-drained soil and rock outcrop on plains and plateaus. The plains are broken by prominent mesas, buttes and escarpments. Steep, rock-walled canyons form the sides of the drainages that traverse the areas. The soils formed in aeolian sandy material weathered from sandstone and shale.

Elevations in the vicinity range from approximately 5220 to 5300 amsl. **MAP 27-B** shows the site's soil regime, which primarily consists of Piute-Bluechief-Rock outcrop complex (515) and Rock outcrop-Needle complex (520). The 515 complex is well drained and the depth to a restrictive layer is 4 to 6 inches to bedrock (lithic). Available water to a depth of 60 inches is very low and shrink-swell potential is also low. The 520 complex is excessively drained and available water capacity to a depth of 60 inches is very low, and shrink swell potential is low

Opportunities

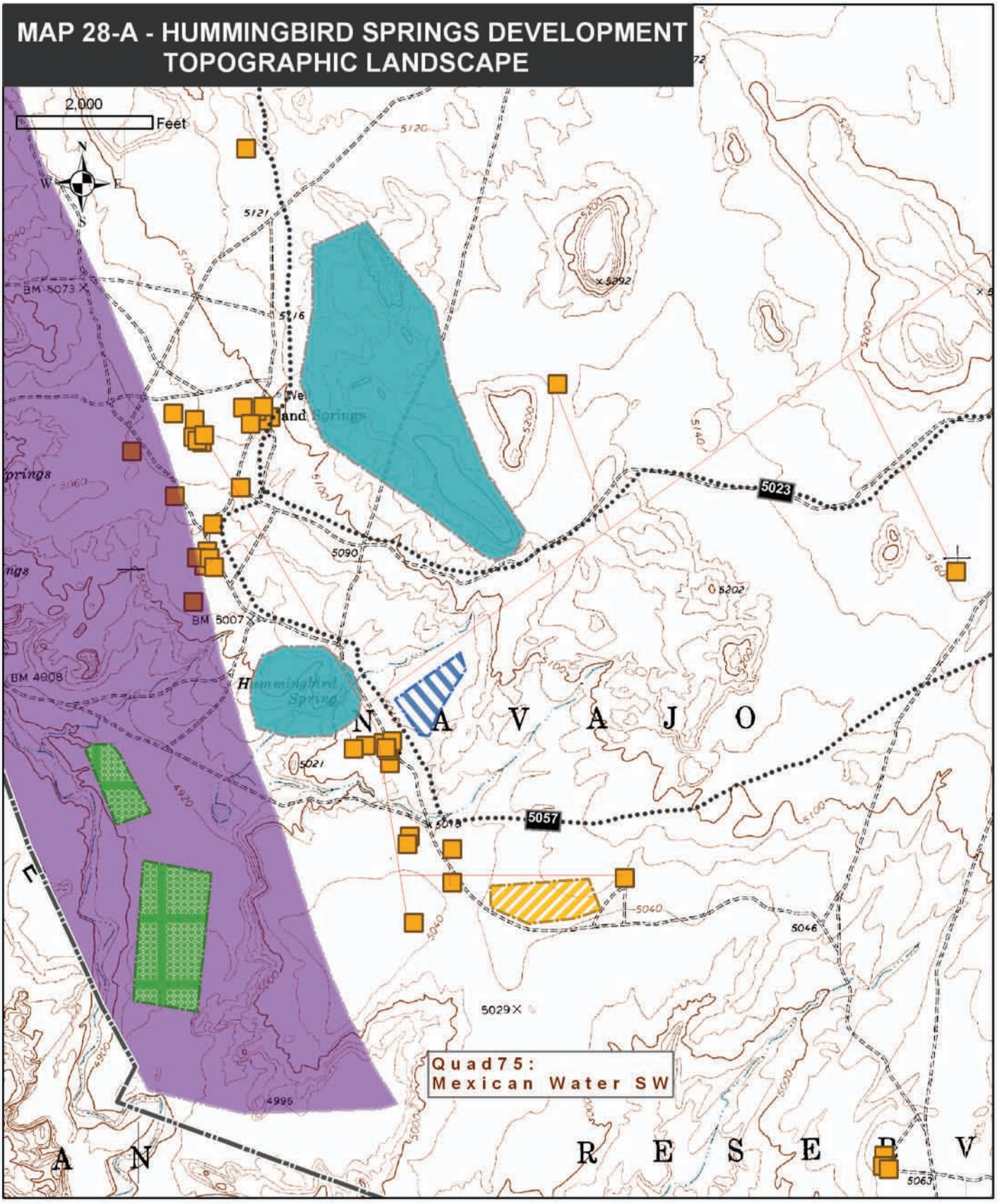
Housing

This area is located in the southwestern corner of the planning area along the east side of Chinle Wash. Approximately 10 acres has been designated for housing.

Farming

Farming would potentially generate income for residents of the area in the form of products that could be sold at markets. There would be no investment to develop the farming area, other than implementing practices by those using the land through typical farming approaches.

MAP 28-A - HUMMINGBIRD SPRINGS DEVELOPMENT TOPOGRAPHIC LANDSCAPE



Legend

Roads
- Navajo Route (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Electric

Existing Land_Use
- Residential,
- Traditional Site
- Zone 1

Proposed Land Use
- Residential
- Community Facilities
- Farming

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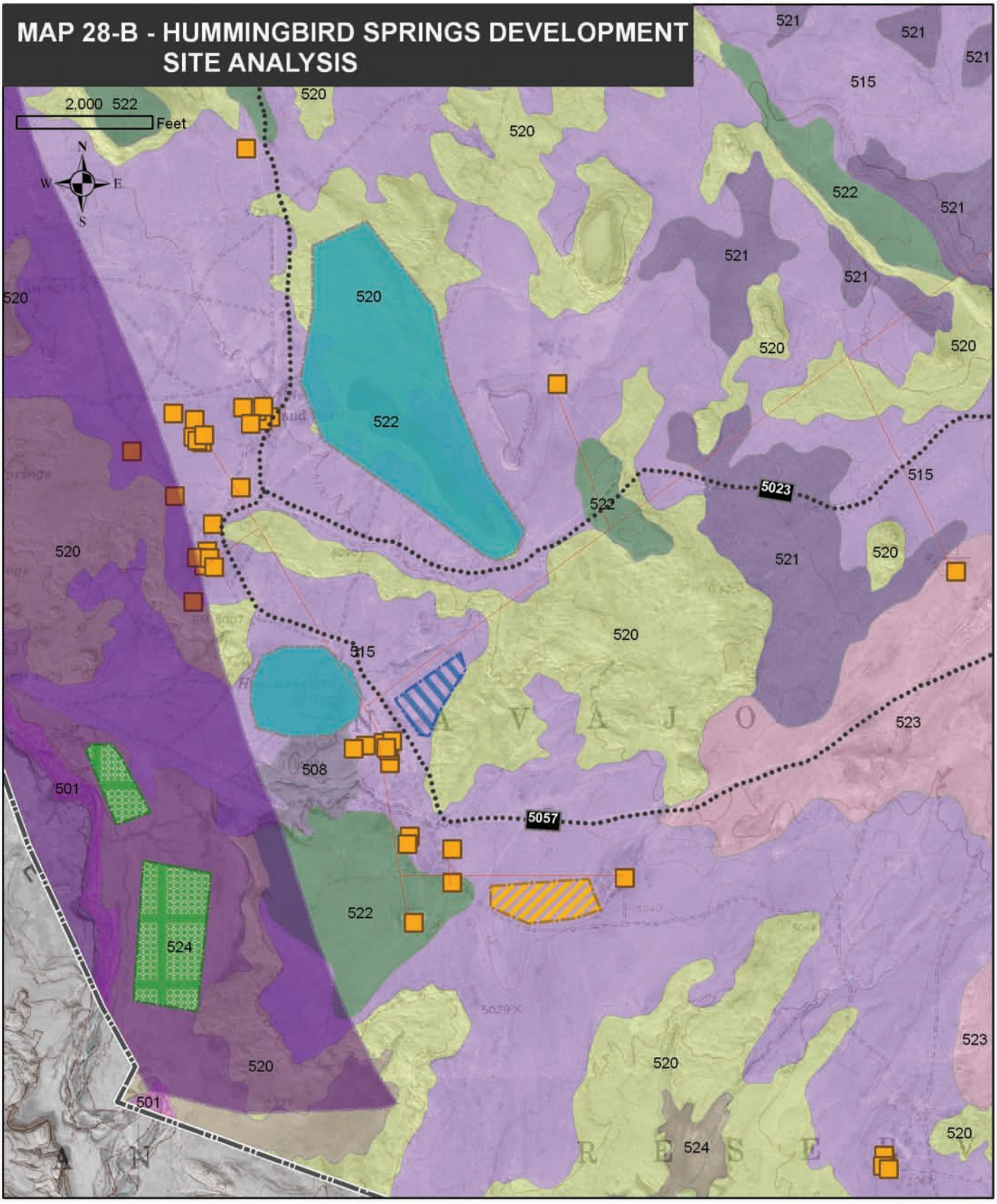
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL

MAP 28-B - HUMMINGBIRD SPRINGS DEVELOPMENT SITE ANALYSIS



Legend

Roads
- Navajo Route (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Electric

Existing Land_Use
- Residential,
- Traditional Site
- Zone 1

Proposed Land Use
- Residential
- Community Facilities
- Farming

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Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL

DESCHEENE DEVELOPMENT

Location

This development consists of two parcels in the Mexican Water (1:24,000) USGS quadrangle in Apache County, Arizona **(MAP 29-A)**.

Existing Conditions and Facilities

The proposed parcels are situated in the floodplain of the Chinle Valley just west of numerous homes. While the homes in the area are serviced with electricity, running water is provided by the wash and several dirt roads give access to the homes as well as the prospective farming plots on the valley's floor. The Chinle wash winds north just west of the parcels and is flanked in its west with sand dunes rise that rise 300 feet. Skinny Mesa sits atop the sand dunes and overlooks the valley to the east.

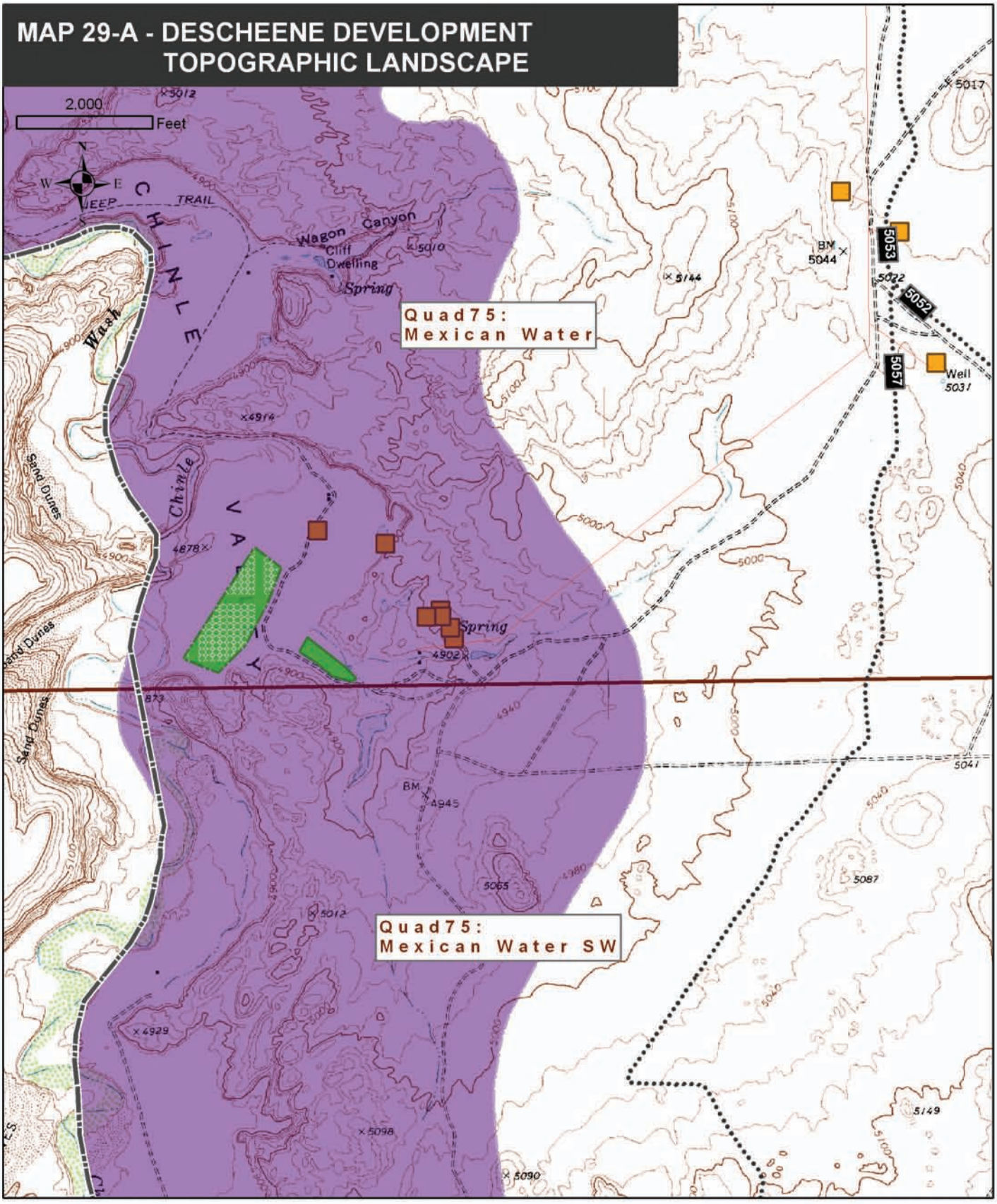
Elevations in the vicinity range from approximately 4800 to 4990 amsl. **MAP 29-B** shows the site's soil regime. Both Uzaneva clay loam (524) and Gotho fine sandy loam (512) are present in the proposed farming parcels. The Gotho component is in valleys. The parent material consists of alluvium derived from sedimentary rock and is well drained. Water movement in the most restrictive layer is moderately low, but water is available to a depth of 60inches. Runoff in the Uzaneva soils is very high but the soil is well drained.

Opportunities

Farming

Existing conditions in the Chinle Valley are ideal for farming. Farming would potentially generate income for residents of the area in the form of products that could be sold at markets. There would be no investment to develop the farming area, other than implementing practices by those using the land through typical farming practices.

MAP 29-A - DESCHEENE DEVELOPMENT TOPOGRAPHIC LANDSCAPE



Legend

Roads
- Navajo Route (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Electric

Existing Land_Use
- Residential
- Farming

Proposed Land Use
- Farming

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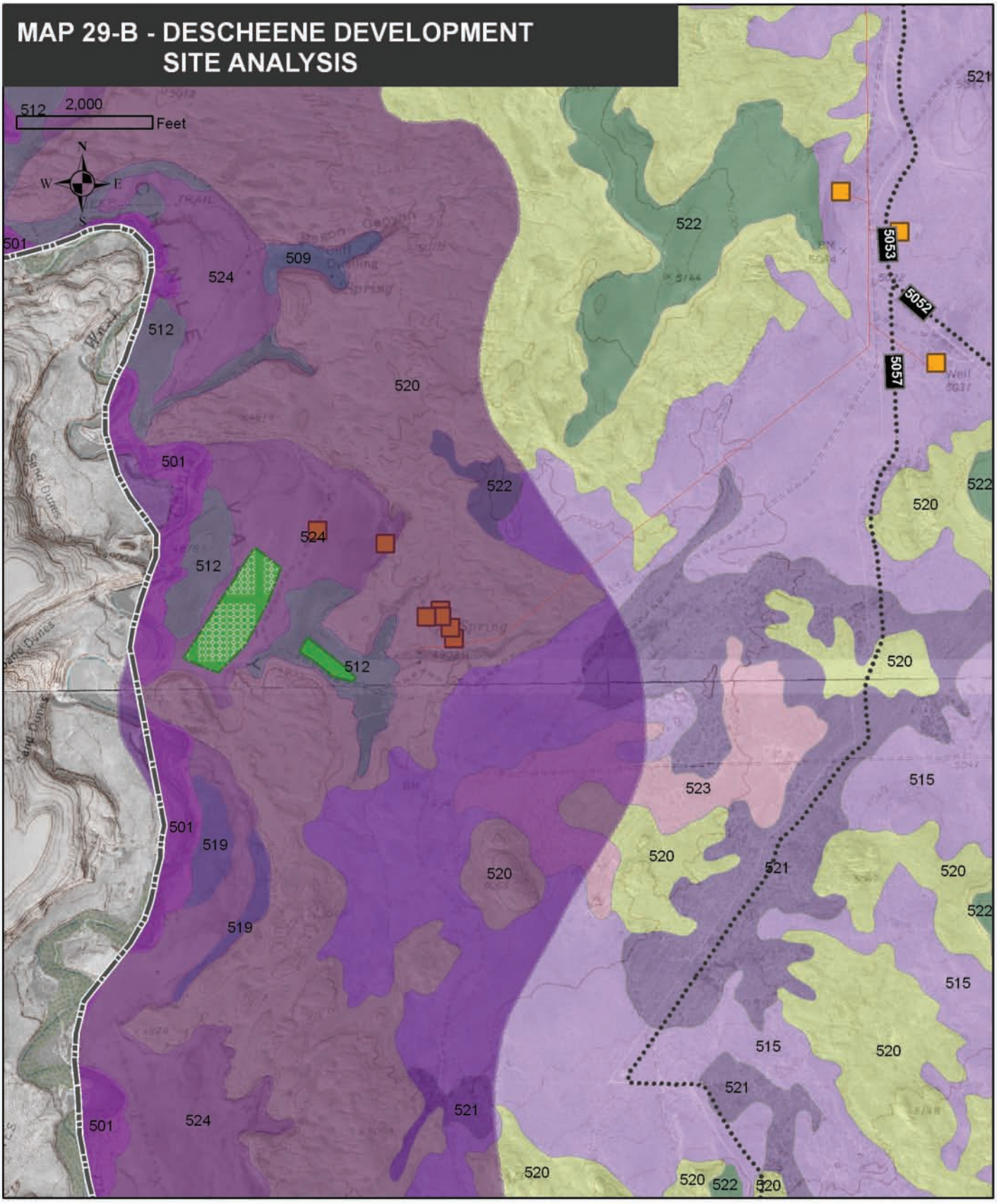
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL

MAP 29-B - DESCHEENE DEVELOPMENT SITE ANALYSIS



Legend

Roads
- Navajo Route (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Electric

Existing Land_Use
- Residential
- Farming

Proposed Land Use
- Farming

Mexican Water Chapter
Community-Based Land Use Plan
December 2007

JJ Clacs & Company

Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL

COMB RIDGE DEVELOPMENT

Location

Two development parcels are proposed for this unit. One parcel will accommodate commercial space and the other parcel will provide a facility suitable for a museum, visitor center, and veteran's hall **(MAP 30-A)**. Both are located on the Mexican Hat SE (1:24,000) USGS quadrangle, San Juan County, Utah.

Existing Conditions and Facilities

The areas under consideration are parcels that are in a relatively undeveloped section of the chapter along Navajo Route 6440. A water line extends from the northwest to within roughly one mile of the parcels. A water line extends from the northwest on the opposite side of the ridge.

The terrain is dissected by ridges and outcrops with elevation increases up to 300 feet at the top of Comb Ridge, just west of the proposed developments.

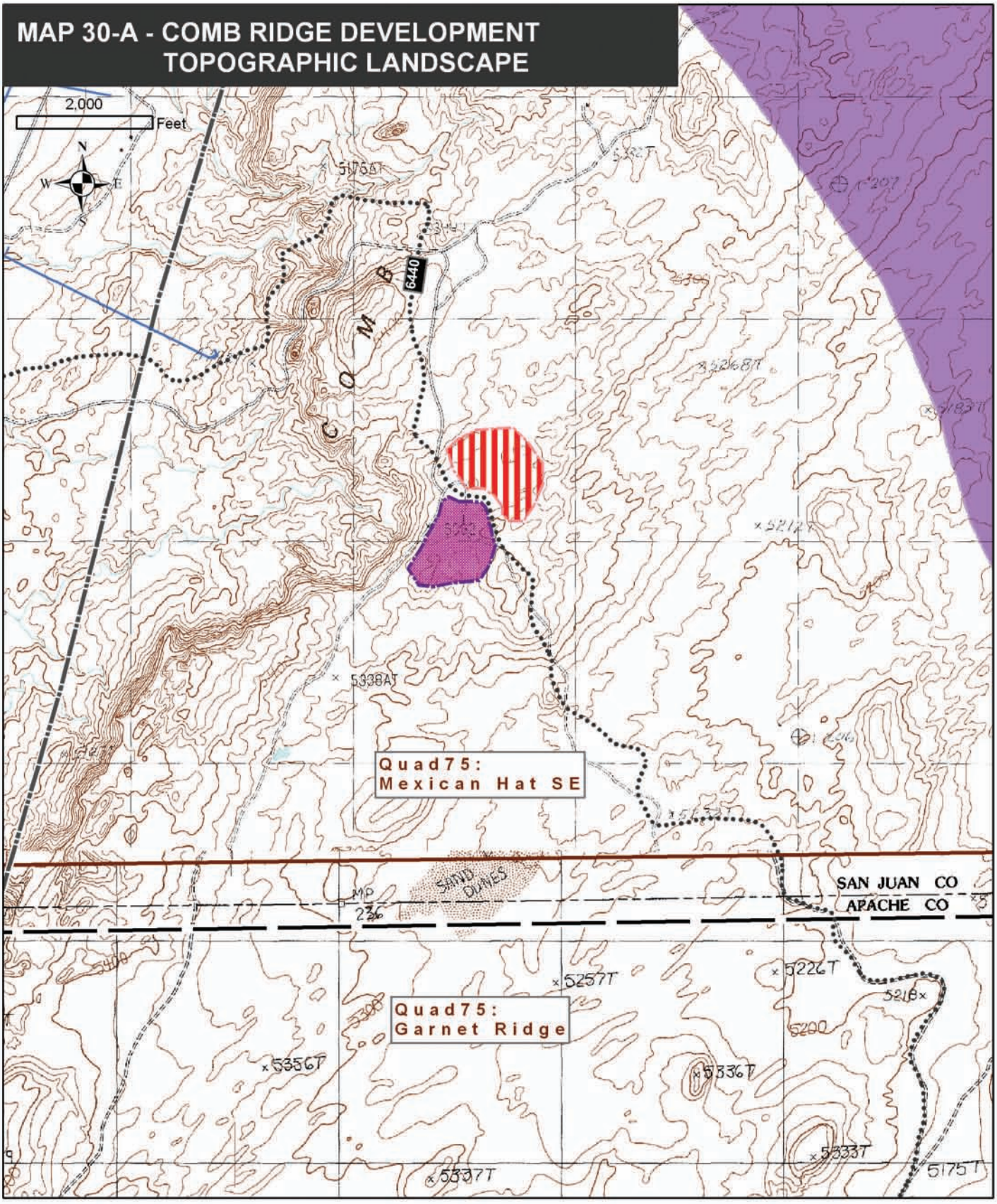
Elevations in the vicinity range from approximately 5300 to 5360 amsl. **MAP 30-B** shows the site's soil regime. The soil is Sheppard fine sand, hummocky. This component is on dunes and structural benches. The parent material consists of eolian deposits derived from sandstone. With the various elevations, the soil is excessively drained and water availability to a depth of 60 inches and is considered low.

Opportunities

This site offers breathtaking views of what Mother Nature has to offer as her rains, winds, sun and movements have developed some of the most beautiful terrain in the world. Over the centuries, grand rock formations with great color variations have mesmerized those who walk these lands.

Such a location as this provides an opportunity for ecotourism that would provide outsiders the opportunity to take in the beauty of the area while also helping to preserve its beauty and majesty. People from around the world could come to the area for a getaway from their cities and work to commune with nature. Camping expeditions could be arranged and managed by local community members who would help assure that the area is preserved in its beautiful state.

MAP 30-A - COMB RIDGE DEVELOPMENT TOPOGRAPHIC LANDSCAPE



Legend

Roads

- Navajo Route (unpaved)
- Dirt Road
- U.S. Highway

Proposed Land Use

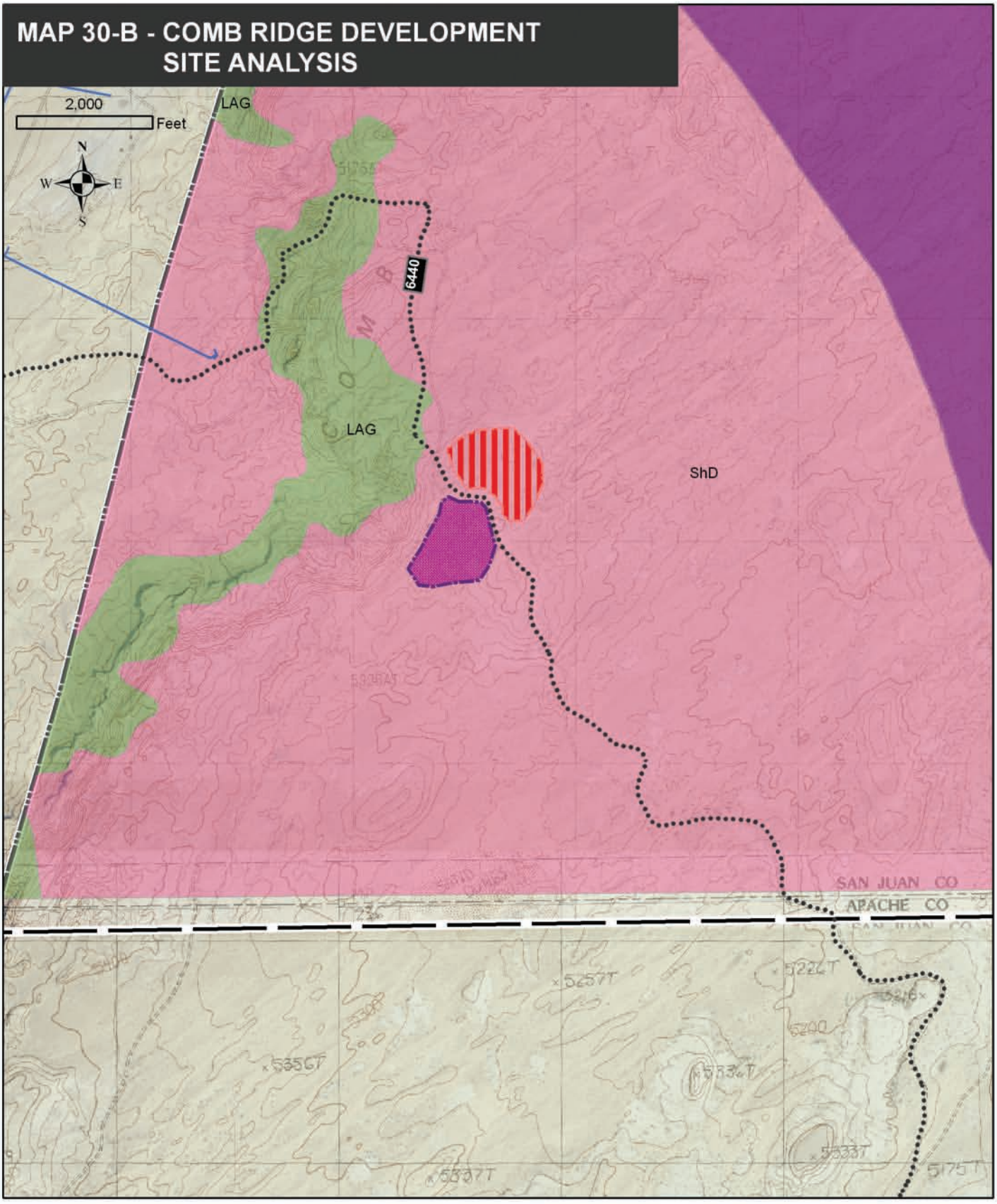
- Commercial
- Culture, Visitor, & Tribute Facilities

Mexican Water Chapter
Community-Based Land Use Plan
December 2007

JJ Clacs & Company

Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., USGS, NDFWL

MAP 30-B - COMB RIDGE DEVELOPMENT SITE ANALYSIS



Legend

Roads

- Navajo Route (unpaved)
- Dirt Road
- U.S. Highway

Proposed Land Use

- Commercial
- Culture, Visitor, & Tribute Facilities

Mexican Water Chapter
Community-Based Land Use Plan
December 2007

JJ Clacs & Company

Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., USGS, NDFWL

LOOKING BOBCAT DEVELOPMENT

Location

This planned area includes three irregular shaped parcels planned for commercial, agricultural, and municipal development. The commercial site lies on the Mexican Water and Garnet Ridge (1:24,000) USGS topographic quadrangles. The farming and municipal sites are on the Mexican Water quadrangle **(MAP 31-A)**. The sites are in Apache County, Arizona.

Existing Conditions and Facilities

All three of the proposed developments are situated along either side of Highway 160 in the vicinity of the intersection of the highway and Navajo Route 6440. A small number of residents are also scattered throughout the area. A traditional site is just east of the intersection of the county road and highway. A large tract of Wildlife Zone1 are immediately south of the parcels, and the agricultural site slightly overlaps. A gaging station and sewage disposal pond are roughly 2,000-3,000 feet east along the highway.

Elevations in the vicinity range from approximately 4800 to 5100 amsl. **MAP 31-B** shows the site's soil regime. The soil is Sheppard-Fruitland-Rock Outcrop Association (MA3). This association consist of somewhat excessively drained and well-drained soil and rock outcrop on plains and plateaus. The plains are broken by prominent mesas, buttes and escarpments. Steep, rock-walled canyons form the sides of the drainages that traverse the areas. The soils formed in aeolian sandy material weathered from sandstone and shale.

The native vegetation is dominantly sand sagebrush and sparse areas of Mormon-tea, blackbrush, rabbitbrush, Indian ricegrass, sand dropseed, galleta, grama grasses. A few scattered stands of juniper and pinyon pine grow in rock areas

Opportunities

Commercial

Because of the proximity to Highway 160, the community believes there are opportunities for commercial development in the area. Such development could include retain shops appropriate to those that would support assisting passing motorist along highways as well as for community use. In addition, other small businesses that need road access could be established in this area.

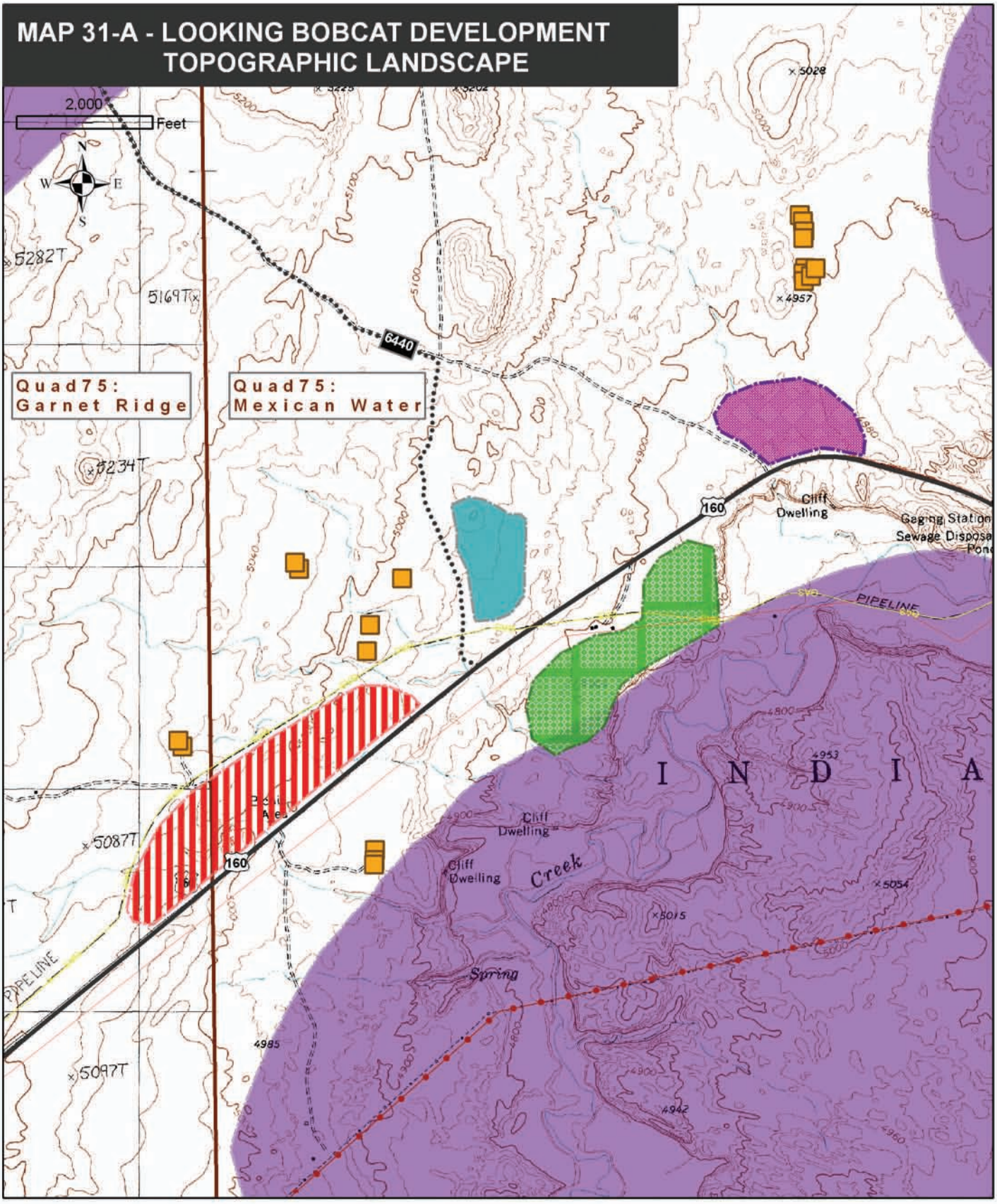
Culture, Visitor and Tribute Facilities

Numerous treasures are currently stored in a warehouse in Bluff. These artifacts from storage could be better preserved and more generously shared with community members and outsiders by placing them into a proper museum. Museums can complement other tourism and nature related businesses within the area. A gift shop could be incorporated in the area of the museum.

Farming

With a history of farming within the community, some families have interest in reestablishing farming within the area, most specifically in the Chinle wash area. Traditional and modern farming methods could be incorporated into the farm activities of the families involved.

MAP 31-A - LOOKING BOBCAT DEVELOPMENT TOPOGRAPHIC LANDSCAPE



Legend

Roads
- Navajo Route (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Electric

Existing Land_Use
- Residential
- Zone 1
- Traditional Site

- Power Tranmission Line
- Questar_Pipeline

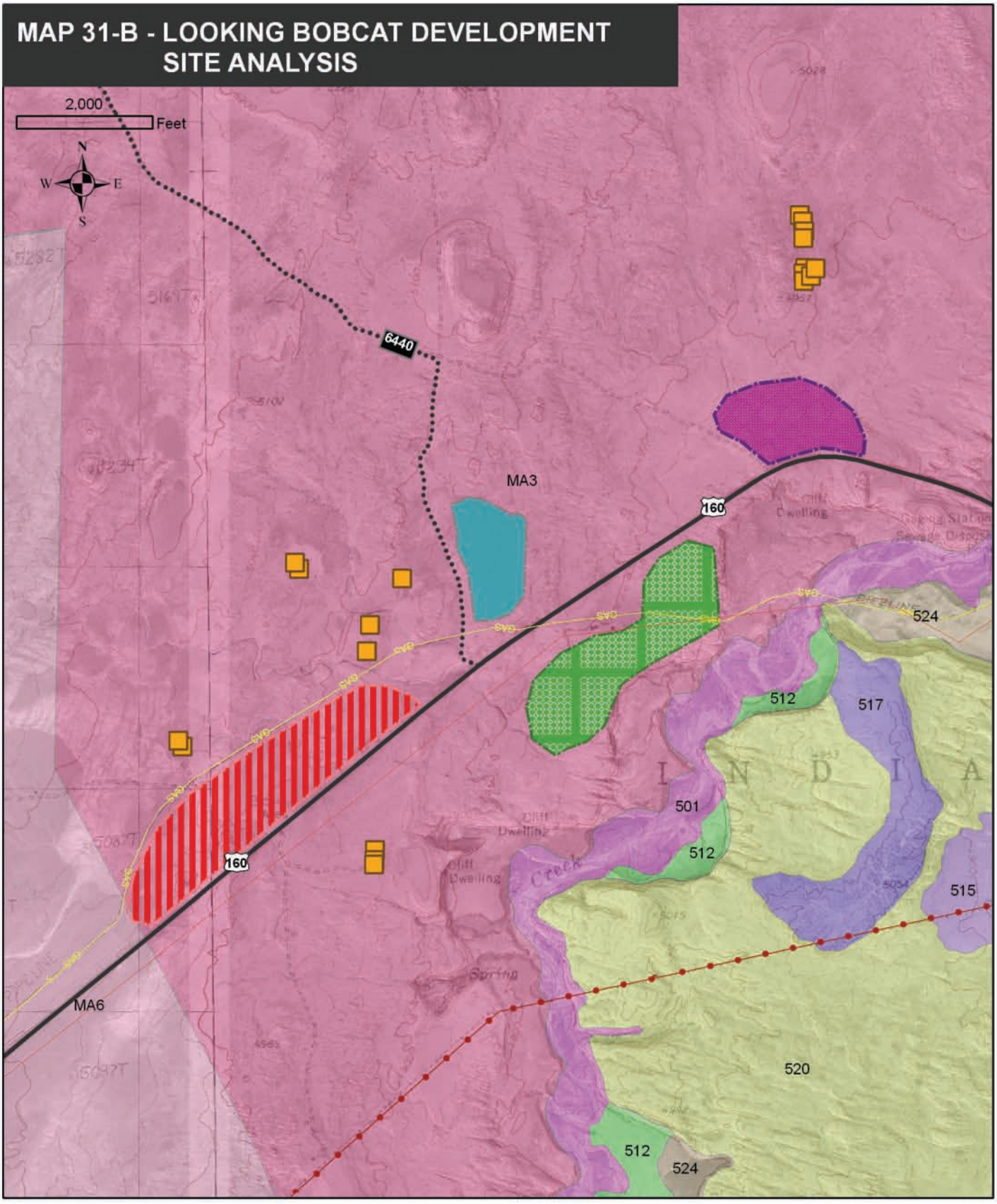
Proposed Land Use
- Commercial
- Farming
- Culture, Visitor, & Tribute Facilities

Mexican Water Chapter
Community-Based Land Use Plan
December 2007

JJ Clacs & Company

Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL

MAP 31-B - LOOKING BOBCAT DEVELOPMENT SITE ANALYSIS



Legend

Roads
- Navajo Route (unpaved)
- Dirt Road
- U.S. Highway

Utilities
- Electric

Existing Land_Use
- Residential
- Zone 1
- Traditional Site

Proposed Land Use
- Commercial
- Farming
- Culture, Visitor, & Tribute Facilities

- Power Tranmission Line
- Questar_Pipeline

Mexican Water Chapter
Community-Based Land Use Plan
December 2007

JJ Clacs & Company

Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., NTUA, USGS, NDFWL

MEXICAN WATER DEVELOPMENT

Location

Three parcels are planned for development in this unit. All are situated on the Mexican Water (1:24,000) USGS quadrangle less than one mile south from the Chapter house in Apache County, Arizona (**MAP 32-A).**

Existing Conditions and Facilities

The parcels proposed for community facilities and commercial development lie directly between the south side of Highway 160 and an east-west trending transmission line. The parcel intended for future open space is just south of the transmission line but west of the highway as it curves south.

Numerous homes are in the vicinity, which have electricity. The area is well accessed via the highway, Navajo Route 5056, and many dirt roads. A Questar natural gas pipeline trends east-west just north of the proposed developments. The parcels are accessed from the chapter house via Navajo Routes 5056 and 5041.

Elevations in the vicinity range from approximately 4900 to 4940 amsl. **MAP 32-B** shows the site's soil regime. The proposed commercial and community parcels are in relatively flat terrain. The soils within the parcels consist mainly of Sandbench-Sheppard fine sands (521) with lesser areas of Piute-Blue chief-Rock outcrop complex (515). The residential parcel slightly overlays Outcrop-Needle complex (520). All three of these soil regimes are excessively drained and have rapid permeability within a depth of 60 inches rendering the available water capacity to this depth very low.

Opportunities

Development ideas include commercial areas and areas to be set aside for schools and housing.

Community Facilities

The proximity to housing and to highways led community members to consider this area as one that could accommodate a new school.

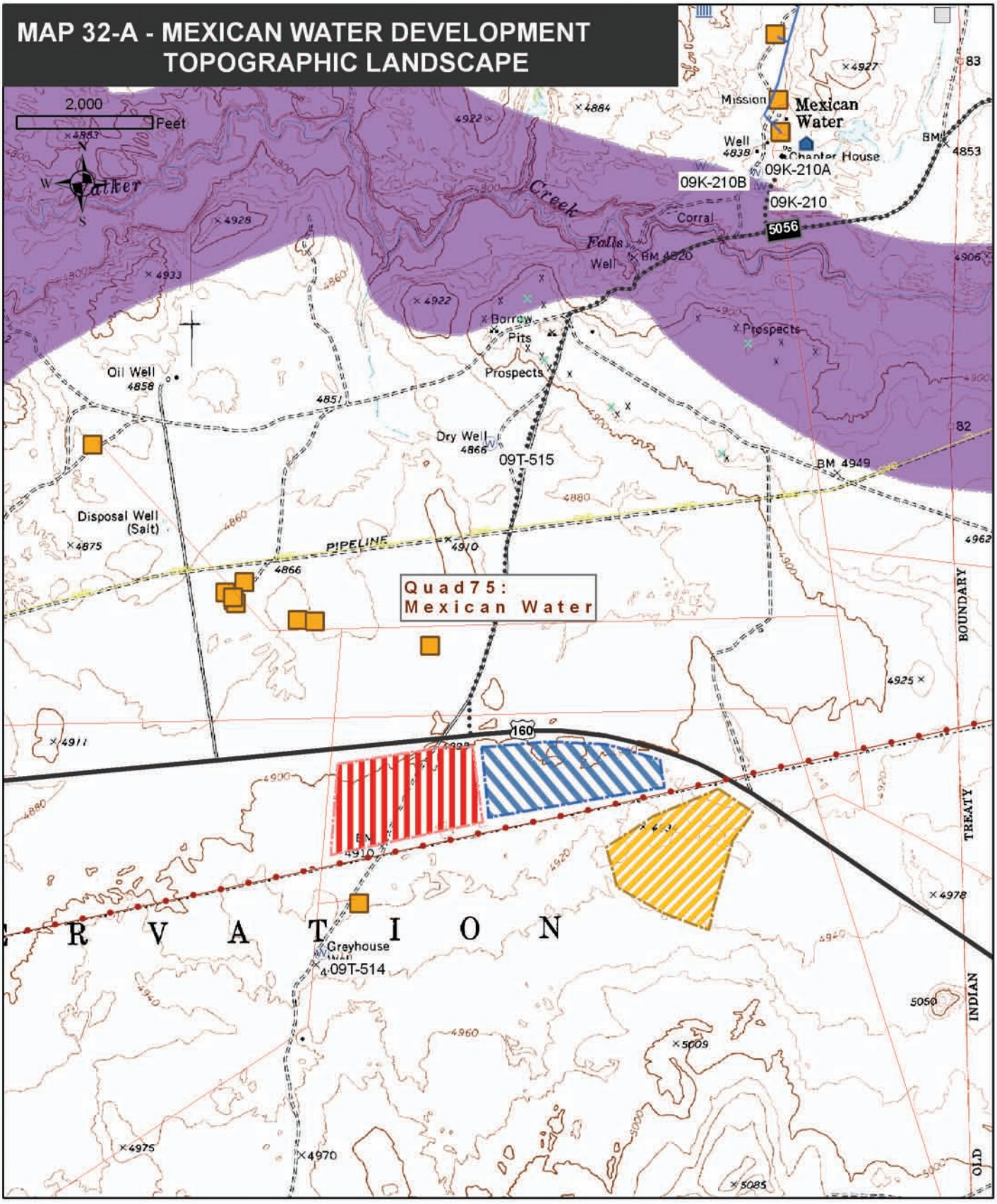
Commercial

Because of the proximity to Highway 160, it is possible for commercial development to take root in this area. The development could include retail shops to support the community and those who come through the area.

Residential

With numerous homes already in the vicinity, it would seem logical that other community members would want to develop homes within the area. The relatively flat terrain and access to electricity makes this an appealing area for potential new homes.

MAP 32-A - MEXICAN WATER DEVELOPMENT TOPOGRAPHIC LANDSCAPE



Legend

- Chapter House

Roads

- U.S. Highway
- Dirt Road
- Navajo Route (unpaved)

Utilities

- Electric

Existing Land_Use

- Residential,
- Commercial
- Zone 1

- Questar Pipeline
- Power Tranmission Line
- Water Well

Proposed Land Use

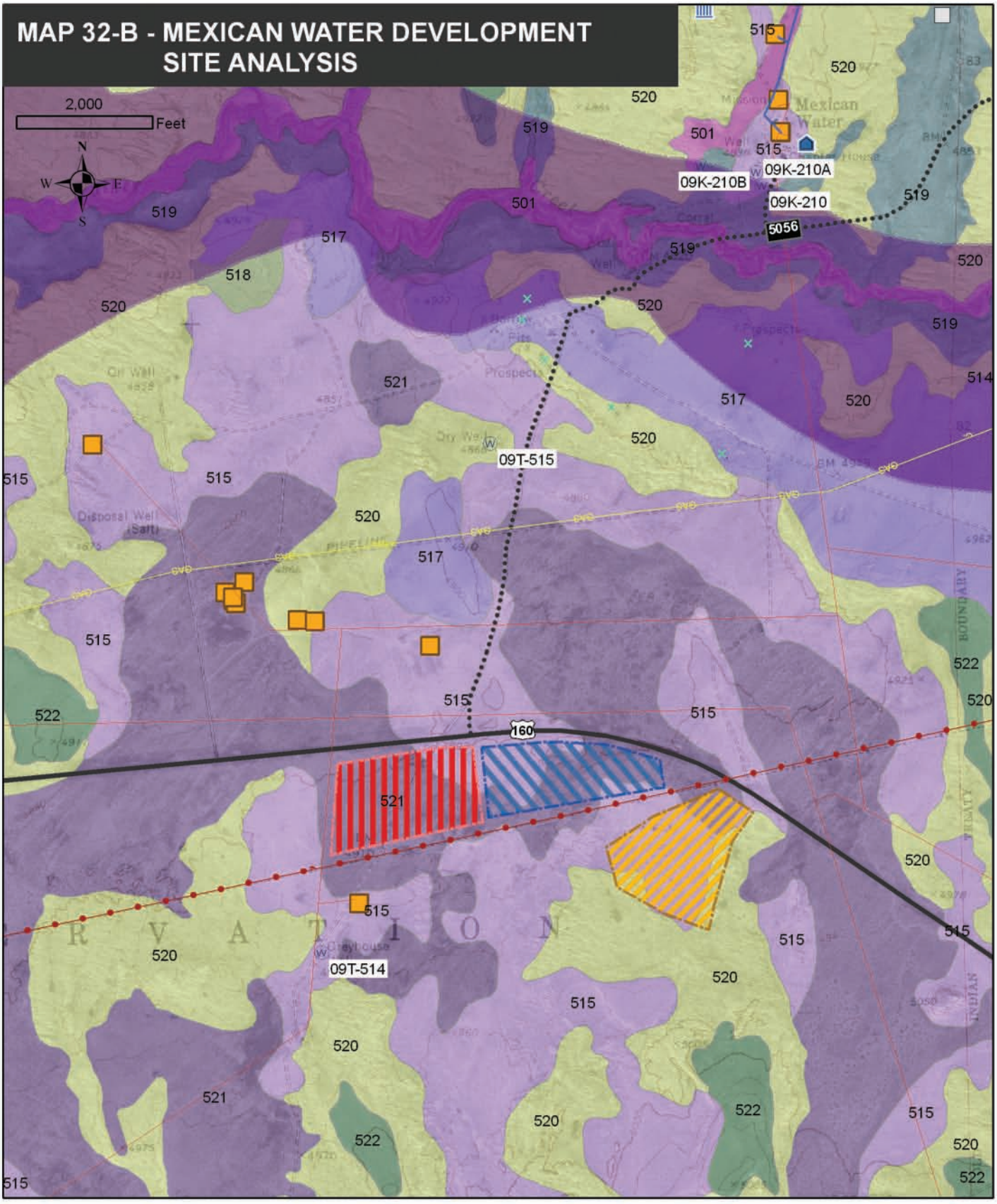
- Residential
- Commercial
- Culture, Visitor, & Tribute Facilities

Mexican Water Chapter
Community-Based Land Use Plan
December 2007

JJ Clacs & Company

Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., Pacificorp, NTUA, Utah GIS

MAP 32-B - MEXICAN WATER DEVELOPMENT SITE ANALYSIS



Legend

- Chapter House

Roads

- U.S. Highway
- Dirt Road
- Navajo Route (unpaved)

Utilities

- Electric

Existing Land_Use

- Residential,
- Commercial
- Zone 1

- Questar Pipeline
- Power Tranmission Line
- Water Well

Proposed Land Use

- Residential
- Commercial
- Culture, Visitor, & Tribute Facilities

Mexican Water Chapter
Community-Based Land Use Plan
December 2007

JJ Clacs & Company

Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept.,
Pacificorp, NTUA, Utah GIS

WALKER CREEK DEVELOPMENT

Location

This development includes three parcels on the Walker Creek Reservoir (1:24,000) USGS quadrangle. One of the proposed parcels will provide commercial space, and two will be dedicated to a municipal facility including a museum, a visitor's center, and a veteran's tribute hall and park **(MAP 33-A)**. The sites are in Apache County, Arizona.

Existing Conditions and Facilities

The prospective municipal locations lie on either side of Highway 191 and south of Highway 160 at the highways' intersection. A rest area is immediately northwest. Sewage disposal ponds are within 2,000 feet east. The commercial development is planned for directly across the road from the municipal facility on the north side of Highway 160.

In addition to the highways, numerous dirt roads provide adequate access to the sites as well as the local residences and the Mexican Water Trading Post approximately one-quarter mile east along Highway 160. A power line runs east-west about 2.5 miles north, and several water wells.

The highly sensitive NDFWL Wildlife Zone 1 covers a large area east of the proposed developments. Walker Creek bisects the western portion of the wildlife zone and extend south past the parcels crossing underneath Highway 160 just west of the trading post. Additionally, Walker Creek Reservoir, just a mile northeast, supplies water for recreation and drinking.

Elevations in the vicinity range from approximately 5000 to 5200 amsl. **MAP 33-B** shows the site's soil regime. The parcels lie in a gently sloping area consisting of the same soil types seen at the Mexican Water development. These are the Sandbench-Sheppard fine sands (521), the Piute-Blue chief-Rock outcrop complex (515), and the Outcrop-Needle complex (520). As referenced above, all three of these soil regimes are excessively drained and have rapid permeability within a depth of 60 inches rendering the available water capacity to this depth very low.

Opportunities

The community envisions great things for this area. Because of its beauty and central location, community members can see this area as a central focal-point or hub for visitor programs and developments. The hub concept grew out of the fact that from this point people can easily travel to Canyon de Chelly, Monument Valley or Mesa Verde or other interesting places in the Four Corners area.

Commercial

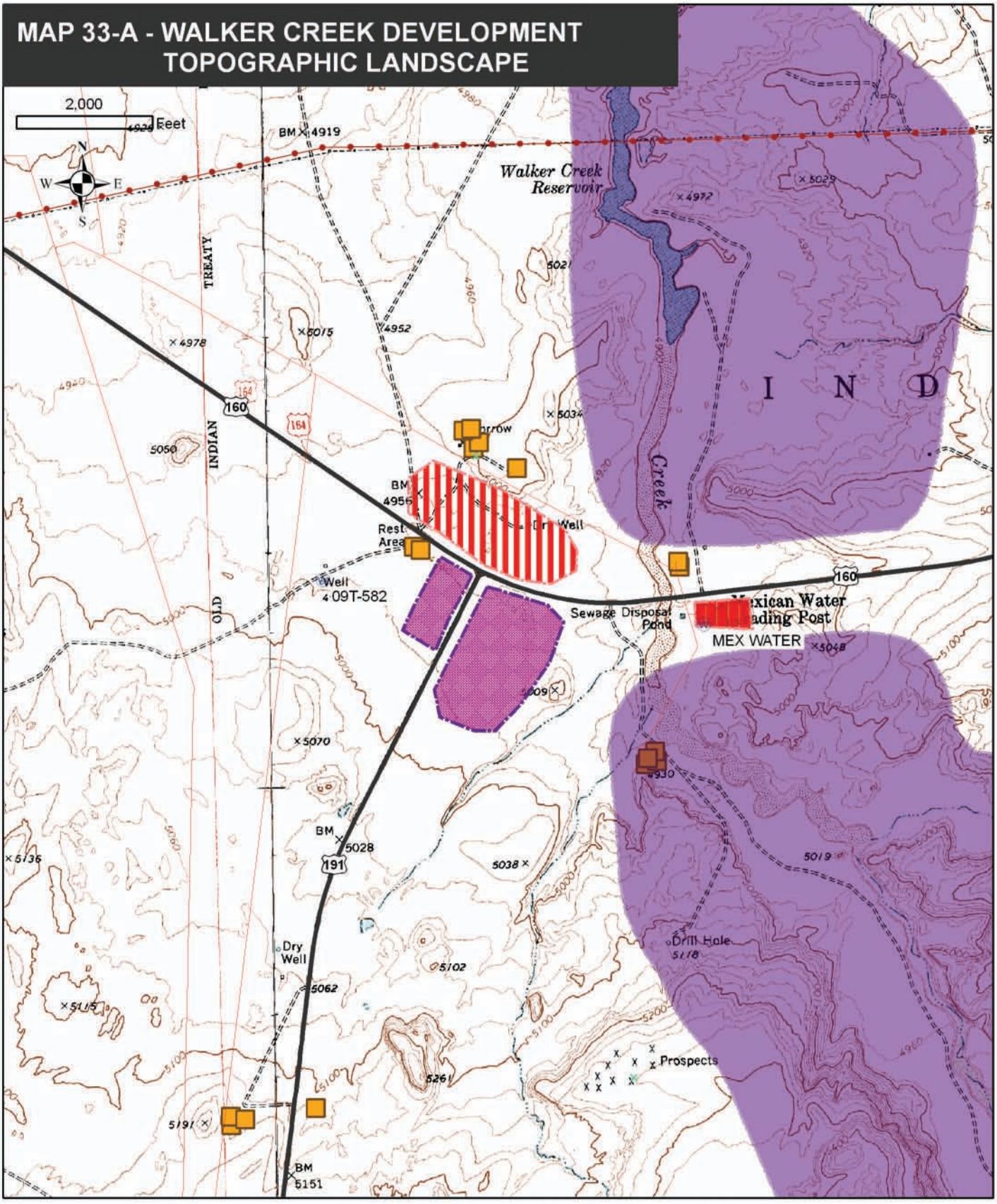
Within a commercial area along 160, there could be opportunities for businesses including retail and tourism. Being at the crossroads to these three natural treasures, various ecotourism and other businesses could be established and promoted.

Culture, Visitor and Tribute Facilities

The community has developed the concept of a grand visitor's center that can provide information and services for travelers who are on their way to or from Canyon de Chelly, Monument Valley or Mesa Verde. Such a center could offer services to recreational vehicles as well as encourage biking and hiking activities associated with ecotourism.

The community can also display their spirit and caring for its fellow veterans by establishing a center for veterans within the area. With the national, indeed, world-wide interests in the Code Talkers, for instance, certain areas of the veterans' center could present information regarding the service of local community members and also a salute to the Code Talkers of the Navajo Nation. Such a center could offer services to veterans while also paying tribute to those individuals. Further, certain artifacts and even military memorabilia could be established with a museum and park to be used by local community members and visitors.

MAP 33-A - WALKER CREEK DEVELOPMENT TOPOGRAPHIC LANDSCAPE



Legend

Roads
- U.S. Highway
- Dirt Road

Utilities
- Electric
- Power Tranmission Line
- Water Well

Existing Land_Use
- Residential,
- Commercial
- Zone 1

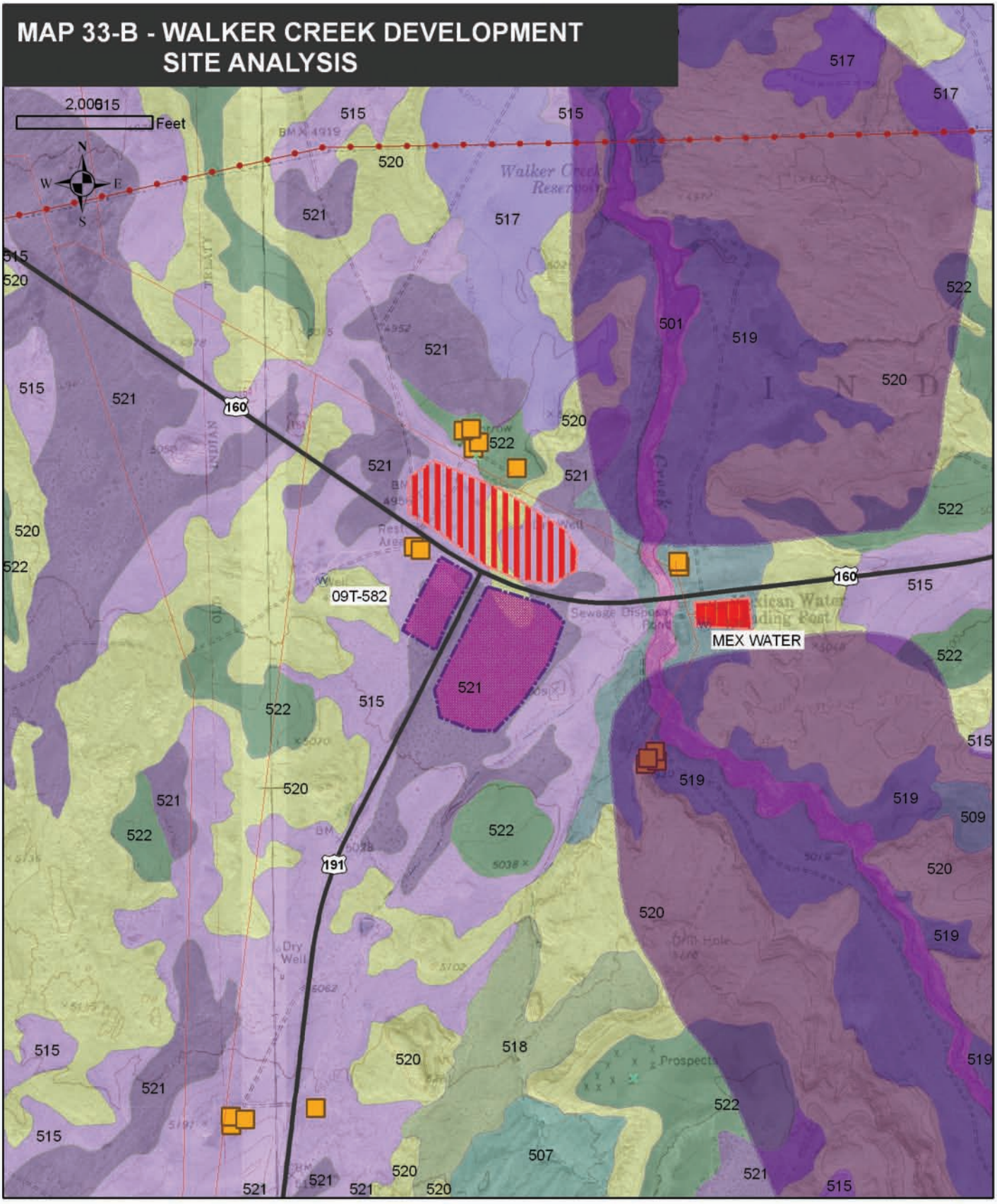
Proposed Land Use
- Commercial
- Culture, Visitor, & Tribute Facilities

Mexican Water Chapter
Community-Based Land Use Plan
December 2007

JJ Clacs & Company

Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., Pacificorp, NTUA, Utah GIS

MAP 33-B - WALKER CREEK DEVELOPMENT SITE ANALYSIS



Legend

Roads
- U.S. Highway
- Dirt Road

Utilities
- Electric

Existing Land_Use
- Residential,
- Commercial
- Zone 1

Proposed Land Use
- Commercial
- Culture, Visitor, & Tribute Facilities

- Power Tranmission Line
- Water Well

Mexican Water Chapter
Community-Based Land Use Plan
December 2007

JJ Clacs & Company

Note: Map is for Planning Purposes Only.
Sources: NDOT, Navajo Land Dept., Pacificorp, NTUA, Utah GIS

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APPENDICES

APPENDIX A

PLANNING & ZONING RESOLUTIONS

Mexican Water Chapter

Naakaii To'

Curtis Yanito. President
Esther Askan, Vice-President
Carmelita l. Sagg, Secretary/Treasurer
Jerry Tsosie, Grazing Representative
David L. John, Council Delegate

Red Mesa TP #1019
Mexican Water Chapter
HC 61 Box 38
Teec Nos Pos, Arizona 86514-9701
Ph/Fax: (520) 674-3641

MWC-991205-001

RESOLUTION OF MEXICAN WATER CHAPTER

Approving The Establishment Of The Mexican Water Chapter Community Land Use Planning Committee & Plan of Operation.

WHEREAS,

1. The Mexican Water Chapter is a certified and recognized chapter of the Navajo Nation vested with the authority and responsibility to plan and implement projects in the best interest of the community; and

2. Pursuant to Resolution No. CAP-34-98, the Navajo Nation Council adopted the Navajo Nation Local Governance Act ("LGA"), Title 26 of the Navajo Nation Code; and

3. To accommodate the short and long-term basic needs of the Chapter relating to community, economic, and infrastructure development, and to preserve grazing and culturally significant areas, the Mexican Water Chapter determines that, the establishment of a Community Land Use Planning Committee (CLUPC) is necessary to begin the planning process.

NOW THEREFORE BE IT RESOLVED THAT;

1. The Mexican Water Chapter hereby approves the establishment of the Mexican Water Chapter Community Land Use Planning Committee. The Mexican Water Chapter further hereby selects the following individuals to serve on the CLUPC. The list is attached herein as Exhibit "A".

2. The Mexican Water Chapter further hereby approves the Community Land Use Planning Committee Plan of Operation attached hereto as Exhibit "B".

CERTIFICATION

We hereby certify the foregoing resolution was considered by Mexican Water Chapter, Arizona at a duly called Chapter Meeting at which a quorum was present and the same approved this resolution by a vote of __ in favor, __ opposed and __ abstained on this 05th day of December 1999.

Curtis Yanito, Chapter President

Esther Askan, Vice-President

Carmelita L. Sagg, Secretary/Treasurer

David L. John, Council Delegate

Mark Maryboy, Council Delegate

Robert B. Whitehorse, Council Delegate

Exhibit "A"

Mexican Water Chapter
Community Land Use Plan
Membership Roster

Land Use Planning Coordinator
Clifford L. Sagg, Community Services Coordinator

1. Curtis Yanito
   Post Office Box 31
   Bluff, Utah 84512

2. Carmelita L. Sagg
   Post Office Box 194
   Teec Nos Pos. Arizona 86514

3. Jerry Tsosie
   Post Office Box 290
   Bluff, Utah 84512

4. Harry Descheene
   Post Office Box
   Farmington, New Mexico 87401

5. Kenneth Maryboy
   Post Office Box 280
   Bluff, Utah 84512

6. Jason R. White
   Post Office Box 426
   Rock Point, Arizona 86545

7. Chester M. Begay
   HCR 6100 Box 50
   Teec Nos Pos, Arizona 86514

8. Ursula R. White
   Post Office Box 868
   Teec Nos Pos, Arizona 86514

Mexican Water Chapter
Community Land Use Planning Committee
Plan of Operation

Section 1 Establishment

There is hereby established the Mexican Water Chapter Community Land Use Planning Committee (CLUPC).

Section 2 Purpose

The purpose of the CLUPC is to develop and approve the processes for local land use planning, oversee land use planning activities. After thorough review and analysis, present the community land use planning to the Mexican Water Chapter membership for consideration.

Section 3 Committee Duties and Responsibilities

The CLUP shall exercise the following duties and responsibilities consistent with the Navajo Nation Local Governance Act, 26 NNC Section 2004:

A. Educate the community on the concepts, needs, and process for planning and implementing a land use plan.

B. May hire, subject to availability of funds, a land use planner, to assist in the preparation of the community land use plan. The hiring and supervision of a land use planner shall be consistent with 26 NNC Section 2004(C))(2). The hiring of the planner shall be on a consultant basis consistent with general procurement and preference requirements.

C. Attempt to ensure that the development of the community land use plan is based upon the guiding principles, priorities, goals, and vision as articulated by the community, and approved a public participation progresses.

D. Shall work closely with the membership, consultants and the designated coordinator as planning progresses.

E. Upon approval of the community land use plan by the Chapter membership, the CLUP shall seek approval of the plan from the Transportation and Community Development Committee, pursuant to 26 NNC Section 102 (C).

F. Upon approval by the community land use plan by the Transportation and Committee Development Committee, the CLUP shall develop recommendations for the implementation of the land use plan.

Section 4 Committee Selection – Membership

A. The selection of the membership to the CLUP shall be by the Chapter membership at a duly called Chapter Meeting at which a quorum is present. The selection of the members shall be set forth via a certified chapter resolution.

B. The members of the CLUP shall be comprised of eight voting members of the chapter that have expertise to provide valuable contribution to the overall land use planning process. Subcommittees such as technical, advisory committees, comprising of voting and non-voting members of the Chapter may be established to assist the CLUP.

Section 5 Meeting and Compensation

Mexican Water Chapter
Community Land Use Planning Committee
Plan of Operation

Section 5 **Meeting and Compensation**

A. The CLUP shall hold a sufficient number of meeting to accomplish the overall purpose of the committee. Desinate, time, location, Date, Regular meetings

B. Each member of the CLUP will receive $60.00 per meeting for attendance.

Section 6 **Selection of and Duties and Responsibilities of Committee Officers**

A. Should the Mexican Water Chapter CLUP hire a land use planner, the duties and responsibilities of the planner, pursuant to 26 NNC Section 2004 © (3), includes but is not limited to the following:

1. The planner shall work with the CLUPC, consultants and the community residents on all land use planning activities and decisions.

2. Coordination of all land planning activities

3. Develop a community education and participation plan describing methods that will foster public education participation through public hearings, newspapers and radio. Chapter members will be periodically informed of the progress of the land use planning activities. All information pertinent to the plan shall be available to the public.

4. Develop and implement, in coordination with the CLUP, a community assessment ascertaining the goals, priorities and visions for the future for the community.

5. Inventory and assess pertinent data. The planner shall request data and seek technical assistance when necessary for compilation of all available data from the Navajo Nation, federal and state governments and agencies for inventorying and assessing natural, cultural and human resources, as well as community infrastructures.

B. Should the chapter not hire a land use planner, the Mexican Water Chpater Community Services Coordinator will assume the duties and responsibilities of the planner to complete the land use-planning project.

Section 8 **Technical Assistance**

The CLUPC may seek technical assistance from the Navajo Nation, Federal, State, and County Goverments, or others, as needed.

Section 9 **Ethics**

Members of the CLUPC are required to comply with Navajo Nation Ethics and Government Law.

Section 10 **Amendments**

The CLUPC Plan of Operation may be amended from time to time, as needed by the Mexican Water Chapter membership.

MEXICAN WATER CHAPTER

Red Mesa TP#1019, HC 61 Box 38 • Teec Nos Pos, AZ 86514 • (928) 674-3641

Mexican Water Chapter

MWC071209-80024

RESOLUTION OF MEXICAN WATER CHAPTER

Approving to ratify and support Mexican Water Chapter Planning & Zoning committee's request to reaffirm the committee's name change and its committee membership

WHEREAS,

1. The Mexican Water Chapter is officially recognized and certified as a political unit of the Navajo Tribal Government pursuant to Navajo Tribe Council Resolution No. CJ-20-55;

2. Pursuant to Resolution No. CAP-34-98, the Navajo Nation Council adopted the Navajo Nation Local Governance Act (LGA);

3. Pursuant to the LGA, all chapters shall develop and implement Community-Based Land Plan in accordance with 26 N.N.C. § 2004;

4. Pursuant to the LGA, the Mexican Water Chapter established a Community Land Use Planning Committee, which was renamed to the Planning & Zoning Commission to oversee all land use planning activities under Resolution No. MWC070830-113;

5. To accommodate the short and long term basic needs of the Chapter relating to community, economic, and infrastructure development, and to preserve grazing and culturally significant areas, the Mexican Water Chapter determines that, the establishment of a Community Land Use Planning committee (CLUPC) is necessary to begin the planning process accordance with 26 N.N.C. § 2004;

6. The Mexican Water Chapter Planning & Zoning Committee has identified (10) voting members to serve as committee members and to include all grazing permittees as members of the committee; and

NOW THEREFORE BE IT RESOLVED THAT;

1. The Mexican Water Chapter hereby approves to ratify and support Mexican Water Chapter Planning & Zoning committee's request to reaffirm the committee's name change and its committee membership

CERTIFICATION

We hereby certify the foregoing resolution was considered by Mexican Water Chapter, (Navajo Nation), Arizona at a duly called Chapter Meeting, at which a quorum was present and the same approved this resolution by a vote of **25** in favor, **00** opposed and **00** abstained on this **9th** day of **December 2007**.

Jerry Tsosie, President

David L. John Sr., Vice-President

Cassandra Beletso, Secretary/Treasurer

Mexican Water Chapter
Community Land Use Planning & Zoning Commission
Membership Roster

1. Darlene Stoney-Yazzie
2. Jerry Tsosie, Vice-President
3. Cassandra Beletso, Secretary/Treasurer
4. Martha Saggboy, Member
5. Alvin Tohtsoni, Member
6. Francis Haskan, Sr., Member
7. David L. John, Sr., Member
8. Harry Descheene, Member
9. Louis Patterson, Member
10. Renae Keith, Member

All Community Grazing Permittees

Resolution of Mexican Water Chapter Planning & Zoning Commission

RECOMMENDING THE COMMUNITY-BASED LAND USE PLAN TO THE MEXICAN WATER CHAPTER FOR APPROVAL

WHEREAS:

1. Pursuant to Resolution No. CAP-34-98, the Navajo Nation Council adopted the Navajo Nation Local Governance Act (LGA);
2. Pursuant to the LGA, the Mexican Water Chapter established a Community Land Use Planning Committee (CLUPC) to oversee all land use planning activities under Resolution No MWC991205-001;
3. Pursuant to Mexican Water Chapter Resolution No. MWC070830-113, the CLUPC was renamed to the Planning & Zoning Commission.
4. The Planning & Zoning Commission worked with the consulting firm JJ Clacs & Company to develop the community-based land use plan in accordance with 26 N.N.C. S2004;
5. The Planning & Zoning Commission and the consultant abided by the Community Participation Plan approved by the CLUPC on August 01, 2007 to ensure local community members were given the opportunity to participated in the planning process; and,
6. The Planning & Zoning Commission, with the support of the consultant and the input and participation of the community, developed the community-based land use plan in the best interest of the community, attached hereto as Exhibit "A".

NOW THEREFORE BE IT RESOLVED THAT:

1. The Mexican Water Chapter Planning & Zoning Commission hereby recommends the Community-Based Land Use Plan to the Chapter for approval, attached hereto as Exhibit "A".

CERTIFICATION

We hereby certify that the foregoing resolution was duly considered by the Mexican Water Chapter Planning & Zoning Commission at a duly called Planning & Zoning Commission meeting at Mexican Water, NAVAJO NATION, Arizona, at which a quorum was present and that the same was passed by a vote of 6 in favor, 0 opposed, and 0 abstained, this 28th day of November, 2007.

Darlene S. Yazzie, President

Jerry Tsosie, President

Cassandra Beletso, Secretary

Mexican Water Chapter
Planning and Zoning Committee
Plan of Operation

Section 1 Establishment

There hereby renamed the Mexican Water Chapter Community Land Use Planning Committee (CLUPC).

Section 2 Purpose

The purpose of the Planning and Zoning Committee is to develop and approve the processes of local use planning, oversee land use planning activities. After thorough review and analysis, present the community land use planning to the Mexican Water Chapter membership for consideration.

Section 3 Committee Duties and Responsibilities

The CLUP shall exercise the following duties and responsibilities consistent with the Navajo Nation Local Governance Act, 26 Section 2004:

A. Educate the community on the concepts, needs and process for planning and implementing a land use plan.
B. May hire, subject to availability of funds, a land use planner, to assist in the preparation of the community land use plan. The hiring and supervision of a land use planner shall be consistent with 26 NNC Section 2004 (2). The hiring of the planner shall be on a consultant basis consistent with general procurement and preference requirements.
C. Attempt to ensure that the development of the community land use plan is bases upon the guiding principles, priorities, goals, and vision as articulated by the community, and approved a public participation progresses.
D. Shall work closely with the membership, consultants and the designated coordinator as planning progresses.
E. Upon approval of the community land use plan by the Chapter membership, the Planning and Zoning Committee shall seek approval of the plan from the Transportation and Community and Development Committee, pursuant to 26 NNC Section 102
F. Upon approval by the community land use plan by the Transportation and Committee, Development Committee, the Planning and Zoning Committee shall develop recommendations for the implementation of the land use plan.

Section 4 Committee Selection-Membership

A. The selection of the membership to the Planning and Zoning Committee shall be by the Chapter membership at a dully called Chapter Meeting at which a quorum is present. The selection of the members shall be set forth via a certified chapter resolution.
B. The members of the Planning and Zoning Committee shall be comprised of ten voting member of the chapter that have expertise to provide valuable contribution to the overall land use planning process. In addition Grazing Permit tees shall be members at large and may vote on Planning and Zoning issues. Subcommittees such as technical, advisory committees, comprising of voting and non-voting members of the Chapter may be established to assist the Planning and Zoning Committee.
C. Members shall constitute a quorum.

Section 5 Meeting and Compensation

A. The CLUPC shall hold a sufficient number of meetings to accomplish the overall purpose of the committee. Designate, time, location, Date Regular meetings.
B. Each member of the Planning and Zoning Committee will receive $ 60.00 per meeting for attendance, contingent upon availability of funds.

Section 6 Selection of the Duties and Responsibilities of Committee Officers

A. Should the Mexican Water Chapter Planning and Zoning Committee hire a land use planner, the duties and responsibilities of the planner, pursuant to 26 NNC Section 2004 (3), includes but is not limited to the following:

1. The planner shall work with the Planning and Zoning Committee, consultants and the community residents on all land use planning activities and decision.
2. Coordination of all land planning activities.
3. Develop a community education and participation plan describing methods that will foster public education participation through hearing, newspapers and radio. Chapter members will be periodically informed of the progress of the land use planning activities. All information pertinent to the plan shall be available to the public.
4. Develop and implement, in coordination with Planning and Zoning Committee, a community assessment ascertaining the goals, priorities and visions for the future for the community.
5. Inventory and assess pertinent data. The planner shall request data seek technical assistance when necessary for compilation of all available data from the Navajo Nation, federal and state

governments, and agencies for inventorying and assessing natural, cultural and human resources, as a community infrastructures.

B. Should the chapter nor hire a land use planner, the Mexican Water Chapter Community Services Coordinator will assume the duties and responsibilities of the planner to complete the land use-planning project.

Section 8 Technical Assistance

The Planning and Zoning Committee may seek technical assistance from the Navajo Nation, Federal, State, and County Governments, or others, as needed.

Section 9 Ethics

Members of the Planning and Zoning Committee are required to comply with Navajo Nation Ethics and Government Law.

Section 10 Amendments

The Planning and Zoning Committee Plan of Operation may be amended from time to time, as needed by the Mexican Water Chapter Membership.

APPENDIX B

SOIL DESCRIPTIONS

Map Unit Text

Shiprock Area, Parts of San Juan County, New Mexico and Apache County, Arizona

[Only those mapunits that have entries for the selected text kinds and categories are included in this report]

Map unit: 501 - Escavada-Riverwash complex, 0 to 1 percent slopes

Text kind/Category: Nontechnical description/SOI

Escavada soils make up 45 percent of the map unit. The runoff class is low. The depth to a restrictive feature is greater than 60 inches. This soil is well drained. The slowest soil permeability within a depth of 60 inches is moderate. Available water capacity to a depth of 60 inches is low, and shrink swell potential is low. Annual flooding is occasional, and annual ponding is none. The minimum depth to the top of the seasonal high water table is at 66 inches. The maximum calcium carbonate equivalent within a depth of 40 inches is 5 percent. The assigned Kw erodibility factor is .17. It is nonirrigated land capability subclass 6e. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 5 inches; loamy fine sand; moderately alkaline.
H2 - 5 to 70 inches; stratified fine sand to silty clay; moderately alkaline.

Map unit: 502 - Sogzie loamy fine sand, 1 to 5 percent slopes

Text kind/Category: Nontechnical description/SOI

Sogzie soils make up 85 percent of the map unit. The runoff class is very low. The depth to a restrictive feature is greater than 60 inches. This soil is well drained. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is moderate, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 10 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 10 inches; loamy fine sand; slightly alkaline.
H2 - 10 to 50 inches; very fine sandy loam; moderately alkaline.
H3 - 50 to 70 inches; fine sandy loam; moderately alkaline.

Map Unit Text

Shiprock Area, Parts of San Juan County, New Mexico and Apache County, Arizona

Map unit: 505 - Recapture-Shorthair-Aneth complex, 1 to 8 percent slopes

Text kind/Category: Nontechnical description/SOI

Recapture soils make up 45 percent of the map unit. The runoff class is medium. The depth to a restrictive feature is greater than 60 inches. This soil is well drained. The slowest soil permeability within a depth of 60 inches is moderately slow. Available water capacity to a depth of 60 inches is moderate, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 30 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7s. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 3 inches; loamy fine sand; moderately alkaline.
H2 - 3 to 17 inches; sandy clay loam; very strongly alkaline.
H3 - 17 to 39 inches; clay loam; very strongly alkaline.
H4 - 39 to 53 inches; fine sandy loam; very strongly alkaline.
H5 - 53 to 65 inches; loamy fine sand; very strongly alkaline.

Shorthair soils make up 30 percent of the map unit. The runoff class is medium. The depth to a restrictive feature is 10 to 20 inches to bedrock (lithic). This soil is well drained. The slowest soil permeability within a depth of 60 inches is moderate. Available water capacity to a depth of 60 inches is very low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 10 percent. The assigned Kw erodibility factor is .10. It is nonirrigated land capability subclass 7s. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 1 inches; gravelly loamy fine sand; moderately alkaline.
H2 - 1 to 5 inches; fine sandy loam; very strongly alkaline.
H3 - 5 to 16 inches; fine sandy loam; very strongly alkaline.
H4 - 16 to 26 inches; unweathered bedrock.

Aneth soils make up 15 percent of the map unit. The runoff class is very low. The depth to a restrictive feature is greater than 60 inches. This soil is somewhat excessively drained. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is moderate, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 5 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 8 inches; loamy fine sand; moderately alkaline.
H2 - 8 to 28 inches; loamy fine sand; moderately alkaline.
H3 - 28 to 37 inches; fine sandy loam; strongly alkaline.
H4 - 37 to 65 inches; loamy fine sand; strongly alkaline.

Map Unit Text

Shiprock Area, Parts of San Juan County, New Mexico and Apache County, Arizona

Map unit: 506 - Blackston-Grazane association, 3 to 50 percent slopes

Text kind/Category: Nontechnical description/SOI

Blackston soils make up 65 percent of the map unit. The runoff class is medium. The depth to a restrictive feature is greater than 60 inches. This soil is well drained. The slowest soil permeability within a depth of 60 inches is moderate. Available water capacity to a depth of 60 inches is low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 40 percent. The assigned Kw erodibility factor is .28. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 9 inches; fine sandy loam; moderately alkaline.
H2 - 9 to 25 inches; gravelly loam; strongly alkaline.
H3 - 25 to 49 inches; extremely gravelly loamy sand; moderately alkaline.
H4 - 49 to 66 inches; loamy sand; moderately alkaline.

Grazane soils make up 20 percent of the map unit. The depth to a restrictive feature is 20 to 40 inches to bedrock (paralithic). This soil is well drained. The slowest soil permeability within a depth of 60 inches is moderately slow. Available water capacity to a depth of 60 inches is low, and shrink swell potential is moderate. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 15 percent. The assigned Kw erodibility factor is .10. It is nonirrigated land capability subclass 7e. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 2 inches; very cobbly fine sandy loam; moderately alkaline.
H2 - 2 to 6 inches; gravelly fine sandy loam; moderately alkaline.
H3 - 6 to 20 inches; sandy clay loam; strongly alkaline.
H4 - 20 to 26 inches; clay loam; strongly alkaline.
H5 - 26 to 36 inches; weathered bedrock.

Map unit: 507 - Sheppard loamy fine sand, 2 to 8 percent slopes, hummocky

Text kind/Category: Nontechnical description/SOI

Sheppard soils make up 90 percent of the map unit. The runoff class is very high. The depth to a restrictive feature is greater than 60 inches. This soil is somewhat excessively drained. The slowest soil permeability within a depth of 60 inches is rapid. Available water capacity to a depth of 60 inches is low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 5 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 3 inches; loamy fine sand; slightly alkaline.
H2 - 3 to 70 inches; loamy fine sand; moderately alkaline.

Map unit: 508 - Shalet-Rock outcrop complex, 8 to 45 percent slopes

Text kind/Category: Nontechnical description/SOI

Shalet soils make up 55 percent of the map unit. The runoff class is very high. The depth to a restrictive feature is 10 to 20 inches to bedrock (paralithic). This soil is well drained. The slowest soil permeability within a depth of 60 inches is moderately slow. Available water capacity to a depth of 60 inches is very low, and shrink swell potential is moderate. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 3 percent. The assigned Kw erodibility factor is .32. It is nonirrigated land capability subclass 7e. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 3 inches; sandy clay loam; moderately alkaline.

H2 - 3 to 6 inches; sandy clay loam; moderately alkaline.
H3 - 6 to 15 inches; sandy clay loam; strongly alkaline.
H4 - 15 to 25 inches; weathered bedrock.

Map unit: 509 - Trail loamy fine sand, 1 to 3 percent slopes

Text kind/Category: Nontechnical description/SOI

Trail soils make up 85 percent of the map unit. The runoff class is very low. The depth to a restrictive feature is greater than 60 inches. This soil is somewhat excessively drained. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is low, and shrink swell potential is low. Annual flooding is occasional, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 3 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 5 inches; loamy fine sand; moderately alkaline.
H2 - 5 to 70 inches; stratified sand to silt loam; strongly alkaline.

Map unit: 510 - Aneth loamy fine sand, 1 to 3 percent slopes

Text kind/Category: Nontechnical description/SOI

Aneth soils make up 80 percent of the map unit. The runoff class is negligible. The depth to a restrictive feature is greater than 60 inches. This soil is somewhat excessively drained. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is moderate, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 5 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 2 inches; loamy fine sand; moderately alkaline.
H2 - 2 to 36 inches; loamy fine sand; moderately alkaline.
H3 - 36 to 65 inches; fine sandy loam; strongly alkaline.

Map Unit Text

Shiprock Area, Parts of San Juan County, New Mexico and Apache County, Arizona

Map unit: 511 - Redlands loamy fine sand, 1 to 3 percent slopes

Text kind/Category: Nontechnical description/SOI

Redlands soils make up 85 percent of the map unit. The runoff class is low. The depth to a restrictive feature is greater than 60 inches. This soil is well drained. The slowest soil permeability within a depth of 60 inches is moderate. Available water capacity to a depth of 60 inches is high, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 10 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 2 inches; loamy fine sand; slightly alkaline.
H2 - 2 to 13 inches; fine sandy loam; moderately alkaline.
H3 - 13 to 22 inches; fine sandy loam; moderately alkaline.
H4 - 22 to 65 inches; clay loam; strongly alkaline.

Map unit: 512 - Gotho fine sandy loam, 0 to 2 percent slopes

Text kind/Category: Nontechnical description/SOI

Gotho soils make up 80 percent of the map unit. The runoff class is medium. The depth to a restrictive feature is greater than 60 inches. This soil is well drained. The slowest soil permeability within a depth of 60 inches is moderately slow. Available water capacity to a depth of 60 inches is moderate, and shrink swell potential is moderate. Annual flooding is rare, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 5 percent. The assigned Kw erodibility factor is .28. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 2 inches; fine sandy loam; strongly alkaline.
H2 - 2 to 13 inches; clay loam; strongly alkaline.
H3 - 13 to 66 inches; stratified fine sandy loam to clay loam; strongly alkaline.

Map unit: 513 - Sogzie-Aneth association, 2 to 8 percent slopes

Text kind/Category: Nontechnical description/SOI

Sogzie soils make up 70 percent of the map unit. The runoff class is very low. The depth to a restrictive feature is 40 to 60 inches to bedrock (paralithic). This soil is well drained. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 25 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 4 inches; loamy fine sand; moderately alkaline.
H2 - 4 to 14 inches; loamy fine sand; moderately alkaline.
H3 - 14 to 36 inches; fine sandy loam; strongly alkaline.
H4 - 36 to 42 inches; loamy fine sand; strongly alkaline.
H5 - 42 to 52 inches; weathered bedrock.

Aneth soils make up 20 percent of the map unit. The runoff class is very low. The depth to a restrictive feature is greater than 60 inches. This soil is somewhat excessively drained. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is moderate, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 5 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 7 inches; loamy fine sand; moderately alkaline.
H2 - 7 to 25 inches; loamy fine sand; moderately alkaline.
H3 - 25 to 54 inches; fine sandy loam; strongly alkaline.
H4 - 54 to 66 inches; loamy fine sand; strongly alkaline.

Map unit: 514 - Aneth loamy fine sand, 2 to 8 percent slopes, hummocky

Text kind/Category: Nontechnical description/SOI

Aneth soils make up 90 percent of the map unit. The runoff class is very low. The depth to a restrictive feature is greater than 60 inches. This soil is somewhat excessively drained. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is moderate, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 5 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 9 inches; loamy fine sand; moderately alkaline.
H2 - 9 to 33 inches; loamy fine sand; moderately alkaline.
H3 - 33 to 51 inches; fine sandy loam; strongly alkaline.
H4 - 51 to 70 inches; loamy fine sand; strongly alkaline.

Map unit: 515 - Piute-Bluechief-Rock outcrop complex, 2 to 25 percent slopes

Text kind/Category: Nontechnical description/SOI

Piute soils make up 45 percent of the map unit. The runoff class is very low. The depth to a restrictive feature is 4 to 10 inches to bedrock (lithic). This soil is well drained. The slowest soil permeability within a depth of 60 inches is rapid. Available water capacity to a depth of 60 inches is very low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 3 percent. The assigned Kw erodibility factor is .10. It is nonirrigated land capability subclass 7s. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 3 inches; gravelly loamy fine sand; moderately alkaline.
H2 - 3 to 7 inches; fine sand; moderately alkaline.
H3 - 7 to 17 inches; unweathered bedrock.

Bluechief soils make up 25 percent of the map unit. The runoff class is very low. The depth to a restrictive feature is 20 to 40 inches to bedrock (lithic). This soil is well drained. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 30 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 5 inches; loamy fine sand; slightly alkaline.
H2 - 5 to 11 inches; very fine sandy loam; moderately alkaline.
H3 - 11 to 22 inches; fine sandy loam; strongly alkaline.
H4 - 22 to 29 inches; fine sandy loam; strongly alkaline.
H5 - 29 to 39 inches; unweathered bedrock.

Map unit: 516 - Kaito-Claysprings complex, 30 to 65 percent slopes

Text kind/Category: Nontechnical description/SOI

Kaito soils make up 50 percent of the map unit. The runoff class is medium. The depth to a restrictive feature is 40 to 60 inches to bedrock (paralithic). This soil is well drained. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is moderate, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 50 percent. The assigned Kw erodibility factor is .05. It is nonirrigated land capability subclass 7e. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 3 inches; extremely gravelly fine sandy loam; moderately alkaline.
H2 - 3 to 10 inches; gravelly fine sandy loam; moderately alkaline.
H3 - 10 to 24 inches; very fine sandy loam; moderately alkaline.
H4 - 24 to 47 inches; fine sandy loam; strongly alkaline.
H5 - 47 to 57 inches; weathered bedrock.

Claysprings soils make up 35 percent of the map unit. The runoff class is very high. The depth to a restrictive feature is 10 to 20 inches to bedrock (paralithic). This soil is well drained. The slowest soil permeability within a depth of 60 inches is impermeable. Available water capacity to a depth of 60 inches is very low, and shrink swell potential is high. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 5 percent. The assigned Kw erodibility factor is .05. It is nonirrigated land capability subclass 7e. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 2 inches; extremely gravelly sandy clay loam; slightly alkaline.
H2 - 2 to 5 inches; clay; strongly alkaline.
H3 - 5 to 16 inches; clay; strongly alkaline.
H4 - 16 to 26 inches; weathered bedrock.

Map unit: 517 - Moffat loamy fine sand, 1 to 12 percent slopes

Text kind/Category: Nontechnical description/SOI

Moffat soils make up 80 percent of the map unit. The runoff class is low. The depth to a restrictive feature is greater than 60 inches. This soil is well drained. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is moderate, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 60 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 6 inches; loamy fine sand; moderately alkaline.
H2 - 6 to 28 inches; fine sandy loam; moderately alkaline.
H3 - 28 to 47 inches; fine sandy loam; strongly alkaline.
H4 - 47 to 65 inches; fine sandy loam; strongly alkaline.

Map unit: 518 - Tohatin-Sheppard loamy fine sands, 5 to 35 percent slopes

Text kind/Category: Nontechnical description/SOI

Tohatin soils make up 50 percent of the map unit. The runoff class is low. The depth to a restrictive feature is greater than 60 inches. This soil is somewhat excessively drained. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 15 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 3 inches; loamy fine sand; moderately alkaline.
H2 - 3 to 48 inches; loamy fine sand; strongly alkaline.
H3 - 48 to 80 inches; loamy fine sand; strongly alkaline.

Sheppard soils make up 35 percent of the map unit. The runoff class is very low. The depth to a restrictive feature is greater than 60 inches. This soil is somewhat excessively drained. The slowest soil permeability within a depth of 60 inches is rapid. Available water capacity to a depth of 60 inches is low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 5 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 8 inches; loamy fine sand; slightly alkaline.
H2 - 8 to 80 inches; loamy fine sand; moderately alkaline.

Map unit: 519 - Shumbegay loamy fine sand, 0 to 8 percent slopes

Text kind/Category: Nontechnical description/SOI

Shumbegay soils make up 85 percent of the map unit. The runoff class is very low. The depth to a restrictive feature is greater than 60 inches. This soil is somewhat excessively drained. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 3 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 2 inches; loamy fine sand; strongly alkaline.
H2 - 2 to 6 inches; loamy fine sand; strongly alkaline.
H3 - 6 to 10 inches; loamy fine sand; strongly alkaline.
H4 - 10 to 80 inches; stratified fine sand to silt loam; strongly alkaline.

Map unit: 520 - Rock outcrop-Needle complex, 2 to 20 percent slopes

Text kind/Category: Nontechnical description/SOI

Needle soils make up 20 percent of the map unit. The runoff class is very low. The depth to a restrictive feature is 10 to 20 inches to bedrock (lithic). This soil is excessively drained. The slowest soil permeability within a depth of 60 inches is rapid. Available water capacity to a depth of 60 inches is very low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 5 percent. The assigned Kw erodibility factor is .17. It is nonirrigated land capability subclass 7s. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 5 inches; fine sand; slightly alkaline.
H2 - 5 to 15 inches; fine sand; slightly alkaline.
H3 - 15 to 19 inches; unweathered bedrock.

Map unit: 521 - Sandbench-Sheppard fine sands, 1 to 8 percent slopes

Text kind/Category: Nontechnical description/SOI

Sandbench soils make up 50 percent of the map unit. The runoff class is medium. The depth to a restrictive feature is 20 to 40 inches to bedrock (lithic). This soil is somewhat excessively drained. The slowest soil permeability within a depth of 60 inches is rapid. Available water capacity to a depth of 60 inches is very low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 20 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 11 inches; fine sand; moderately alkaline.
H2 - 11 to 17 inches; loamy fine sand; moderately alkaline.
H3 - 17 to 31 inches; loamy fine sand; moderately alkaline.
H4 - 31 to 41 inches; unweathered bedrock.

Sheppard soils make up 40 percent of the map unit. The runoff class is very low. The depth to a restrictive feature is greater than 60 inches. This soil is somewhat excessively drained. The slowest soil permeability within a depth of 60 inches is rapid. Available water capacity to a depth of 60 inches is low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 5 percent. The assigned Kw erodibility factor is .17. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 4 inches; fine sand; slightly alkaline.
H2 - 4 to 61 inches; fine sand; moderately alkaline.

Map unit: 522 - Pennell loamy fine sand, 1 to 6 percent slopes

Text kind/Category: Nontechnical description/SOI

Pennell soils make up 80 percent of the map unit. The runoff class is very low. The depth to a restrictive feature is 10 to 20 inches to bedrock (lithic). This soil is well drained. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is very low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 40 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7s. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 5 inches; loamy fine sand; moderately alkaline.
H2 - 5 to 10 inches; fine sandy loam; moderately alkaline.
H3 - 10 to 18 inches; gravelly sandy loam; moderately alkaline.
H4 - 18 to 22 inches; unweathered bedrock.

Map unit: 523 - Tyende-Aneth-Shumbegay loamy fine sands, 1 to 25 percent slopes

Text kind/Category: Nontechnical description/SOI

Tyende soils make up 50 percent of the map unit. The runoff class is low. The depth to a restrictive feature is 20 to 40 inches to bedrock (paralithic). This soil is well drained. The slowest soil permeability within a depth of 60 inches is moderate. Available water capacity to a depth of 60 inches is very low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 15 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7s. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 6 inches; loamy fine sand; moderately alkaline.
H2 - 6 to 10 inches; fine sandy loam; very strongly alkaline.
H3 - 10 to 14 inches; sandy clay loam; very strongly alkaline.
H4 - 14 to 37 inches; very fine sandy loam; strongly alkaline.
H5 - 37 to 41 inches; weathered bedrock.

Aneth soils make up 25 percent of the map unit. The runoff class is very low. The depth to a restrictive feature is greater than 60 inches. This soil is somewhat excessively drained. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is moderate, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 5 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 2 inches; loamy fine sand; moderately alkaline.
H2 - 2 to 32 inches; loamy fine sand; moderately alkaline.
H3 - 32 to 63 inches; fine sandy loam; strongly alkaline.

Shumbegay soils make up 15 percent of the map unit. The runoff class is low. The depth to a restrictive feature is greater than 60 inches. This soil is somewhat excessively drained. The slowest soil permeability within a depth of 60 inches is moderately rapid. Available water capacity to a depth of 60 inches is low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 3 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 1 inches; loamy fine sand; strongly alkaline.
H2 - 1 to 5 inches; loamy fine sand; strongly alkaline.
H3 - 5 to 80 inches; loamy fine sand; strongly alkaline.

Map unit: 524 - Uzaneva clay loam, 0 to 2 percent slopes

Text kind/Category: Nontechnical description/SOI

Uzaneva soils make up 85 percent of the map unit. The runoff class is very high. The depth to a restrictive feature is greater than 60 inches. This soil is well drained. The slowest soil permeability within a depth of 60 inches is very slow. Available water capacity to a depth of 60 inches is high, and shrink swell potential is moderate. Annual flooding is rare, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 5 percent. The assigned Kw erodibility factor is .32. It is irrigated land capability subclass 3s. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 1 inches; clay loam; moderately alkaline.
H2 - 1 to 13 inches; clay; strongly alkaline.
H3 - 13 to 25 inches; silty clay; strongly alkaline.
H4 - 25 to 80 inches; stratified sandy loam to silty clay; strongly alkaline.

Map unit: 526 - Sandbench-Rock outcrop-Piute, cool complex, 1 to 8 percent slopes

Text kind/Category: Nontechnical description/SOI

Sandbench soils make up 45 percent of the map unit. The runoff class is high. The depth to a restrictive feature is 20 to 40 inches to bedrock (lithic). This soil is somewhat excessively drained. The slowest soil permeability within a depth of 60 inches is rapid. Available water capacity to a depth of 60 inches is very low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 20 percent. The assigned Kw erodibility factor is .20. It is nonirrigated land capability subclass 7c. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 8 inches; fine sand; moderately alkaline.
H2 - 8 to 19 inches; loamy fine sand; moderately alkaline.
H3 - 19 to 37 inches; loamy fine sand; moderately alkaline.
H4 - 37 to 41 inches; unweathered bedrock.

Piute soils make up 20 percent of the map unit. The runoff class is very low. The depth to a restrictive feature is 4 to 10 inches to bedrock (lithic). This soil is well drained. The slowest soil permeability within a depth of 60 inches is rapid. Available water capacity to a depth of 60 inches is very low, and shrink swell potential is low. Annual flooding is none, and annual ponding is none. The minimum depth to a water table is greater than 6 feet. The maximum calcium carbonate equivalent within a depth of 40 inches is 3 percent. The assigned Kw erodibility factor is .10. It is nonirrigated land capability subclass 7s. This component is not a hydric soil.

Typical Profile:
H1 - 0 to 3 inches; gravelly loamy fine sand; moderately alkaline.
H2 - 3 to 8 inches; fine sand; moderately alkaline.
H3 - 8 to 12 inches; unweathered bedrock.

Component Text

San Juan County, Utah, Navajo Indian Reservation

[Only those components that have entries for the selected text kinds and categories are included in this report]

Map unit: AmB - Aneth loamy fine sand, 1 to 8 percent slopes

Componet: Aneth

Text kind/Category: Nontechnical description/GENSOIL

The Aneth component makes up 90 percent of the map unit. Slopes are 1 to 8 percent. This component is on terraces, valleys. The parent material consists of eolian deposits derived from sandstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R035XY118UT Desert Sandy Loam (four-Wing Saltbush) ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Map unit: AnA - Aneth loamy fine sand, moderately alkali, 0 to 3 percent slopes

Componet: Aneth

Text kind/Category: Nontechnical description/GENSOIL

The Aneth component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains, valleys. The parent material consists of eolian deposits derived from sandstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R035XY009UT Alkali Flat (greasewood) ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Map unit: AsA - Aneth sandy clay loam, 0 to 3 percent slopes

Componet: Aneth

Text kind/Category: Nontechnical description/GENSOIL

The Aneth component makes up 95 percent of the map unit. Slopes are 0 to 3 percent. This component is on valleys. The parent material consists of eolian deposits derived from sandstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R035XY015UT Sandy Bottom (fourwing Saltbush) ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Component Text

San Juan County, Utah, Navajo Indian Reservation

Map unit: AV - Aquic Ustifluvents-Typic Fluvaquents association, gently sloping

Componet: Aquic Ustifluvents

Text kind/Category: Nontechnical description/GENSOIL

The Aquic Ustifluvents component makes up 40 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 10 inches during March, April, May, June. Organic matter content in the surface horizon is about 2 percent. This component is in the R035XY012UT Semiwet Saline Streambank (fremont Cottonwood) ecological site. Nonirrigated land capability classification is 7w. This soil meets hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 14 percent. The soil has a moderately saline horizon within 30 inches of the soil surface. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Componet: Typic Fluvaquents

Text kind/Category: Nontechnical description/GENSOIL

The Typic Fluvaquents component makes up 40 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 10 inches during March, April, May, June. Organic matter content in the surface horizon is about 1 percent. This component is in the R035XY012UT Semiwet Saline Streambank (fremont Cottonwood) ecological site. Nonirrigated land capability classification is 6w. This soil meets hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 17 percent. The soil has a moderately saline horizon within 30 inches of the soil surface. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Map unit: BA - Badland

Componet: Badland

Text kind/Category: Nontechnical description/GENSOIL

Generated brief soil descriptions are created for major soil components. The Badland is a miscellaneous area.

Map unit: BD - Badland-Typic Torrifluvents association, steep

Componet: Badland

Text kind/Category: Nontechnical description/GENSOIL

Generated brief soil descriptions are created for major soil components. The Badland is a miscellaneous area.

Component Text

San Juan County, Utah, Navajo Indian Reservation

Map unit: BD - Badland-Typic Torrifluvents association, steep

Componet: Typic Torrifluvents

Text kind/Category: Nontechnical description/GENSOIL

The Typic Torrifluvents component makes up 30 percent of the map unit. Slopes are 0 to 10 percent. This component is on drainageways. The parent material consists of alluvium derived from sandstone and shale and/or eolian deposits derived from sandstone and shale. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 71 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R035XY109UT Desert Loam (shadscale) ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 9 percent. The soil has a slightly saline horizon within 30 inches of the soil surface. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Map unit: DeE - Deleco loamy fine sand, 12 to 55 percent slopes

Componet: Deleco

Text kind/Category: Nontechnical description/GENSOIL

The Deleco component makes up 90 percent of the map unit. Slopes are 12 to 55 percent. This component is on fans, terraces. The parent material consists of alluvium derived from sedimentary rock and/or colluvium derived from sedimentary rock. Depth to a root restrictive layer, petrocalcic, is 7 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R035XY133UT Desert Shallow Sandy Loam (blackbrush) ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 53 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Map unit: GtA - Gotho soils, 0 to 3 percent slopes

Componet: Gotho

Text kind/Category: Nontechnical description/GENSOIL

The Gotho component makes up 45 percent of the map unit. Slopes are 0 to 3 percent. This component is on valleys. The parent material consists of alluvium derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R035XY009UT Alkali Flat (greasewood) ecological site. Nonirrigated land capability classification is 7c. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 6 percent. The soil has a slightly saline horizon within 30 inches of the soil surface. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Component Text

San Juan County, Utah, Navajo Indian Reservation

Map unit: GtA - Gotho soils, 0 to 3 percent slopes

Componet: Gotho

Text kind/Category: Nontechnical description/GENSOIL

The Gotho component makes up 45 percent of the map unit. Slopes are 0 to 3 percent. This component is on valleys. The parent material consists of alluvium derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R035XY009UT Alkali Flat (greasewood) ecological site. Nonirrigated land capability classification is 7c. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 6 percent. The soil has a slightly saline horizon within 30 inches of the soil surface. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Map unit: LAG - Lithic Torriorthents-Typic Torriorthents-Rock outcrop association, steep

Componet: Lithic Torriorthents

Text kind/Category: Nontechnical description/GENSOIL

The Lithic Torriorthents component makes up 30 percent of the map unit. Slopes are 20 to 45 percent. This component is on canyons, mesas. The parent material consists of colluvium derived from sedimentary rock and/or residuum weathered from sedimentary rock. Depth to a root restrictive layer, bedrock, lithic, is 4 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R035XY130UT Desert Shallow Sandy Loam (shadscale) ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 13 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Componet: Typic Torriorthents

Text kind/Category: Nontechnical description/GENSOIL

The Typic Torriorthents component makes up 30 percent of the map unit. Slopes are 40 to 80 percent. This component is on mesas, canyons. The parent material consists of colluvium derived from sedimentary rock and/or residuum weathered from sedimentary rock. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R035XY018UT Talus Slope (blackbrush-Shadscale) ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 18 percent. The soil has a very slightly saline horizon within 30 inches of the soil surface. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Componet: Rock outcrop

Text kind/Category: Nontechnical description/GENSOIL

Generated brief soil descriptions are created for major soil components. The Rock outcrop is a miscellaneous area.

Component Text

San Juan County, Utah, Navajo Indian Reservation

Map unit: MbD - Moenkopie sandy loam, 3 to 8 percent slopes

Componet: Moenkopie, sandy loam

Text kind/Category: Nontechnical description/GENSOIL

The Moenkopie, sandy loam component makes up 90 percent of the map unit. Slopes are 3 to 8 percent. This component is on structural benches. The parent material consists of residuum weathered from sandstone and shale. Depth to a root restrictive layer, bedrock, lithic, is 5 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R035XY130UT Desert Shallow Sandy Loam (shadscale) ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 18 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Map unit: McF - Moenkopie-Rock outcrop complex, 8 to 25 percent slopes

Componet: Moenkopie

Text kind/Category: Nontechnical description/GENSOIL

The Moenkopie component makes up 65 percent of the map unit. Slopes are 8 to 25 percent. This component is on hills, structural benches. The parent material consists of residuum weathered from sandstone and shale. Depth to a root restrictive layer, bedrock, lithic, is 5 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R035XY130UT Desert Shallow Sandy Loam (shadscale) ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 18 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Componet: Rock outcrop

Text kind/Category: Nontechnical description/GENSOIL

Generated brief soil descriptions are created for major soil components. The Rock outcrop is a miscellaneous area.

Map unit: MoB - Mota loamy fine sand, 1 to 8 percent slopes

Componet: Mota

Text kind/Category: Nontechnical description/GENSOIL

The Mota component makes up 85 percent of the map unit. Slopes are 1 to 8 percent. This component is on structural benches. The parent material consists of eolian deposits derived from sandstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R035XY121UT Desert Sandy Loam (blackbrush) ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 20 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Component Text

San Juan County, Utah, Navajo Indian Reservation

Map unit: MRE - Mota-Moenkopie-Rock outcrop association, sloping

Componet: Moenkopie

Text kind/Category: Nontechnical description/GENSOIL

The Moenkopie component makes up 30 percent of the map unit. Slopes are 3 to 8 percent. This component is on valleys. The parent material consists of residuum weathered from sandstone and shale. Depth to a root restrictive layer, bedrock, lithic, is 5 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R035XY130UT Desert Shallow Sandy Loam (shadscale) ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 18 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Componet: Mota

Text kind/Category: Nontechnical description/GENSOIL

The Mota component makes up 30 percent of the map unit. Slopes are 1 to 8 percent. This component is on valleys. The parent material consists of eolian deposits derived from sandstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R035XY121UT Desert Sandy Loam (blackbrush) ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 20 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Componet: Rock outcrop

Text kind/Category: Nontechnical description/GENSOIL

Generated brief soil descriptions are created for major soil components. The Rock outcrop is a miscellaneous area.

Map unit: NnD - Neskahi fine sandy loam, 2 to 6 percent slopes

Componet: Neskahi

Text kind/Category: Nontechnical description/GENSOIL

The Neskahi component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on valleys, alluvial fans. The parent material consists of alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R035XY121UT Desert Sandy Loam (blackbrush) ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 9 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Component Text

San Juan County, Utah, Navajo Indian Reservation

Map unit: Py - Playas

Componet: Playas

Text kind/Category: Nontechnical description/GENSOIL

Generated brief soil descriptions are created for major soil components. The Playas is a miscellaneous area.

Map unit: RaE - Raplee very fine sandy loam, 2 to 12 percent slopes

Componet: Raplee

Text kind/Category: Nontechnical description/GENSOIL

The Raplee component makes up 90 percent of the map unit. Slopes are 2 to 12 percent. This component is on pediments. The parent material consists of residuum weathered from gypsiferous sandstone. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 36 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R035XY126UT Desert Shallow Gypsum ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. The soil has a slightly saline horizon within 30 inches of the soil surface. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Map unit: RO - Rock outcrop

Componet: Rock outcrop

Text kind/Category: Nontechnical description/GENSOIL

Generated brief soil descriptions are created for major soil components. The Rock outcrop is a miscellaneous area.

Map unit: RRG - Rock outcrop, sandstone-Lithic Torriorthents, association, steep

Componet: Lithic Torriorthents

Text kind/Category: Nontechnical description/GENSOIL

The Lithic Torriorthents component makes up 50 percent of the map unit. Slopes are 5 to 40 percent. This component is on structural benches. The parent material consists of colluvium derived from sedimentary rock and/or residuum weathered from sedimentary rock. Depth to a root restrictive layer, bedrock, lithic, is 2 to 10 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R035XY130UT Desert Shallow Sandy Loam (shadscale) ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 9 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Componet: Rock outcrop, sandst

Text kind/Category: Nontechnical description/GENSOIL

Generated brief soil descriptions are created for major soil components. The Rock outcrop, sandst is a miscellaneous area.

Component Text

San Juan County, Utah, Navajo Indian Reservation

Map unit: ShD - Sheppard fine sand, hummocky

Componet: Sheppard

Text kind/Category: Nontechnical description/GENSOIL

The Sheppard component makes up 80 percent of the map unit. Slopes are 2 to 12 percent. This component is on dunes on structural benches. The parent material consists of eolian deposits derived from sandstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R035XY115UT Desert Sand (sand Sagebrush) ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 5 percent.

Map unit: ShE - Sheppard fine sand, rolling

Componet: Sheppard

Text kind/Category: Nontechnical description/GENSOIL

The Sheppard component makes up 85 percent of the map unit. Slopes are 2 to 8 percent. This component is on dunes on structural benches. The parent material consists of eolian deposits derived from sandstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R035XY115UT Desert Sand (sand Sagebrush) ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 5 percent.

Map unit: SME - Sheppard-Rock outcrop association, hummocky

Componet: Sheppard

Text kind/Category: Nontechnical description/GENSOIL

The Sheppard component makes up 70 percent of the map unit. Slopes are 2 to 12 percent. This component is on dunes on structural benches. The parent material consists of eolian deposits derived from sandstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R035XY115UT Desert Sand (sand Sagebrush) ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 5 percent.

Componet: Rock outcrop

Text kind/Category: Nontechnical description/GENSOIL

Generated brief soil descriptions are created for major soil components. The Rock outcrop is a miscellaneous area.

Component Text

San Juan County, Utah, Navajo Indian Reservation

Map unit: w - Water

Componet: Water

Text kind/Category: Nontechnical description/GENSOIL

Generated brief soil descriptions are created for major soil components. The Water is a miscellaneous area.

APPENDIX C

SOIL LIMITATIONS ~ DWELLING AND SMALL COMMERCIAL BUILDINGS

Dwellings and Small Commercial Buildings

Shiprock Area, Parts of San Juan County, New Mexico and Apache County, Arizona

[The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
501:							
Escavada	45	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
				Depth to saturated zone	0.03		
Riverwash	40	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
502:							
Sogzie	85	Not limited		Not limited		Not limited	
505:							
Recapture	45	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
Shorthair	30	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
						Slope	0.13
Aneth	15	Not limited		Not limited		Somewhat limited	
						Slope	0.13
Riverwash	1	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
506:							
Blackston	65	Not limited		Not limited		Somewhat limited	
						Slope	0.50
Grazane	20	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Shrink-swell	0.50	Depth to soft bedrock	0.79	Shrink-swell	0.50
				Shrink-swell	0.50		
507:							
Sheppard	90	Not limited		Not limited		Somewhat limited	
						Slope	0.13

Dwellings and Small Commercial Buildings

Shiprock Area, Parts of San Juan County, New Mexico and Apache County, Arizona

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
508:							
Shalet	55	Very limited		Very limited		Very limited	
		Depth to soft bedrock	1.00	Depth to soft bedrock	1.00	Slope	1.00
		Slope	1.00	Slope	1.00	Depth to soft bedrock	1.00
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
Rock outcrop	40	Not rated		Not rated		Not rated	
509:							
Trail	85	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
510:							
Aneth	80	Not limited		Not limited		Not limited	
511:							
Redlands	85	Not limited		Not limited		Not limited	
512:							
Gotho	80	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
513:							
Sogzie	70	Not limited		Not limited		Not limited	
Aneth	20	Not limited		Not limited		Somewhat limited	
						Slope	0.50
514:							
Aneth	90	Not limited		Not limited		Somewhat limited	
						Slope	0.13
515:							
Piute	45	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Slope	0.96	Slope	0.96	Slope	1.00
Bluechief	25	Somewhat limited		Very limited		Somewhat limited	
		Depth to hard bedrock	0.54	Depth to hard bedrock	1.00	Depth to hard bedrock	0.54
Rock outcrop	20	Not rated		Not rated		Not rated	

Dwellings and Small Commercial Buildings

Shiprock Area, Parts of San Juan County, New Mexico and Apache County, Arizona

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
516:							
Kaito	50	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
Claysprings	35	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Depth to soft bedrock	1.00	Shrink-swell	1.00	Depth to soft bedrock	1.00
		Shrink-swell	1.00	Depth to soft bedrock	1.00	Shrink-swell	1.00
517:							
Moffat	80	Not limited		Not limited		Somewhat limited	
						Slope	0.88
518:							
Tohatin	50	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
Sheppard	35	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
519:							
Shumbegay	85	Not limited		Not limited		Not limited	
520:							
Rock outcrop	75	Not rated		Not rated		Not rated	
Needle	20	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Slope	0.37	Slope	0.37	Slope	1.00
521:							
Sandbench	50	Somewhat limited		Very limited		Somewhat limited	
		Depth to hard bedrock	0.35	Depth to hard bedrock	1.00	Depth to hard bedrock	0.35
Sheppard	40	Not limited		Not limited		Somewhat limited	
						Slope	0.13
522:							
Pennell	80	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
523:							
Tyende	50	Not limited		Somewhat limited		Not limited	
				Depth to soft bedrock	0.03		

Dwellings and Small Commercial Buildings

Shiprock Area, Parts of San Juan County, New Mexico and Apache County, Arizona

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
523:							
Aneth	25	Not limited		Not limited		Somewhat limited	
						Slope	0.13
Shumbegay	15	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
524:							
Uzaneva	85	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
526:							
Sandbench	45	Somewhat limited		Very limited		Somewhat limited	
		Depth to hard bedrock	0.03	Depth to hard bedrock	1.00	Slope	0.13
						Depth to hard bedrock	0.03
Rock outcrop	25	Not rated		Not rated		Not rated	
Piute	20	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
						Slope	0.13

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. This table shows the degree and kind of soil limitations that affect dwellings with and without basements and small commercial buildings.

The ratings in the table are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. Not limited indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. Somewhat limited indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. Very limited indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Dwellings are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Small commercial buildings are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Dwellings and Small Commercial Buildings

San Juan County, Utah, Navajo Indian Reservation

[The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The columns that identify the rating class and limiting features show no more than five limitations for any given soil. The soil may have additional limitations]

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AmB:							
Aneth	90	Not limited		Not limited		Somewhat limited	
						Slope	0.13
AnA:							
Aneth	85	Not limited		Not limited		Not limited	
AsA:							
Aneth	95	Not limited		Not limited		Not limited	
AV:							
Aquic Ustifluvents	40	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
Typic Fluvaquents	40	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
BA:							
Badland	90	Not rated		Not rated		Not rated	
BD:							
Badland	40	Not rated		Not rated		Not rated	
Typic Torrifluvents	30	Not limited		Not limited		Somewhat limited	
						Slope	0.13
DeE:							
Deleco	90	Very limited		Very limited		Very limited	
		Slope	1.00	Depth to thin cemented pan	1.00	Slope	1.00
		Depth to thin cemented pan	0.50	Slope	1.00	Depth to thin cemented pan	1.00
GtA:							
Gotho	45	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
Gotho	45	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50

Dwellings and Small Commercial Buildings

San Juan County, Utah, Navajo Indian Reservation

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
LAG:							
Lithic Torriorthents	30	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
Typic Torriorthents	30	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Depth to hard bedrock	0.42	Depth to hard bedrock	1.00	Depth to hard bedrock	0.42
Rock outcrop	25	Not rated		Not rated		Not rated	
MbD:							
Moenkopie, sandy loam	90	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
						Slope	0.50
McF:							
Moenkopie	65	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Slope	1.00
		Slope	1.00	Slope	1.00	Depth to hard bedrock	1.00
Rock outcrop	20	Not rated		Not rated		Not rated	
MoB:							
Mota	85	Not limited		Not limited		Somewhat limited	
						Slope	0.13
MRE:							
Moenkopie	30	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
						Slope	0.50
Mota	30	Not limited		Not limited		Somewhat limited	
						Slope	0.13
Rock outcrop	15	Not rated		Not rated		Not rated	
NnD:							
Neskahi	85	Not limited		Not limited		Not limited	
Py:							
Playas	90	Not rated		Not rated		Not rated	

Dwellings and Small Commercial Buildings

San Juan County, Utah, Navajo Indian Reservation

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
RaE:							
Raplee	90	Not limited		Somewhat limited		Somewhat limited	
				Depth to soft bedrock	0.97	Slope	0.88
RO:							
Rock outcrop	90	Not rated		Not rated		Not rated	
RRG:							
Lithic Torriorthents	50	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Slope	1.00	Slope	1.00	Slope	1.00
Rock outcrop, sandst	50	Not rated		Not rated		Not rated	
ShD:							
Sheppard	80	Not limited		Not limited		Somewhat limited	
						Slope	0.88
ShE:							
Sheppard	85	Not limited		Not limited		Somewhat limited	
						Slope	0.13
SME:							
Sheppard	70	Not limited		Not limited		Somewhat limited	
						Slope	0.88
Rock outcrop	20	Not rated		Not rated		Not rated	
w:							
Water	100	Not rated		Not rated		Not rated	

Dwellings and Small Commercial Buildings

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. This table shows the degree and kind of soil limitations that affect dwellings and small commercial buildings.

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"Small commercial buildings" are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Information in this table is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this table. Local ordinances and regulations should be considered in planning, in site selection, and in design.

APPENDIX D

VEGETATIVE LANDCOVER

USGS
science for a changing world

Gap Analysis Program History and Overview

"Gap analysis" is a scientific method for identifying the degree to which native animal species and natural plant communities are represented in our present-day network of conservation lands …

The concept for the Gap Analysis Program (GAP) was born in 1987 in response to the need to complement species-by-species management in dealing with broad-spectrum habitat loss. The need for clear, geographically explicit information on the distribution of native vertebrate species, their habitat preferences, and their management status was evident.

Following two years of methods development, the program was launched in 1989 as a research project exploring how to develop predictive information that can be used to manage the nation's biological diversity ("biodiversity") so that ordinary plant and animal species will not become threatened with extinction. Over the past fourteen years, important new and successful methods needed to manage the country's diversity of life forms have emerged, overcoming barriers to mapping elements of biological diversity across large areas – something that had never been done before.

A wide range of tools and procedures are now available, including standards for classifying natural vegetative communities, a consistent set of satellite images from which to render digital databases, and methods to apply GAP information to everyday resource decisions and long-range planning. Today, GAP is operational nationwide and has enjoyed substantial international interest.

GAP's mission is to promote biodiversity conservation by developing and sharing information on where species and natural communities occur and how they are being managed for their long-term survival – making it an important part of the overall National Biological Information Infrastructure (NBII). "Gap analysis" is a scientific method for identifying the degree to which native animal species and natural plant communities are represented in our present-day network of conservation lands. Those species and communities not adequately represented constitute "gaps" in conservation lands and efforts.

Mapping Natural Community and Species Distributions

The ability to successfully map natural communities and species in terrestrial as well as aquatic environments has required breakthroughs in science, technology, and effective partnering. To develop maps of natural plant assemblages, satellite imagery is combined with aerial photography, air video, field data, and expert knowledge to create state- and region-wide maps for use by land managers and planners. GAP partners include state and federal agencies, universities, businesses, and nonprofit organizations. The program develops standards – such as those used to classify natural vegetation communities or to predict the distribution of animal species – that provide a framework for individual states and other organizations to further develop creative techniques and tools.

"Predictive modeling" is used to map species that breed or use habitats in a given state. To predict their distributions, species are associated with mapped habitat characteristics using computerized GIS (geographic information system) tools. The resultant maps are checked for accuracy against verified checklists and published reports of species occurrences and peer-reviewed by experts species by species. GAP began by mapping distributions of amphibian, bird, mammal, and reptile species. Recognizing that biodiversity includes all life forms, the program is currently developing methods to extend its coverage to fish, mussel, crayfish, snail, and other species, and will include additional species as knowledge and resources allow.

Mapping Land Stewardship and Finding Conservation Gaps

GAP characterizes land and water management according to the steward's (resource manager's) intent to maintain biodiversity. Stewardship maps identify categories of land ownership, managing authority, and management intent using standardized criteria applied by the resource manager. The distribution of a species or a natural community is overlaid with a land stewardship map, and the extent of an element's representation in conservation lands can then be determined.

Products

GAP data and reports are distributed through state data distribution centers for the cost of shipping and handling. Data are also made available on CD-ROM and through the GAP Web site <gapanalysis.usgs.gov>. Current products include:

- Land Cover Maps: Produced from 30-meter satellite imagery, in digital GIS format, showing dominant vegetation types (for example, "Eastern Cottonwood Floodplain Forest").
- Species Distribution Maps: Depict the predicted distribution of each vertebrate species, in digital GIS format.
- Land Stewardship Maps: Indicate categories of ownership, managing authority, and management status for biodiversity conservation, in digital GIS format.
- State Project Reports: Offer analyses of the conservation status for each species and natural community, in digital form with graphic versions of all GIS maps.

Partnership Opportunities

GAP projects could not be conducted without the participation of nearly 500 cooperating state and federal agencies, academic and nonprofit institutions, and businesses. Nationwide cooperators include multiple Department of the Interior bureaus, the Department of Defense, the Environmental Protection Agency, and NatureServe. Partnerships often link entities that may not have previously worked together and provide benefits to all parties.

As part of the overall NBII Program, GAP investigators are helping many organizations apply GAP data to their projects and missions. Numerous GAP applications have been developed nationwide, ranging from forest management, conservation planning, and scientific research endeavors to business and industry applications. A sample of applications of GAP data can be accessed on the Gap Analysis Program Web site. These Web pages also provide general information on the program, a collection of GAP literature, state contacts, the status of GAP projects, and specific data availability.

gap
KEEPING COMMON SPECIES COMMON

For More Information

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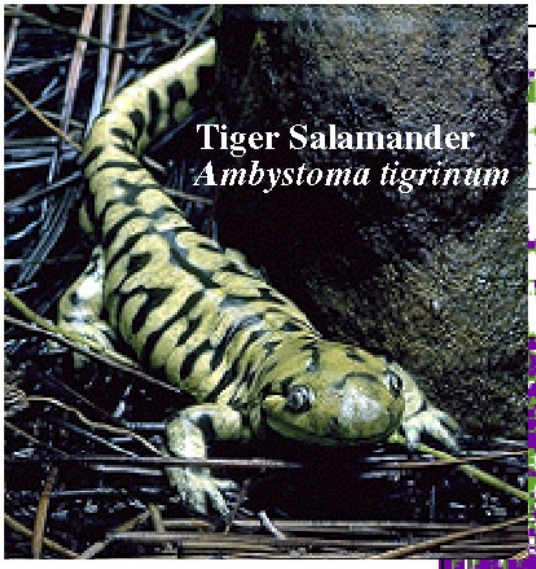

Example of Species Distribution Maps: modeled ranges of birds, mammals, reptiles, and amphibians.

EXCERPTS FROM
LANDCOVER DESCRIPTIONS
FOR
THE SOUTHWEST REGIONAL GAP
ANALYSIS PROJECT

Compiled by NatureServe
10 September, 2004

Modified to include only landcover found
in the Mexican Water planning area
December 2007

TABLE OF CONTENTS

OTHER COVER TYPES

N11—Open Water

Source: NLCD draft legend, 25 July, 2003
Description: All areas of open water, generally with less than 25% cover of vegetation or soil.

N31—Barren Lands

Source: NLCD draft legend, 25 July, 2003
Description: (Rock/Sand/Clay)-Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulation of earthen material. Generally, vegetation accounts for less than 15% of total cover.

ALTERED OR DISTURBED LAND COVER TYPES

D04—Invasive Southwest Riparian Woodland and Shrubland

Source: SWReGAP/NatureServe
Description: Tamarix spp. Semi-Natural Temporarily Flooded Shrubland Alliance (A842), or Elaegnus angustifolus Semi-Natural Woodland Alliance (A3566).

D08—Invasive Annual Grassland

Source: SWReGAP/NatureServe
Description: Avena spp., Bromus spp., Schismus spp.

NATURAL LAND COVER TYPES / ECOLOGCIAL SYSTEM DESCRIPTIONS

NLCD Barren Lands Types

(Rock/Sand/Clay)-Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulation of earthen material. Generally, vegetation accounts for less than 15% of total cover.

S010 Colorado Plateau Mixed Bedrock Canyon and Tableland

Division 304, Barren, CES304.765
Spatial Scale & Pattern: Matrix **Classification Confidence:** low
Required Classifiers: Natural/Semi-natural, Non-vegetated (<10% vasc.), Upland
Diagnostic Classifiers: Montane [Lower Montane], Lowland [Foothill], Shrubland (Shrub-dominated), Ridge/Summit/Upper Slope, Sedimentary Rock, Temperate [Temperate Xeric], Alkaline Soil, Aridic

Non-Diagnostic Classifiers: Moss/Lichen (Nonvascular), Cliff (Substrate), Talus (Substrate)

Concept Summary: The distribution of this ecological system is centered on the Colorado Plateau where it is comprised of barren and sparsely vegetated landscapes (generally <10% plant cover) of steep cliff faces, narrow canyons, and open tablelands of predominantly sedimentary rocks, such as sandstone, shale, and limestone. Some eroding shale layers similar to Inter-Mountain Basins Shale Badland (CES304.789) may be interbedded between the harder rocks. The vegetation is characterized by very open tree canopy or scattered trees and shrubs with a sparse herbaceous layer. Common species includes *Pinus edulis, Pinus ponderosa, Juniperus* spp., *Cercocarpus intricatus,* and other short-shrub and herbaceous species, utilizing moisture from cracks and pockets where soil accumulates.

Comments: Geographically restricted and distinct from the related, but broader Inter-Mountain Basins Cliff and Canyon (CES304.779). Shale areas are not extensive as in shale badlands.

DISTRIBUTION

Range: Colorado Plateau.
Ecological Divisions: 304
TNC Ecoregions: 18:C, 19:C, 20:?
Subnations/Nations: AZ:c, CO:c, NM:c, UT:c

CONCEPT

Alliances and Associations:

- CERCOCARPUS INTRICATUS SPARSELY VEGETATED ALLIANCE (A.2543) Cercocarpus intricatus Slickrock Sparse Vegetation (CEGL002977)
- CERCOCARPUS MONTANUS SPARSELY VEGETATED ALLIANCE (A.2544) Cercocarpus montanus Rock Pavement Sparse Vegetation (CEGL002978)
- EPHEDRA TORREYANA SPARSELY VEGETATED ALLIANCE (A.2571) Ephedra torreyana - (Atriplex canescens, Atriplex confertifolia) Sparse Vegetation (CEGL005801)
- JUNIPERUS OSTEOSPERMA WOODLAND ALLIANCE (A.536) Juniperus osteosperma / Artemisia nova / Rock Woodland (CEGL000729) Juniperus osteosperma / Cercocarpus intricatus Woodland (CEGL000733)
- PINUS EDULIS - (JUNIPERUS SPP.) WOODLAND ALLIANCE (A.516) Pinus edulis - Juniperus osteosperma / Cercocarpus intricatus Woodland (CEGL000779)
- SANDSTONE SPARSELY VEGETATED ALLIANCE (A.2568) Atriplex canescens - (Ephedra viridis) / (Muhlenbergia porteri) Sandstone Sparse Vegetation [Provisional] (CEGL002927)
- WOODED BEDROCK SPARSELY VEGETATED ALLIANCE (A.2546) Pinus ponderosa Slickrock Sparse Vegetation (CEGL002972)

Environment: This system includes limestone escarpments and plateaus occurring in a relatively narrow band of unvegetated or sparsely vegetated badlands formed by the red beds of Claron (Wasatch) Formation along the eastern edge of the Pausaugunt Plateau (Bryce Canyon) and the western edge of the Markagunt Plateau (Cedar Breaks National Monument) (Graybosch and Buchanan 1983). It includes areas of which often 90% of the exposed surface consists of barren rock. It forms, or includes, areas of fixed bedrock forming the vertical or near-vertical parts on the plateau faces. The rocks forming such areas are predominantly limestone-capped plateaus. These areas are highly erodible and form the basic scenic structure of Bryce Canyon and Cedar Breaks national parks. The area is generally too steep to allow any significant soil development. Scattered plants obtain a precarious foothold in the crevices of the rocks. Knolls may form at the base of the cliffs.

This ecological system also includes sandstone and shale escarpments, which form, or include, areas of fixed bedrock forming the vertical or near-vertical parts of canyon walls and plateau faces. The scenic cliffs of the East Tavaputs area, e.g., the Book Cliffs are excellent examples of this. The rocks forming such areas are dominantly sandstone and shale with some limestone and marlstone. These areas are unstable and rocks are frequently rolling down onto the talus slopes below (often forming Inter-Mountain Basins Shale Badland (CES304.789)). The area is generally too steep to allow any significant soil development. Scattered plants obtain a precarious foothold in the crevices of the rocks. Knolls may form at the base of the cliffs. The larger drainages (e.g., East Fork Parachute Creek) plunge several hundred feet at this escarpment, which creates scenic and lush hanging gardens. Many of these escarpments are over 1000 feet in height and provide excellent habitat for cliff-nesting birds such as peregrine falcons and golden eagles.

The Claron limestone, a Tertiary deposit, is divisible into Red Eocene beds and White Oligocene beds, which differ somewhat in presence or absence of pigmentation in the form of iron and manganese oxides,

and in amounts of sand and conglomerates in the limestone (Graybosch and Buchanan 1983). The Claron Formation is characterized by a rapid rate of erosion, largely a function of creep resulting from winter freeze-thaw activity and wash away by summer thunderstorm runoff (Graybosch and Buchanan 1983). Freeze-thaw cycles are most pronounced on south-facing slopes. Soil development is limited. Infiltration rates are low and runoff high.

Vegetation: For the most part, this system is sparsely vegetated. Small patches of scattered trees and shrubs may occur. These small vegetated patches are usually dominated by conifer trees, and may include *Abies concolor, Juniperus scopulorum, Picea pungens, Pinus flexilis, Pinus longaeva, Pinus ponderosa,* and *Pseudotsuga menziesii*. If a shrub layer exists it may include *Acer glabrum, Amelanchier utahensis, Arctostaphylos patula, Ceanothus martinii, Cercocarpus montanus, Cercocarpus intricatus, Juniperus communis, Mahonia repens, Purshia tridentata, Ribes cereum,* and *Gutierrezia sarothrae*. Grasses and forbs, if present, may include *Astragalus kentrophyta, Cirsium arizonicum, Clematis columbiana, Leymus salinus, Eriogonum panguicense, Achnatherum hymenoides,* and *Linum kingii*.

This ecological system is noted for its high rate of endemic species of forbs, especially in Bryce Canyon. Nine of the eleven endemic species occur in the *Pinus longaeva* community, three are found in the *Pinus ponderosa - Arctostaphylos patula* plant association, and two occur in the mixed conifer type. Species that occur only in the *Pinus longaeva* type have the narrowest geographic distributions, although *Eriogonum panguicense var. panguicense* is an exception (Graybosch and Buchanan 1983). Within Bryce Canyon, most of these endemics are restricted to the Claron Formation (Graybosch and Buchanan 1983). The majority of endemic species found in southern Utah are restricted to substrates derived from a specific geologic formation (Welsh 1979). Welsh notes that most of these taxa are found in areas of exposed parent material. The distribution of endemic species in Utah is not a random one; fine-textured substrates support more species than coarser ones, and desert and foothill vegetation is richer in endemic species than montane communities (Welsh 1978, 1979).

Dynamics: This ecological system has a naturally high rate of erosion. Fires are infrequent and not an important ecological process.

SOURCES

References: Graybosch and Buchanan 1983, LaMarche and Mooney 1972, Shute and West 1977, Thorne Ecological Institute 1973a, Welsh 1979, Welsh and Chatterly 1985
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S011 Inter-Mountain Basins Shale Badland

Division 304, Shrubland, CES304.789
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Lowland], Badlands, Badland, Alkaline Soil, Shale and Mudstone, Silt Soil Texture, Clay Soil Texture

Non-Diagnostic Classifiers: Shrubland (Shrub-dominated), Moss/Lichen (Nonvascular), Temperate [Temperate Continental], Aridic, Very Short Disturbance Interval, Broad-Leaved Shrub, Dwarf-Shrub, Semi-Shrub

Concept Summary: This widespread ecological system of the Intermountain western U.S. is composed of barren and sparsely vegetated substrates (<10% plant cover) typically derived from marine shales, but also including substrates derived from siltstones and mudstones (clay). Landforms are typically rounded hills and plains that form a rolling topography. The harsh soil properties and high rate of erosion and deposition are driving environmental variables supporting sparse dwarf-shrubs, e.g., *Atriplex corrugata, Atriplex gardneri, Artemisia pedatifida,* and herbaceous vegetation.

DISTRIBUTION

Range: Intermountain western U.S.
Ecological Divisions: 304, 306
TNC Ecoregions: 10:C, 11:C, 12:?, 18:C, 19:C, 20:C, 21:C, 6:P, 9:C

Subnations/Nations: AZ:c, CA:c, CO:c, ID:c, MT:c, NM:c, NV:c, OR:c, UT:c, WA:?, WY:c

CONCEPT

Alliances and Associations:

- ACHNATHERUM HYMENOIDES HERBACEOUS ALLIANCE (A.1262) Achnatherum hymenoides Shale Barren Herbaceous Vegetation (CEGL001651)
- ARTEMISIA BIGELOVII SHRUBLAND ALLIANCE (A.1103) Artemisia bigelovii / Achnatherum hymenoides Shrubland (CEGL000990)
- ARTEMISIA PEDATIFIDA SHRUBLAND ALLIANCE (A.1127) Artemisia pedatifida - Atriplex gardneri Shrubland (CEGL001525) Artemisia pedatifida / Elymus elymoides Shrubland (CEGL001450) Artemisia pedatifida / Festuca idahoensis Shrubland (CEGL001526) Artemisia pedatifida / Pascopyrum smithii Shrubland (CEGL001451) Artemisia pedatifida / Pseudoroegneria spicata Shrubland (CEGL001527)
- ARTEMISIA PYGMAEA SHRUBLAND ALLIANCE (A.1106) Artemisia pygmaea / Elymus elymoides - Achnatherum hymenoides Shrubland (CEGL001436)
- ATRIPLEX CORRUGATA DWARF-SHRUBLAND ALLIANCE (A.1109) Atriplex corrugata Dwarf-shrubland (CEGL001437)
- ATRIPLEX CUNEATA SHRUBLAND ALLIANCE (A.871) Atriplex cuneata - Frankenia jamesii / Sporobolus airoides Shrubland (CEGL001316)
- ATRIPLEX GARDNERI DWARF-SHRUBLAND ALLIANCE (A.1110) Atriplex gardneri - Picrothamnus desertorum Dwarf-shrubland (CEGL001439) Atriplex gardneri / Achnatherum hymenoides Dwarf-shrubland (CEGL001444) Atriplex gardneri / Artemisia tridentata Dwarf-shrubland (CEGL001440) Atriplex gardneri / Leymus salinus Dwarf-shrubland (CEGL001442) Atriplex gardneri / Monolepis nuttalliana Dwarf-shrubland (CEGL001443) Atriplex gardneri / Pascopyrum smithii Dwarf-shrubland (CEGL001445) Atriplex gardneri / Pleuraphis jamesii Dwarf-shrubland (CEGL001441) Atriplex gardneri / Xylorhiza venusta Dwarf-shrubland (CEGL001446) Atriplex gardneri Dwarf-shrubland (CEGL001438)
- ATRIPLEX OBOVATA DWARF-SHRUBLAND ALLIANCE (A.1108) Atriplex obovata Dwarf-shrubland [Placeholder] (CEGL001789)
- ERIOGONUM CORYMBOSUM DWARF-SHRUBLAND ALLIANCE (A.1126) Eriogonum corymbosum / Leymus salinus Dwarf-shrubland (CEGL001343)
- LEYMUS SALINUS SSP. SALMONIS SPARSELY VEGETATED ALLIANCE (A.1258) Leymus salinus Shale Sparse Vegetation (CEGL002745)
- PAINTED DESERT SPARSELY VEGETATED ALLIANCE (A.2545) Atriplex obovata Badland Sparse Vegetation (CEGL002928) Ephedra nevadensis / Lichens Sparse Vegetation [Provisional] (CEGL002976) Eriogonum corymbosum Badlands Sparse Vegetation (CEGL002979)
- PSEUDOROEGNERIA SPICATA SPARSELY VEGETATED ALLIANCE (A.1876) Pseudoroegneria spicata - Eriogonum brevicaule Sparse Vegetation (CEGL001667)

SOURCES

References: DeVelice and Lesica 1993, Knight 1994, Knight et al. 1987
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S012 Inter-Mountain Basins Active and Stabilized Dune

Division 304, Barren, CES304.775
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Non-vegetated (<10% vasc.), Upland
Diagnostic Classifiers: Dune (Landform), Dune field, Dune (Substrate), Temperate [Temperate Continental], Sand Soil Texture, Aridic, W-Landscape/High Intensity

Non-Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Woody-Herbaceous, Dune (undifferentiated)

Concept Summary: This ecological system occurs in the Intermountain basins and is composed of unvegetated to moderately vegetated (generally <10% plant cover, but up to 30%), active and stabilized dunes and sandsheets. Species occupying these environments are often adapted to the shifting, coarse-textured substrate (usually quartz sand) and form patchy or open grasslands, shrublands or steppe composed of *Achnatherum hymenoides, Artemisia filifolia, Artemisia tridentata ssp. tridentata, Atriplex canescens, Ephedra* spp., *Coleogyne ramosissima, Ericameria nauseosa, Leymus flavescens, Prunus virginiana, Psoralidium lanceolatum, Purshia tridentata, Sporobolus airoides, Tetradymia tetrameres*, or

Tiquilia spp. This system is distinguished by its generally low vegetative cover and distinct eolian geomorphic features.

DISTRIBUTION

Range: Occurs in the Intermountain basins.
Ecological Divisions: 304
TNC Ecoregions: 10:C, 11:C, 19:C, 6:C
Subnations/Nations: AZ:c, MT:c, NM:p, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

- ACHNATHERUM HYMENOIDES HERBACEOUS ALLIANCE (A.1262) Achnatherum hymenoides - Psoralidium lanceolatum Herbaceous Vegetation (CEGL001650) Achnatherum hymenoides - Sporobolus contractus Herbaceous Vegetation (CEGL001652)
- ARTEMISIA FILIFOLIA SHRUBLAND ALLIANCE (A.816) Artemisia filifolia - Ephedra (torreyana, viridis) Shrubland (CEGL002786)
- ELYMUS LANCEOLATUS HERBACEOUS ALLIANCE (A.1242) Elymus lanceolatus - Phacelia hastata Herbaceous Vegetation (CEGL001745)
- EPHEDRA CUTLERI SHRUBLAND ALLIANCE (PROPOSED)
- EPHEDRA TORREYANA SHRUBLAND ALLIANCE (A.2572) Ephedra torreyana - Achnatherum hymenoides Hummock Shrubland (CEGL005802)
- ERICAMERIA NAUSEOSA SHRUBLAND ALLIANCE (A.835) Ericameria nauseosa / Leymus flavescens / Psoralidium lanceolatum Shrubland (CEGL001329) Ericameria nauseosa Sand Deposit Sparse Shrubland (CEGL002980)
- LEYMUS FLAVESCENS HERBACEOUS ALLIANCE (A.1237) Leymus flavescens Herbaceous Vegetation (CEGL001563)
- PINUS PONDEROSA SPARSELY VEGETATED ALLIANCE (A.1859) Pinus ponderosa / Achnatherum hymenoides Sparse Vegetation (CEGL001490)
- POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED FOREST ALLIANCE (A.310) Populus angustifolia Sand Dune Forest (CEGL002643)
- PSOROTHAMNUS POLYDENIUS SHRUBLAND ALLIANCE (A.1039) Psorothamnus polydenius var. polydenius / Achnatherum hymenoides Shrubland (CEGL001353)
- PURSHIA TRIDENTATA SHRUBLAND ALLIANCE (A.825) Purshia tridentata - Artemisia tridentata ssp. tridentata Shrubland (CEGL001054) Purshia tridentata - Ericameria nauseosa Shrubland (CEGL001056) Purshia tridentata / Achnatherum hymenoides Shrubland (CEGL001058) Purshia tridentata / Prunus virginiana Shrubland (CEGL001060)
- REDFIELDIA FLEXUOSA HERBACEOUS ALLIANCE (A.2505) Redfieldia flexuosa - (Psoralidium lanceolatum) Herbaceous Vegetation (CEGL002917)
- ROCK OUTCROP SPARSELY VEGETATED ALLIANCE (A.1838) Redbeds (Siltstone, Sandstone, Gypsum) Sparse Vegetation (CEGL005261)
- SARCOBATUS VERMICULATUS SHRUBLAND ALLIANCE (A.1041) Sarcobatus vermiculatus Dune Shrubland (CEGL001364)
- TETRADYMIA TETRAMERES SPARSELY VEGETATED ALLIANCE (A.2525) Tetradymia tetrameres Dune Sparse Vegetation (CEGL002759)

SOURCES

References: anderson 1999, Bowers 1982, Fryberger et al. 1990, Knight 1994, Pineada et al. 1999
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S014 Inter-Mountain Basins Wash

Division 304, Barren, CES304.781
Spatial Scale & Pattern: Linear **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Non-vegetated (<10% vasc.), Upland, Wetland
Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Wash, Toeslope/Valley Bottom, Alkaline Soil, Xeromorphic Shrub, Sarcobatus vermiculatus, Riverine / Alluvial

Non-Diagnostic Classifiers: Temperate [Temperate Continental], Saline Substrate Chemistry, Deep (>15 cm) Water

Concept Summary: This barren and sparsely vegetated (generally <10% plant cover) ecological system is restricted to intermittently flooded streambeds and banks that are often lined with *Sarcobatus vermiculatus, Ericameria nauseousa, Fallugia* paradoxa and/or *Artemisia cana ssp. cana* (in more northern and mesic stands). *Grayia spinosa* may also dominate in the Great Basin. Shrubs often form a continuous or intermittent linear canopy in and along drainages but do not extend out into flats. Typically it includes patches of saltgrass meadow where water remains for the longest periods. Soils are generally less alkaline than those found in the playa system. Desert scrub species, e.g., *Acacia greggii, Prosopis* spp., that are common in the Mojave, Sonoran and Chihuahuan desert washes, are not present. This type can occur in limited portions of the southwest Great Plains.

Comments: Compare with Inter-Mountain Basins Greasewood Flat (CES304.780); should it include nonsparse shrublands?

DISTRIBUTION

Range: This system occurs thoughout the Intermountain western U.S. extending east into the western Great Plains.
Ecological Divisions: 303, 304, 306
TNC Ecoregions: 10:C, 11:C, 19:C, 20:C, 26:C, 4:C, 6:C, 8:C, 9:C
Subnations/Nations: AZ:c, CA:c, CO:c, ID:c, MT:c, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

- DISTICHLIS SPICATA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1332) Distichlis spicata - (Scirpus nevadensis) Herbaceous Vegetation (CEGL001773) Distichlis spicata - Lepidium perfoliatum Herbaceous Vegetation (CEGL001772) Distichlis spicata Herbaceous Vegetation (CEGL001770) Distichlis spicata Mixed Herb Herbaceous Vegetation (CEGL001771)
- ERICAMERIA NAUSEOSA SHRUBLAND ALLIANCE (A.835) Ericameria nauseosa / Bromus tectorum Semi-natural Shrubland (CEGL002937)
- GRAYIA SPINOSA SHRUBLAND ALLIANCE (A.1038) Grayia spinosa / Poa secunda Shrubland (CEGL001351)
- HORDEUM BRACHYANTHERUM TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.2585) Hordeum brachyantherum Herbaceous Vegetation (CEGL003430)
- SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SHRUB HERBACEOUS ALLIANCE (A.1554) Sarcobatus vermiculatus / Pascopyrum smithii - (Elymus lanceolatus) Shrub Herbaceous Vegetation (CEGL001508)
- SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.1046) Sarcobatus vermiculatus - Atriplex parryi / Distichlis spicata Shrubland (CEGL002764) Sarcobatus vermiculatus - Psorothamnus polydenius Shrubland (CEGL002763) Sarcobatus vermiculatus / Achnatherum hymenoides Shrubland (CEGL001373) Sarcobatus vermiculatus / Atriplex confertifolia - (Picrothamnus desertorum, Suaeda moquinii) Shrubland (CEGL001371) Sarcobatus vermiculatus / Atriplex gardneri Shrubland (CEGL001360) Sarcobatus vermiculatus / Distichlis spicata Shrubland (CEGL001363) Sarcobatus vermiculatus / Elymus elymoides - Pascopyrum smithii Shrubland (CEGL001365) Sarcobatus vermiculatus / Elymus elymoides Shrubland (CEGL001372) Sarcobatus vermiculatus / Ericameria nauseosa Shrubland (CEGL001362) Sarcobatus vermiculatus / Leymus cinereus Shrubland (CEGL001366) Sarcobatus vermiculatus / Nitrophila occidentalis - Suaeda moquinii Shrubland (CEGL001369) Sarcobatus vermiculatus / Suaeda moquinii Shrubland (CEGL001370) Sarcobatus vermiculatus Shrubland (CEGL001357)
- SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SPARSELY VEGETATED ALLIANCE (A.1877) Sarcobatus vermiculatus / Sporobolus airoides Sparse Vegetation (CEGL001368)

- **California community types:**
- Greasewood Scrub (36.400.00)

SOURCES

References: Knight 1994, West 1983b
Last updated: 20 Feb 2003 **Stakeholders:** WCS, MCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

NLCD Evergreen Forest Types

Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.

S039 Colorado Plateau Pinyon-Juniper Woodland

Division 304, Forest and Woodland, CES304.767
Spatial Scale & Pattern: Matrix **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Montane [Lower Montane], Lowland [Foothill], Mesa, Ridge/Summit/Upper Slope, Sedimentary Rock, Temperate [Temperate Xeric], Aridic, Pinus edulis, Juniperus osteosperma

Non-Diagnostic Classifiers: Forest and Woodland (Treed), Foothill(s), Piedmont, Plateau, Sideslope, Alkaline Soil, Long Disturbance Interval, F-Patch/Medium Intensity

Concept Summary: This ecological system occurs on dry mountains and foothills of the Colorado Plateau region from the Western Slope of Colorado to the Wasatch Range, south to the Mogollon Rim and east into the NW corner of New Mexico. It is typically found at lower elevations ranging from 1500-2440 m. These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Soils supporting this system vary in texture ranging from stony, cobbly, gravelly sandy loams to clay loam or clay. *Pinus edulis* and/or *Juniperus osteosperma* dominate the tree canopy. In the southern portion of the Colorado Plateau in northern Arizona and northwestern New Mexico, *Juniperus monosperma* and hybrids of *Juniperus* spp may dominate or codominate tree canopy. *Juniperus scopulorum* may codominate or replace *Juniperus osteosperma* at higher elevations. Understory layers are variable and may be dominated by shrubs, graminoids, or be absent. Associated species include *Arctostaphylos patula, Artemisia tridentata, Cercocarpus intricatus, Cercocarpus montanus, Coleogyne ramosissima, Purshia stansburiana, Purshia tridentata, Quercus gambelii, Bouteloua gracilis, Pleuraphis jamesii*, or *Poa fendleriana*. This system occurs at higher elevations than Great Basin Pinyon-Juniper Woodland (CES304.773) and Colorado Plateau shrubland systems where sympatric.

DISTRIBUTION

Range: Occurs on dry mountains and foothills of the Colorado Plateau region from the Western Slope of Colorado to the Wasatch Range, south to the Mogollon Rim. It is typically found at lower elevations ranging from 1500-2440 m.
Ecological Divisions: 304, 306
TNC Ecoregions: 18:C, 19:C, 20:?
Subnations/Nations: AZ:c, CO:c, NM:c, UT:c

CONCEPT

Alliances and Associations:

- JUNIPERUS MONOSPERMA WOODLAND ALLIANCE (A.504) Juniperus monosperma - Rhus trilobata / Schizachyrium scoparium Woodland (CEGL002121) Juniperus monosperma / Agave lechuguilla Woodland (CEGL000703) Juniperus monosperma / andropogon hallii Woodland (CEGL000704) Juniperus monosperma / Artemisia bigelovii Woodland (CEGL000705) Juniperus monosperma / Artemisia tridentata Woodland (CEGL000706) Juniperus monosperma / Atriplex confertifolia / Achnatherum hymenoides Woodland (CEGL000707) Juniperus monosperma / Bouteloua curtipendula Woodland (CEGL000708) Juniperus monosperma / Bouteloua eriopoda Woodland (CEGL000709) Juniperus monosperma / Bouteloua gracilis Woodland (CEGL000710) Juniperus monosperma / Bouteloua hirsuta Woodland (CEGL000711) Juniperus monosperma / Cercocarpus montanus - Ribes cereum Woodland (CEGL000714) Juniperus monosperma / Cercocarpus montanus Woodland (CEGL000713) Juniperus monosperma / Ericameria nauseosa - Fallugia paradoxa Woodland (CEGL000715) Juniperus monosperma / Fallugia paradoxa / Xanthoparmelia neoconspersa Woodland (CEGL000716) Juniperus monosperma / Hesperostipa neomexicana Woodland (CEGL000722) Juniperus monosperma / Krascheninnikovia lanata Woodland (CEGL000712) Juniperus monosperma / Nolina microcarpa - Agave lechuguilla Woodland (CEGL000718) Juniperus monosperma / Quercus turbinella Woodland (CEGL000720) Juniperus monosperma / Quercus X pauciloba Woodland (CEGL000721)

- JUNIPERUS OSTEOSPERMA WOODED HERBACEOUS ALLIANCE (A.1502) Juniperus osteosperma / Hesperostipa comata Wooded Herbaceous Vegetation (CEGL001489) Juniperus osteosperma / Leymus salinus ssp. salmonis Wooded Herbaceous Vegetation (CEGL001488)
- JUNIPERUS OSTEOSPERMA WOODED SHRUBLAND ALLIANCE (A.2541) Juniperus osteosperma Wooded Shrubland [Placeholder] (CEGL002964)
- JUNIPERUS OSTEOSPERMA WOODLAND ALLIANCE (A.536) Juniperus osteosperma - Juniperus monosperma / Sparse Understory Woodland (CEGL000737) Juniperus osteosperma / Artemisia arbuscula Woodland (CEGL002757) Juniperus osteosperma / Artemisia nova / Rock Woodland (CEGL000729) Juniperus osteosperma / Artemisia nova Woodland (CEGL000728) Juniperus osteosperma / Artemisia tridentata / Achnatherum hymenoides Woodland (CEGL000731) Juniperus osteosperma / Artemisia tridentata Woodland (CEGL000730) Juniperus osteosperma / Cercocarpus intricatus Woodland (CEGL000733) Juniperus osteosperma / Cercocarpus ledifolius Woodland (CEGL000734) Juniperus osteosperma / Cercocarpus montanus Woodland (CEGL000735) Juniperus osteosperma / Coleogyne ramosissima Woodland [Provisional] (CEGL002909) Juniperus osteosperma / Hesperostipa neomexicana Woodland (CEGL000740) Juniperus osteosperma / Pleuraphis mutica Woodland (CEGL000736) Juniperus osteosperma / Pseudoroegneria spicata Woodland (CEGL000738) Juniperus osteosperma / Sparse Understory Woodland (CEGL000732) Juniperus osteosperma / Symphoricarpos oreophilus Woodland (CEGL000741) Juniperus osteosperma Woodland (CEGL000727)
- PINUS EDULIS - (JUNIPERUS SPP.) WOODLAND ALLIANCE (A.516) Pinus edulis - (Juniperus monosperma) / Bouteloua gracilis Woodland (CEGL002151) Pinus edulis - (Juniperus monosperma, Juniperus osteosperma) / Hesperostipa comata Woodland (CEGL000797) Pinus edulis - (Juniperus osteosperma) / Bouteloua gracilis Woodland (CEGL000778) Pinus edulis - Juniperus osteosperma / Arctostaphylos patula Woodland (CEGL002939) Pinus edulis - Juniperus osteosperma / Cercocarpus intricatus Woodland (CEGL000779) Pinus edulis - Juniperus osteosperma / Coleogyne ramosissima Woodland (CEGL000781) Pinus edulis - Juniperus osteosperma / Purshia stansburiana Woodland (CEGL000782) Pinus edulis - Juniperus spp. / Artemisia tridentata Woodland (CEGL000776) Pinus edulis - Juniperus spp. / Cercocarpus montanus Woodland (CEGL000780) Pinus edulis - Juniperus spp. / Quercus gambelii Woodland (CEGL000791) Pinus edulis - Quercus arizonica / Rhus trilobata Woodland (CEGL000790) Pinus edulis / Achnatherum nelsonii ssp. dorei Woodland (CEGL000796) Pinus edulis / Achnatherum scribneri Woodland (CEGL000798) Pinus edulis / andropogon hallii Woodland (CEGL000774) Pinus edulis / Arctostaphylos pungens Woodland (CEGL000775) Pinus edulis / Bouteloua curtipendula Woodland (CEGL000777) Pinus edulis / Festuca arizonica Woodland (CEGL000783) Pinus edulis / Muhlenbergia pauciflora Woodland (CEGL000785) Pinus edulis / Nolina microcarpa Woodland (CEGL000786) Pinus edulis / Poa fendleriana Woodland (CEGL000787) Pinus edulis / Pseudoroegneria spicata Woodland (CEGL000788) Pinus edulis / Purshia tridentata Woodland (CEGL000789) Pinus edulis / Quercus X pauciloba Woodland (CEGL000793) Pinus edulis / Rockland Woodland (CEGL000794)
- PINUS EDULIS FOREST ALLIANCE (A.135) Pinus edulis / Sparse Understory Forest (CEGL000795)

SOURCES

References: Baker and Kennedy 1985, Stuever and Hayden 1997a, Tuhy et al. 2002, West et al. 1998
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

NLCD Shrub/Scrub Types

Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early sucesional stage or trees stunted from environmental conditions.

S045 Inter-Mountain Basins Mat Saltbush Shrubland

Division 304, Shrubland, CES304.783
Spatial Scale & Pattern: Matrix **Classification Confidence:** low
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Alluvial flat, Alluvial plain, Plain, Alkaline Soil, Saline Substrate Chemistry, Calcareous, Silt Soil Texture, Clay Soil Texture, Dwarf-Shrub, Atriplex spp.

Non-Diagnostic Classifiers: Basin floor, Temperate [Temperate Continental], Oligotrophic Soil

Concept Summary: This ecological system occurs on gentle slopes and rolling plains in the northern Colorado Plateau and Uinta Basin on Mancos Shale and arid, wind-swept basins and plains across parts of Wyoming. Substrates are shallow, typically saline, alkaline, fine-textured soils developed from shale or alluvium and may be associated with shale badlands. Infiltration rate is typically low. These landscapes that typically support dwarf-shrublands composed of relatively pure stands of *Atriplex* spp. such as *Atriplex corrugata* or *Atriplex gardneri*. Other dominant or codominant dwarf-shrubs may include *Artemisia longifolia, Artemisia pedatifida*, or *Picrothamnus desertorum*, sometimes with a mix of other low shrubs such as *Krascheninnikovia lanata* or *Tetradymia spinosa*. *Atriplex confertifolia* or *Atriplex canescens* may be present, but do not codominate. The herbaceous layer is typically sparse. Scattered perennial forbs occur, such as *Xylorhiza glabriuscula* and *Sphaeralcea grossulariifolia*, and the perennial grasses *Achnatherum hymenoides, Bouteloua gracilis, Elymus elymoides, Elymus lanceolatus ssp. lanceolatus, Pascopyrum smithii*, or *Sporobolus airoides* may dominate the herbaceous layer. In less saline areas, there may be inclusions grasslands dominated by *Hesperostipa comata, Leymus salinus, Pascopyrum smithii*, or *Pseudoroegneria spicata*. In Wyoming and possibly elsewhere, inclusions of non-saline, gravelly barrens or rock outcrops dominated by cushion plants such as *Arenaria hookeri* and *Phlox hoodii* without dwarf-shrubs may be present. Annuals are seasonally present and may include *Eriogonum inflatum, Plantago tweedyi*, and the introduced annual grass *Bromus tectorum*.

DISTRIBUTION

Range: Occurs on gentle slopes and rolling plains in the northern Colorado Plateau and Uinta Basin on Mancos Shale and arid, wind-swept basins and plains across parts of Wyoming.
Ecological Divisions: 304
TNC Ecoregions: 10:C, 19:C
Subnations/Nations: AZ:c, CO:c, NM:c, UT:c, WY:c

CONCEPT

Alliances and Associations:

- ATRIPLEX CORRUGATA DWARF-SHRUBLAND ALLIANCE (A.1109) Atriplex corrugata Dwarf-shrubland (CEGL001437)
- ATRIPLEX CUNEATA SHRUBLAND ALLIANCE (A.871) Atriplex cuneata - Frankenia jamesii / Sporobolus airoides Shrubland (CEGL001316)
- ATRIPLEX GARDNERI DWARF-SHRUBLAND ALLIANCE (A.1110) Atriplex gardneri - Picrothamnus desertorum Dwarf-shrubland (CEGL001439) Atriplex gardneri / Achnatherum hymenoides Dwarf-shrubland (CEGL001444) Atriplex gardneri / Artemisia tridentata Dwarf-shrubland (CEGL001440) Atriplex gardneri / Leymus salinus Dwarf-shrubland (CEGL001442) Atriplex gardneri / Monolepis nuttalliana Dwarf-shrubland (CEGL001443) Atriplex gardneri / Pascopyrum smithii Dwarf-shrubland (CEGL001445) Atriplex gardneri / Pleuraphis jamesii Dwarf-shrubland (CEGL001441) Atriplex gardneri / Xylorhiza venusta Dwarf-shrubland (CEGL001446) Atriplex gardneri Dwarf-shrubland (CEGL001438)

Environment: This ecological system occurs on gentle slopes and rolling plains in the northern Colorado Plateau and Uinta Basin on Mancos Shale and arid, wind-swept plains and basins across parts of Wyoming. Substrates are shallow, typically saline, alkaline, fine-textured soils developed from shale or alluvium and may be associated with shale badlands. Infiltration rate is typically low. In Wyoming and possibly elsewhere inclusions of non-saline, gravelly barrens or rock outcrops may be present.

Vegetation: This ecological system typically supports dwarf-shrublands composed of relatively pure stands of *Atriplex* spp. such as *Atriplex corrugata* or *Atriplex gardneri*. Other dominant or codominant dwarf-shrub may include *Artemisia longifolia, Artemisia pedatifida*, or *Picrothamnus desertorum*, sometimes with a mix of other low shrubs such as *Krascheninnikovia lanata*, or *Tetradymia spinosa*. *Atriplex confertifolia* or *Atriplex canescens* may be present, but do not codominate. The herbaceous layer is typically sparse. Scattered perennial forbs occur, such as *Xylorhiza glabriuscula* and *Sphaeralcea grossulariifolia*, and the perennial grasses *Achnatherum hymenoides, Bouteloua gracilis, Elymus elymoides, Elymus lanceolatus ssp. lanceolatus, Pascopyrum smithii*, or *Sporobolus airoides* may dominate the herbaceous layer. In less saline areas, there may be inclusions grasslands dominated by *Hesperostipa comata, Leymus salinus, Pascopyrum smithii*, or *Pseudoroegneria spicata*. In Wyoming and possibly elsewhere, vegetation dominated by cushion plants such as *Arenaria hookeri, Phlox hoodii* without dwarf-shrubs may be present and occur on

inclusions of non-saline, gravelly barrens or rock outcrops. Annuals are seasonally present and may include *Eriogonum inflatum, Plantago tweedyi*, and the introduced annual grass *Bromus tectorum*.

SOURCES

References: Branson et al. 1976, Knight 1994, Potter et al. 1985, Welsh 1957
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S052 Colorado Plateau Pinyon-Juniper Shrubland

Division 304, Shrubland, CES304.766
Spatial Scale & Pattern: Matrix **Classification Confidence:** low
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Foothill], Mesa, Ridge/Summit/Upper Slope, Sedimentary Rock, Temperate [Temperate Xeric], Aridic, Pinus edulis, Juniperus osteosperma

Non-Diagnostic Classifiers: Shrubland (Shrub-dominated), Foothill(s), Sideslope, Alkaline Soil, Long Disturbance Interval, F-Patch/Medium Intensity

Concept Summary: This ecological system is characteristic of the rocky mesa tops and slopes on the Colorado Plateau and western slope of Colorado, but these stunted tree shrublands may extend further upslope along the low-elevation margins of taller pinyon-juniper woodlands. Sites are drier than Colorado Plateau Pinyon-Juniper Woodland (CES304.767). Substrates are shallow/rocky and shaley soils at lower elevations (1200-2000 m). Sparse examples of the system grade into Colorado Plateau Mixed Bedrock Canyon and Tableland (CES304.765). The vegetation is dominated by dwarfed (usually <3 m tall) *Pinus edulis* and/or *Juniperus osteosperma* trees forming extensive tall shrublands in the region along low-elevation margins of pinyon-juniper woodlands. Other shrubs, if present, may include *Artemisia nova, Artemisia tridentata ssp. wyomingensis, Chrysothamnus viscidiflorus*, or *Coleogyne ramosissima*. Herbaceous layers are sparse to moderately dense and typically composed of xeric graminoids.

DISTRIBUTION

Range: Rocky mesa tops and slopes on the Colorado Plateau.
Ecological Divisions: 304, 306?
TNC Ecoregions: 18:C, 19:C, 20:?
Subnations/Nations: AZ:c, CO:c, NM:c, UT:c

CONCEPT

Alliances and Associations:

- JUNIPERUS OSTEOSPERMA WOODLAND ALLIANCE (A.536) Juniperus osteosperma / Cercocarpus intricatus Woodland (CEGL000733)
- PINUS EDULIS - (JUNIPERUS SPP.) WOODLAND ALLIANCE (A.516) Pinus edulis - Juniperus osteosperma / Arctostaphylos patula Woodland (CEGL002939) Pinus edulis - Juniperus osteosperma / Cercocarpus intricatus Woodland (CEGL000779) Pinus edulis - Juniperus osteosperma / Coleogyne ramosissima Woodland (CEGL000781) Pinus edulis - Juniperus osteosperma / Purshia stansburiana Woodland (CEGL000782) Pinus edulis - Juniperus spp. / Cercocarpus montanus Woodland (CEGL000780) Pinus edulis / Arctostaphylos pungens Woodland (CEGL000775) Pinus edulis / Purshia tridentata Woodland (CEGL000789) Pinus edulis / Rockland Woodland (CEGL000794)

SOURCES

References: Tuhy et al. 2002, West et al. 1998
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S054 Inter-Mountain Basins Big Sagebrush Shrubland

Division 304, Shrubland, CES304.777
Spatial Scale & Pattern: Matrix **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Toeslope/Valley Bottom, Deep Soil, Aridic, Artemisia tridentata ssp. tridentata

Non-Diagnostic Classifiers: Alluvial plain, Plain, Temperate [Temperate Continental], Alkaline Soil, Xeromorphic Shrub

Concept Summary: This ecological system occurs throughout much of the western U.S., typically in broad basins between mountain ranges, plains and foothills between 1500-2300 m elevation. Soils are typically deep, well-drained and non-saline. These shrublands are dominated by *Artemisia tridentata ssp. tridentata* and/or *Artemisia tridentata ssp. wyomingensis*. Scattered Juniper spp., *Sarcobatus vermiculatus* and *Atriplex* spp. may be present in some stands. *Ericameria nauseosa, Chrysothamnus viscidiflorus, Purshia tridentata,* or *Symphoricarpos oreophilus* may codominate disturbed stands. Perennial herbaceous components typically contribute less than 25% vegetative cover. Common graminoid species include *Achnatherum hymenoides, Bouteloua gracilis, Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata, Leymus cinereus, Pleuraphis jamesii, Pascopyrum smithii, Poa secunda,* or *Pseudoroegneria spicata*.

DISTRIBUTION

Range: Occurs throughout much of the western U.S., typically in broad basins between mountain ranges, plains and foothills between 1500-2300 m elevation.
Ecological Divisions: 303, 304, 306
TNC Ecoregions: 10:C, 11:C, 18:C, 19:C, 20:C, 26:C, 27:C, 4:C, 6:C, 8:C, 9:C
Subnations/Nations: CA:c, CO:c, ID:c, MT:c, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

- ARTEMISIA TRIDENTATA (SSP. TRIDENTATA, SSP. XERICENSIS) SHRUB HERBACEOUS ALLIANCE (A.1522) Artemisia tridentata (ssp. tridentata, ssp. xericensis) / Pseudoroegneria spicata - Poa secunda Shrub Herbaceous Vegetation (CEGL001019) Artemisia tridentata (ssp. tridentata, ssp. xericensis) / Pseudoroegneria spicata Shrub Herbaceous Vegetation (CEGL001018)
- ARTEMISIA TRIDENTATA (SSP. TRIDENTATA, SSP. XERICENSIS) SHRUBLAND ALLIANCE (A.830) Artemisia tridentata ssp. tridentata - Grayia spinosa Shrubland (CEGL001004) Artemisia tridentata ssp. tridentata / Distichlis spicata Shrubland (CEGL001000)
- Artemisia tridentata ssp. tridentata / Festuca idahoensis Shrubland (CEGL001014) Artemisia tridentata ssp. tridentata / Hesperostipa comata Shrubland (CEGL002966) Artemisia tridentata ssp. tridentata / Leymus cinereus Shrubland (CEGL001016) Artemisia tridentata ssp. tridentata / Pascopyrum smithii - (Elymus lanceolatus) Shrubland (CEGL001017) Artemisia tridentata ssp. tridentata / Pleuraphis jamesii Shrubland (CEGL001015) Artemisia tridentata ssp. tridentata / Poa secunda Shrubland (CEGL001008)
- ARTEMISIA TRIDENTATA SHRUB HERBACEOUS ALLIANCE (A.1521) Artemisia tridentata / Festuca idahoensis Shrub Herbaceous Vegetation (CEGL001530) Artemisia tridentata / Leymus cinereus Shrub Herbaceous Vegetation (CEGL001458)
- ARTEMISIA TRIDENTATA SHRUBLAND ALLIANCE (A.829) Artemisia tridentata - (Ericameria nauseosa) / Bromus tectorum Semi-natural Shrubland (CEGL002699) Artemisia tridentata / Achnatherum hymenoides Shrubland (CEGL001006) Artemisia tridentata / Achnatherum lettermanii Shrubland (CEGL001011) Artemisia tridentata / Bouteloua gracilis - Pascopyrum smithii Shrubland (CEGL000997) Artemisia tridentata / Bouteloua gracilis - Pleuraphis jamesii Shrubland (CEGL000996) Artemisia tridentata / Bouteloua gracilis Shrubland (CEGL000995)
- Artemisia tridentata / Chrysothamnus viscidiflorus / Poa secunda Shrubland (CEGL000999) Artemisia tridentata / Elymus elymoides Shrubland (CEGL001001) Artemisia tridentata / Ericameria nauseosa Shrubland (CEGL000998) Artemisia tridentata / Pleuraphis jamesii Shrubland (CEGL001005) Artemisia tridentata / Symphoricarpos longiflorus Shrubland (CEGL001012) Artemisia tridentata Shrubland (CEGL000991) Artemisia tridentata Upperzone Community Shrubland (CEGL001013)
- ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS SHRUB HERBACEOUS ALLIANCE (A.1527) Artemisia tridentata ssp. wyomingensis / Mixed Grasses Shrub Herbaceous Vegetation (CEGL001534) Artemisia tridentata ssp. wyomingensis / Pascopyrum smithii Shrub Herbaceous Vegetation (CEGL001047) Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata Shrub Herbaceous Vegetation (CEGL001535)
- ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS SHRUBLAND ALLIANCE (A.832) Artemisia tridentata ssp. wyomingensis - Atriplex confertifolia Shrubland (CEGL001040) Artemisia tridentata ssp. wyomingensis - Peraphyllum ramosissimum / Festuca idahoensis Shrubland (CEGL001048) Artemisia tridentata ssp. wyomingensis - Purshia tridentata / Pseudoroegneria spicata Shrubland (CEGL001050) Artemisia tridentata ssp. wyomingensis / Achnatherum hymenoides Shrubland (CEGL001046) Artemisia tridentata ssp. wyomingensis / Achnatherum thurberianum Shrubland (CEGL001052) Artemisia tridentata ssp. wyomingensis / Balsamorhiza sagittata Shrubland (CEGL000994) Artemisia tridentata ssp. wyomingensis / Carex filifolia Shrubland (CEGL001042) Artemisia tridentata ssp. wyomingensis / Elymus albicans Shrubland (CEGL001044) Artemisia tridentata ssp. wyomingensis / Elymus elymoides Shrubland (CEGL001043) Artemisia tridentata ssp. wyomingensis / Hesperostipa comata

Shrubland (CEGL001051) Artemisia tridentata ssp. wyomingensis / Leymus ambiguus Shrubland (CEGL001045) Artemisia tridentata ssp. wyomingensis / Poa secunda Shrubland (CEGL001049) Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata Shrubland (CEGL001009)
- ATRIPLEX CANESCENS SHRUBLAND ALLIANCE (A.869) Artemisia tridentata - Atriplex canescens - Sarcobatus vermiculatus / (Achnatherum hymenoides) Shrubland (CEGL001355)
- EPHEDRA NEVADENSIS SHRUBLAND ALLIANCE (A.857) Artemisia tridentata - Ephedra nevadensis Shrubland (CEGL001002)
- EPHEDRA VIRIDIS SHRUBLAND ALLIANCE (A.858) Artemisia tridentata - Ephedra viridis Shrubland (CEGL001003)
- ERICAMERIA NAUSEOSA SHRUBLAND ALLIANCE (A.835) Ericameria nauseosa Shrubland [Provisional] (CEGL002713)

- **California community types:**
- Big Sagebrush - Desert Snowberry (35.110.04)
- Big Sagebrush - Antelope Bitterbrush (35.110.07)
- Antelope Bitterbrush Scrub (35.200.00)
- Antelope Bitterbrush - Big Sagebrush - Horesebush (35.200.01)
- Antelope Bitterbrush - Big Sagebrush / Indian Ricegrass (35.200.02)
- Antelope Bitterbrush - Big Sagebrush - Round-leaf Snowberry (35.200.03)
- Antelope Bitterbrush / Nelson's Needlegrass (35.200.04)
- Antelope Bitterbrush / Sulphur-flower Buckwheat (35.200.05)
- Rubber Rabbitbrush Scrub (35.310.00)
- Parry Rabbitbrush Dwarf Scrub (35.320.00)
- Needle-leaved Rabbitbrush (35.330.00)
- Blackstem Rabbitbrush (35.340.00)

SOURCES

References: Barbour and Billings 1988, Barbour and Major 1977, Holland and Keil 1995, West 1983a
Last updated: 20 Feb 2003 **Stakeholders:** WCS, MCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S059 Colorado Plateau Blackbrush-Mormon-Tea Shrubland

Division 304, Shrubland, CES304.763
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Foothill], Shrubland (Shrub-dominated), Temperate [Temperate Xeric], Aridic

Non-Diagnostic Classifiers: Ridge/Summit/Upper Slope, Sideslope, Alkaline Soil, Sand Soil Texture, Very Long Disturbance Interval, F-Patch/High Intensity

Concept Summary: This ecological system occurs in the Colorado Plateau on benchlands, colluvial slopes, pediments or bajadas. Elevation ranges from 560-1650 m. Substrates are shallow, typically calcareous, non-saline and gravelly or sandy soils over sandstone or limestone bedrock, caliche or limestone alluvium. It also occurs in deeper soils on sandy plains where it may have invaded desert grasslands. The vegetation is characterized by extensive open shrublands dominated by *Coleogyne ramosissima* often with *Ephedra viridis*, *Ephedra torreyana*, or *Grayia spinosa*. Sandy portions may include *Artemisia filifolia* as codominant. Within a blackbrush shrubland disturbed patches are dominated by shrubs such as *Chrysothamnus viscidiflorus*, *Ericameria* spp., *Ephedra* spp., *Grayia spinosa*, *Poliomintha incana* or exotic annual grasses. The herbaceous layer is sparse and composed of graminoids such as *Achnatherum hymenoides*, *Pleuraphis jamesii*, or *Sporobolus cryptandrus*.

DISTRIBUTION

Range: Occurs in the Colorado Plateau on benchlands, colluvial slopes, pediments or bajadas. Elevation ranges from 560-1600 m.
Ecological Divisions: 304
TNC Ecoregions: 18:C, 19:C
Subnations/Nations: AZ:c, CO:c, NM:c, UT:c

CONCEPT

Alliances and Associations:

- ACHNATHERUM HYMENOIDES SHRUB HERBACEOUS ALLIANCE (A.1543) Ephedra viridis / Achnatherum hymenoides - Bouteloua gracilis Shrub Herbaceous Vegetation (CEGL001648) Ephedra viridis / Achnatherum hymenoides - Sporobolus cryptandrus Shrub Herbaceous Vegetation (CEGL001649)
- ARTEMISIA FILIFOLIA SHRUBLAND ALLIANCE (A.816) Artemisia filifolia / Bouteloua eriopoda Shrubland (CEGL001077) Artemisia filifolia Colorado Plateau Shrubland (CEGL002697)
- BOUTELOUA ERIOPODA XEROMORPHIC SHRUB HERBACEOUS ALLIANCE (A.1553) Ephedra torreyana / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001731)
- COLEOGYNE RAMOSISSIMA SHRUBLAND ALLIANCE (A.874) Coleogyne ramosissima / Pleuraphis jamesii Shrubland (CEGL001334) Coleogyne ramosissima Shrubland (CEGL001332)
- EPHEDRA NEVADENSIS - EPHEDRA VIRIDIS SHRUBLAND ALLIANCE (A.856) Ephedra nevadensis - Ephedra viridis - Salvia dorrii - Lycium andersonii Shrubland (CEGL001256)
- EPHEDRA NEVADENSIS SHRUBLAND ALLIANCE (A.857) Ephedra nevadensis / Achnatherum hymenoides Shrubland (CEGL001255)
- EPHEDRA VIRIDIS SHRUBLAND ALLIANCE (A.858) Ephedra viridis / Pleuraphis rigida Shrubland (CEGL001257)
- POLIOMINTHA INCANA SHRUBLAND ALLIANCE (A.862) Poliomintha incana / (Pleuraphis jamesii) Shrubland (CEGL002930)

Environment: This ecological system typically occurs on gentle to steep, bouldery or rocky slopes of mountains, canyons, and mesas with varying aspects. This system is an evergreen, microphyllous desert scrub with succulents, half-shrubs, and scattered deciduous shrubs typically found at elevations ranging from 580 to 1600 m. (1903-5249 feet). This shrubland system occurs in an arid to semi-arid climate with annual precipitation in the form of summer monsoons and winter storms averaging approximately 20 cm. Soils are highly variable and parent materials may include shale, sandstone, limestone, quartzites, and igneous rocks. Soils are generally coarse-textured, often rocky, shallow and well-drained. Effective soil moisture appears to be primarily controlled by regolith depth and position in relation to the water table. This brushland system occupies most sites where regolith is uniformly shallow. In association with blackbrush (*Coleogyne ramosissima*) sites, the soil moisture is concentrated on top of impermeable bedrock at a shallow depth. This perching effect allows for gradual uptake of moisture by the plants roots (Loope and West 1979). This permits growth of plants with more mesic habitat requirements (Warren et al. 1982). On sites with deep soil, blackbrush may occur in almost pure occurrences with only a few associated species (Warren et al. 1982). Dark-colored cryptogamic soil crusts, composed of lichens, mosses, fungi, and algae, are often present in this system in fairly undisturbed areas. Sandy soils may have more cryptogamic crusts than clayish or silty soil surfaces.

Vegetation: This ecological system is dominated by sparse to moderately dense shrubs. Dominant shrubs include *Coleogyne ramosissima, Ephedra nevadensis*, and *Ephedra viridis* (which may codominate with *Grayia spinosa, Salvia dorrii*, and *Lycium andersonii*). There is usually a sparse herbaceous layer with some perennial grasses and forbs. Annual grasses and forbs are present seasonally. Some characteristic species associated with this system include the shrubs *Gutierrezia sarothrae, Chrysothamnus viscidiflorus, Yucca baccata*, and *Krameria grayi*, succulents such as *Ferocactus cylindraceus (= Ferocactus acanthodes), Opuntia* spp., *Echinocereus* spp., *Echinocactus* spp., and *Agave* spp., the graminoid *Pleuraphis rigida*, and perennial forbs such as *Machaeranthera pinnatifida* and *Sphaeralcea ambigua*.

Dynamics: Fire does not appear to play a role in maintenance of shrublands within this system. Topographic breaks dissect the landscape, and isolated pockets of vegetation are separated by rock walls or steep canyons. Blackbrush is fire-intolerant (Loope and West 1979). Following fires, these communities are often colonized by non-native grasses, which serve to encourage recurrent fires and delay shrub regeneration (IVC 1999). In shallow regolith situations, secondary succession, in the sense of site preparation by seral plants, may not occur at all (Loope and West 1979).

SPATIAL CHARACTERISTICS

Adjacent Ecological Systems: Adjacent vegetation often includes *Atriplex* dominated shrubland communities and upland areas of pinyon-juniper woodlands. Grasslands dominated by *Pleuraphis jamesii, Hesperostipa comata*, and *Achnatherum hymenoides* also occur.

SOURCES

References: Loope and West 1979, Thatcher 1975, Tuhy and MacMahon 1988, Tuhy et al. 2002, Warren et al. 1982, West 1983d

Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S065 Inter-Mountain Basins Mixed Salt Desert Scrub

Division 304, Shrubland, CES304.784
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Alluvial flat, Alluvial plain, Plain, Alkaline Soil, Saline Substrate Chemistry, Calcareous, Silt Soil Texture, Clay Soil Texture, Xeromorphic Shrub, Dwarf-Shrub, Atriplex spp.

Non-Diagnostic Classifiers: Basin floor, Temperate [Temperate Continental], Oligotrophic Soil

Concept Summary: This extensive ecological system includes open-canopied shrublands of typically saline basins, alluvial slopes and plains across the Intermountain western U.S. This type also extends in limited distribution into the southern Great Plains. Substrates are often saline and calcareous, medium- to fine-textured, alkaline soils, but include some coarser-textured soils. The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more *Atriplex* species such as *Atriplex confertifolia, Atriplex canescens, Atriplex polycarpa*, or *Atriplex spinifera*. Other shrubs present to codominate may include *Artemisia tridentata ssp. wyomingensis, Chrysothamnus viscidiflorus, Ericameria nauseosa, Ephedra nevadensis, Grayia spinosa, Krascheninnikovia lanata, Lycium* spp., *Picrothamnus desertorum*, or *Tetradymia* spp. *Sarcobatus vermiculatus* is generally absent, but if present does not codominate. The herbaceous layer varies from sparse to moderately dense and is dominated by perennial graminoids such as *Achnatherum hymenoides, Bouteloua gracilis, Elymus lanceolatus ssp. lanceolatus, Pascopyrum smithii, Pleuraphis jamesii, Pleuraphis rigida, Poa secunda*, or *Sporobolus airoides*. Various forbs are also present.

DISTRIBUTION

Range: Intermountain western U.S., extending in limited distribution into the southern Great Plains.
Ecological Divisions: 303, 304, 306
TNC Ecoregions: 10:C, 11:C, 18:C, 19:C, 20:C, 21:C, 26:C, 27:C, 28:C, 4:?, 6:C, 8:?, 9:C
Subnations/Nations: AZ:c, CA:c, CO:c, ID:c, MT:c, NM:c, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

- ATRIPLEX (LENTIFORMIS, POLYCARPA) SHRUBLAND ALLIANCE (A.864) Atriplex (lentiformis, polycarpa) Shrubland [Placeholder] (CEGL003016)
- ATRIPLEX CANESCENS SHRUBLAND ALLIANCE (A.869) Atriplex canescens - Artemisia tridentata Shrubland (CEGL001282) Atriplex canescens - Ephedra viridis Shrubland (CEGL001287) Atriplex canescens - Krascheninnikovia lanata Shrubland (CEGL001285) Atriplex canescens / Achnatherum hymenoides Shrubland (CEGL001289) Atriplex canescens / Bouteloua gracilis Shrubland (CEGL001283) Atriplex canescens / Calycoseris parryi Shrubland (CEGL001284) Atriplex canescens / Parthenium confertum Shrubland (CEGL001290) Atriplex canescens / Pleuraphis jamesii Shrubland (CEGL001288) Atriplex canescens / Purshia stansburiana Shrubland (CEGL001286) Atriplex canescens / Sporobolus airoides Shrubland (CEGL001291) Atriplex canescens / Sporobolus wrightii Shrubland (CEGL001292) Atriplex canescens Shrubland (CEGL001281)

- ATRIPLEX CONFERTIFOLIA SHRUBLAND ALLIANCE (A.870) Atriplex confertifolia - Ephedra nevadensis Shrubland (CEGL001303) Atriplex confertifolia - Krascheninnikovia lanata Shrubland (CEGL001301) Atriplex confertifolia - Lycium andersonii Shrubland (CEGL001308) Atriplex confertifolia - Lycium pallidum / Mirabilis pudica Shrubland (CEGL001309) Atriplex confertifolia - Lycium shockleyi Shrubland (CEGL001310) Atriplex confertifolia - Picrothamnus desertorum / Achnatherum hymenoides Shrubland (CEGL001297) Atriplex confertifolia - Picrothamnus desertorum / Krascheninnikovia lanata Shrubland (CEGL001296) Atriplex confertifolia - Picrothamnus desertorum / Sarcobatus vermiculatus Shrubland (CEGL001298) Atriplex confertifolia - Picrothamnus desertorum Shrubland (CEGL001295) Atriplex confertifolia - Sarcobatus vermiculatus Shrubland (CEGL001313) Atriplex confertifolia / Achnatherum hymenoides Shrubland (CEGL001311) Atriplex confertifolia / Elymus elymoides Shrubland (CEGL001302) Atriplex confertifolia / Ericameria nauseosa Shrubland (CEGL001300) Atriplex confertifolia / Hesperostipa comata Shrubland (CEGL001314) Atriplex confertifolia / Kochia americana Shrubland (CEGL001305) Atriplex confertifolia / Leymus salinus Shrubland (CEGL001307) Atriplex confertifolia / Leymus salinus ssp. salmonis Shrubland (CEGL001306) Atriplex confertifolia / Pleuraphis jamesii Shrubland

(CEGL001304) Atriplex confertifolia / Pseudoroegneria spicata Shrubland (CEGL001312) Atriplex confertifolia / Tetradymia glabrata Shrubland (CEGL001315) Atriplex confertifolia Great Basin Shrubland (CEGL001294) Atriplex confertifolia Wyoming Basins Shrubland (CEGL001293)

- ATRIPLEX OBOVATA DWARF-SHRUBLAND ALLIANCE (A.1108) Atriplex obovata / Sporobolus airoides - Sporobolus cryptandrus Dwarf-shrubland (CEGL001447) Atriplex obovata / Tidestromia carnosa Dwarf-shrubland (CEGL004575)
- ATRIPLEX PARRYI SHRUBLAND ALLIANCE (A.2507) Atriplex parryi Shrubland [Placeholder] (CEGL002711)
- ATRIPLEX POLYCARPA SHRUBLAND ALLIANCE (A.873) Atriplex polycarpa / Pleuraphis mutica Shrubland (CEGL001319) Atriplex polycarpa Shrubland (CEGL001318)
- ATRIPLEX SPINIFERA SHRUBLAND ALLIANCE (A.865) Atriplex spinifera Shrubland [Placeholder] (CEGL003015)
- KRASCHENINNIKOVIA LANATA DWARF-SHRUBLAND ALLIANCE (A.1104) Krascheninnikovia lanata / Achnatherum hymenoides Dwarf-shrubland (CEGL001323) Krascheninnikovia lanata / Hesperostipa comata Dwarf-shrubland (CEGL001327) Krascheninnikovia lanata Dwarf-shrubland [Provisional] (CEGL001320)
- PICROTHAMNUS DESERTORUM SHRUBLAND ALLIANCE (A.1128) Picrothamnus desertorum / Elymus elymoides Shrubland [Provisional] (CEGL002992) Picrothamnus desertorum Shrubland (CEGL001452)
- PLEURAPHIS JAMESII SHRUB HERBACEOUS ALLIANCE (A.1532) Atriplex obovata / Pleuraphis jamesii - Sporobolus airoides Shrub Herbaceous Vegetation (CEGL001775)

- **California community types:**
- Fourwing Saltbush Scrub (36.310.00)
- Fourwing Saltbush (36.310.01)
- Shadscale - Fourwing Saltbush (36.320.06)
- Shadscale - Winter Fat (36.320.08)
- Spinescale Scrub (36.350.00)
- Great Valley Spinescale Scrub (36.351.00)
- Winter Fat dwarf scrub (36.500.00)

Environment: This salt-desert shrubland system is a matrix system in the Intermountain West. This system is comprised of arid to semi-arid shrublands on lowland and upland sites usually at elevations between 1520 and 2200 m (4987-7218 feet). Sites can be found on all aspects and include valley bottoms, alluvial and alkaline flats, mesas and plateaus, playas, drainage terraces, washes and interdune basins, bluffs, and gentle to moderately steep sandy or rocky slopes. Slopes are typically gentle to moderately steep, but are sometimes unstable and prone to surface movement. Many areas within this system are degraded due to erosion and may resemble “badlands.” Soil surface is often very barren in occurrences of this system. The interspaces between the characteristic plant clusters are commonly covered by a microphytic crust (West 1982).

This is typically a system of extreme climatic conditions, with warm to hot summers and freezing winters. Annual precipitation ranges from approximately 13-33 cm. In much of the ecological system, the period of greatest moisture will be mid- to late summer, although in the more northern areas a moist period is to be expected in the cold part of the year. However, plotted seasonality of occurrence is probably of less importance on this desert system than in other ecosystems because desert precipitation comes with an extreme irregularity that does not appear in graphs of long-term seasonal or monthly averages (Blaisdell and Holmgren 1984). Soils are shallow to moderately deep, poorly developed, and a product of an arid climate and little precipitation. Soils are often alkaline or saline. Vegetation within this system is tolerant of these soil conditions but not restricted to it. The shallow soils of much of the area are poorly developed Entisols. Vegetation within this system can occur on level pediment remnants where coarse-textured and well-developed soil profiles have been derived from sandstone gravel and are alkaline, or on Mancos shale badlands, where soil profiles are typically fine-textured and non-alkaline throughout (West and Ibrahim 1968). They can also occur in alluvial basins where parent materials from the other habitats have been deposited over Mancos shale and the soils are heavy-textured and saline-alkaline throughout the profile (West and Ibrahim 1968).

Vegetation: Occurrences of this ecological system vary from almost pure occurrences of single species to fairly complex mixtures. The characteristic mix of low shrubs and grasses is sparse, with large open spaces between the plants (Blaisdell and Holmgren 1984). Occurrences have a sparse to moderately dense cover of woody species that is dominated by *Atriplex canescens* (may codominate with *Artemisia tridentata*),

Atriplex confertifolia (may codominate with *Lycium andersonii*), *Atriplex obovata, Picrothamnus desertorum,* or *Krascheninnikovia lanata*. Other shrubs that may occur within these occurrences include *Purshia stansburiana, Psorothamnus polydenius, Ephedra* spp., *Acacia greggii, Encelia frutescens, Tiquilia latior, Parthenium confertum, Atriplex polycarpa, Atriplex lentiformis, Atriplex spinifera, Picrothamnus desertorum (= Artemisia spinescens), Frankenia salina, Artemisia frigida, Chrysothamnus* spp., *Lycium* ssp., *Suaeda* spp., *Yucca glauca,* and *Tetradymia spinosa*. Dwarf-shrubs include *Gutierrezia sarothrae* and *Eriogonum* spp. Warm-season medium-tall and short perennial grasses dominate in the sparse to moderately dense graminoid layer. The species present depend on the geographic range of the grasses, alkalinity/salinity and past land use. Species may include *Pleuraphis jamesii, Bouteloua gracilis, Sporobolus airoides, Sporobolus cryptandrus, Achnatherum hymenoides, Elymus elymoides, Distichlis spicata, Leymus salinus, Pascopyrum smithii, Hesperostipa comata, Pseudoroegneria spicata, Poa secunda, Leymus ambiguus*, and *Muhlenbergia torreyi*. A number of annual species may also grow in association with the shrubs and grasses of this system, although they are usually rare and confined to areas of recent disturbance (Blaisdell and Holmgren 1984). Forb cover is generally sparse. Perennial forbs that might occur include *Sphaeralcea coccinea, Chaetopappa ericoides, Xylorhiza venusta, Descurainia sophia*, and *Mentzelia* species. Annual natives include *Plantago* spp., *Vulpia octoflora,* or *Monolepis nuttalliana*. Associated halophytic annuals include *Salicornia rubra, Salicornia bigelovii,* and *Suaeda* species. Exotic annuals that may occur include *Salsola kali, Bromus rubens,* and *Bromus tectorum*. Cacti like *Opuntia* spp. and *Echinocereus* spp. may be present in some occurrences. Trees are not usually present but some scattered *Juniperus* spp. may be found.

Dynamics: West (1982) stated that "salt desert shrub vegetation occurs mostly in two kinds of situations that promote soil salinity, alkalinity, or both. These are either at the bottom of drainages in enclosed basins or where marine shales outcrop." However, salt-desert shrub vegetation may be an indication of climatically dry as well as physiologically dry soils (Blaisdell and Holmgren 1984). Not all salt-desert shrub soils are salty, and their hydrologic characteristics may often be responsible for the associated vegetation (Naphan 1966). Species of the salt-desert shrub complex have different degrees of tolerance to salinity and aridity, and they tend to sort themselves out along a moisture/salinity gradient (West 1982). Species and communities are apparently sorted out along physical, chemical, moisture, and topographic gradients through complex relations that are not understood and are in need of further study (Blaisdell and Holmgren 1984).

The winter months within this system are a good time for soil moisture accumulation and storage. There is generally at least one good snow storm per season that will provide sufficient moisture to the vegetation. The winter moisture accumulation amounts will affect spring plant growth. Plants may grow as little as a few inches to 1 m. Unless more rains come in the spring, the soil moisture will be depleted in a few weeks, growth will slow and ultimately cease, and the perennial plants will assume their various forms of dormancy (Blaisdell and Holmgren 1984). If effective rain comes later in the warm season, some of the species will renew their growth from the stage at which it had stopped. Others, having died back, will start over as if emerging from winter dormancy (Blaisdell and Holmgren 1984). *Atriplex confertifolia* shrubs often develop large leaves in the spring, which increase the rate of photosynthesis. As soil moisture decreases, the leaves are lost, and the plant takes on a dead appearance. During late fall, very small overwintering leaves appear which provide some photosynthetic capability through the remainder of the year (IVC 1999). Other communities are maintained by intra- or inter-annual cycles of flooding followed by extended drought, which favor accumulation of transported salts. The moisture supporting these intermittently flooded wetlands is usually derived off-site, and they are dependent upon natural watershed function for persistence (Reid et al. 1999).

In summary, desert communities of perennial plants are dynamic and changing. The composition within this system may change dramatically and may be both cyclic and unidirectional. Superimposed on the compositional change is great variation from year to year in growth of all the vegetation – the sum of varying growth responses of individual species to specific conditions of different years (Blaisdell and Holmgren 1984). Desert plants grow when temperature is satisfactory, but only if soil moisture is available at the same time. Because amount of moisture is variable from year to year and because different species flourish under different seasons of soil moisture, seldom do all components of the vegetation thrive in the same year (Blaisdell and Holmgren 1984).

SOURCES

References: Barbour and Major 1988, Blaisdell and Holmgren 1984, Branson et al. 1967, Branson et al. 1976, Brown 1982, Campbell 1977, Francis 1986, Holland and Keil 1995, Reid et al. 1999, West 1979, West 1982, West 1983b, West and Ibrahim 1968
Last updated: 20 Feb 2003 **Stakeholders:** WCS, MCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S136 Southern Colorado Plateau Sand Shrubland

Division 304, Shrubland, CES304.793
Spatial Scale & Pattern: Large patch **Classification Confidence:** low
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Foothill], Lowland [Lowland], Woody-Herbaceous, Temperate [Temperate Xeric], Alkaline Soil, Aridic, Very Short Disturbance Interval, G-Landscape/High Intensity,

Non-Diagnostic Classifiers: Mechanical Disturbance, Xeromorphic Shrub, Short (50-100 yrs) Persistence

Concept Summary: This large patch ecological system is found on the south-central Colorado Plateau in northeastern Arizona extending into southern Utah. It occurs on windswept mesas, broad basins and plains at low to moderate elevations (1300-1800m). Substrates are stabilized sandsheets or shallow to moderately deep sandy soils that may form small hummocks or small coppice dunes. This semi-arid, open shrubland is typically dominated by short shrubs (10-30 % cover) with a sparse graminoid layer. The woody layer is often a mixture of shrubs and dwarf-shrubs. Characteristic species include *Ephedra cutleri, Ephedra torreyana, Ephedra viridis,* and *Artemisia filifolia. Coleogyne ramosissima* is typically not present. , *Poliomentha incana, Parryella filifolia,* or *Ericameria nauseosa* may be present to dominant locally. Ephedra cutleri and E.viridis often assume a distinctive matty growth form. . Characteristic grasses include *Achnatherum hymenoides, Bouteloua gracilis, Hesperostipa comata,* and *Pleuraphis jamesii.* The general aspect of occurrences is an open low shrubland, but may include small blowouts and dunes. Occasionally grasses may be moderately abundant locally and form a distinct layer. Disturbance may be important in maintaining the woody component. Eolian processes are evident such as pediceled plants, occasional blowouts or small dunes, but the generally higher vegetative cover and less prominent geomorphic features distinguish this system from the Inter-Mountain Basins Active and Stabilized Dunes.

DISTRIBUTION

Range: Occurs in sandy plains and mesas in south-central Colorado Plateau in northeastern Azizona extending into southern Utah.
Ecological Divisions: 304
TNC Ecoregions: 19:C
Subnations/Nations: AZ:c, CO:?, NM:?, UT:c,

CONCEPT

Alliances and Associations:

- ACHNATHERUM HYMENOIDES SHRUB HERBACEOUS ALLIANCE (A.1543) Ephedra viridis / Achnatherum hymenoides - Bouteloua gracilis Shrub Herbaceous Vegetation (CEGL001648) Ephedra viridis / Achnatherum hymenoides - Sporobolus cryptandrus Shrub Herbaceous Vegetation
- ARTEMISIA FILIFOLIA SHRUBLAND ALLIANCE (A.816) Artemisia filifolia - Ephedra (torreyana, viridis) Shrubland (CEGL002786)
- EPHEDRA CUTLERI SHRUBLAND ALLIANCE [PROVISIONAL] (A.2644)
- Ephedra cutleri Shrubland [Provisional] (CEGL005804)
- EPHEDRA TORREYANA SHRUBLAND ALLIANCE (A.2572) Ephedra torreyana - Achnatherum hymenoides Hummock Shrubland (CEGL005802)
- EPHEDRA VIRIDIS SHRUBLAND ALLIANCE (A.858) Ephedra viridis / Pleuraphis rigida Shrubland (CEGL001257)
- ERICAMERIA NAUSEOSA SHRUBLAND ALLIANCE (A.835) Ericameria nauseosa / Leymus flavescens / Psoralidium lanceolatum Shrubland (CEGL001329) Ericameria nauseosa Sand Deposit Sparse Shrubland (CEGL002980)
- POLIOMINTHA INCANA SHRUBLAND ALLIANCE (A.862)

Poliomintha incana / (Pleuraphis jamesii) Shrubland [Provisional] (CEGL002980)

SOURCES

References: Unpublished AZGAP field data 2004, Unpublished UTGAP field data 2004
Last updated: 20 Feb 2004 **Stakeholders:** WCS
Concept Author: K. Pohs, K. Schulz, J.Kirby **LeadResp:** WCS

NLCD Grassland/Herbaceous Types

Areas dominated by grammanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.

S079 Inter-Mountain Basins Semi-Desert Shrub Steppe

Division 304, Steppe/Savanna, CES304.788
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Foothill], Lowland [Lowland], Woody-Herbaceous, Temperate [Temperate Xeric], Alkaline Soil, Aridic, Very Short Disturbance Interval, G-Landscape/High Intensity, Graminoid

Non-Diagnostic Classifiers: Mechanical Disturbance, Broad-Leaved Evergreen Shrub, Xeromorphic Shrub, Thorn Shrub, Evergreen Sclerophyllous Shrub, Succulent Shrub, Dwarf-Shrub, Forb, Short (50-100 yrs) Persistence

Concept Summary: This ecological system occurs throughout the Intermountain western U.S., typically at lower elevations on alluvial fans and flats with moderate to deep soils. This semi-arid shrub-steppe is typically dominated by graminoids (>25% cover) with an open shrub layer, but includes sparse mixed shrublands without a strong graminoid layer. Characteristic grasses include *Achnatherum hymenoides, Bouteloua gracilis, Distichlis spicata, Hesperostipa comata, Pleuraphis jamesii, Poa secunda,* and *Sporobolus airoides*. The woody layer is often a mixture of shrubs and dwarf-shrubs. Characteristic species include *Atriplex canescens, Artemisia filifolia, Chrysothamnus greenei, Chrysothamnus viscidiflorus, Ephedra* spp., *Ericameria nauseosa, Gutierrezia sarothrae*, and *Krascheninnikovia lanata*. Scattered *Artemisia tridentata* may be present but does not dominate. The general aspect of occurrences may be either open shrubland with patchy grasses or patchy open herbaceous layer.

Disturbance may be important in maintaining the woody component. Microphytic crust is very important in some occurrences.

DISTRIBUTION

Range: Occurs throughout the Intermountain western U.S., typically at lower elevations.
Ecological Divisions: 304
TNC Ecoregions: 10:C, 11:C, 18:C, 19:C, 20:C, 21:C, 4:C, 6:C, 8:C, 9:C
Subnations/Nations: AZ:c, CA:c, CO:c, ID:c, MT:p, NM:c, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

- ACHNATHERUM HYMENOIDES SHRUB HERBACEOUS ALLIANCE (A.1543) Ephedra viridis / Achnatherum hymenoides - Bouteloua gracilis Shrub Herbaceous Vegetation (CEGL001648) Ephedra viridis / Achnatherum hymenoides - Sporobolus cryptandrus Shrub Herbaceous Vegetation (CEGL001649)
- ACHNATHERUM SPECIOSUM SHRUB HERBACEOUS ALLIANCE (A.1549) Achnatherum speciosum Shrub Herbaceous Vegetation [Placeholder] (CEGL003113)
- ARTEMISIA FILIFOLIA SHRUBLAND ALLIANCE (A.816) Artemisia filifolia - Ephedra (torreyana, viridis) Shrubland (CEGL002786) Artemisia filifolia Colorado Plateau Shrubland (CEGL002697)
- BOUTELOUA ERIOPODA MICROPHYLLOUS EVERGREEN SHRUB HERBACEOUS ALLIANCE (A.1545) Gutierrezia sarothrae - Krascheninnikovia lanata - Atriplex canescens / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001733)

- BOUTELOUA ERIOPODA XEROMORPHIC SHRUB HERBACEOUS ALLIANCE (A.1553) Bouteloua eriopoda Coconino Plateau Shrub Herbaceous Vegetation (CEGL002787) Ephedra torreyana / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001731)
- BOUTELOUA GRACILIS DWARF-SHRUB HERBACEOUS ALLIANCE (A.1571) Artemisia bigelovii / Bouteloua gracilis Dwarf-shrub Herbaceous Vegetation (CEGL001742) Bouteloua gracilis Dwarf-shrub Herbaceous Vegetation [Placeholder] (CEGL005810)
- BOUTELOUA GRACILIS HERBACEOUS ALLIANCE (A.1282) Bouteloua gracilis - Hesperostipa comata Herbaceous Vegetation [Provisional] (CEGL002932)
- CHRYSOTHAMNUS VISCIDIFLORUS SHRUB HERBACEOUS ALLIANCE (A.1524) Chrysothamnus viscidiflorus - Ericameria parryi Shrub Herbaceous Vegetation [Provisional] (CEGL002781) Chrysothamnus viscidiflorus / Leymus salinus ssp. salinus Shrub Herbaceous Vegetation (CEGL001501) Chrysothamnus viscidiflorus / Poa pratensis Semi-natural Shrub Herbaceous Vegetation [Provisional] (CEGL002933)
- EPHEDRA NEVADENSIS SHRUBLAND ALLIANCE (A.857) Ephedra nevadensis / Achnatherum hymenoides Shrubland (CEGL001255) Ephedra nevadensis Basalt Shrubland [Provisional] (CEGL002936)
- EPHEDRA TORREYANA SHRUBLAND ALLIANCE (A.2572) Ephedra torreyana - Achnatherum hymenoides Hummock Shrubland (CEGL005802)
- ERICAMERIA NAUSEOSA SHRUB SHORT HERBACEOUS ALLIANCE (A.1546) Ericameria nauseosa / Bouteloua gracilis Shrub Herbaceous Vegetation (CEGL003495) Ericameria nauseosa / Muhlenbergia pungens - Achnatherum hymenoides Shrub Herbaceous Vegetation (CEGL002921)
- ERICAMERIA NAUSEOSA SHRUBLAND ALLIANCE (A.835) Ericameria nauseosa / Bromus tectorum Semi-natural Shrubland (CEGL002937)
- ERICAMERIA PARRYI SHRUBLAND ALLIANCE (A.818) Ericameria parryi / Pleuraphis jamesii - Bouteloua gracilis Shrubland (CEGL001331)
- GRAYIA SPINOSA SHRUBLAND ALLIANCE (A.1038) Grayia spinosa / Poa secunda Shrubland (CEGL001351)
- GUTIERREZIA SAROTHRAE DWARF-SHRUBLAND ALLIANCE (A.2528) Gutierrezia sarothrae - (Opuntia spp.) / Pleuraphis jamesii Dwarf-shrubland (CEGL002690)
- KRASCHENINNIKOVIA LANATA DWARF-SHRUB HERBACEOUS ALLIANCE (A.1565) Krascheninnikovia lanata / Bouteloua gracilis Dwarf-shrub Herbaceous Vegetation (CEGL001321) Krascheninnikovia lanata / Pascopyrum smithii - Bouteloua gracilis Dwarf-shrub Herbaceous Vegetation (CEGL001324)
- KRASCHENINNIKOVIA LANATA DWARF-SHRUBLAND ALLIANCE (A.1104) Krascheninnikovia lanata / Pleuraphis jamesii Dwarf-shrubland (CEGL001322) Krascheninnikovia lanata / Poa secunda Dwarf-shrubland (CEGL001326)
- PLEURAPHIS JAMESII SHRUB HERBACEOUS ALLIANCE (A.1532) Atriplex obovata / Pleuraphis jamesii - Sporobolus airoides Shrub Herbaceous Vegetation (CEGL001775) Ericameria nauseosa / Pleuraphis jamesii - (Hesperostipa comata) Shrub Herbaceous Vegetation (CEGL002996) Gutierrezia sarothrae / Sporobolus airoides - Pleuraphis jamesii Shrub Herbaceous Vegetation (CEGL001776)
- PLEURAPHIS RIGIDA / GUTIERREZIA SAROTHRAE SHRUB HERBACEOUS ALLIANCE (A.1529) Gutierrezia sarothrae / Pleuraphis rigida Shrub Herbaceous Vegetation (CEGL001543)

- SPHAEROMERIA ARGENTEA HERBACEOUS ALLIANCE (A.1654) Sphaeromeria argentea - Achnatherum swallenii Herbaceous Vegetation (CEGL001993) Sphaeromeria argentea - Artemisia frigida - Poa secunda Herbaceous Vegetation (CEGL001992)

Environment: This ecological system occurs throughout the Intermountain West from the western Great Basin to the northern Rocky Mountains and Colorado Plateau at elevations ranging from 300 m up to 2500 m. The climate where this system occurs is generally hot in summers and cold in winters with low annual precipitation, ranging from 18-40 cm and high inter-annual variation. Much of the precipitation falls as snow, and growing-season drought is characteristic. Temperatures are continental with large annual and diurnal variation. Sites are generally alluvial fans and flats with moderate to deep soils. Some sites can be flat, poorly drained and intermittently flooded with a shallow or perched water table often within 1 m depth (West 1983). Substrates are generally shallow, calcareous, fine-textured soils (clays to silt-loams), derived from alluvium; or deep, fine to medium-textured alluvial soils with some source of sub-irrigation during the summer season. Soils may be alkaline and typically moderately saline (West 1983). Some occurrences occur on deep, sandy soils, or soils that are highly calcareous (Hironaka et al. 1983).

Vegetation: The plant associations in this system are characterized by a somewhat sparse to moderately dense (10-70% cover) shrub layer of *Artemisia filifolia, Ephedra cutleri, Ephedra nevadensis, Ephedra torreyana, Ephedra viridis, Ericameria nauseosa, Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Sarcobatus vermiculatus*, or *Atriplex canescens*. Other shrubs occasionally present include *Purshia tridentata* and *Tetradymia canescens*. *Artemisia tridentata* may be present but does not dominate. Trees are

very rarely present in this system, but some individuals of *Pinus ponderosa, Juniperus scopulorum, Juniperus occidentalis*, or *Cercocarpus ledifolius* may occur. The herbaceous layer is dominated by bunch grasses which occupy patches in the shrub matrix. The most widespread species is *Pseudoroegneria spicata*, which occurs from the Columbia Basin to the northern Rockies. Other locally dominant or important species include *Sporobolus airoides, Leymus cinereus, Festuca idahoensis, Pascopyrum smithii, Bouteloua gracilis, Distichlis spicata, Pleuraphis jamesii, Elymus lanceolatus, Elymus elymoides, Koeleria macrantha, Muhlenbergia richardsonis, Hesperostipa comata*, and *Poa secunda*. Annual grasses, especially the exotics *Bromus japonicus* and *Bromus tectorum*, may be present to abundant. Forbs are generally of low importance and are highly variable across the range, but may be diverse in some occurrences. Species that often occur are *Symphyotrichum ascendens (= Aster adscendens), Collinsia parviflora, Penstemon caespitosus, Achillea millefolium, Erigeron compositus, Senecio* spp, and *Taraxacum officinale*. Other important genera include *Astragalus, Oenothera, Eriogonum*, and *Balsamorhiza*. Mosses and lichens may be important ground cover. Forbs are common on disturbed weedy sites. Weedy annual forbs may include the exotics *Descurainia* spp., *Helianthus annuus, Halogeton glomeratus, Lactuca serriola*, and *Lepidium perfoliatum*.

SOURCES

References: Branson et al. 1976, Hanson 1929, Hironaka et al. 1983, Tuhy et al. 2002, West 1983
Last updated: 20 Feb 2003 **Stakeholders:** WCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

S090 Inter-Mountain Basins Semi-Desert Grassland

Division 304, Herbaceous, CES304.787
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland
Diagnostic Classifiers: Lowland [Foothill], Lowland [Lowland], Herbaceous, Temperate [Temperate Xeric], Alkaline Soil, Aridic, Graminoid

Non-Diagnostic Classifiers: Intermediate Disturbance Interval, F-Landscape/Medium Intensity, G-Landscape/Low Intensity, Forb, Moderate (100-500 yrs) Persistence

Concept Summary: This widespread ecological system occurs throughout the Intermountain western U.S. on dry plains and mesas, at approximately 1450 to 2320 m (4750-7610 feet) in elevation. These grasslands occur in lowland and upland areas and may occupy swales, playas, mesa tops, plateau parks, alluvial flats, and plains, but sites are typically xeric. Substrates are often well-drained sandy- or loamy-textured soils derived from sedimentary parent materials, but are quite variable and may include fine-textured soils derived from igneous and metamorphic rocks. When they occur near foothills grasslands they will be at lower elevations. The dominant perennial bunch grasses and shrubs within this system are all very drought-resistant plants. These grasslands are typically dominated or codominated by *Achnatherum hymenoides, Aristida* spp., *Bouteloua gracilis, Hesperostipa comata, Muhlenbergia torreyana*, or *Pleuraphis jamesii*, and may include scattered shrubs and dwarf-shrubs of species of *Artemisia, Atriplex, Coleogyne, Ephedra, Gutierrezia*, or *Krascheninnikovia lanata*.

DISTRIBUTION

Range: Occurs throughout the Intermountain western U.S. on dry plains and mesas, at approximately 1450 to 2320 m (4750-7610 feet) in elevation.
Ecological Divisions: 304, 306
TNC Ecoregions: 10:C, 11:C, 18:C, 19:C, 20:C, 21:C, 4:C, 6:C, 8:C, 9:C
Subnations/Nations: AZ:c, CA:c, CO:c, ID:c, MT:p, NM:c, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

- ACHNATHERUM HYMENOIDES HERBACEOUS ALLIANCE (A.1262) Achnatherum hymenoides - Sporobolus contractus Herbaceous Vegetation (CEGL001652)
- ACHNATHERUM LETTERMANII HERBACEOUS ALLIANCE (A.2524) Achnatherum lettermanii - Oxytropis oreophila Herbaceous Vegetation (CEGL002734)
- ACHNATHERUM NELSONII HERBACEOUS ALLIANCE (A.1271) Achnatherum nelsonii - Koeleria macrantha Herbaceous Vegetation (CEGL001707)

- ACHNATHERUM SPECIOSUM HERBACEOUS ALLIANCE (A.1290) Achnatherum speciosum Herbaceous Vegetation [Placeholder] (CEGL003112)
- ARISTIDA PURPUREA HERBACEOUS ALLIANCE (A.2570) Aristida purpurea Herbaceous Vegetation (CEGL005800)
- BOUTELOUA ERIOPODA HERBACEOUS ALLIANCE (A.1284) Bouteloua eriopoda - Hesperostipa neomexicana Herbaceous Vegetation (CEGL001753) Bouteloua eriopoda - Pleuraphis jamesii Herbaceous Vegetation (CEGL001751) Bouteloua eriopoda Semi-desert Herbaceous Vegetation (CEGL001752)
- BOUTELOUA ERIOPODA MICROPHYLLOUS EVERGREEN SHRUB HERBACEOUS ALLIANCE (A.1545) Gutierrezia sarothrae - Krascheninnikovia lanata - Atriplex canescens / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001733)
- BOUTELOUA GRACILIS HERBACEOUS ALLIANCE (A.1282) Bouteloua gracilis - Bouteloua curtipendula Herbaceous Vegetation (CEGL001754) Bouteloua gracilis - Bouteloua hirsuta Herbaceous Vegetation (CEGL001755) Bouteloua gracilis - Hesperostipa comata Herbaceous Vegetation [Provisional] (CEGL002932) Bouteloua gracilis - Pleuraphis jamesii Herbaceous Vegetation (CEGL001759) Bouteloua gracilis Herbaceous Vegetation (CEGL001760)
- BOUTELOUA HIRSUTA HERBACEOUS ALLIANCE (A.1285) Bouteloua hirsuta - Bouteloua radicosa Herbaceous Vegetation (CEGL001765)
- BROMUS INERMIS SEMI-NATURAL HERBACEOUS ALLIANCE (A.3561) Bromus inermis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation (CEGL005264)
- BROMUS TECTORUM SEMI-NATURAL HERBACEOUS ALLIANCE (A.1814) Bromus tectorum Semi-natural Herbaceous Vegetation [Placeholder] (CEGL003019)
- ERICAMERIA NAUSEOSA SHRUB SHORT HERBACEOUS ALLIANCE (A.1546) Ericameria nauseosa / Bouteloua gracilis Shrub Herbaceous Vegetation (CEGL003495)
- HESPEROSTIPA COMATA BUNCH HERBACEOUS ALLIANCE (A.1270) Hesperostipa comata - (Bouteloua eriopoda, Pleuraphis jamesii) Herbaceous Vegetation (CEGL002997) Hesperostipa comata - Achnatherum hymenoides Herbaceous Vegetation (CEGL001703) Hesperostipa comata Great Basin Herbaceous Vegetation (CEGL001705)
- HESPEROSTIPA NEOMEXICANA HERBACEOUS ALLIANCE (A.1272) Hesperostipa neomexicana Herbaceous Vegetation (CEGL001708)
- MUHLENBERGIA ASPERIFOLIA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1334) Muhlenbergia asperifolia Herbaceous Vegetation (CEGL001779)
- MUHLENBERGIA MONTANA HERBACEOUS ALLIANCE (A.1260) Muhlenbergia (pungens, montana) - Heterotheca villosa Herbaceous Vegetation (CEGL002938)
- PLEURAPHIS JAMESII HERBACEOUS ALLIANCE (A.1287) Pleuraphis jamesii Herbaceous Vegetation (CEGL001777)
- PLEURAPHIS JAMESII SHRUB HERBACEOUS ALLIANCE (A.1532) Atriplex obovata / Pleuraphis jamesii - Sporobolus airoides Shrub Herbaceous Vegetation (CEGL001775)
- PLEURAPHIS RIGIDA HERBACEOUS ALLIANCE (A.1246) Pleuraphis rigida Herbaceous Vegetation [Placeholder] (CEGL003051)
- PLEURAPHIS RIGIDA SHRUB HERBACEOUS ALLIANCE (A.1539) Pleuraphis rigida Shrub Herbaceous Vegetation [Placeholder] (CEGL003052)
- POA FENDLERIANA HERBACEOUS ALLIANCE (A.1263) Poa fendleriana ssp. fendleriana Herbaceous Vegetation (CEGL001655)
- POA SECUNDA HERBACEOUS ALLIANCE (A.1291) Aristida purpurea var. longiseta - Poa secunda Herbaceous Vegetation (CEGL001781)
- POA SECUNDA SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1410) Poa secunda - Muhlenbergia richardsonis Herbaceous Vegetation (CEGL002755) Poa secunda Herbaceous Vegetation (CEGL001657)
- PSEUDOROEGNERIA SPICATA HERBACEOUS ALLIANCE (A.1265) Pseudoroegneria spicata - Achnatherum hymenoides Herbaceous Vegetation (CEGL001674) Pseudoroegneria spicata ssp. inermis Herbaceous Vegetation (CEGL001661)
- SPOROBOLUS AIROIDES HERBACEOUS ALLIANCE (A.1267) Sporobolus airoides Monotype Herbaceous Vegetation (CEGL001688)
- SPOROBOLUS AIROIDES SOD HERBACEOUS ALLIANCE (A.1241) Sporobolus airoides - Bouteloua gracilis Herbaceous Vegetation (CEGL001686) Sporobolus airoides Sod Herbaceous Vegetation [Placeholder] (CEGL001791)
- SPOROBOLUS CRYPTANDRUS HERBACEOUS ALLIANCE (A.1252) Aristida purpurea var. longiseta - Pseudoroegneria spicata - Sporobolus cryptandrus Herbaceous Vegetation (CEGL001589) Aristida purpurea var. longiseta - Sporobolus cryptandrus Herbaceous Vegetation (CEGL001515) Sporobolus cryptandrus - Poa secunda Herbaceous Vegetation (CEGL001516) Sporobolus cryptandrus Great Basin Herbaceous Vegetation (CEGL002691)
- SPOROBOLUS CRYPTANDRUS SHRUB HERBACEOUS ALLIANCE (A.1525) Sporobolus cryptandrus Shrub Herbaceous Vegetation (CEGL001514)

- THINOPYRUM INTERMEDIUM SEMI-NATURAL HERBACEOUS ALLIANCE (A.2529) Thinopyrum intermedium Semi-natural Herbaceous Vegetation (CEGL002935)

- **California community types:**
- Needle-and-thread (41.130.00)
- Great Basin Grassland (41.300.00)
- Little Galleta Grassland (41.610.00)
- Little Galleta - California Buckwheat (41.610.01)
- Little Galleta - anderson's Wolfberry (41.610.02)
- Little Galleta - Nevada Ephedra (41.610.03)

Environment: Low-elevation grasslands in the Intermountain West region occur in semi-arid to arid climates at approximately 1450 to 2320 m (4750-7610 feet) in elevation. Grasslands within this system are typically characterized by a sparse to moderately dense herbaceous layer dominated by medium-tall and short bunch grasses, often in a sod-forming growth. These grasslands occur in lowland and upland areas and may occupy swales, playas, mesa tops, plateau parks, alluvial flats, and plains. These grasslands typically occur on xeric sites. This system experiences cold temperate conditions. Hot summers and cold winters with freezing temperatures and snow are common. Annual precipitation is usually from 20-40 cm (7.9-15.7 inches). A significant portion of the precipitation falls in July through October during the summer monsoon storms, with the rest falling as snow during the winter and early spring months.

These grasslands occur on a variety of aspects and slopes. Sites may range from flat to moderately steep. Soils supporting this system also vary from deep to shallow, and from sandy to finer-textured. The substrate is typically sand- or shale-derived. Some sandy soil occurrences have a high cover of cryptogams on the soil. These cryptogamic species would tend to increase the stability of the highly erodible sandy soils of these grasslands during torrential summer rains and heavy wind storms (Kleiner and Harper 1977). *Muhlenbergia*-dominated grasslands which flood temporarily, combined with high evaporation rates in this dry system, can have accumulations of soluble salts in the soil. Soil salinity depends on the amount and timing of precipitation and flooding.

Dynamics: This system is maintained by frequent fires and sometimes associated with specific soils, often well-drained clay soils. A combination of precipitation, temperature, and soils limits this system to the lower elevations within the region. The dominant perennial bunch grasses and shrubs within this system are all very drought-resistant plants. Grasses that dominate semi-arid grasslands develop a dense network of roots concentrated in the upper parts of the soil where rainfall penetrates most frequently (Blydenstein 1966, Cable 1969, Sala and Lauenroth 1985, as cited by McClaran and Van Devender 1995). *Bouteloua gracilis* is also very grazing-tolerant and generally forms a short sod. *Pleuraphis jamesii* is only moderately palatable to livestock, but decreases when heavily grazed during drought and in the more arid portions of its range where it is the dominant grass (West 1972). This grass reproduces extensively from scaly rhizomes. These rhizomes make the plant resistant to trampling by livestock and have good soil-binding properties (Weaver and Albertson 1956, West 1972). *Achnatherum hymenoides* is one of the most drought-tolerant grasses in the western U.S. (USDA 1937). It is also a valuable forage grass in arid and semi-arid regions. Improperly managed livestock grazing could increase soil erosion, decrease cover of this palatable plant species and increase weedy species (USDA 1937). *Muhlenbergia asperifolia* with its flooding regime combined with high evaporation rate in these dry climates causes accumulations of soluble salts in the soil. Total vegetation cover (density and height), species composition and soil salinity depend on the amount and timing of precipitation and flooding. Growth-inhibiting salt concentrations are diluted when the soil is saturated allowing the growth of less salt-tolerant species. As the saturated soils dry, the salt concentrates until it precipitates out on the soil surface (Dodd and Coupland 1966, Ungar 1968). *Hesperostipa comata* is a deep-rooted grass that uses soil moisture below 0.5 m during the dry summers.

SOURCES

References: Cable 1967, Cable 1969, Cable 1975, Dodd and Coupland 1966, Kleiner and Harper 1977, Mast et al. 1997, Mast et al. 1998, McClaran and Van Devender 1995, Tuhy et al. 2002, Ungar 1968, Weaver and Albertson 1956, West 1983

Last updated: 20 Feb 2003 **Stakeholders:** WCS

Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

NLCD Woody Wetland Types

Areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

S093 Rocky Mountain Lower Montane Riparian Woodland and Shrubland

Division 306, Woody Wetland, CES306.821
Spatial Scale & Pattern: Linear **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Wetland
Diagnostic Classifiers: Montane [Lower Montane], Mineral: W/ A-Horizon <10 cm, Unconsolidated, Short (50-100 yrs) Persistence, Riverine / Alluvial, Short (<5 yrs) Flooding Interval
Non-Diagnostic Classifiers: Forest and Woodland (Treed), Shrubland (Shrub-dominated), Braided channel or stream, Drainage bottom (undifferentiated), Floodplain, Stream terrace (undifferentiated), Valley bottom, Temperate [Temperate Continental], Circumneutral Water

Concept Summary: This system is found throughout the Rocky Mountain and Colorado Plateau regions within a broad elevation range from approximately 900 to 2800 m. This system often occurs as a mosaic of multiple communities that are tree-dominated with a diverse shrub component. This system is dependent on a natural hydrologic regime, especially annual to episodic flooding. Occurrences are found within the flood zone of rivers, on islands, sand or cobble bars, and immediate streambanks. They can form large, wide occurrences on mid-channel islands in larger rivers or narrow bands on small, rocky canyon tributaries and well-drained benches. It is also typically found in backwater channels and other perennially wet but less scoured sites, such as floodplains swales and irrigation ditches. Dominant trees may include *Acer negundo, Populus angustifolia, Populus balsamifera, Populus deltoides, Populus fremontii, Pseudotsuga menziesii, Picea pungens, Salix amygdaloides*, or *Juniperus scopulorum*. Dominant shrubs include *Acer glabrum, Alnus incana, Betula occidentalis, Cornus sericea, Crataegus rivularis, Forestiera pubescens, Prunus virginiana, Rhus trilobata, Salix monticola, Salix drummondiana, Salix exigua, Salix irrorata, Salix lucida, Shepherdia argentea*, or *Symphoricarpos* spp. Exotic trees of *Elaeagnus angustifolia* and *Tamarix* spp. are common in some stands. Generally, the upland vegetation surrounding this riparian system is different and ranges from grasslands to forests.

DISTRIBUTION

Range: Found throughout the Rocky Mountain and Colorado Plateau regions within a broad elevation range from approximately 900 to 2800 m.
Ecological Divisions: 304, 306
TNC Ecoregions: 11:C, 18:C, 19:C, 20:C, 21:C, 25:C, 6:P, 8:C, 9:C
Subnations/Nations: AZ:c, CO:c, ID:c, MT:c, NM:c, NV:c, OR:c, SD:c, UT:c, WY:c

CONCEPT

Alliances and Associations:

- ACER NEGUNDO SEASONALLY FLOODED FOREST ALLIANCE (A.341) Acer negundo / Equisetum arvense Forest (CEGL000626)
- ACER NEGUNDO TEMPORARILY FLOODED FOREST ALLIANCE (A.278) Acer negundo - Populus angustifolia / Cornus sericea Forest (CEGL000627) Acer negundo / Cornus sericea Forest (CEGL000625) Acer negundo / Prunus virginiana Forest (CEGL000628)
- ACER NEGUNDO TEMPORARILY FLOODED WOODLAND ALLIANCE (A.642) Acer negundo / Betula occidentalis Woodland (CEGL000936) Acer negundo / Brickellia grandiflora Woodland [Provisional] (CEGL002692) Acer negundo / Disturbed Understory Woodland (CEGL002693)
- BETULA OCCIDENTALIS INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.936) Betula occidentalis / Purshia tridentata / Hesperostipa comata Shrubland (CEGL001084)
- BETULA OCCIDENTALIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.967) Populus fremontii / Betula occidentalis Wooded Shrubland (CEGL002981)
- BETULA PAPYRIFERA FOREST ALLIANCE (A.267) Betula papyrifera / Corylus cornuta Forest (CEGL002079)
- EQUISETUM (ARVENSE, VARIEGATUM) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.3539) Equisetum (arvense, variegatum) Herbaceous Vegetation (CEGL005148)
- FORESTIERA PUBESCENS TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.969) Forestiera pubescens Shrubland (CEGL001168)

- FRAXINUS ANOMALA TEMPORARILY FLOODED WOODLAND ALLIANCE (A.2511) Fraxinus anomala Woodland (CEGL002752)
- JUNIPERUS SCOPULORUM TEMPORARILY FLOODED WOODLAND ALLIANCE (A.563) Juniperus scopulorum / Cornus sericea Woodland (CEGL000746) Juniperus scopulorum Temporarily Flooded Woodland [Placeholder] (CEGL002777)
- JUNIPERUS SCOPULORUM WOODLAND ALLIANCE (A.506) Juniperus scopulorum Woodland (CEGL003550)
- PINUS PONDEROSA TEMPORARILY FLOODED WOODLAND ALLIANCE (A.565) Pinus ponderosa / Alnus incana Woodland (CEGL002638) Pinus ponderosa / Cornus sericea Woodland (CEGL000853)

S096 Inter-Mountain Basins Greasewood Flat

Division 304, Mixed Upland and Wetland, CES304.780
Spatial Scale & Pattern: Large Patch **Classification Confidence:** medium
Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland, Wetland
Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Toeslope/Valley Bottom, Alkaline Soil, Deep Soil, Xeromorphic Shrub

Non-Diagnostic Classifiers: Alluvial flat, Alluvial plain, Alluvial terrace, Temperate [Temperate Continental], Saline Substrate Chemistry, Sarcobatus vermiculatus, Riverine / Alluvial, Deep (>15 cm) Water

Concept Summary: This ecological system occurs throughout much of the western U.S. in Intermountain basins and extends onto the western Great Plains. It typically occurs near drainages on stream terraces and flats or may form rings around playas. Sites typically have saline soils, a shallow water table and flood intermittently, but remain dry for most growing seasons. This system usually occurs as a mosaic of multiple communities, with open to moderately dense shrublands dominated or codominated by *Sarcobatus vermiculatus*. *Atriplex canescens*, *Atriplex confertifolia*, or *Krascheninnikovia lanata* may be present to codominant. Occurrences are often surrounded by mixed salt desert scrub. The herbaceous layer, if present, is usually dominated by graminoids. There may be inclusions of *Sporobolus airoides*, *Distichlis spicata* (where water remains ponded the longest), or *Eleocharis palustris* herbaceous types.

DISTRIBUTION

Range: Occurs throughout much of the western U.S. in Intermountain basins and extends onto the western Great Plains.
Ecological Divisions: 303, 304
TNC Ecoregions: 10:C, 11:C, 19:C, 20:C, 26:C, 4:C, 6:C, 8:C, 9:C
Subnations/Nations: AZ:c, CA:c, CO:c, ID:c, MT:c, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:
- DISTICHLIS SPICATA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1332) Distichlis spicata - (Scirpus nevadensis) Herbaceous Vegetation (CEGL001773) Distichlis spicata - Lepidium perfoliatum Herbaceous Vegetation (CEGL001772) Distichlis spicata Herbaceous Vegetation (CEGL001770) Distichlis spicata Mixed Herb Herbaceous Vegetation (CEGL001771)
- ELEOCHARIS PALUSTRIS SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1422) Eleocharis palustris Herbaceous Vegetation (CEGL001833)
- ERICAMERIA NAUSEOSA SHRUBLAND ALLIANCE (A.835) Ericameria nauseosa / Sporobolus airoides Shrubland [Provisional] (CEGL002918)
- LEYMUS CINEREUS HERBACEOUS ALLIANCE (A.1204) Leymus cinereus Herbaceous Vegetation (CEGL001479)
- LEYMUS CINEREUS INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1329) Leymus cinereus - Distichlis spicata Herbaceous Vegetation (CEGL001481) Leymus cinereus Bottomland Herbaceous Vegetation (CEGL001480)
- PUCCINELLIA NUTTALLIANA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1335) Puccinellia nuttalliana Herbaceous Vegetation (CEGL001799)
- SALICORNIA RUBRA SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1818) Salicornia rubra Herbaceous Vegetation (CEGL001999)

- SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SHRUB HERBACEOUS ALLIANCE (A.1554) Sarcobatus vermiculatus / Pascopyrum smithii - (Elymus lanceolatus) Shrub Herbaceous Vegetation (CEGL001508)
- SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.1046) Sarcobatus vermiculatus - Atriplex parryi / Distichlis spicata Shrubland (CEGL002764) Sarcobatus vermiculatus - Psorothamnus polydenius Shrubland (CEGL002763) Sarcobatus vermiculatus / Achnatherum hymenoides Shrubland (CEGL001373) Sarcobatus vermiculatus / Artemisia tridentata Shrubland (CEGL001359) Sarcobatus vermiculatus / Atriplex confertifolia - (Picrothamnus desertorum, Suaeda moquinii) Shrubland (CEGL001371) Sarcobatus vermiculatus / Atriplex gardneri Shrubland (CEGL001360) Sarcobatus vermiculatus / Distichlis spicata Shrubland (CEGL001363) Sarcobatus vermiculatus / Elymus elymoides - Pascopyrum smithii Shrubland (CEGL001365) Sarcobatus vermiculatus / Elymus elymoides Shrubland (CEGL001372) Sarcobatus vermiculatus / Leymus cinereus Shrubland (CEGL001366) Sarcobatus vermiculatus / Nitrophila occidentalis - Suaeda moquinii Shrubland (CEGL001369) Sarcobatus vermiculatus / Suaeda moquinii Shrubland (CEGL001370) Sarcobatus vermiculatus Shrubland (CEGL001357)
- SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SPARSELY VEGETATED ALLIANCE (A.1877) Sarcobatus vermiculatus / Juncus balticus Sparse Vegetation (CEGL002919) Sarcobatus vermiculatus / Sporobolus airoides Sparse Vegetation (CEGL001368)
- SARCOBATUS VERMICULATUS SHRUBLAND ALLIANCE (A.1041) Sarcobatus vermiculatus / Bouteloua gracilis Shrubland (CEGL001361) Sarcobatus vermiculatus / Pseudoroegneria spicata Shrubland (CEGL001367)
- SPOROBOLUS AIROIDES HERBACEOUS ALLIANCE (A.1267) Sporobolus airoides Southern Plains Herbaceous Vegetation (CEGL001685)
- SPOROBOLUS AIROIDES INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1331) Sporobolus airoides - Distichlis spicata Herbaceous Vegetation (CEGL001687)

- **California community types:**
- Greasewood - Shadscale (36.320.01)
- Greasewood - Saltgrass (41.200.03)

SOURCES

References: Knight 1994, West 1983b
Last updated: 20 Feb 2003 **Stakeholders:** WCS, MCS
Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

Pinus ponderosa / Crataegus douglasii Woodland (CEGL000855) Pinus ponderosa / Juglans major Woodland (CEGL000858) Pinus ponderosa Temporarily Flooded Woodland [Provisional] (CEGL002766)
- POA PRATENSIS SEMI-NATURAL SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1382) Poa pratensis Semi-natural Seasonally Flooded Herbaceous Vegetation [Placeholder] (CEGL003081)
- POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED FOREST ALLIANCE (A.310) Populus angustifolia - Populus deltoides - Salix amygdaloides Forest (CEGL000656) Populus angustifolia / Acer grandidentatum Forest (CEGL000646) Populus angustifolia / Lonicera involucrata Forest (CEGL000650) Populus angustifolia Sand Dune Forest (CEGL002643)
- POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED WOODLAND ALLIANCE (A.641) Populus angustifolia - Juniperus scopulorum Woodland (CEGL002640) Populus angustifolia - Picea pungens / Alnus incana Woodland (CEGL000934) Populus angustifolia - Pinus ponderosa Woodland (CEGL000935) Populus angustifolia - Pseudotsuga menziesii Woodland (CEGL002641) Populus angustifolia / Alnus incana Woodland (CEGL002642) Populus angustifolia / Betula occidentalis Woodland (CEGL000648) Populus angustifolia / Cornus sericea Woodland (CEGL002664) Populus angustifolia / Crataegus rivularis Woodland (CEGL002644) Populus angustifolia / Prunus virginiana Woodland (CEGL000651) Populus angustifolia / Rhus trilobata Woodland (CEGL000652) Populus angustifolia / Salix (monticola, drummondiana, lucida) Woodland (CEGL002645) Populus angustifolia / Salix drummondiana - Acer glabrum Woodland (CEGL002646) Populus angustifolia / Salix exigua Woodland (CEGL000654) Populus angustifolia / Salix irrorata Woodland (CEGL002647) Populus angustifolia / Salix ligulifolia - Shepherdia argentea Woodland (CEGL000655) Populus angustifolia / Symphoricarpos albus Woodland (CEGL002648)
- POPULUS DELTOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE (A.636) Populus deltoides - (Salix amygdaloides) / Salix (exigua, interior) Woodland (CEGL000659) Populus deltoides / Symphoricarpos occidentalis Woodland (CEGL000660) Populus deltoides ssp. wislizeni / Rhus trilobata Woodland (CEGL000940)
- POPULUS FREMONTII SEASONALLY FLOODED WOODLAND ALLIANCE (A.654) Populus fremontii / Leymus triticoides Woodland (CEGL002756) Populus fremontii / Salix geyeriana Woodland (CEGL000943)
- POPULUS FREMONTII TEMPORARILY FLOODED FOREST ALLIANCE (A.313) Populus fremontii / Salix exigua Forest (CEGL000666)
- PSEUDOTSUGA MENZIESII TEMPORARILY FLOODED WOODLAND ALLIANCE (A.568) Pseudotsuga menziesii / Betula occidentalis Woodland (CEGL002639) Pseudotsuga menziesii / Cornus sericea Woodland (CEGL000899)

- RHUS TRILOBATA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.938) Rhus trilobata Intermittently Flooded Shrubland (CEGL001121)
- SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.947) Salix exigua - Salix ligulifolia Shrubland (CEGL002655) Salix exigua - Salix lucida ssp. caudata Shrubland (CEGL001204) Salix exigua / Agrostis stolonifera Shrubland (CEGL001199) Salix exigua / Barren Shrubland (CEGL001200) Salix exigua / Elymus X pseudorepens Shrubland (CEGL001198) Salix exigua / Equisetum arvense Shrubland (CEGL001201) Salix exigua / Mesic Forbs Shrubland (CEGL001202) Salix exigua / Mesic Graminoids Shrubland (CEGL001203) Salix exigua Temporarily Flooded Shrubland (CEGL001197)
- SALIX AMYGDALOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE (A.645) Salix amygdaloides Woodland (CEGL000947)
- SALIX EASTWOODIAE SEASONALLY FLOODED SHRUBLAND ALLIANCE (A.1005) Salix eastwoodiae / Carex aquatilis Shrubland (CEGL001195) Salix eastwoodiae / Carex utriculata Shrubland (CEGL001196) Salix eastwoodiae Shrubland [Provisional] (CEGL001194)
- SALIX IRRORATA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.976) Salix irrorata Shrubland (CEGL001214)
- SALIX LASIOLEPIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.977) Salix lasiolepis - Cornus sericea / Rosa woodsii Shrubland (CEGL003453)
- Salix lasiolepis / Barren Ground Shrubland (CEGL001216) Salix lasiolepis / Rosa woodsii / Mixed Herbs Shrubland (CEGL001217)
- SHEPHERDIA ARGENTEA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.960) Shepherdia argentea Shrubland (CEGL001128)

Environment: This system is dependent on a natural hydrologic regime, especially annual to episodic flooding. This ecological system is found within the flood zone of rivers, on islands, sand or cobble bars, and immediate streambanks. It can form large, wide occurrences on mid-channel islands in larger rivers or narrow bands on small, rocky canyon tributaries and well-drained benches. It is also typically found in backwater channels and other perennially wet but less scoured sites, such as floodplains swales and irrigation ditches. It may also occur in upland areas of mesic swales and hillslopes below seeps and springs.

The climate of this system is continental with typically cold winters and hot summers.

Surface water is generally high for variable periods. Soils are typically alluvial deposits of sand, clays, silts and cobbles that are highly stratified with depth due to flood scour and deposition. Highly stratified profiles consist of alternating layers of clay loam and organic material with coarser sand or thin layers of sandy loam over very coarse alluvium. Soils are fine-textured with organic material over coarser alluvium. Some soils are more developed due to a slightly more stable environment and greater input of organic matter.

Dynamics: This ecological system contains early-, mid- and late-seral riparian plant associations. It also contains non-obligate riparian species. Cottonwood communities are early-, mid- or late-seral, depending on the age class of the trees and the associated species of the occurrence (Kittel et al. 1998). Cottonwoods, however, do not reach a climax stage as defined by Daubenmire (1952). Mature cottonwood occurrences do not regenerate in place, but regenerate by "moving" up and down a river reach. Over time a healthy riparian area supports all stages of cottonwood communities (Kittel et al. 1999b).

SOURCES

References: Baker 1988, Baker 1989a, Baker 1989b, Baker 1990, Comer et al. 2002, Crowe and Clausnitzer 1997, Daubenmire 1952, Kittel et al. 1999b, Kovalchik 1987, Kovalchik 1992, Manning and Padgett 1995, Muldavin et al. 2000a, Nachlinger et al. 2001, Neely et al. 2001, Padgett et al. 1989, Szaro 1989, Tuhy et al. 2002, Walford 1996, Walford et al. 1997, Walford et al. 2001

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