RESOLUTION OF THE
RESOURCES AND DEVELOPMENT COMMITTEE
23rd Navajo Nation Council --- Third Year, 2017

AN ACTION

RELATING TO RESOURCES AND DEVELOPMENT COMMITTEE, RECERTIFYING RED MESA CHAPTER'S COMMUNITY-BASED LAND USE PLAN WHICH HAS REEVALUATED AND READJUSTED RED MESA CHAPTER'S FORMER COMMUNITY-BASED LAND USE PLAN

BE IT ENACTED:

SECTION 1. AUTHORITY

A. The Resources and Development Committee shall certify community based land use plans. 26 N.N.C. § 2004 (D)(2).

B. "Every five years the plan shall be reevaluated and readjusted to meet the needs of the changing community" and such readjustments are subject to the certification of the Resources and Development Committee of the Navajo Nation Council. 26 N.N.C. § 2004 (D)(2).

SECTION 2. FINDINGS

A. "The chapter, at a duly-called chapter meeting shall by resolution, vote to implement a community based land use plan, after the CLUPC has educated the community on the concepts, needs, and process for planning and implementing a community based land use plan. The community based land use plan shall project future community land needs, shown by location and extent, of areas identified for residential, commercial, industrial, and public purposes. The land use plan shall be based upon the guiding principles and vision as articulated by the community; along with information revealed in inventories and assessments of the natural, cultural, human resources, and community infrastructure; and, finally with consideration for the land-carrying capacity. Such a plan may also include the following: 1. An open space plan which preserves for the people certain areas to be retained in their natural state or developed for recreational purposes. 2. A thoroughfare plan which provides information about the existing and proposed road network in relation to the land use of the surrounding area. 3. A community facilities plan which shows the location, type, capacity, and area served, of

present and projected or required community facilities including, but not limited to, recreation areas, schools, libraries, and other public buildings. It will also show related public utilities and services and indicate how these services are associated with future land use." 26 N.N.C. § 2004 (B).

B. The Red Mesa Chapter's former Community Land Use Plans were prepared in 2005 and 2008. *See* **Exhibit A** at 3.

C. From June 7, 2016 to November 21, 2016, the Red Mesa Chapter conducted nine community involvement meetings in order to maximize community involvement and to build social interaction between the community and the chapter government. *See* **Exhibit A** at 4.

D. In Accordance with 26 N.N.C. § 2004, the Red Mesa Chapter membership approved the updated land use plan through Chapter Resolution RMC-11-21-16-01 on November 21, 2016, during a duly called Special Chapter Meeting. *See* **Exhibit A** at iii, RMC-11-21-16-01.

E. Chapter Resolution RMC-11-21-16-01 recommends the approval and recertification of the Red Mesa Chapter's Community-Based Land Use Plan to the Resources and Development Committee of the Navajo Nation Council.

F. On June 5, 2017, through Resolution-06-05-17-01, the Red Mesa Chapter's Land Commissioners approved and adopted the revised Community-Based Land Use Plan and request recertification from the Resources and Development Committee of the Navajo Nation Council, resolution is attached as **Exhibit B.**

G. The Resources and Development Committee of the Navajo Nation Council finds it in the best interest of the Navajo Nation to recertify the Red Mesa Chapter's Community-Based Land Use Plan, which has been reevaluated and readjusted to meet the needs of the changing community.

SECTION 3. Recertification of Red Mesa Chapter's Reevaluated and Readjusted Community-Based Land Use Plan

A. The Resources and Development Committee of the Navajo Nation Council hereby certifies the reevaluated and readjusted Red Mesa Chapter's Community-Based Land Use Plan, attached hereto as **Exhibit A.**

B. Recertification of this Community Land Use Recertification Plan shall not delineate adjacent chapter boundaries. Any chapter disputes rest solely with the Courts of the Navajo Nation.

CERTIFICATION

I, hereby certify that the following resolution was duly considered by the Resources and Development Committee of the 23rd Navajo Nation Council at a duly called meeting at Red Mesa Chapter House, Red Mesa, Navajo Nation (Utah), at which a quorum was present and that same was passed by a vote of 3 in favor, 0 opposed, 1 abstained on this 20th day of December, 2017.

Benjamin Bennett, Vice Chairperson
Resources and Development Committee
of the 23rd Navajo Nation Council

Motion: Honorable Leonard Pete
Second: Honorable Jonathan Perry

Tse Lichii' Dahazkani

RED MESA CHAPTER

COMMUNITY-BASED LAND USE PLAN

Adopted
November 21, 2016

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EXHIBIT

A

RED MESA CHAPTER
Red Mesa, Navajo Nation, Utah

Resolution# RMC-11-21-16-01

RESOLUTION
TO
RESOURCE DEVELOPMENT COMMITTEE OF THE NAVAJO NATION COUNCIL

APPROVING THE RED MESA CHAPTER'S REVISED COMMUNITY-BASED LAND USE PLAN AND REQUESTING THE NAVAJO NATION COUNCIL'S RESOURCE DEVELOPMENT COMMITTEE TO GRANT LOCAL GOVERNANCE CERIFICATION.

WHEREAS:

1. Pursuant to Resolution No. CAP-34-98, the Navajo Nation Council adopted the Navajo Nation Code (N.N..C.): Title 26 codified Navajo Nation Local Governance Act (LGA); and
2. Pursuant to 26 N.N.C., Section 1, (B), (1), (2) and Section103, (b), the Red Mesa Chapter is recognized as a local government entity and delegated certain authorities and responsibilities with respect to local matters consistent with Navajo Nation laws; and
3. Pursuant to 26 N.N.C., Section 4028 (a), the Red Mesa Chapter has the authority to review all matters affecting the community and make appropriate recommendations to the Navajo Nation, County, and State government agencies; and
4. Pursuant to the 26 N.N.C., Subchapter 3, Section 101 (B), Chapter wanting to administer land, pursuant to this Act, are required to develop a community based land use plan based upon the results of a community assessment; and
5. Pursuant to 26 N.N.C., Section 2004, (C), (1)m, the Red Mesa Chapter established the Red Mesa Chapter Land Commissioners (formerly Community Land Use Planning Committee) and Plan of Operation to oversee all land use planning activities by passing a resolution on August 11, 2008; and
6. Pursuant to 26 N.N.C., Section 2004, (C), (2), the Red Mesa Chapter retained JJ Clacs & Company to prepare the revision of Red Mesa Chapter's Community-Based Land Use Plan under the Supervision of the Land Commissioners and Chapter Officials; and
7. Pursuant to 26 N.N.C., Section 2004, the Red Mesa Chapter Land Commissioners with technical assistance from JJ Clacs & Company completed the Community-Based Land Use Plan with community involvement and conducting public hearings; and
8. The Red Mesa Chapter's updated Community-Based Land Use Plan was revised in the best of the community; and
9. The Red Mesa Land Commissioners reviewed and recommended to the Chapter approval of the revised and updated Community-Based Land Use Plan,, attached hereto as Exhibit "A"; and
10. Pursuant to 26 N.N.C., Section 2004, (D) (1), the Red Mesa Chapter shall by resolution vote to adopt the Community-Based Land Use Plan; and
11. Pursuant to 26 N.N.C., Section 2004, (D) (2), Resource Development of Committee of the Navajo Nation Council by resolution shall recertify the updated Community-Based Land Use Plan.

NOW THEREFORE BE IT RESOLVED THAT:

1. The Red Mesa Chapter hereby approves and adopts the revised updated Community-Based Land Use Plan in accordance with the requirements of the 26 N.N.C., Section 2004, (D) (1), attached hereto as Exhibit "A"; and

2. The Red Mesa Chapter further hereby requests the Resource Development Committee of the Navajo Nation Council to grant recertification of our Community-Based Land Use Plan pursuant to 26 N.N.C., Section 2004, (D) (2) for another 5 year term.

CERTIFICATION

We hereby certify that the foregoing resolution was duly considered by the Red Mesa Chapter of the Northern Navajo Agency at a duly called meeting in Red Mesa, Navajo Nation, Utah, at which a quorum was present that same passes by a vote of **32** in favor, **0** opposed, and **6** abstained on this **21st** day of **November** 2016.

Motioned by: Floyd Tsinnijinnie Seconded by: Sam Dee

Herman Farley, President

Doris J. Tsinnijinnie, Vice-President

Marlene Dee-Ben, Secretary/Treasurer

Davis Filfred, Council Delegate

Chapter File

Red Mesa Chapter

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Acknowledgements

This updated Community-Based Land Use Plan is the result of the dedication of community members, elected leaders, appointed officials and the administration staff. Countless hours were dedicated to this project. In addition to those listed below, we extend our sincere appreciation to the many people who participated in the planning process by attending public meetings, and submitting comments. Special thanks to those who provided information, opinions, historical facts and testimony. Lastly, we thank the organizations who provided information and data. Ahéhee'.

Community Members

Land Commissioners

Floyd Tsinnijinnie, Chairman
Bruce H. Benally, Vice-Chairman
Cynthia Tapaha, Secretary
Mary Louise Dee-Harvey, Member

Chapter Elected Leaders

Herman Farley, Chapter President
Doris Tsinnijinnie, Vice-President
Marlene Dee-Ben, Secretary/Treasurer
Bruce H. Benally, Grazing Official
Davis Filfred, Council Delegate

Chapter Administration

Minnie John, Community Services Coordinator
Jennifer Begay, AMS

Former Council Delegates

Kenneth Maryboy, Council Delegate
Mark Maryboy, Former Council Delegate

Former Land Use Planning Committees

Kenneth Joe, Chairman
Lloyd Toney, Vice-Chairman
Marilyn Holly, Secretary
Charley Lee Begay, Member
Tully Lameman, Member

Edward, Tapaha, President
Stanley Sam, Vice-President
Martha Long, Secretary
Charley Lee Begay, Member
Tully Lameman, Member
Lloyd Toney, Member

Table of Contents

Section I

Introduction

A. Purpose

This updated land use plan complies with Title 26 Navajo Nation Local Governance Act (LGA) of 1998.

More importantly, this land use plan helps us understand our land base and enables us to plan for our future in a way that will encourage development while conserving our natural and cultural resources for generations to come. This land use plan illustrates for us where our infrastructure such as water wells, roads and other facilities are located. It allows us to see where the oil leases are and if there is potential for additional development. From this we can make plans so that there will be housing and community facilities for our children, places to eat and other commercial endeavors.

The land use plan outlines decisions that support community members' ideas and vision for the future. As such, this Community-Based Land Use Plan is an official public document approved by the Red Mesa Chapter membership through a resolution dated November 21, 2016 (a copy of the resolution is inserted at the beginning of the document).

B. Title 26 Navajo Nation Local Governance Act

This land use plan satisfies LGA. This law recognizes governance at the local level and requires that if

chapters wish to administer their own lands, a Community-Based Land Use Plan must be developed and implemented, pursuant to the law, and updated every five years. The plan must be based upon results of a community assessment. Chapters who complete a Community-Based Land Use Plan must then receive certification from the Navajo Nation Council Resources and Development Committee (RDC). Once the land use plan is certified, the Chapter is on their way to administering land pursuant to the LGA and consistent with all other Navajo laws.

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 improves 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.

C. Land Commissioners

In conformance with the LGA, Red Mesa Chapter established a Community Based Land Use Committee (CLUPC) comprised of community members that operate according to a plan of operation under a Chapter Resolution approved April 14, 2003. The CLUPC was established to approve the planning processes and oversee planning activities. Members advise, review, and make recommendations related to land use to the Red Mesa Chapter's membership at duly called chapter meetings.

To better represent the CLUPC's mission and the growth and development of the community, the CLUPC recently changed the CLUPC name to Red Mesa Land Commissioners per a Resolution dated December 7, 2007. Copies of the resolutions referenced above are provided in **APPENDIX A**.

Figure 1. LAND USE PLANNING PROCESS

D. Previous Land Use Plan

This 2016 Community-Based Land Use Plan supersedes previous land use plans including those prepared in 2008 and 2005. The 2016 land use plan is an updated version of the 2008 land use plan. The 2008 plan was prepared according to LGA.

The 2005 land use plan focused on housing according to Native American Housing Assistance and Self-Determination Act of 1996 (NAHASDA) guidelines. The purpose of the 2005 plan was to identify land available for the development of affordable housing. A NAHASDA grant funded the plan under the Office of Navajo Government Development.

E. Community Involvement & Public Participation

In accordance with LGA, the Land Commissioners approved a Community Involvement and Participation Plan on June 7, 2016. The purpose of the participation plan was to guide community members through the land use planning process (**FIGURE 1**) by giving all interested parties the greatest possible opportunity to learn and actively participate in developing this Community-Based Land Use Plan. Through the participation plan, community members were encouraged to participate in every step of the Community- Based Land Use Plan development.

The objective of the Community Involvement and Participation Plan was to maximize community involvement and build social interaction between community members and the Chapter government. The plan also fostered community education and active participation that ultimately allowed the membership to contribute to core components of the Community-Based Land Use Plan.

The education component of the planning process relied on public meetings, work sessions, and public hearings. Each session's approach is defined below.

- *Public Meetings* informed, updated, and recommended the land use planning activities
- *Work Sessions* offered participants a more informal and hands-on approach
- *Public Hearings* were held in a formal setting to obtain views, comments, opinions and testimonies of community members

These approaches 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 sessions. Information pertaining to the land use plan was available to the public. **TABLE 1** outlines the meetings conducted.

Table 2. COMMUNITY INVOLVEMENT MEETINGS

Activity	Date	Purpose
Public Meeting	June 7, 2016	Regular Land Commission Meeting — Approval of Community Involvement and Participation Plan
Work Session	June 20, 2016	Purpose, LGA, CLUPC, Amendments Vision Goals and Objectives from Community Members
Work Session	July 7, 2016	Identify Existing Conditions and Designate Future Land Use
Public Hearing	July 29, 2016	Present Draft Community-Based Land Use Plan (start of 60-day comment period)
Public Hearing	August 19, 2016	Continue Presentation of Draft Community-Based Land Use Plan
Public Meeting	September 15, 2016	Regular Land Commission Meeting — Review Community-Based Land Use Plan Comments
CLUPC Meeting	November 14, 2016	Close 60-day comment period
Planning Meeting	November 14, 2016	Recommend to the Chapter for approval and adoption via Chapter Resolution
Chapter Meeting	November, 2016	Approval and Adoption of Community-Based Land Use Plan

F. Amendments

Amendments to the Community-Based Land Use Plan can be made on an as needed basis. Such amendments would reflect changes in on-going work or new information and may include changes to policies, maps, appendices or other components of the Community-Based Land Use Plan. 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 Land Commissioners approve an amendment, it shall become part of this Community-Based Land Use Plan as an addendum. All addendums will be reviewed and incorporated, as appropriate, into the Community-Based Land Use Plan during the Five-Year Update.

1. Five -Year Update

Red Mesa Chapter anticipates that the Community-Based Land Use Plan will function well for some time to come; however, to assure that the plan is meeting the needs of the community, the Plan will be completely reviewed, revised, and updated by the Land Commission, as appropriate, every five years pursuant to LGA regulations.

2. Process for Proposing an Amendment

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

If someone proposes an amendment, specific questions are asked as part of the evaluation process. Such questions may include but are not limited to the list below.

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

3. Approval/Disapproval of an Amendment

The Land Commissioners shall conduct a public hearing for all proposed amendments determined to be appropriate to the Community-Based Land Use Plan. At the end of the public hearing, the Land Commissioners shall vote to accept or reject the proposed amendment. If the proposed amendment is accepted, the Land Commissioners shall recommend adoption, via a resolution, of the proposed amendment. The Chapter membership shall then vote on the resolution at a duly called chapter meeting. Pursuant to the LGA, Chapter approved amendments or modifications shall be approved by the Resources and Development Committee (RDC) of the Navajo Nation Council. The approval by the RDC is the formal acknowledgement of Red Mesa Chapter amending its Community-Based Land Use Plan.

Section II

The Red Mesa Chapter

A. Location

The Red Mesa Chapter planning area is located in the southeastern corner of Utah and northeastern corner of Arizona **(MAP 1)**. Its chapter house and upper two thirds is in San Juan County, Utah, and the remainder in Apache County, Arizona. Mexican Water lies immediately west, Teec Nos Pos to the east, and Sweetwater is to the south. Highway 160 runs east-west in the bottom of the planning area. The junction of Navajo Route 35 (N35) and Highway 160 is to the south of the chapter house.

B. Brief Chapter History

History of Red Mesa Chapter

The Red Mesa Chapter s one of 110 chapters on the Navajo Nation. The Chapter is part of the Shiprock Agency. Once part of Teec Nos Pos Chapter, then Sweetwater Chapter, long distances and treacherous roads led the Red Mesa community to request to become

a separate chapter. Red Mesa was the very first Utah community chapter certified by the Navajo Tribal Council and today, is one of seven Utah Navajo chapters.

Community leaders, Tabaaha Yazzie (first Utah Navajo Councilman), Robert James, and James Oliver were influential in the early discussions of establishing Red Mesa as its own chapter. Upon separating from Sweetwater, Red Mesa joined the Mexican Water Chapter under the direction of its Councilman Little Pouch. When oil was discovered in the early 1940s, and the revenue began pouring in, Councilman Evans Holly, Sr. led the Red Mesa community toward chapter certification.

In 1965, the Red Mesa Chapter was certified by the Navajo Tribal Council and elected Curtis Dee as President, Slim Benally, Vice President, Caleb Tsosie (WWII-POW) as Secretary and Evans Holly, Sr. as Councilman. The newly elected leaders begin conducting meetings in a horse corral and people cooked outside. Prior to the chapter certification, Evans Holly, Sr., James Tabaha, Curtis Dee, and Jess Toney talked about building a chapter house and selected the first site of chapter house. The chapter house is now located next to the large red mesa that gives the chapter its name.

Over the last 50 years, Red Mesa has seen an increase in its membership. Not only has intermarriage brought new residents, employment opportunities with the energy companies and the schools have provided an incentive for population growth. Families in the area are mostly of the Red House People, Bitani (Folded Arm), Mud Clan, Mexican People, Bitter Water People, Waters Edge People, Towering House People, Tachiinii, Yucca Fruit People and the Red Bottom People Clans.

Red Mesa Chapter members currently have a deep sense of pride and respect for the land. While they envision their community's progress towards the future, many residents have fond memories of where roads led and where they roamed and played while growing up. Despite the changing landscape, other residents recall from childhood certain vegetation and herbs that grew

in the area, scenic locations, and breathtaking views. Residents also recall stories told of first settlers and saw remaining fence line and posts of areas that identified grazing sections.

Oldfield Development

Oil and Gas Oil and gas were first discovered in this region at Boundary Butte prior to 1947, almost on the Utah-Arizona border. Community members recall oil gushing from the exploratory drilling and some actually saw the first well drilled and watched the drill pipes working. The well is still pumping today.

Subsequent geophysical work in the area resulted in the 1956 discovery of the Greater Aneth field located on either side of the San Juan River. The Greater Aneth actually includes five fields, Cahone Mesa (the smallest producer), White Mesa, Ratherford, Aneth, and McElmo Creek (the largest producer). Three of these fields, as discussed in Section IV-H of this document, extend into the Red Mesa planning area. The approximately 500 producing wells in these five related fields accounts for 70 per cent of Utah's present crude-oil production.

With the discovery and development of the Greater Aneth fields, Utah moved into the nation's top dozen producing states. In 1959, there were only 10 states which produced more crude oil than Utah's 40.1 million barrels, certainly a far cry from the half-million barrels produced in Utah in 1949—the first full year after commercial oil production began. In fact, in 1959, the value of Utah crude-oil production surpassed the value of the state's copper production, the most important mineral produced in the state (partly because of the prolonged work stoppage in the Utah copper industry). Since 1960, crude-oil production has ranked second (only copper is higher) and ahead of each of Utah's other minerals in value of product produced. (Hairline, 2008)

Red Mesa Trading Post

The advent of trading posts in the late 1800's led to the establishment of the Red Mesa Trading Post. It was built with no foundation, just the rock walls of the store. In

1936, Roscoe and Ruth McGee spent up to two years building a cement floor for the trading post. Ruth McGee describes early trading on early trading on the Navajo Nation, "Trading in those times occurred with no cash. Navajos would have a goat skin or a sheep skin to sell. We'd maybe give him a dime for it, and they'd trade it right back for a bottle of pop. So about all we had in the cash drawer was dimes and nickels, and maybe a fifty-cent piece or two. That's the way we traded, that's all." (Ruth McGee, interviewed by Brad Cole.
http://www.nau.edu/library/speccoll/exhibits/traders/oral histories/mcgee-r.html; accessed July 10, 2008).

Trading post owners were instrumental in encouraging the local weavers to adapt an oriental rug design. Sharply moving away from the simplicity of Navajo chief blanket weaving during the Classic Period (1650's to 1870's), the introduction of an almost endless palette of commercial dyes and pre-dyed yarn colors laid the foundation for bold new expressions in Navajo weaving in general and Red Mesa rugs in particular.

adorn walls, floors and furniture in Anglo homes. Inspired by the eye-dazzling designs on Mexican Saltillo and New Mexican Hispanic serapes, the breadth and application of color in Navajo weaving literally exploded into a variety of exotic representations.

Most typically, the Red Mesa weaving design consists of a line of chevrons running down the vertical middle of the weaving surrounded by radiating serrated diamonds. The most extreme eye dazzler effect is created by laying a line of contrasting color against a lighter or darker color. The border of Red Mesa rugs will appear to come in from each of the vertical sides to meet the outward radiating pattern. (Navajo Red Mesa Rugs. http://www.twinrocks.com/ categories/82-Navajo-Red-Mesa-Rugs.html; accessed July 10, 2008).

Brief History of Red Mesa Schools

On line sources provide a vivid history of Red Mesa Schools.

On a cold and breezy spring day in 1960, several distinguished representatives from the community paid a visit to the Hogan of Kits'ili and his wife, Evelyn at their winter camp near mount No Water Mesa. Mr. Bradley Blair, Mr. Rosco McGee, both Anglo store owners, Mr. John Nelson Dee, Teec Nos Pos Council delegate, Mr. John Benally, Sweetwater Chapter President, and Kits'ili Boy, son of Kits'ili and his wife, Evelyn, approached his parents and said, 'Hello, my mother and father, we are here to ask that a school be constructed on the north side of the highway on my grazing permit. I want a school nearby, so our children, grandchildren, great-grandchildren, and other peoples' children can attend school. We do not want our children to go off the reservation to school or far away to seek for jobs. We want them to be around us to learn our Dine culture and the modern society.'

Kits'ili's wife, Evelyn, sitting by the fire, with a fire poker beside her replied, 'My children, I herd sheep all my life and don't know much about education, but yes, let there be a school. Let our children go to school and come back and work here.' This was what the representatives wanted to hear. With this verbal approval, Kits'ili and his wife, Evelyn and most of their children later signed the agreement. From this cold day in 1960 came the vision to build the schools for the children of the area. Kee, Mary, Grace, Bessie, and Lucy were the children who gave their blessing to that vision. Later, 1967 saw the ground being prepared for the eventual construction of Red Mesa Elementary School which began in 1970. At that time, Red Mesa was under the Chinle School district with Mr. John L. Mathews serving as superintendent. Dr. Blast Maxy was the principal of RMES which took in students from Dennehotso, Baby Rocks, Mexican Water, Sweetwater, Teec Nos Pos, Red Mesa, Arizona, and Utah.

In 1972, after the completion of the junior high brick building, and the dedication by Mr. Thomas Brady, Sr., a medicine man from Sweetwater, junior high students from the same areas began their careers at RMJHS

Under the direction of Dr. Bob Roessell, superintendent of the Chinle School District #24, and the first principal of the high school, Mr. John Birdsong, the doors to the high school were opened to welcome a small group of students who had been meeting in the elementary school. The A, B, and C buildings were dedicated by Little Dan, a medicine man from Sweetwater.

In July of 1983, the Red Mesa Unified School District #27 was formed, splitting from the old Chinle School District #24. Other buildings have been added such as the high school gym (1987), the district administration building (1988), the parent education center (1996), the staff development center (1998), and the music-art- preschool (MAP) building (1999). This was the vision that prompted Kits'ili Boy to ask his parents for permission to "build on the north side of the road." (History of Red Mesa Schools. http://www.rmusd.net/history.php; accessed May 13, 2008).

C. Planning Area

The extent of the planning area is based on oral histories of traditional farming and grazing lifestyles of the Navajo families who have resided in and around Red Mesa for many generations. After much in-depth discussion among the Chapter's membership and its officials, it cannot be emphasized enough that the planning area defined in this document will be used to facilitate land use planning activities and make important choices pertaining to where and how people live, where and how they earn a living, and how they use the land. The planning area's boundaries are for planning purposes only **(MAP 2)**. They are not necessarily interchangeable with the Chapter's legal boundaries.

Section III

Community Assessment

A. Guiding Principles and Vision

Vision Statement

Land is sacred to man's (Diné) well-being, happiness, health, spiritual and harmonious living. The Red Mesa Chapter will plan, use, manage, and preserve its land, natural resources, and traditional culture to foster economic growth, promote organized community neighborhoods, and re-establish a viable vegetative and animal habitat for use and enjoyment by residents today and in the future.

Mission Statement

Using the resources available to the community, the Red Mesa Land Commissioners will work together and maintain communication with public and private sectors of the Red Mesa community to conduct planning that meets the needs of today as well as anticipates future needs.

To achieve our mission in the most effective way and help our community realize their goals for a thriving

economy and brighter future, the Chapter will do its utmost to:

- To inform community members of land use planning activities and decisions through public education and participation efforts,
- To establish a community-based land use plan,
- To obtain TCDC approval and Title 26 LGA certification for the community-based land use plan,
- To review and revise the community-based plan every 5 years and make amendments as circumstances change,
- To use the community-based land use plan as the guide and resource for the Land Commissioners to review and make recommendations to the Chapter on proposed development projects, land withdrawals, home site lease applications, business lease applications, utility line extensions and community facilities,
- To review mineral and energy resources lease applications, renewals and/or extraction agreements,
- To protect water resources and water rights,
- To assist the Chapter in strategic planning for the community, including the development of community goals and objectives,
- To develop a growth management master plan, zoning ordinances and other land development

standards and guidelines, that will help ensure that new growth and projects within the Chapter area are built in a manner that protects the health, welfare and safety of residents and visitors,

- To develop plans for community transportation needs,
- To develop plans for cultural and civic centers and other community facilities,
- To ensure that the Chapter's land use and land development planning activities are consistent with applicable guidelines, and
- To guide growth and development in a way that enhances the quality of life for community members.

B. Goals and Objectives

The land use planning goals and objectives shown in TABLE 2A were compiled through the hard work of

many community members who attended work sessions and public meetings to provide input about their visions for a stronger economy and outlook for their futures. It was also clear from the work sessions and public meetings that among the complex and details list of goals and objectives, the community felt that a priority should be given to numerous issues, which are outlined in **TABLE 2B**. The priority issues are rated 1–12 based on the community's feedback regarding those perceived to be the most immediate for economic stimulation. The priority ranking indicated that certain areas of business development, education, community development projects, transportation, and environmental, in that order, should take precedence.

C. Infrastructure Capital Improvement Plan

Capital projects are planned for and built over a period of several years. They are important to the implementation of the land use plan.

Under the Navajo Nation, the Infrastructure and Capital Improvement Plan (ICIP) is a list of priority projects showing the estimated costs and source of revenue and funding for selected projects over a six-year period.

Red Mesa's ICIP Plan covers prioritized projects. A current project summary is presented in **TABLE 3**. As the ICIP plan is updated, it will supersede the current version.

TABLE 2A. RED MESA CHAPTER LAND USE PLANNING GOALS & OBJECTIVES

BUSINESS & ECONOMIC DEVELOPMENT

Community Issue/Concern	Goal	Objective
Lack of employment and business opportunities is a major concern among Chapter residents. These are also primary factors in determining the health and quality of life for the people.	1. Create a Community Development Corporation (CDC) to assist the community and the Chapter in economic development planning and project management	• Develop a mission statement for the CDC • Identify a task force or working group to create the CDC corporate papers and bylaws • Identify Board members for the CDC • Register the CDC with the Navajo Nation and with the States of Arizona and Utah • Apply to the US Internal Revenue Service for tax-exempt status • Hand over operations to the Board & assist them in seeking funding for first 2 years or the first project
There is currently no land available within the Chapter area for business development. This is a major drawback to attracting new businesses to the Chapter.	2. Provide new opportunities for business development within the Chapter by developing a commercial zone along the highway for new business site leases (see utilities below) 3. Casino	• Identify/designate land for a commercial zone • Have the Chapter withdraw this land for business use • Develop/implement a utility plan for the commercial zone so that there are individual business lease sites with utility and communication systems hook-ups • Make business lease sites available to Chapter members and others for business development
The community needs more business services.	4. Support/encourage the development of new businesses The following are requested by chapter members: • Convenience store; gas station, barbershop/hair salon; restaurant; flea market; laundromat; supermarket; car wash; general discount merchant; storage rental; truck stop; fresh products	• Create a commercial zone and a community development corporation that can work with the Navajo Regional Business Development Office to attract new businesses to the Chapter area
Chapter members need more training on how to obtain good jobs and how to start and run small businesses.	5. Create Job Training/Business Incubator program to assist Chapter members in preparing/finding new jobs and starting new businesses	• This could be part of the community education center • Funding might be available through the U.S. Economic Development Administration

TABLE 2A. RED MESA LAND USE PLANNING GOALS & OBJECTIVES (CONTINUED)

BUSINESS & ECONOMIC DEVELOPMENT continued

Community Issue/Concern	Goal	Objective
Traditional arts and crafts need to be promoted as a source of income.	6. Support local weavers and other artisans	• Explore the creation of a local weavers and artisan's cooperative to help market/promote local arts & crafts
Chapter needs to take advantage of opportunities to develop new industries & support existing industries.	7. Tourism & Sports 8. Retailing 9. Recreational equipment and clothing	
The Chapter may not be receiving fair market value for existing oil and gas leases.	10. Review the gas and oil leases for all lessees including small operators	• The Chapter should pursue for local development a percentage of the royalties collected by the Navajo Nation for oil and gas leases within the Chapter's planning area
The livestock and ranching industry in the Chapter needs to be supported.	11. Promote/support the creation of local: • Livestock auction; meatpacking facility; livestock associations	
The Chapter needs a better airport facility for emergency use and economic development.	12. Identify a new location for the airstrip and construct a better airstrip with a small office facility	• Investigate why the existing airstrip is not being used • Develop a plan for a new or improved airport facility • See if a new site can be identified near the health center or the land identified for commercial develop
Access to community health services is a high priority concern among Chapter residents.	13. Promote and support the development of a nursing home	• Have the Chapter Officials and staff adopt construction of the Nursing Home as a high priority

TABLE 2A. RED MESA LAND USE PLANNING GOALS & OBJECTIVES (CONTINUED)

PUBLIC SAFETY

Community Issue/Concern	Goal	Objective
Public safety is a primary concern among Chapter residents.	1. Improve public safety systems in the Chapter while ensuring adequate community coverage: • Police sub-station • Fire station with fire truck • EMT services	• Assess the public safety needs within the Chapter • Develop a plan for improving public safety in the Chapter • Create an implementation or action plan to improve public safety

EDUCATION

Community Issue/Concern	Goal	Objective
Education is a major concern among Chapter residents.	1. Create youth/community centers in each neighborhood area to provide traditional teaching and counseling. These centers would also be used as study halls for after school programs	• Identify sites within each neighborhood area for the youth/community center • Have Chapter or the Community Development Corporation seek funding to construct and set up the centers • Develop programming for the centers and find funding for staffing or teachers
	2. Renovate the old building in the White Rock Curve neighborhood into a youth/community center	
	3. Create a community education center to provide opportunities for high school equivalency and higher education through distance learning programs	• Work with Chapter, Diné College, and Northern Arizona University to set up programs and the distance learning system. The Center could use the Chapter's computers • Develop training program for skills such as: mechanics, carpenters, etc.
	4. Create and develop a training center to enhance skills and local workforce	
	5. Provide pre-school centers	
	6. Create services and development to accommodate population growth	

TABLE 2A. RED MESA LAND USE PLANNING GOALS & OBJECTIVES (CONTINUED)

UTILITIES

Community Issue/Concern	Goal	Objective
Many areas of the Chapter do not have domestic water systems serving homes. Areas needing service include: • White Mesa • Scattered homes	1. Develop a domestic water system to serve all homes with a priority to homes within neighborhood areas: • White Rock Curve • Boundary Butte • Casa del Echo • Red Mesa • White Mesa	• Identify homes without water service • Seek innovative solutions to providing domestic water to areas with shallow topsoil or bedrock near the surface • Apply for funding with IHS and other sources to construct the water systems
Water quality is an issue in some parts of the Chapter. As a result, some people are drinking well water rather than water from the domestic water systems.	2. Improve the taste and quality of domestic water systems	• Investigate and select small scale wastewater treatment systems for the remote areas of the Chapter • Seek funding for small waste-water treatment systems
Many areas of the Chapter do not have adequate waste water treatment systems.	3. Provide homes in remote areas with wastewater treatment systems with a priority to homes within neighborhood areas (see list above)	• Investigate and select small scale wastewater treatment systems for the remote areas of the Chapter • Seek funding for small waste-water treatment systems
Many Chapter homes do not have electrical power. Areas needing service include: • Scattered homes	4. Provide homes in remote areas electrical power with a priority to homes within neighborhood areas (see list above) 5. Utilize solar power where feasible	• Investigate the most effective and quickest electrical power source for homes in remote areas, including the NTUA grid and alternative electrical power generating system such as solar panels and wind turbines • Select system(s) for areas and seek funding to install and construct new systems
The lack of an area with accessible business lease sites served by utilities is prohibiting new business development in the Chapter.	6. Create a commercial zone and extend water, wastewater, electrical and gas service to the zone	• Identify an area for the commercial zone and have the Chapter withdraw the land for that purpose • Develop a utility plan for the new commercial zone • Seek funding to construct utility service within the commercial zone so that commercial sites are ready for business leases

TABLE 2A. RED MESA LAND USE PLANNING GOALS & OBJECTIVES (CONTINUED)

UTILITIES continued

Community Issue/Concern	Goal	Objective
The roadway system within the Chapter needs improvement.	7. Improve the Chapter roadway system so that all parts of the Chapter are accessible	• Develop a thoroughfare plan to address Chapter roadway needs

COMMUNICATIONS

Community Issue/Concern	Goal	Objective
The roadway system within the Chapter needs improvement.	1. Improve the Chapter roadway system so that all parts of the Chapter are accessible	• Develop a thoroughfare plan to address Chapter roadway needs
Phone and television service to the Chapter area needs to be improved. Much of the Chapter area does not have adequate internet access.	2. Improve phone, television and internet access service to homes within the Chapter	• Work with Navajo Communications and other service providers to improve line sharing and coordination of services • Increase the number of cell phone towers serving the Chapter area • Extend land lines to unserved areas

HOUSING

Community Issue/Concern	Goal	Objective
With population growth, new housing will continue to be needed in the Chapter area.	1. Develop plans to improve the existing housing stock and to build new housing every year • Scattered Housing • No Sub-Divisions	• Finish the Chapter housing projects from last year including bath and kitchen additions and repairs • Develop new housing for low income families • Create a housing initiative for new market-rate housing for homeownership opportunities • Develop more housing for veterans
	2. Assisted Living facility	
	3. Develop plans to provide areas for mobile homes	

TABLE 2A. RED MESA LAND USE PLANNING GOALS & OBJECTIVES (CONTINUED)

COMMUNITY SERVICES AND PROJECTS

Community Issue/Concern	Goal	Objective
	1. Library 2. Child care center near Montezuma Creek 3. Cleaning services for the elderly 4. Community activities such as weaving, quilting, etc.	• Develop services similar to those provided by urban Native American community centers • Take advantage of available resources
	5. Community services at trading post	• The Chapter Administration and Officials should assess the need for more office space and Chapter owned equipment

GOVERNMENT

Community Issue/Concern	Goal	Objective
Improve Chapter operations.	1. More office space for Chapter 2. Have Chapter obtain a grader, a back hoe, a bulldozer and a cement mixer for Chapter projects and for community use	• Develop a government center building for the Chapter
Improve communication between the Chapter and the community.	3. Information center with staff 4. Create a program to encourage more community involvement in the Chapter	
Improve Chapter and land administration.	5. Better communication and coordination with grazing committee	
Improve the effectiveness of Chapter administration and governance.	6. A well run and effective Chapter organization	• Conduct an internal audit on Chapter operations to determine areas that need improvement • Create and implement an action plan to improve Chapter operations

TABLE 2A. RED MESA LAND USE PLANNING GOALS & OBJECTIVES (CONTINUED)

GOVERNMENT continued

Community Issue/Concern	Goal	Objective
The Arizona/Utah jurisdictional concerns and issues are a problem.	7. Identify and define Chapter planning area/border	

GRAZING, LAND PRESERVATION & RESTORATION

Community Issue/Concern	Goal	Objective
Grazing is still an important source of income for Chapter members. Grazing areas are in poor shape and need land restoration to improve and maintain grazing.	1. Develop a plan to improve grazing areas and land management 2. Reestablish farming practices 3. Grazing permittees should be consulted for authorization in any proposed development	• The Chapter should promote adoption of the new grazing regulations • Institute fencing of grazing permit areas to facilitate better land management • Seek assistance in developing land restoration programs

RECREATION

Community Issue/Concern	Goal	Objective
More recreational opportunities for Red Mesa residents and visitors are needed to improve the health and quality of life of the community.	1. Re-institute community events which will also attract tourism 2. Explore rafting as a recreational activity 3. Develop a horse track for tourism opportunities and educational purposes	• The Chapter should sponsor a Rodeo with traditional horse games and a long distance horse relay race. This event might be similar to the Navajo Mountain Annual Pioneer Days
	4. Provide healthy programs for Chapter youth	• Create neighborhood youth centers (see Education above)
	5. Provide health and recreation opportunities for Chapter residents	• Develop a Chapter Community Center with recreational and sports facilities and classes serving all age groups • Create an educational program which incorporates traditional teachings for good health.

TABLE 2A. RED MESA LAND USE PLANNING GOALS & OBJECTIVES (CONTINUED)

TRANSPORTATION

Community Issue/Concern	Goal	Objective
Improve roads within community.	1. Work with grazing permittees to widen roads to accommodate future development 2. Improve the Chapter roadway system so that all parts of the community are accessible 3. Provide airstrip for medical and emergency purposes	

ENVIRONMENTAL

Community Issue/Concern	Goal	Objective
Improve proper disposal of hazardous material.	1. Provide education on proper disposal of hazardous material 2. Provide proper disposal of items such as refrigerators	• Develop a government center building for the Chapter

WATER RIGHTS

Community Issue/Concern	Goal	Objective
Ensure the water rights of the Chapter are exercised.	1. A say in negotiations 2. For community use and irrigation for farming activities	

TABLE 2B. PRIORITY STATUS OF GOALS & OBJECTIVES

Priority Status	Community Issue/Concern	Description
1	Grazing, Land Preservation & Restoration, and Environment	Grazing is still an important source of income for Chapter members. Grazing areas are in poor shape and need land restoration to improve and maintain grazing.
2	Infrastructure – Utilities, Transportation and Communication	Develop utilities to serve all homes. Improve the Chapter roadway system so that all parts of the community are accessible, improve communications including internet.
3	Water Rights	Ensure Water Rights of the Chapter are exercised.
4	Education	Education is a major concern among Chapter residents.
5	Governance and Community Services	A well run and effective Chapter organization
6	Housing	With population growth, new housing will continue to be needed in the Chapter area.
7	Public Safety	Resolve jurisdictional issues and ensure public safety is available
8	Business and Economic Development	Lack of employment and business opportunities is a major concern among Chapter residents. These are also primary factors in determining the health and quality of life for the people.
9	Recreation	Promote recreational activities

TABLE 3. INFRASTRUCTURE CAPITAL IMPROVEMENT PLAN 2018-2023

Rank	PROJECT TITLE
1	Road Grader
2	Construction of Red Mesa Scattered Powerlines Phase V
3	Construct New Administration Building 2
4	Red Mesa Transfer Station
5	New Red Mesa Chapter Warehouse
6	Renovate Chapter House
7	Picnic Pavilion
8	Red Mesa Community Recreational Center

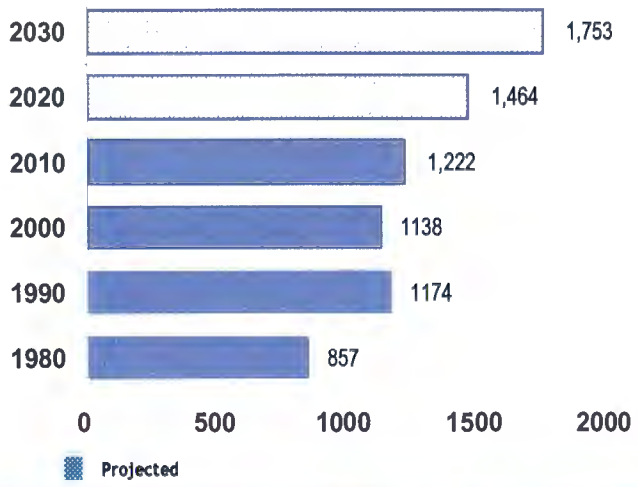


FIGURE 2. POPULATION TRENDS & FORECASTS

D. Population and Demographics

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 U.S. Census 2000 provided data for Apache County, AZ and San Juan County, UT. Some information related to the Chapter was derived from LSR Innovations 2004 and Choudhary (2005–2006). Data from the Arizona Department of Economic Security, the Utah Department of Workforce Development, the U.S. Department of Commerce, and the Navajo Nation Division of Economic Development (NNDED) were also used.

Population Trends and Forecasts

The Red Mesa population has fluctuated over the last decades **(FIGURE 2)**. In 2010, the Chapter's total population was 1,222, which is a 6.9 percent increase from 2000. The 1990 Census reported a population of 1,174 persons. The LSR Innovations' 2004 Chapter Images report estimated the population at 857 persons in 1980. Based on these data, there was more than a 43 percent increase in population from 1980 to 2010 or 281 more residents. Using projections of 1.82 percent per year, the Navajo Nation population

growth rate (Choudhary 2005–2006), the Red Mesa population is expected to have recovered from the decrease this year (2008) and continue to grow to 1,632 people by the year 2030.

In comparison, the Navajo Nation showed an overall 56.6 percent increase between 1990 and 2010. Apache County's population grew 21.0 percent during this time. The population in San Juan County, Utah, increased 16.0 percent whereas the U.S. only increased 20.3 percent **(TABLE 4)**.

TABLE 4. POPULATION AND HOUSEHOLD TRENDS

	Population (1990)	Population (2000)	Population (2010)	Households (2010)(1)
United States	248,709,873	281,421,906	308,745,538	116,716,292
Arizona	3,665,228	5,130,632	6,392,017	2,380,990
Utah	1,722,850	2,233,169	2,763,885	877,692
Navajo Nation	128,356	155,214	173,667	49,946
Apache County	61,591	69,423	1,222	22,771
San Juan County	12,621	14,413	71,518	4,505
Red Mesa Chapter	1,174	1,138	14,746	337

Sources: U.S. Census Bureau (2000 and 2010), *Navajo Nation: Chapter Images (2004)

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

TABLE 5. AGE CHARACTERISTICS: 2010

	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
Apache County, AZ	69,423	32.8	8.3	27.0
San Juan County, UT	14,413	33.1	8.4	25.5
Red Mesa Chapter	**1,138**	**36.7**	**7.6**	**22.0**

Sources: U.S. Census Bureau (2000)

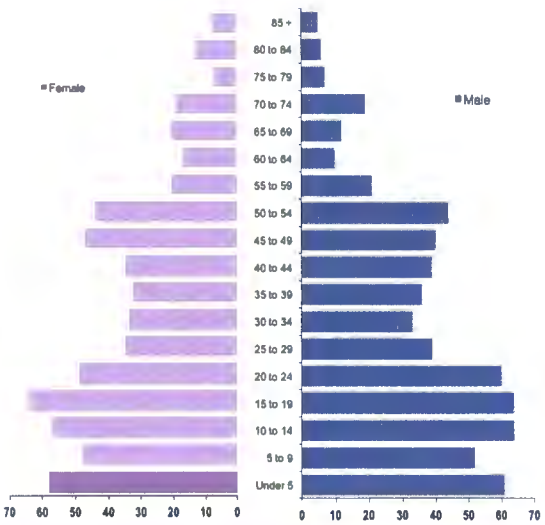


FIGURE 3. AGE DISTRIBUTION

Age

Red Mesa has the youngest population of all jurisdictions shown in **TABLE 5**. The U.S. and the State of Arizona have the highest median ages. The percent of the population over 65 years of age is lowest in the Navajo Nation and slightly higher in Red Mesa. The senior population steadily increases in Arizona out ranking the U.S. in the number of seniors, a statistic that is likely due to better access to health care. Red Mesa not only has the highest percentage of school-age children; they also have the lowest median age of all entities shown in **TABLE 5**.

Census data show that there are approximately the same number of females and males **(FIGURE 3)**. In the age category, newborn through 19 years there

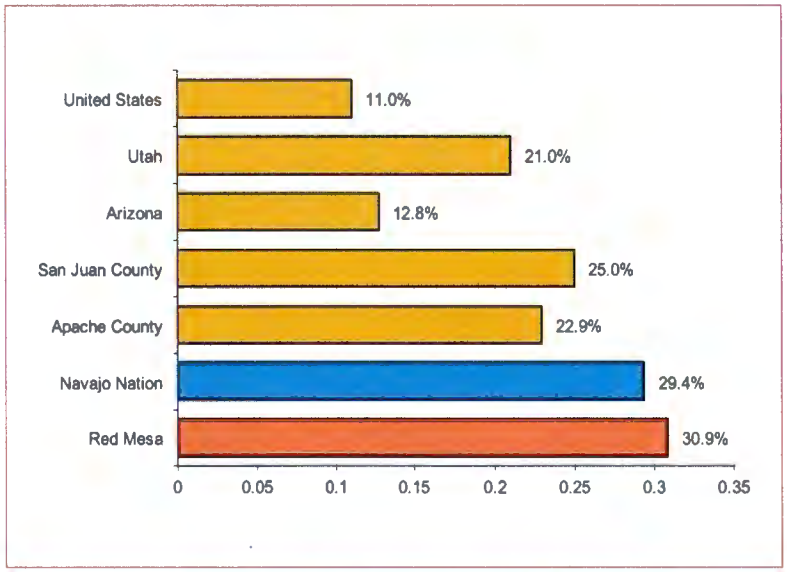


FIGURE 4. LARGE FAMILY HOUSEHOLDS

are fewer males than females under four. This is a typical infant mortality profile, which tends to favor the females. This trend is reversed in the age groups between 20 and 34 years of age with slightly fewer males. From age 35 through 49, the male and female distribution is again nearly the same. After age 49, however, a notable decline in the number of males relative to female is obvious). The evident decline in the male population from age 50 on may be the result of several factors. One may indeed be tied to a naturally occurring longer life span in women. It is also likely that many men have moved out of the area to find work and were not counted in the census.

Veterans

The Red Mesa community honors veterans for their service. Approximately 30 veterans are reported in Census 2010. A decrease from 2000 (n=37).

Household Size

Of the 337 households, Census 2010 shows 30.9 percent are large family households **(FIGURE 4)**. Large family households are defined as households with five or more persons. Large family households have special housing needs due to the lack of adequately sized and affordably priced homes, which results in overcrowding. A 5-person household would typically need a 3-bedroom unit while a 7-person household would need a 5 to 6-bedroom unit.

The Chapter has the highest percentage of large families followed by the Navajo Nation, Apache and San Juan Counties, Utah, Arizona, and lastly, the U.S. In addition, to a high number of large family households, Red Mesa has the highest average household size 3.63 for owner-occupied and 4.06 for renter-occupied, which is slightly higher than the Navajo Nation and substantially higher than the other regions listed in **TABLE 6.** This figure might not seem high, but when the majority of units have one bedroom or less, the average household size of 3.63 indicates that people are overcrowded in undersized housing units, often without adequate facilities.

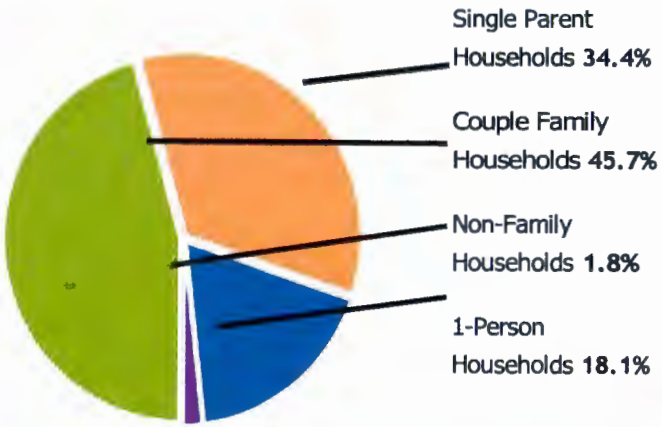


FIGURE 5. HOUSEHOLD TYPE

Household Type

According to 2010 Census and as depicted in **FIGURE 5**, approximately 45.7 percent of the 337 households in the Chapter are couple family households. This is compared to 34.4 percent for single parent and 18.1 percent for single person households; Non-family households make-up 1,8 percent.

TABLE 6. AVERAGE HOUSEHOLD SIZE (2010)

	Red Mesa Chapter	Navajo Nation	Apache County, AZ	San Juan County, UT	Arizona	Utah	United States
Total	3.63	3.46	3.1	3.21	2.63	3.1	2.58
Owner Occupied	3.6	3.45	3.07	3.26	2.63	3.21	2.65
Renter Occupied	4.06	3.49	3.2	3.01	2.62	2.82	2.44

Source: U.S. Census Bureau (2000)

E. Community Setting

Grazing District

The Red Mesa Chapter is located in Grazing District 9 **(MAP 3)**. Grazing districts 9, 12 and 13 comprise the Northern Navajo Agency.

Generations of herding and grazing on the Navajo Nation led the federal government to form grazing districts over 80 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 served many purposes over the years.

Land Status

The vast majority of the Chapter's planning area is located on Navajo Tribal Trust Land as shown in **MAP 4**. There are two narrow strips along the San Juan River that are withdrawn as Native American and

Navajo Indian Power Sites.

The Arizona portion of the planning area lies within the original Navajo Reservation designated under the Treaty of 1868. The Utah portion of the planning area lies within Executive Order May, 17, 1884. The geographic boundaries of these two land expansions including two adjacent executive orders are shown in **MAP 5.**

Section IV

Natural Environment

A. Topography

Located on the Colorado Plateau, outstanding natural beauty characterizes the land surrounding the Red Mesa Chapter. The area consists of low, broad mesas and buttes, high plateaus, deep canyons, and wide valleys with gently rolling desert grasslands, sand dunes, and hills **(MAP 6)**.

Cow Butte is located in the southeastern part of the planning area; Red Mesa is on the Arizona-Utah State line near N35; Toh Atin Mesa borders the southern Edge; Boundary Butte Mesa is in the west; and Ute Canyon, Window Rock Canyon, White Rock Casa Del Eco Mesa, and Hogan Mesa are located in the northwestern portion.

The San Juan River comes in from the east and flows in a northwestern direction along the northwestern edge of the planning area. Plat Top Mountain, Lone Mountain and Clay Hill Canyon are adjacent to the San Juan River. Three ephemeral streams, Tsitah Wash, Desert Creek and Gothic Creek also make up part of the landscape.

TABLE 7. 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	TI - Intrusive rock - Tertiary
UT	Qa - Surficial alluvium and colluvium
UT	Qe - Surficial eolian deposits
UT	Qao - Surficial older alluvium and colluvium

Source: Hintze et al. 2000

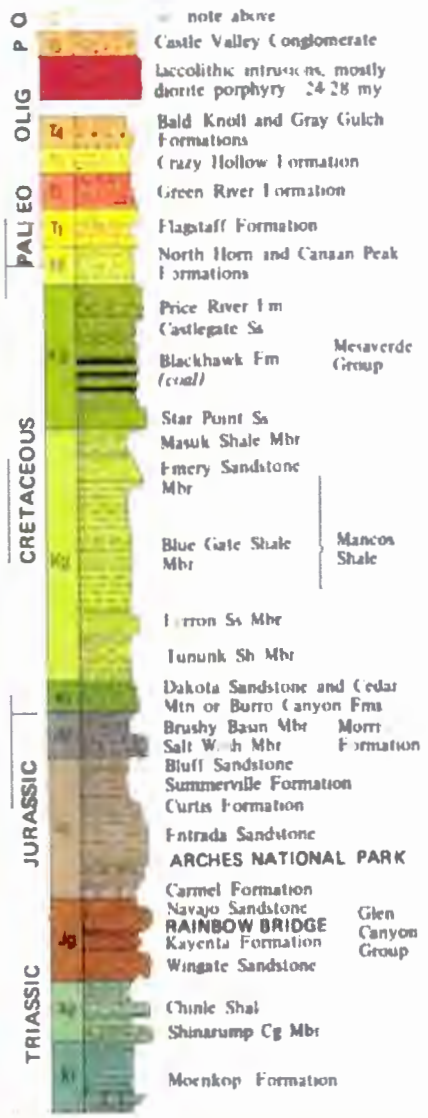
White Mesa and several canyons are located in the northeastern quadrant of the planning area. Stitch Valley separates White Mesa and Yellow Rocks Point.

MAP 7 shows the Geological Survey (USGS) 7.5' quadrangles for the planning area. Within Utah, the planning area is situated in portions of the following quadrangles: Bluff; Recapture Pocket; Montezuma Creek; White Rock Point; Hogan Mesa; White Mesa Village; Aneth; Peters Nipple; Boundary Butte; Gray Spot Rock; White Mesa Village SE; and Yellow Rock Point West. In Arizona, the quadrangles include: Walker Creek Reservoir; Toh Atin Mesa West; Toh Atin Mesa East; and Cow Butte.

B. Geology

Describing the geology is not straight forward. The map symbols presented in **TABLE 7** 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



Source: Hintze et al. 2000

FIGURE 10. GEOLOGIC TIMETABLE

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 8)**.

The geological age of the planning unit's deposits is extensive (Hintze et al. 2000) **(FIGURE 10)**. 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 edged 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."

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 deposits. There are outstanding 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.

C. Soils

Although many soil variations are present in the planning area, 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 the 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 9, TABLE 8)**. 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**.

Additional tables indicating the severity of individual soil limitations are provided in **APPENDIX C**. 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 experts.

TABLE 8. 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

Source: Soil Survey Geographic (SSURGO) data base for Shiprock Area, Parts of San Juan County, New Mexico and Apache County Arizona

UTAH

Map Symbol	Description
AmB	Aneth loamy fine sand, 1 to 8 percent slopes
AnA	Aneth loamy 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

Source: Soil Survey Geographic (SSURGO) data base for Navajo Indian Reservation, San Juan County, Utah

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.

D. Ground Water

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 wells in the Chapter's planning unit draw water from eight geologic formations held within these four hydrological systems, which are listed in **TABLE 9** and summarized from the Navajo Nation Department of Water Resources, beginning with the shallowest.

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

TABLE 9. 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)

Source: Navajo Nation Department of Water Resources

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 (Utah Division of Water Resources 2000). 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 Wingate, 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 10 shows water well locations according to their aquifers. **TABLE 10** below lists all wells along with the operator and the aquifer they draw water from. Not all wells are operational.

E. Surface Water

The San Juan River is the principal base-level stream in the planning area, into which all surface drainage directly or indirectly flows **(MAP 11)**. Discharge of the San Juan River has been regulated at Navajo Reservoir in northwestern New Mexico since 1962; hence, river discharge is substantially influenced by reservoir releases, which depend on precipitation in the drainage basin. Records of stream discharge from the U.S. Geological Survey stream flow-gaging station at Mexican Hat, Utah, about 20 mi west of the plan area, indicate that the mean daily discharge for the 1992–94 water years ranged from 528 ft3/s (August 1994) to 7,123 ft3/s (June 1993) (ReMillard et al., 1993, 1994, and 1995).

TABLE 10. WELLS WITHIN THE RED MESA CHAPTER PLANNING AREA

Well No.	Operator	Elevation	Depth	Aquifer	SWL
00-4034	BUTLER	4320.0	27.0	110ALVM	8.8
09-0614	MOBIL	4415.0	30.0	111ALVM	0.0
09-0615	MOBIL	4415.0	30.0	111ALVM	0.0
09-0616	MOBIL	4415.0	30.0	111ALVM	0.0
09-0617	MOBIL	4415.0	30.0	111ALVM	0.0
09-0618	MOBIL	4415.0	30.0	111ALVM	0.0
09-0619	MOBIL	4415.0	30.0	111ALVM	0.0
09-0620	MOBIL	4415.0	30.0	111ALVM	0.0
09-0621	MOBIL	4415.0	30.0	111ALVM	0.0
09-0622	MOBIL	4415.0	30.0	111ALVM	0.0
09-0623	MOBIL	4415.0	30.0	111ALVM	0.0
09-0624	MOBIL	4415.0	30.0	111ALVM	0.0
09-0625	MOBIL	4415.0	30.0	111ALVM	0.0
09-0626	MOBIL	4415.0	30.0	111ALVM	0.0
09-0627	MOBIL	4415.0	30.0	111ALVM	0.0
09-0628	MOBIL	4415.0	30.0	111ALVM	0.0
09-0629	MOBIL	4415.0	30.0	111ALVM	0.0
09-0630	NTUA	4414.0	27.5		4.0
09-0632	TRIBE O&M	4696.0	600.0	221ENRD	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-0006	SAN JUAN	4080.0	54.0	310HLGT	11.0
09-UNK-0007	UNKNOWN	4810.0	0.0		0.0
09-UNK-0008	UNKNOWN	4835.0	0.0		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-0012	SHELL OIL	4760.0	460.0	220NVJO	-13.0
09-UNK-0013	CARTER OIL	4950.0	530.0	221ENRD	0.0
09-UNK-0014	PHILLIPS	5120.0	1111.0	220NVJO	0.0

TABLE 10. WELLS WITHIN THE RED MESA CHAPTER PLANNING AREA

Well No.	Operator	Elevation	Depth	Aquifer	SWL
00-4034	BUTLER	4320.0	27.0	110ALVM	8.8
09-0614	MOBIL	4415.0	30.0	111ALVM	0.0
09-0615	MOBIL	4415.0	30.0	111ALVM	0.0
09-0616	MOBIL	4415.0	30.0	111ALVM	0.0
09-0617	MOBIL	4415.0	30.0	111ALVM	0.0
09-0618	MOBIL	4415.0	30.0	111ALVM	0.0
09-0619	MOBIL	4415.0	30.0	111ALVM	0.0
09-0620	MOBIL	4415.0	30.0	111ALVM	0.0
09-0621	MOBIL	4415.0	30.0	111ALVM	0.0
09-0622	MOBIL	4415.0	30.0	111ALVM	0.0
09-0623	MOBIL	4415.0	30.0	111ALVM	0.0
09-0624	MOBIL	4415.0	30.0	111ALVM	0.0
09-0625	MOBIL	4415.0	30.0	111ALVM	0.0
09-0626	MOBIL	4415.0	30.0	111ALVM	0.0
09-0627	MOBIL	4415.0	30.0	111ALVM	0.0
09-0628	MOBIL	4415.0	30.0	111ALVM	0.0
09-0629	MOBIL	4415.0	30.0	111ALVM	0.0
09-0630	NTUA	4414.0	27.5		4.0
09-0632	TRIBE O&M	4696.0	600.0	221ENRD	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-0006	SAN JUAN	4080.0	54.0	310HLGT	11.0
09-UNK-0007	UNKNOWN	4810.0	0.0		0.0
09-UNK-0008	UNKNOWN	4835.0	0.0		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-0012	SHELL OIL	4760.0	460.0	220NVJO	-13.0
09-UNK-0013	CARTER OIL	4950.0	530.0	221ENRD	0.0
09-UNK-0014	PHILLIPS	5120.0	1111.0	220NVJO	0.0

TABLE 10. WELLS WITHIN THE RED MESA CHAPTER PLANNING AREA (continued)

Well No.	Operator	Elevation	Depth	Aquifer	SWL
09-UNK-0015	SHELL OIL	4640.0	612.0		0.0
09-UNK-0016	PHILLIPS	4790.0	604.0	220NVJO	0.0
09-UNK-0019	NIELSON	4760.0	925.0	220NVJO	221.7
09-UNK-0020	UNKNOWN	4830.0	755.0	221ENRD	315.2
09-UNK-0022	UNKNOWN	5059.0	0.0		0.0
09-UNK-0023	UNKNOWN	5067.0	0.0		0.0
09B-17	TRIBE O&M	5420.0	528.0	220NVJO	280.0
09B-21	UNKNOWN	5540.0	0.0		0.0
09K-209	BIA	4950.0	775.0	220NVJO	0.0
09K-212	TRIBE O&M	5400.0	715.0	220NVJO	0.0
09K-214	TRIBE O&M	5110.0	590.0	220NVJO	332.6
09K-219	TRIBE O&M	5194.0	508.0	220NVJO	136.4
09K-220	TRIBE O&M	4600.0	405.0	220NVJO	47.8
09P-524	RED MESA T	5440.0	642.0		0.0
09T-225	TRIBE O&M	4925.0	403.0	221MRSN	207.4
09T-227	TRIBE O&M	5216.0	560.0	221MRSN	0.0
09T-506	TRIBE O&M	5042.0	0.0	220NVJO	230.2
09T-507	TRIBE O&M	5490.0	806.0		299.0
09T-530	TRIBE O&M	4635.0	93.0	220NVJO	0.0
09T-538	TRIBE O&M	5475.0	950.0	220NVJO	0.0
09T-539	TRIBE O&M	5200.0	660.0	221ENRD	0.0
09T-547	TRIBE O&M	5115.0	200.0	221MRSN	0.0
09T-555	TRIBE O&M	5480.0	575.0		0.0
09T-564	BIA	5660.0	1342.0	221ENRD	842.0
09T-567	NTUA	5285.0	1150.0	231LKCK	312.9
09T-568	TRIBE O&M	4810.0	140.0	220NVJO	6.2
09T-572	TRIBE O&M	5220.0	540.0	221BLFF	0.0
09T-574	TRIBE O&M	5150.0	759.0	220NVJO	0.0
09T-575	TRIBE O&M	5350.0	240.0	220NVJO	205.0
09T-578	TRIBE O&M	0.0	0.0		266.0
09T-581	UNKNOWN	0.0	0.0		0.0
09T-600	NTUA	5415.0	1057.0	231LKCK	309.0

TABLE 10. WELLS WITHIN THE RED MESA CHAPTER PLANNING AREA (continued)

Well No.	Operator	Elevation	Depth	Aquifer	SWL
09T-602	TRIBE O&M	0.0	0.0		0.0
09T-606	NTUA	4660.0	480.0	220NVJO	20.0
09Y-10	TRIBE O&M	5260.0	603.0	220NVJO	149.3
09Y-100	TRIBE O&M	5220.0	356.0	220NVJO	94.6
09Y-100A	TRIBE O&M	5200.0	750.0		97.0
09Y-12	TRIBE O&M	5165.0	592.0	221ENRD	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-32	TRIBE O&M	5310.0	735.0	231LKCK	365.0
09Y-40	BIA	4615.0	0.0	221RCPR	0.0
09Y-41	BIA	0.0	0.0	221RCPR	0.0
09Y-42	BIA	4765.0	0.0	221RCPR	0.0
09Y-43A	BIA	0.0	0.0	221RCPR	0.0
09Y-57	BIA	5350.0	0.0	231LKCK	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
09Y-9	TRIBE O&M	5479.0	0.0	220NVJO	0.0
1 ANIDO CR	CARTER OIL	5223.0	6800.0		0.0
1 C-N-110	AMERADA PE	5231.0	6257.0		0.0
1 GOVT-NRW	BRITISH-AM	4744.0	5884.0		0.0
1 N. BDY B	SHELL OIL	5028.0	5230.0		0.0
1 NAVA-117	CARTER OIL	5196.0	5959.0		0.0
1 NAVA-127	CARTER OIL	4740.0	5779.0		0.0
1 NAVA-130	CHAMPLIN O	5040.0	5846.0		0.0
1 NAVAJ C	MIAMI PETR	4946.0	5781.0		0.0
1 NAVAJ X	TEXACO OIL	4530.0	5555.0		0.0
1 NAVAJ-5	SINCLAIR O	5106.0	5423.0		0.0
1 NAVAJ-H	DAVIS OIL	5625.0	7145.0		0.0
1 NAVAJ-W	MONCRIEF	4448.0	5438.0		0.0
1 NAVAJO A	MIAMI PETR	4708.0	5970.0		0.0

TABLE 10. WELLS WITHIN THE RED MESA CHAPTER PLANNING AREA (continued)

Well No.	Operator	Elevation	Depth	Aquifer	SWL
1 NAVAJO35	CHAMPLIN	4457.0	6505.0		0.0
1 PARA-NAV	DAVIS OIL	5267.0	7125.0		0.0
1 ST GULF	KIMBARK OP	5948.0	9540.0		0.0
1 WHITE MS	SHELL OIL	5470.0	6925.0		0.0
1-22 NAVAJ	BELCO PETR	4898.0	5681.0		0.0
1-29 NAVAJ	MESA	5106.0	5640.0		0.0
1-33 NAVAJ	SHENANODOA	4618.0	5590.0		0.0
1-35 DES C	LADD & LEW	5035.0	5620.0		0.0
1-N 112	CHAMPLIN	5086.0	5218.0		0.0
108-1 NAVA	MIAMI PETR	4874.0	5690.0		0.0
12-0731	MOBIL	4460.0	28.5	111ALVM	9.0
12-UNK-0020	UNKNOWN	4694.0	0.0		0.0
12-UNK-0021	UNKNOWN	4675.0	0.0		0.0
12K-308	UNKNOWN	4520.0	1163.0	220NVJO	0.0
12K-308A	UNKNOWN	4520.0	300.0	221BLFF	0.0
18-23 RATH	PHILLIPS P	4808.0	5784.0		0.0
1NAVAJ B	MIAMI PETR	4598.0	5830.0		0.0
2 N. BDY B	SHELL OIL	4934.0	5925.0		0.0
2 NAVA-130	CHAMPLIN	5070.0	5770.0		0.0
2 NAVAJ D	MONCRIEF	4491.0	5493.0		0.0
2 NAVAJ-JC	GULF ENERG	4671.0	5656.0		0.0
22-A	PHILLIPS	4777.0	5759.0		0.0
2A WHITE M	CONOCO	4647.0	5584.0		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
5 DUN-NAV	ZOLLER AND	5419.0	6284.0		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
92-1 ZOLLER	ZOLLER AND	5818.0	6900.0		0.0
A-1 NAVAJ	ANADARKO P	4964.0	5785.0		0.0

TABLE 10. WELLS WITHIN THE RED MESA CHAPTER PLANNING AREA (continued)

Well No.	Operator	Elevation	Depth	Aquifer	SWL
B-2 NAVAJ	SUPERIOR O	4739.0	0.0		0.0
BOUNDARY BUT	BOUNDARY B	5403.0	0.0		0.0
CARTER-NAV	CARTER-NAV	5231.0	0.0		0.0
D C 1	DESERT CK	4822.0	0.0		0.0
D.C.1	SHELL OIL	4822.0	6645.0		0.0
DES CK-FED.1	DESERT CK-	4849.0	0.0		0.0
DESERT 22-A	DESERT 22-	4777.0	0.0		0.0
DESERT CK 1	DESERT CK	5337.0	0.0		0.0
DESERT CL	NORTH DESE	4708.0	0.0		0.0
ENGLISH 15	ENGLISH 15	4948.0	0.0		0.0
FRANCO NV1	FRANCO WES	5450.0	5902.0		0.0
GOTHIC MES	SOUTHLAND	4680.0	932.0	220NVJO	0.0
GOVT F-L 2	CARTER OIL	4535.0	6345.0		0.0
HANCK 29-1	UNKNOWN	5670.0	6500.0		0.0
HUM NAV E2	UNKNOWN	5535.0	6520.0		0.0
HUM NVJO 1	UNKNOWN	5400.0	6382.0		0.0
HUMBLE E-1	UNKNOWN	5520.0	5410.0		0.0
N-E3		0.0	0.0		0.0
N. BOUND BUT	N.BOUNDARY	4920.0	0.0		0.0
N. BOUNDARY	N.BOUNDARY	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 1-28-X	UNKNOWN	5120.0	0.0		0.0
NAV 110-2	UNKNOWN	5166.0	0.0		0.0
NAV 111-1	UNKNOWN	5144.0	0.0		0.0
NAV 111-2	UNKNOWN	5145.0	0.0		0.0
NAV 111-3	UNKNOWN	5104.0	0.0		0.0
NAV 112-1	UNKNOWN	5076.0	0.0		0.0
NAV 116-1	UNKNOWN	5067.0	0.0		0.0
NAV 21-1	UNKNOWN	4897.0	0.0		0.0
NAV 30-1	UNKNOWN	5000.0	0.0		0.0
NAV 40-1	UNKNOWN	4914.0	0.0		0.0

TABLE 10. WELLS WITHIN THE RED MESA CHAPTER PLANNING AREA (continued)

Well No.	Operator	Elevation	Depth	Aquifer	SWL
NAV 50-2	UNKNOWN	4965.0	0.0		0.0
NAV 92-1	UNKNOWN	5818.0	0.0		0.0
NAV B-1	UNKNOWN	5135.0	0.0		0.0
NAV G14-7	UNKNOWN	5140.0	0.0		0.0
NAV J-2	UNKNOWN	5749.0	0.0		0.0
NAV N12-16	UNKNOWN	4990.0	0.0		0.0
NAV TRACT 48	UNKNOWN	4604.0	0.0		0.0
NAV-ANIDO	UNKNOWN	5223.0	0.0		0.0
NAVAJO 1	UNKNOWN	5160.0	0.0		0.0
NAVAJO 4	UNKNOWN	4825.0	0.0		0.0
NAVAJO-SAN	UNKNOWN	4925.0	0.0		0.0
NE1		0.0	0.0		0.0
NH3-3		0.0	0.0		0.0
RD MES SCH	UNKNOWN	5420.0	1080.0		0.0
S-R NAV63-	SHELL OIL	5068.0	6213.0		0.0
SHEL EBB 8	UNKNOWN	5460.0	5515.0		0.0
SHEL EBB2	UNKNOWN	5310.0	6339.0		0.0
SHELL EBB1	UNKNOWN	5230.0	6490.0	231WNGT	0.0
TOHONADLA 1	TOHONADLA	4680.0	0.0		0.0
TOHONADLA 2	TOHONADLA	4817.0	0.0		0.0
TRIBAL 1	TRIBAL 1	5312.0	0.0		0.0
UTAH-NAV 1	UTAH-NAVAJ	4803.0	0.0		0.0
WHITE MESA	WHITE MESA	4904.0	0.0		0.0
WHITE MESA 1	WHITE MESA	5508.0	0.0		0.0
WHITE MESA 2	WHITE MESA	5316.0	0.0		0.0

Source: Navajo Nation Water Management Department

TABLE 11. 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 & Shrubland
S096	Inter-Mountain Basins Greasewood Flat
S136	Southern Colorado Plateau Sand Shrubland

Source: USGS Gap Analysis Program, 2004

F. 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 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**.

G. 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.

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.

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 Department of Fish and Wildlife (NNDFWL) 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 13)**.

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.

H. Energy and Minerals

Map 14 shows the locations of known mineral deposits such as uranium along with gas and oil wells and their pipelines that are situated in the planning unit.

Uranium

From the 1940's through the 1970s, hundreds of uranium mines were opened throughout the Navajo Nation. Three uranium mines are noted in the southern part of the planning area and shown in **MAP 14**. The mines have since been reclaimed.

Transmission & Pipelines

An APS 500-KV transmission line originates from the Four Corners Coal-Fired Generating Station, which is 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 to 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.

Oil and Gas

Thirteen oil and gas fields exist in the planning area but only in the Utah portion. Although some are inactive, others are producing. The largest of these include Ratherford and White Mesa, which consist of both active and inactive wells. Boundary Butte, Akah, and Tohonadla, and Gothic Mesa are the next largest fields and only include active wells. Numerous other small active and inactive fields are scattered throughout the planning area. Ratherfords, White Mesa, Lone Mountain, Big Wash and McElmo Creek are included in the Greater Aneth Field. **TABLE 12** provides production data.

MAP 15 shows all the wells according to their status. There are 292 producing wells. Of these 170 are producing oil wells within the Greater Aneth field. In addition, Greater Aneth is the only field that has 100 water injection wells. Boundary Butte has eight producing oil wells and two producing gas wells. Akah has one producing oil well. Gothic Mesa has

three. Dessert Creek has six, and Tohonadla has four.

A more detailed table is included in **APPENDIX E.**

I. 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).

J. 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 *National Historic Preservation Act of 1966* (NHPA), *Native American Graves Protections and Repatriation Act of 1990* (NAGPRA) and Executive Order 13007.

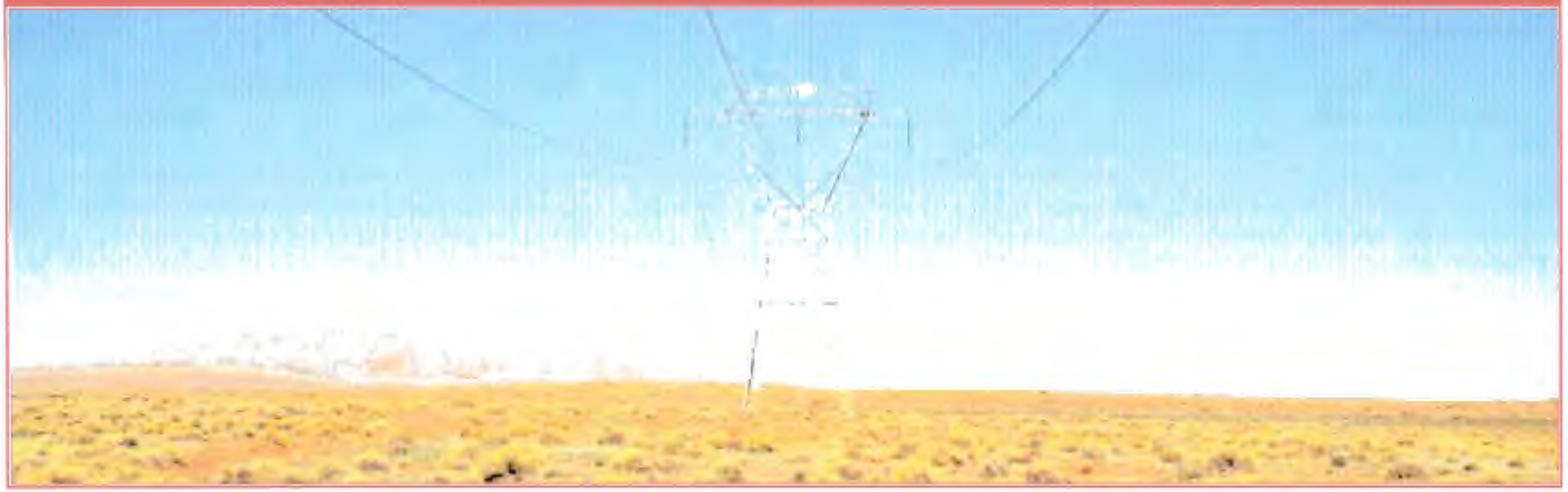
Several traditionally sensitive sites are located throughout the planning area. Some of these have been indicated on the map while other sites have not been designated on maps so as to add an additional layer of protection for them.

TABLE 12. OIL & GAS WELL PRODUCTION DATA

Field	Status	Total Number of Wells	Total Cum Oil (bbl)	Total Cum Gas (mcf)	Total Cum Water (gal)
Akah	Active	6	536,783	504,882	2,033,462
Anido Creek	Abandoned	8	612,082	424,388	718,051
Boundary Butte	Active	54	5,503,590	13,645,425	24,215,981
Casa Mesa	Abandoned	1	3,370	5,252	13,573
Desert Creek	Active	16	2,151,041	1,842,433	325,683
Gothic Mesa	Active	34	1,952,566	1,277,313	363,009
Greater Aneth	Combined	505	161,116,153	151,579,425	469,362,407
Hogan	Abandoned	2	756	775	98
Rabbit Ears	Abandoned	2	54,068	154,717	641,817
Tohonadla	Active	22	2,323,303	923,443	941,860
Turner Bluff	Active	3	83,250	156,726	1,848
Undesignated	Plugged or Location	59	28	-	1
Wildcat	Plugged	110	9,563	14,702	9,666

Production Data for 1984 through latest complete report period: February 2008.
Source: http://oilgas.ogm.utah.gov/Data_Center/LiveData_Search/production.htm

Section V



Infrastructure Assessment

A. Utilities

Some basic needs that the Chapter must address include the availability, reliability, and affordability of the community's electricity, water, sewer and wastewater management, and communications needs. Existing facilities are represented on **MAP 16**.

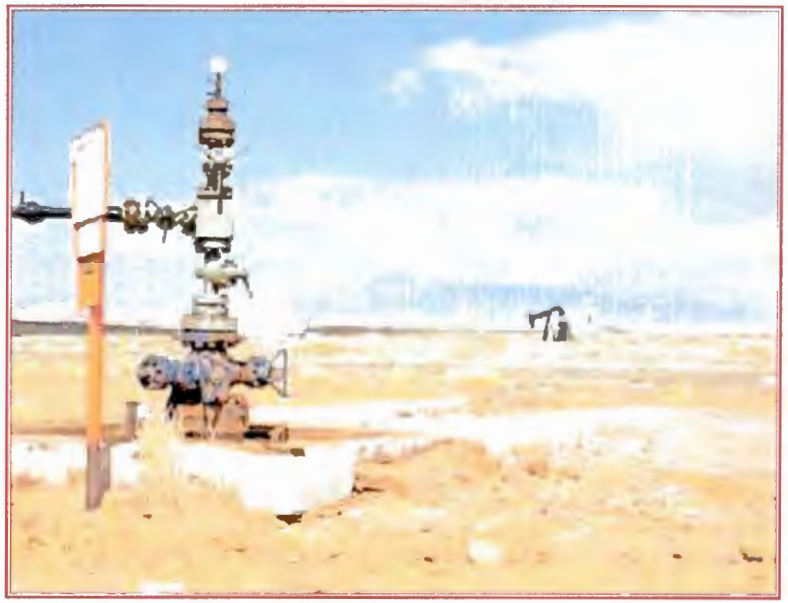
Electric

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; although, their Red Mesa substation is located adjacent to the Chapter house in Utah. As referenced above, 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.

NTUA is one of several companies that draw gas from Questar's pipeline whereby they provide service to the Red Mesa community. NTUA's natural gas pipelines parallels N35 and serves the Health Clinic, Trading Post, NHA housing and the RMUSD.



The community also widely relies on local propane distributors.

Domestic Water

Public water systems are available. 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 four sewage lagoons in the planning area (see Map 16). Two belong to NTUA; one services the NHA housing at the junction of N35 and Highway 160 while the other is located in the White Mesa Village area in the northern part of the chapter. The RMUSD and the Health Clinic both operate their own lagoons within their respective compounds.

Most people rely on individual septic systems.

B. Solid Waste Disposal

The Chapter does not have an existing transfer station. Community members have to find alternative ways to dispose of their waste. The nearest solid waste disposal is located in Bluff, Utah.

C. Technology and Communications

Citizens Communications is the primary provider of telephone service on the Navajo Nation and they serve the Red Mesa Chapter. 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 cell-phone service in Red Mesa is limited.

Clearly transmitted AM radio stations include KNDN, KTNN and KTUA from Farmington, NM, Window Rock, AZ, and Blanding, UT, respectively. Several clear FM radio stations can be readily heard (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 Times* and *Gallup Independent* on a daily basis to the Red Mesa Trading Post. *The Navajo Times* and the *Navajo/Hopi Observer* are available on a weekly basis. Internet service is available via modem and satellite.

D. Transportation

Red Mesa's transportation network is vital because 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 Red Mesa Chapter is serviced by Highway 160 and N35 **(MAP 17)**. Highway 160 runs east and west in the lower southern portion of the planning area while N35 runs north and south. Highway 160 is located entirely within AZ and is under the jurisdiction of the Arizona Department of Transportation (ADOT). N35 is under the jurisdiction of the Navajo Department of Transportation (NDOT).

The Utah Department of Transportation (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 "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. Roads within the Utah portion of Red Mesa Chapter are either Class B or D. The majority are Class B as shown on the **MAP 17**.

Highway 160 is classified as a Rural Principal Other road under the ADOT classification system. The Rural Principal Other system consists of all non-Interstate 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 Bureau of Indian Affairs (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.

N35 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 Red Mesa 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 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 Red Mesa 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 located at the Four Corners Health Care Center at the junction of N35 and Highway 160.

Section VI

Existing Land Uses

A. Introduction

Land use patterns in the Red Mesa Chapter have been shaped by physical and cultural factors such as topography, water availability, land ownership and roads. **MAP 18** illustrates the land use patterns that exist within the planning area.

B. Existing Residential Land Uses

Scattered housing in the form of single family detached dwellings is the predominant form of residential land use in the Red Mesa Chapter. Housing areas are generally clustered based on family areas and typically include a home, Hogan and other structures.

Census 2000 data for this area indicates that there are approximately 454 total housing units in the Chapter area. Of these units, 291 are occupied and 163 are vacant. About 35.9 percent of the units are vacant. The majority of the vacant housing units are for seasonal, recreational, or occasional use, which may indicate these vacant units are mostly hogans.

TABLE 13. UNITS IN STRUCTURE

Type of Unit	No.
Total housing units	489
1 room	30
2 rooms	30
3 rooms	39
4 rooms	136
5 or more rooms	254

Source: U.S. Census Bureau (2000) (SF-3)

TABLE 13 shows the distribution of the housing units based on number of rooms. The majority of the houses within Red Mesa are 4 or 5room units. The one room homes (n=30) are most likely hogans.

The median home value for the communities in the Chapter is far below all other jurisdictions examined in **TABLE 14**. It is likely due to 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.

TABLE 14. HOUSING CHARACTERISTICS

	Total Housing Units		Type of Housing Unit (2000)(1)		Median
	1990	2000	Single	Mobile Home	Home Value (2000)
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
Red Mesa Chapter	**490***	**454**	**329**	**104 (22.6%)**	**$14,800**
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

(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.
* Takahashi, 2005

Housing construction is a mix of frame houses, log and frame hogans, and mobile homes. Red Mesa chapter shows the greatest percentage of mobile homes compared to the other areas shown in the previous table. Approximately one-quarter (22.6 percent) of the homes in Red Mesa are mobile homes. 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 home. The age of the housing units varies from 50+ years to new.

Generally, a slow but constant annual growth rate Chapter- wide of around 2.5–2.7 percent will result in a need for around 35 new homes per year to allow young families and new households to have their own home. The current growth rate is probably a mix of new births and residents moving back into the Chapter's area. This also assumes that there is an out-migration of residents moving to other locations and some younger people who prefer to live with other family members.

At least half of all new housing units should be in the affordable range. Median income in 1999 for families in Red Mesa Chapter was $23,036. Per capita income was $7,247 and 44.07 percent of the residents had incomes below the poverty level.

There is, however, a significant number of households (37.0 percent) with incomes over $40,000 per year. Thus, the Land Commissioners has identified a need for additional, new, market rate housing units in the Chapter.

In the Chapter, housing rehabilitation and remodeling is probably the greatest need with 27.33 percent of the existing homes lacking complete kitchens (n=126) and 33.84 percent (n=156) lacking complete plumbing facilities. Additionally, there are many homes that need rehabilitation and repair.

C. Existing Community Facilities Land Use

A few community facilities are spread across the planning area. Public purpose land uses in Red Mesa Chapter include:

- The Chapter House,
- The Senior Citizens Center,
- Head Start Program,
- Four Corners Regional Health Center,
- The Red Mesa Elementary School, and
- The Red Mesa High School.

Chapter House

The Chapter house tract is approximately 16 acres and is located along N35 approximately 10 miles no

the Arizona-Utah State line. Built in the 1960s, the Chapter house serves as a local governance center for the community, which conducts monthly meetings to address its members' needs and concerns.

Within the Chapter tract is a Senior Citizen Center, NTUA sub-office, and the preschool. Public, social, and health services located at the Chapter House include:

- Government Services:
  - Community Health Representative (CHR)
  - Food Distribution
  - Senior Citizen's programs
  - Division of Social Services
  - Community Services
  - Navajo Housing Services
  - Navajo Land Administration
  - Head Start
  - Community Services programs

Preschool education is provided by the Red Mesa Head Start program. Other educational services available in the Chapter area include the Red Mesa High School. Chapter children and youth also attend educational programs at the following schools:

- Todahidekani Pre-school
- Montezuma Creek Elementary School
- Bluff Elementary School
- Tiis Nas Bas Community School
- Aneth Community School
- Whitehorse and San Juan High Schools

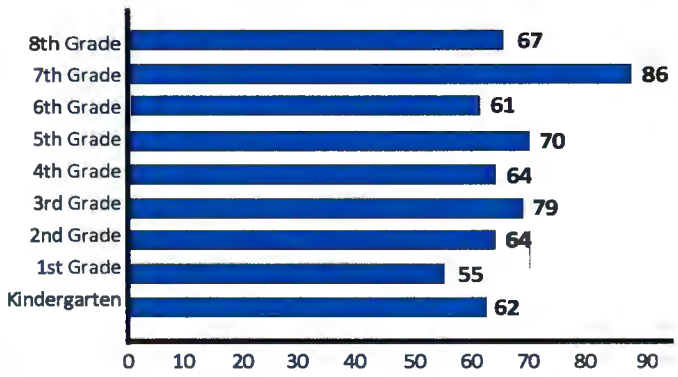


FIGURE 11. K-8 GRADE 2008 ENROLLMENT
Red Mesa Unified School District #27

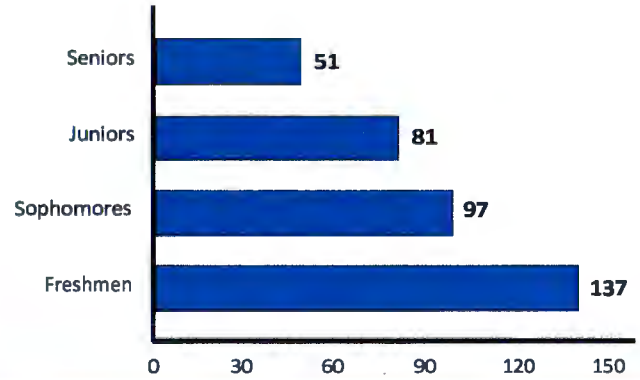


FIGURE 12. HIGH SCHOOL 2008 ENROLLMENT
Red Mesa Unified School District #27

The main K–12 education provider is the Red Mesa Unified School District #27. The following data was obtained from the District-wide Attendance Officer for the Red Mesa Unified School District #27. The data is for public school attendance for grades K–12. Students in the school district reside in Teec Nos Pos, Red Mesa, Montezuma Creek, Mexican Water, Sweetwater, Bluff, Rock Point, Lukachukai, Round Rock, Dennehotso, and Kayenta Chapters. Thus the statistics are not strictly for the Red Mesa Chapter, but they give a more accurate picture of school enrollment for the region.

FIGURE 11 shows enrollment for kindergarten through Junior High School (8th Grade). There are a total of 608 students enrolled in these grades.

FIGURE 12 shows high school enrollment. There are a total of 366 students enrolled in grades 9–12. The graduation rate is currently around 55 percent, which is mostly due to transfers out of the school system.

Emergency Services

The Chapter area receives emergency services from the Shiprock District of the Navajo Police Department. The Chapter does not have a fire department and relies on adjacent communities for these services. New facilities are needed for both of these emergency services. Fire department response times are affected by a lack of good identification systems for residences, lack of phones, and poor road conditions.

The Chapter area has been receiving health services from the Indian Health Service Hospital in Shiprock, the Teec Nos Pos Health Center, and the Montezuma Creek Health Clinic.

A new health clinic, the Four Corners Health Center, is located at the intersection of N 35/County Road 406 and. Highway 160. This clinic will provide walk-in/outpatient care, emergency health services and emergency transport services.

There are Traditional Navajo Medicine Practitioners (both Medicine Men and Herbalists) in the Chapter area and surrounding areas.

D. Existing Commercial Land Uses

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 of establishments followed by the accommodations and food service industry. Education rounds out the top three industries in the local zip code areas. Of the 32 establishments, Red Mesa Trading Post is located near the northwest intersection of N 35 and Highway 160. The trading post includes a convenience store and gas station.

TABLE 15. NUMBER OF ESTABLISHMENTS

Industry Code	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: Navajo Nation Division of Economic Development

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. There is some intermittent "flea market" activity with vendors selling retail goods and food. The Chapter has not taken advantage of potential tourism focused business opportunities related to location and recreational opportunities provide by the San Juan River.

E. Existing Industrial Land Uses

Although there are no manufacturing facilities or construction materials yards in the area, industrial development is mainly focused on oil and gas development. As referenced above, there are 13 oil and gas fields that include 822 wells. While many of them are abandoned, oil and gas production is strong (refer to Table 11 in Section IV).

F. Existing Agricultural Land Uses

Livestock and ranching are still a source of income for some residents. It is strongly recommending maintenance of existing grazing areas. In addition, they have expressed an interest in land restoration for grazing areas in order to increase productivity.

Red Mesa is part of the BIA Grazing District 9, which includes portions of the Chapters of Red Mesa, Mexican

Water, Rock Point, Sweet Water, and Teec Nos Pos. In 1995,District 9 had 35 percent of the land or 951,897.60 acres in the Grazing District.

Agriculture in the Chapter area occurs mostly along the riparian edge of the San Juan River. Much of the irrigated land is not currently under production; however, there is interest in revitalizing the agricultural industry in the area and reinstating the Farm Board. The community feels strongly about maintaining existing agricultural areas.

Section VII

Future Land Uses

A. Introduction

The future land use plan is the Chapter's general guide for managing the location, type, scale and density of growth in the community. Wise planning inevitably leads to a stronger economic base, which greatly facilitates a more efficient system of roads and utilities, and the protection of natural, cultural and traditional resources. Effective administration of these resources will greatly enhance the way the community lives, works, and spends its leisure time. Ultimately, prudent land-use decisions will shape not only the community's earning potential but its spending patterns as well. Further, the way communities are planned has a direct impact on its members' health, safety, general welfare, emotional stability and future outlook.

Thus, the designation of future land uses for development is important to any community. This is especially true for the Red Mesa Chapter as it moves towards local governance and sustainability.

TABLE 16. FUTURE DEVELOPMENT AREAS

No.	Map	Name	Development Type
1	20	Yaa dez' ahi Development	Scattered Housing
2	21	Des Tsini Development	Scattered Housing
3	22	Tall Mountain Development	Scattered Housing, Farming
4	23	Big Ben 1 Development	Scattered Housing
5	24	Big Ben 2 Development	Scattered Housing
6	25	Chapter House Tract Dev.	Community Facilities
7	26	White Mesa Marketplace	Commercial
8	27	Tseta' Market Development	Commercial, Culture, Tourism
9	28	San Juan River Farm	Farming
10	29	White Mesa Farm	Farming
11	30	Red Mesa Farm	Farming

During the process, the Land Commission fully advertised the public planning meetings where everyone including grazing permittees had an opportunity to express their opinions. Because land stewardship and tenure is central to Red Mesa community members, the Chapter's membership unanimously agreed that the needs and desires of the grazing permittees should take precedence during the planning process.

B. Land Use Designation

Red Mesa's future land use plan **(MAP 19)** demonstrates the proposed land uses that the community's members, grazing permittees, leaders. Together, these key stake holders identified 11 sites for future development that include a variety of land uses **(TABLE 16)**.

Maps for each of these sites show the proposed development areas. The maps indicate the intended predominate future function and the current 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 uses and should not be construed as tying individual projects to designations. To achieve appropriate balance among the goals promoted by the land use plan, some flexibility in specific decisions may be required.

YAA DEZ' AHI DEVELOPMENT

DES TSINI DEVELOPMENT

Residential Housing

Community members who attended the public planning meetings strongly voiced their desires to continue the development of scattered housing sites. Scattered housing is generally comprised of clusters of one-acre home sites that include a small number of extended families. Community members do not want reticulated subdivisions, which they believe bring in more crime and cause families to lose their culture. They believe scattered housing is more conducive to the lifestyles of the Navajo people.

Site 1 – Yaa dez' ahi Development

This development site is located along County Road 451 north of the Red Mesa landmark. A Few homes exist in this area, but scattered housing is proposed on the south side of County Road 451 in an area where two homes are already present. The families living in these two homes are overcrowded and need additional housing to ease these conditions. Water and electric lines are nearby at the existing houses **(MAP 20)**.

Site 2 – Des Tsini Development

Two areas are proposed for scattered housing just east of County Road 444 on top of White Mesa in the northern region of the planning unit. Although, numerous homes are present, the families who reside in them proposed the additional housing to ease overcrowding and improve living conditions. The proposed development is surrounded by

TALL MOUNTAIN DEVELOPMENT

BIG BEN 1 DEVELOPMENT

BIG BEN 2 DEVELOPMENT

grazing and open space. The views are gorgeous from this site and water and electric lines are nearby at the existing houses **(MAP 21)**.

Site 3 – Tall Mountain Development

This site is located along County Road 457 near the San Juan River in the northern part of the planning unit. The proposed development at this site includes two large areas for scattered housing, an access road and the restoration of a farming area. The families holding the grazing permit for this area have identified the two areas for scattered housing, and they wish to have an existing but run down earthen dam restored. Currently the surface water flows northerly towards the San Juan River dissecting the terrain near the existing and proposed housing sites **(MAP 22)**.

Site 3 & 4 – Big Ben 1 & 2 Development

In the original land use plan (2008), Mr. Big Ben designated two residential sites. Both sites remain in this updated land as originally proposed until families can resolve the circumstances. New housing is proposed in the immediate vicinity within their grazing areas just east of County Road 457 and Tsitah Wash **(MAP 23)**.

MAP 24 demonstrates how the scattered housing development, Big Ben 2, will be situated near an existing home at the end of County Road 478 where the terrain is somewhat rugged and characterized by the name, Rough Canyon.

CHAPTER TRACT DEVELOPMENT

Community Facilities

The community wishes to develop public facilities that include schools, colleges, libraries, fire stations, police stations and governmental offices in places that will provide appropriate access for each service.

No new areas were identified, but several of the existing sites such as the Chapter House tract and the White Mesa Curve Community Center area are designated for future expansion. The grazing permittees, particularly those with holdings around the Chapter house tract, expressed concern over more development adjacent to their grazing areas that might lead to the accumulation of more trash, traffic and crime. Therefore, proposed development is limited in this area.

Site 6 – Chapter House Tract Development

The Chapter proposes a new Chapter house and governmental building to expand its current services **(MAP 25A)**. The new Chapter house and governmental building are situated within the existing chapter house tract. A conceptual plan for the center shows a central parking area with the governmental center just north and a field and playground immediately south. Community gardens, market stalls and picnic areas are also proposed along the exterior perimeter to enhance the community-friendly character of the complex **(MAP 25B)**.

WHITE MESA MARKETPLACE

TSETA' DEVELOPMENT

Commercial

While some community members support commercial development, others want to limit it. As demonstrated by the goals and objectives, community members envision commercial activity ranging from cafes, gas stations, and a golf course to a casino. Only White Mesa Marketplace and Tseta' Development are proposed.

Site 7 – White Mesa Marketplace

White Mesa Marketplace is proposed on the west side of County Road 406. The community envisions an outdoor market where local artisans and farmers will be encouraged to sell their products. Shaded and open air stalls will be constructed around a parking area with an indoor facility in the northwest corner. Eventually, as the market grows, the community also foresees the installation of a café or other tourist draws **(MAP 26).**

Site 8 – Tseta' Market Development

Tseta' Market is proposed along the south side of Highway 160. The goal is to provide an area for economic development - places for businesses to be developed and grow. Businesses can provide jobs and create an economic base, and potential 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 **(MAP 27).**

Industrial

Industrial development is another way to enhance economic development. No future industrial sites were identified, but the existing oils and gas leases will remain in place for some time.

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 with a trail along the San Juan River. An outdoor facility such as a park, playground, or skate park is proposed at White Rock Curve as shown in the Map 26 and discussed above under community facilities.

Open Space

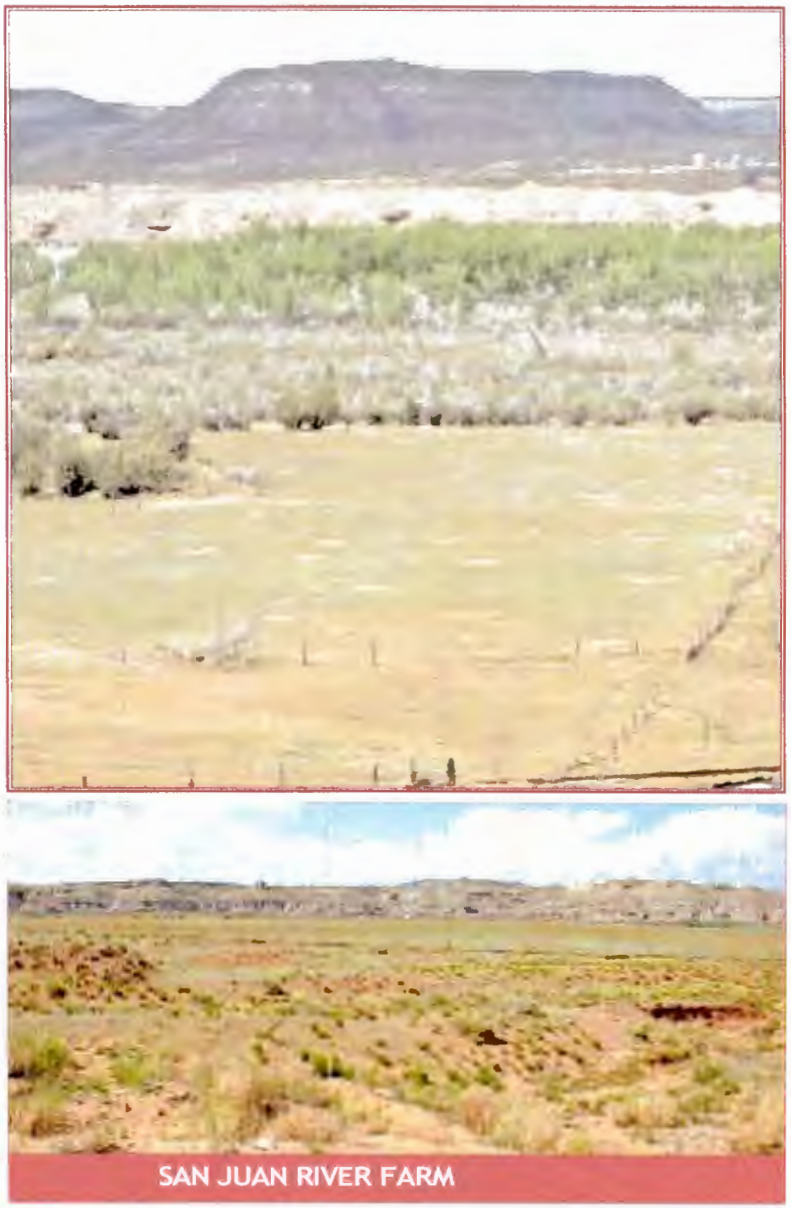
Areas designated as open space are those areas that the community has identified as having special significance and are areas that should be preserved in their natural state without development. The designation as open space does not mean that people cannot use the space for limited grazing, hiking or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

Grazing

The suitability of land for grazing is dependent on various factors, including the amount of annual precipitation, soil conditions, and the degree of slope on the land. The type of vegetation that will grow on the land is also affected by these factors. Land where the degree of slope is steep is suitable for grazing and/or open space. Thus, grazing areas should be regulated by a grazing management plan.

A priority, voiced by grazing permit holders at the public hearing, is to research and correct the permits. Apparently, the numbering system and permit areas were changed without consultation with permittees. For example, only four grazing permits were originally issued in the Gray Spotted and White Mesa area. Today, these four permit areas are no longer recognized and a new system was implemented without the grazing permittee's knowledge. It is imperative to uncover the process used for the new system and provide answers to the grazing permittees.

A grazing permit system that is understood by all is necessary to ensure grazing lands are properly managed and preserved for the future. Ranching is an important part of the social, cultural and economic identity of the Chapter. Ranching is also a custom that dates back many years and is well embedded in the community's traditional heritage.



SAN JUAN RIVER FARM

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.

Site 10 – White Mesa Farm

Farming is proposed adjacent to the San Juan River **(MAP 28).** The family wants to revitalize farming in this area.

Site 10 – White Mesa Farm

Running along the west side of County Road 406 in the northern region of the planning unit, White Mesa Farm is situated in an ideal local for farming with adequate surface water and access roads for the sale and transportation of produce **(MAP 29),**

Site 11 – Red Mesa Farm

Red Mesa Farm is proposed for a site along Highway 470. Its proximity to the marketplace and the highway provides easy access for the sale and transportation of produce. Water and electric lines are nearby. A large area is identified because the community members expressed desires about having something large. **(MAP 30),**

References

Barnes, F.A., Canyon Country Geology for the Layman and Rockhound. Arch Hunter Books, Thompson Springs, 2000.

Choudhary T., 2005-2006 Comprehensive Economic Development Strategy of the Navajo Nation, Navajo Nation Division of Economic Development, 2006.

Condon 1997

Harline, Osmond L., "Utah's Black Gold: The Petroleum Industry," Utah Historical Quarterly Vol. 31, No. 3, 2008. http://historytogo.utah.gov/utah_chapters/utah_today/utahsblackgold.html/ (accessed July 10, 2008).

Hendricks David M., Arizona Soils. University of Arizona, Tucson, 1985.

Hintze, F., Grant C. Willis, Denise Y.M. Laes, Douglas A. Sprinkle, and Kent D. Brown, Digital Geological Map of Utah. Utah Geological Survey, 2000.

LSR Innovations Research and Planning, Chapter Images, Division of Community Development, The Navajo Nation, Window Rock, 2004.

Maryboy, Nancy C. and David Begay, The Navajos of Utah-Chapter Seven, Utah's Native Americans Begay, 2007. http://historytogo.utah.gov/people/ethnic_cultures/the_history_of_utahs_american_indians/chapter7.html. (accessed September 30, 2007)

Remillard et al. 1993, 1994, 1995

Ruth McGee (trading post operator), interviewed by Brad Cole, Northern Arizona University Library Special Collections, February 11, 1998. http://www.nau.edu/library/speccoll/exhibits/traders/oralhistories/mcgee-r.html (accessed July 10, 2008)

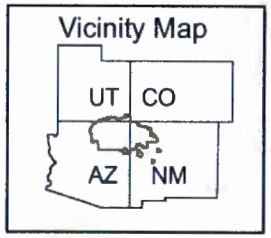
Spangler, L.E., D.L. Naftz, and Z.E. Peterman, Hydrology, Chemical Quality, and the Characterization of Salinity in the Navajo Aquifer in and Near the Greater Aneth Oil Field, San Juan County. Utah. Water-Resources Investigations Report 96-4155, U.S. Geological Survey, Slat Lake City, 1996.

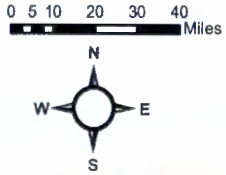
Takahashi Associates, Comprehensive Report and Implementation Recommendations Report, Red Mesa Chapter Tse Lichíí' Dahazkan. Prepared for the Navajo Government Development and the Navajo Housing Authority, Takahashi Associates, Santa Fe, 2005.

United States Department of Agriculture, Natural Resources Conservation Service, Soil Survey Geographic (SURGO) database for Shiprock Area, Parts of San Juan County, New Mexico and Apache County, Arizona. USDA, Fort Worth, 2005.

United States Department of Agriculture, Natural Resources Conservation Service, Soil Survey Geographic (SURGO) database for Navajo Indian Reservation, San Juan County, Utah. . USDA, Fort Worth, 2006.

Utah Division of Water Resources, Southeast Colorado River Basin, Utah State Water Plan, 2000. http://www.water.utah.gov/planning/SWP/SEastcol/swp_sc19.pdf (accessed September 30, 2007).





MAP 1
Locatiion of
Red Mesa Chapter

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

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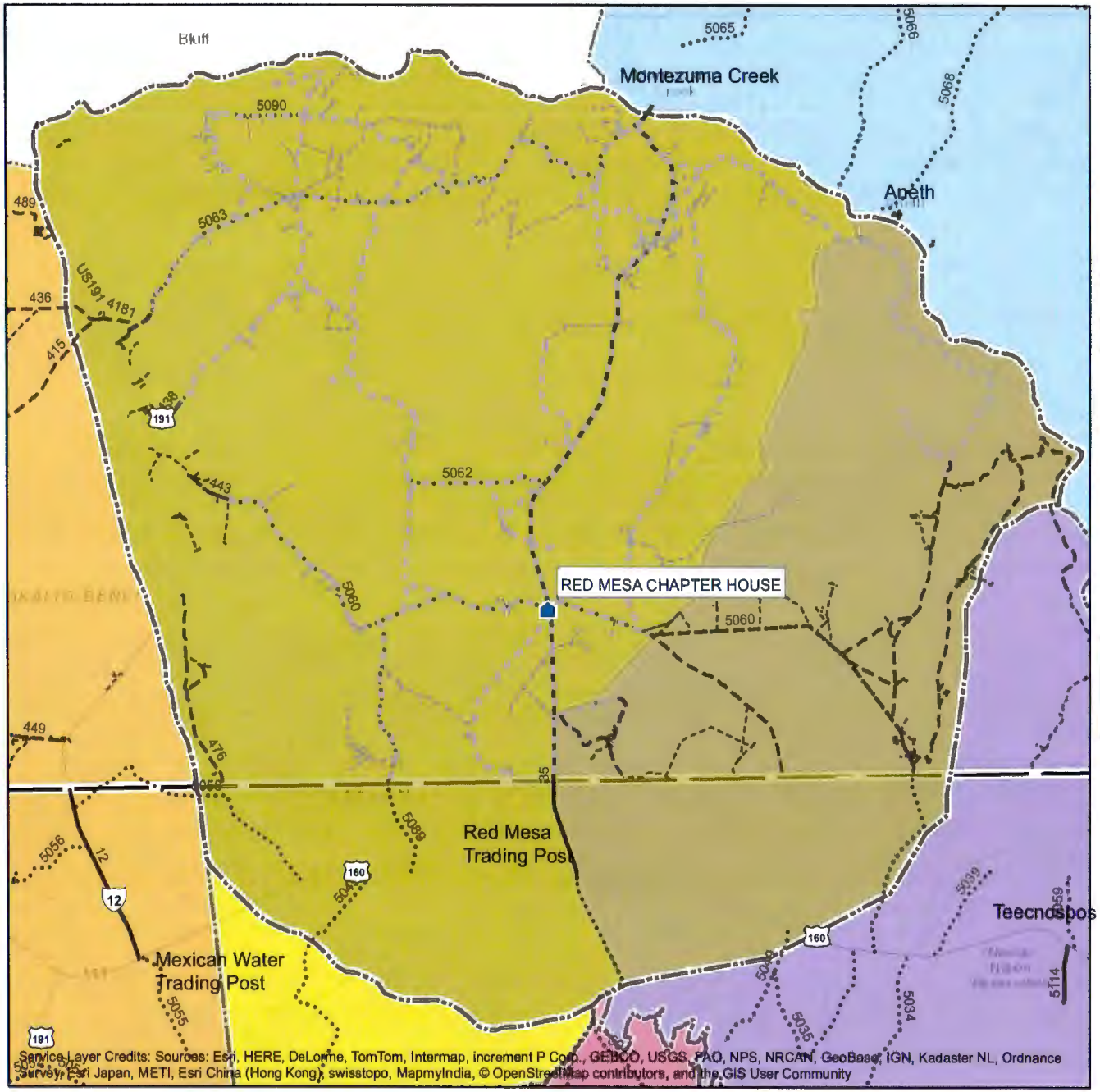
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (image)



Legend

- Chapter House
- Planning Area
- Stateline

Roads

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

Chapter Areas

- Aneth
- Mexican Water
- Red Mesa
- Sweetwater
- Teecnospos

0 0.5 1 2 3 4 Miles

N W E S

MAP 2
Planning Area

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

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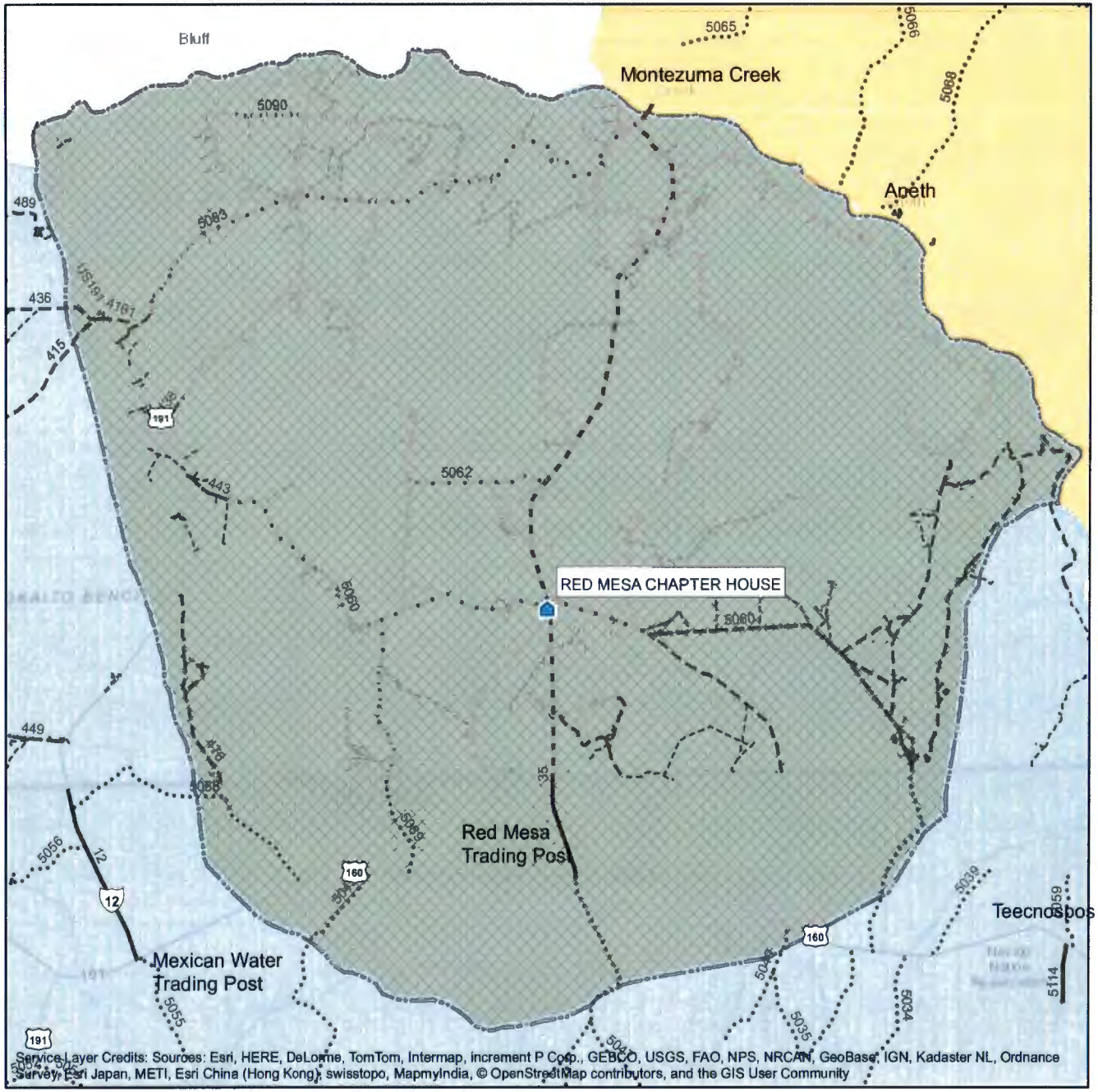

Legend

- Chapter House
- Planning Area
- Stateline

Roads

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

Grazing District

- Grazing District 9
- Grazing District 12

0 0.5 1 2 3 4 Miles

N W E S

MAP 3
Grazing Districts

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

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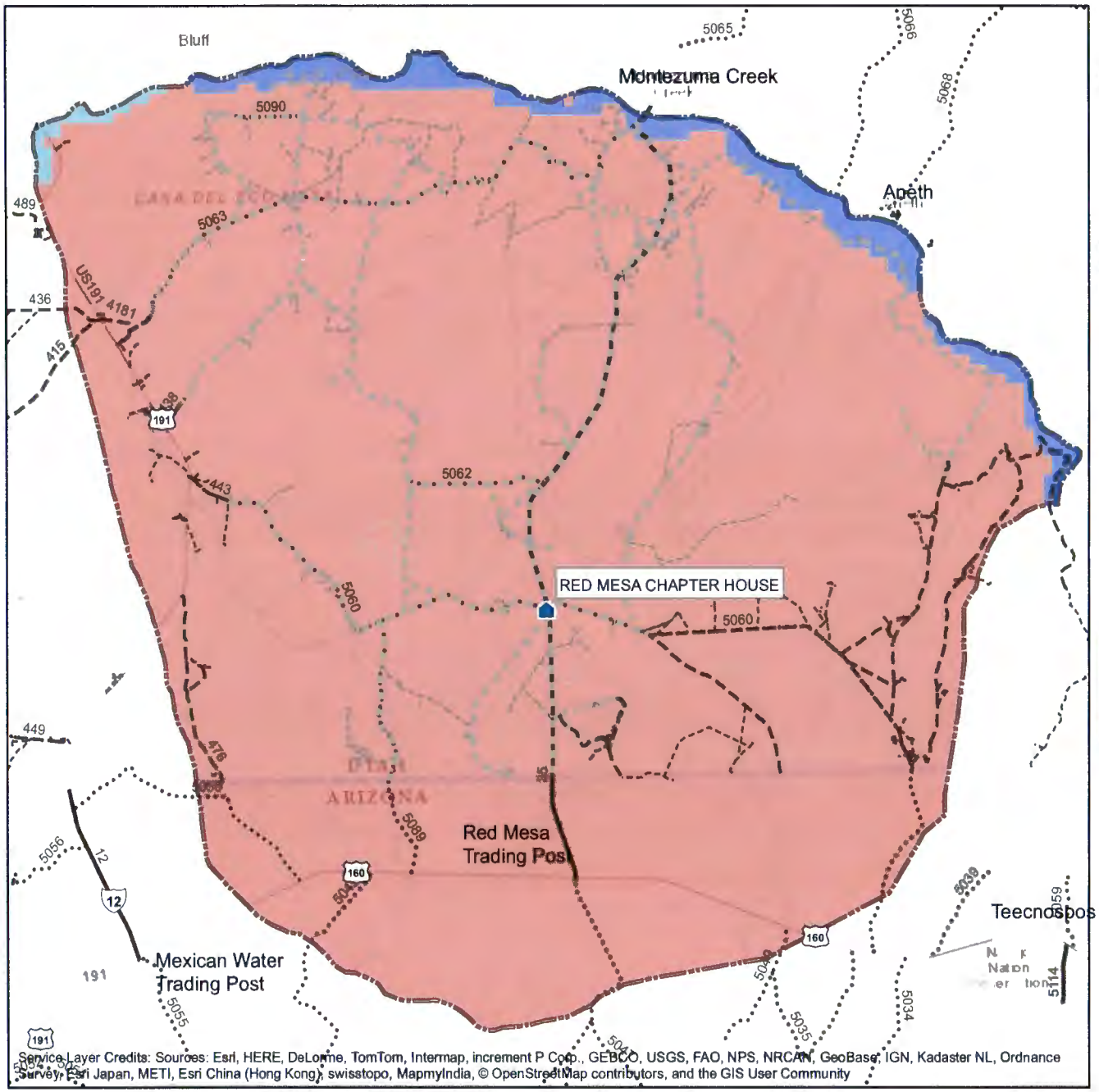
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (image)



Legend

- Chapter House
- Planning Area
- Stateline

Roads

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

Land Status

- Native American/Power Withdrawal
- Navajo Indian Reservation
- Navjao Indian/Power Sites

0 0.5 1 2 3 4 Miles

N W E S

MAP 4
Land Status

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

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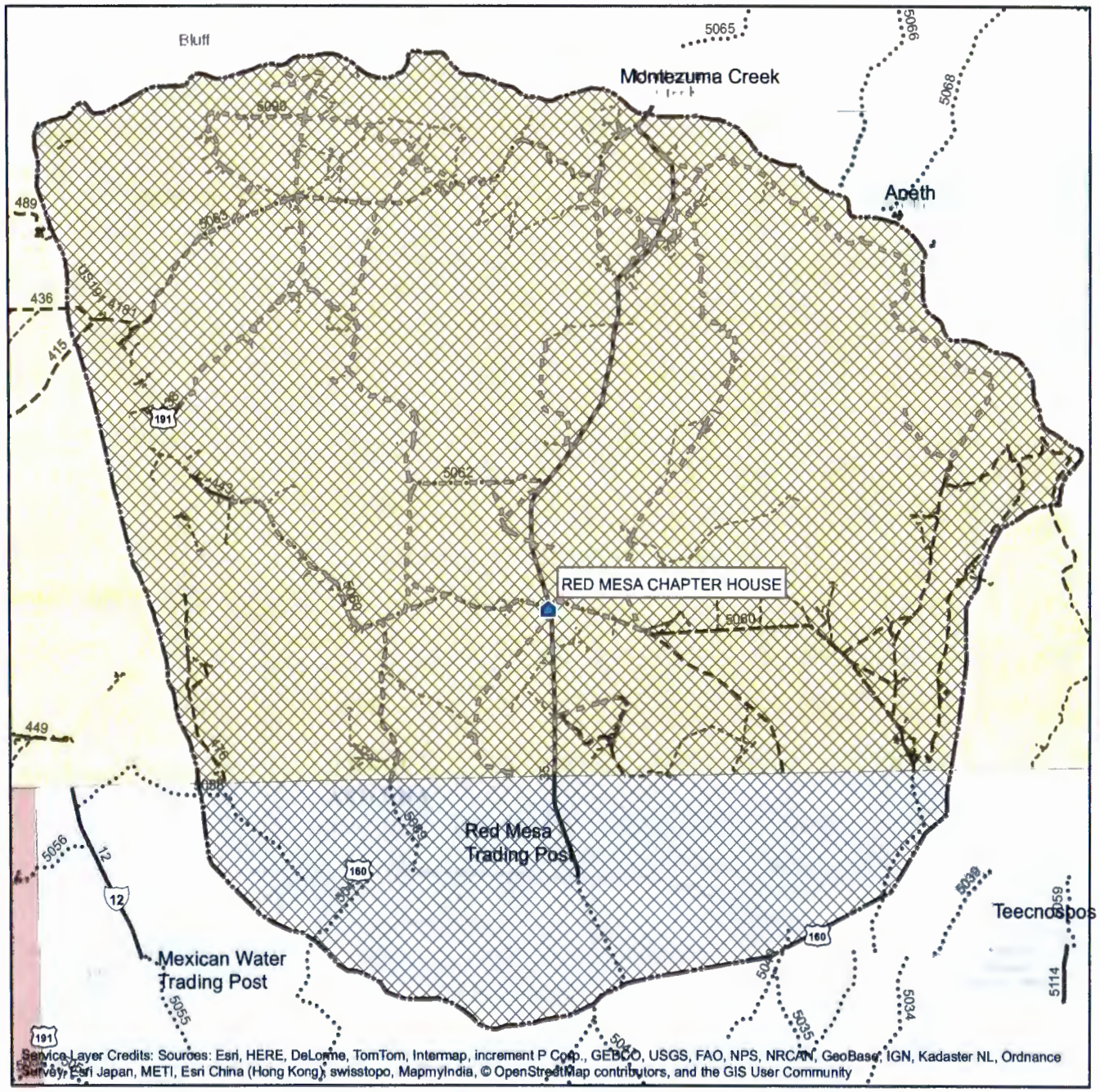

Legend

- Chapter House
- Planning Area
- Stateline

Roads

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

Boundary

- Executive Order 5/15/1906
- Executive Order May, 17 1884
- Executive Order Oct. 29, 1878
- Treaty of 6-1-1868

0 0.5 1 2 3 4 Miles

N W E S

MAP 5
Executive Order Treaty Boundaries

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

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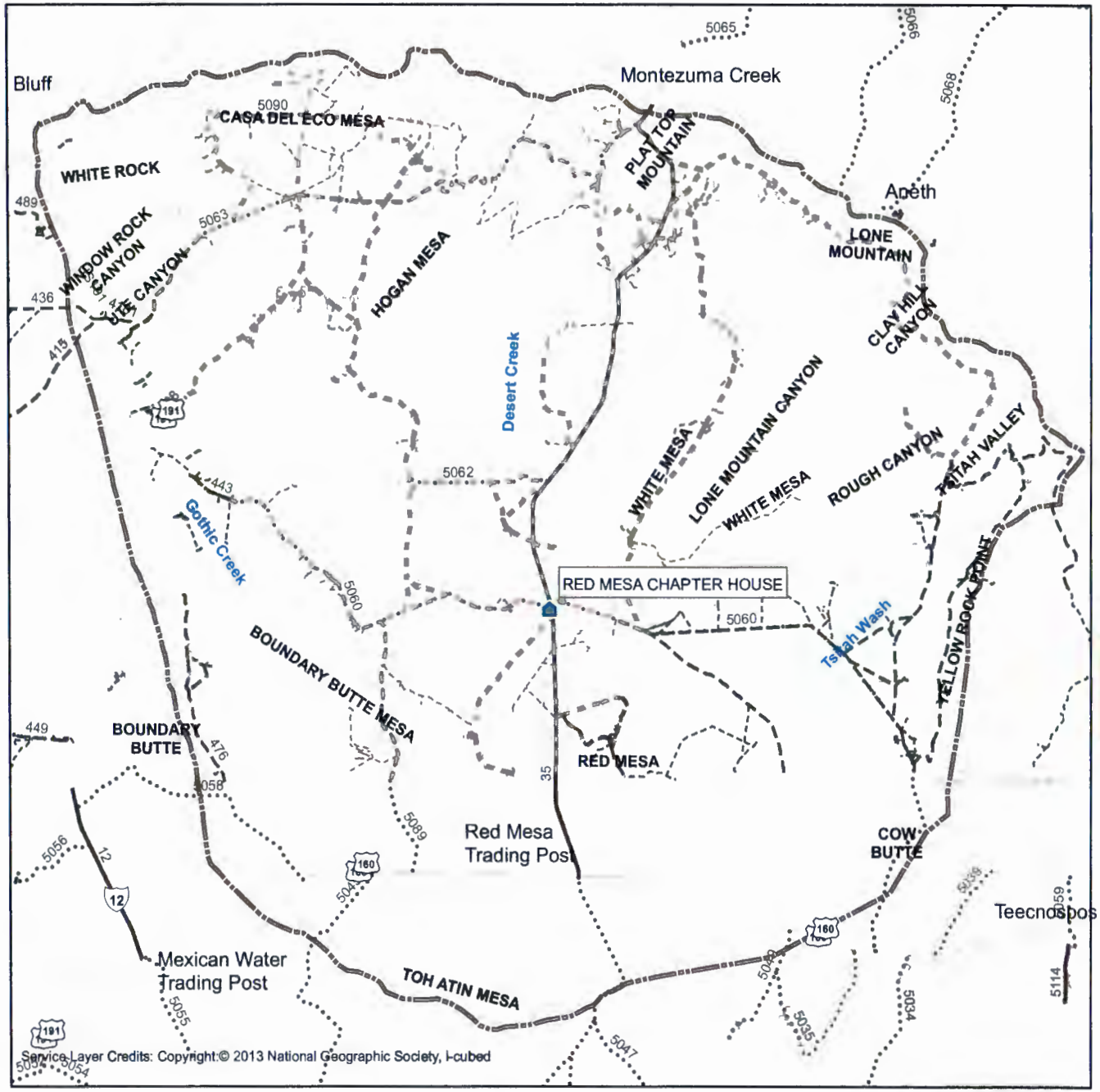
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (image)



Legend

- Chapter House
- Planning Area
- Stateline

Roads

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

0 0.5 1 2 3 4 Miles

N W E S

MAP 6
Topography

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

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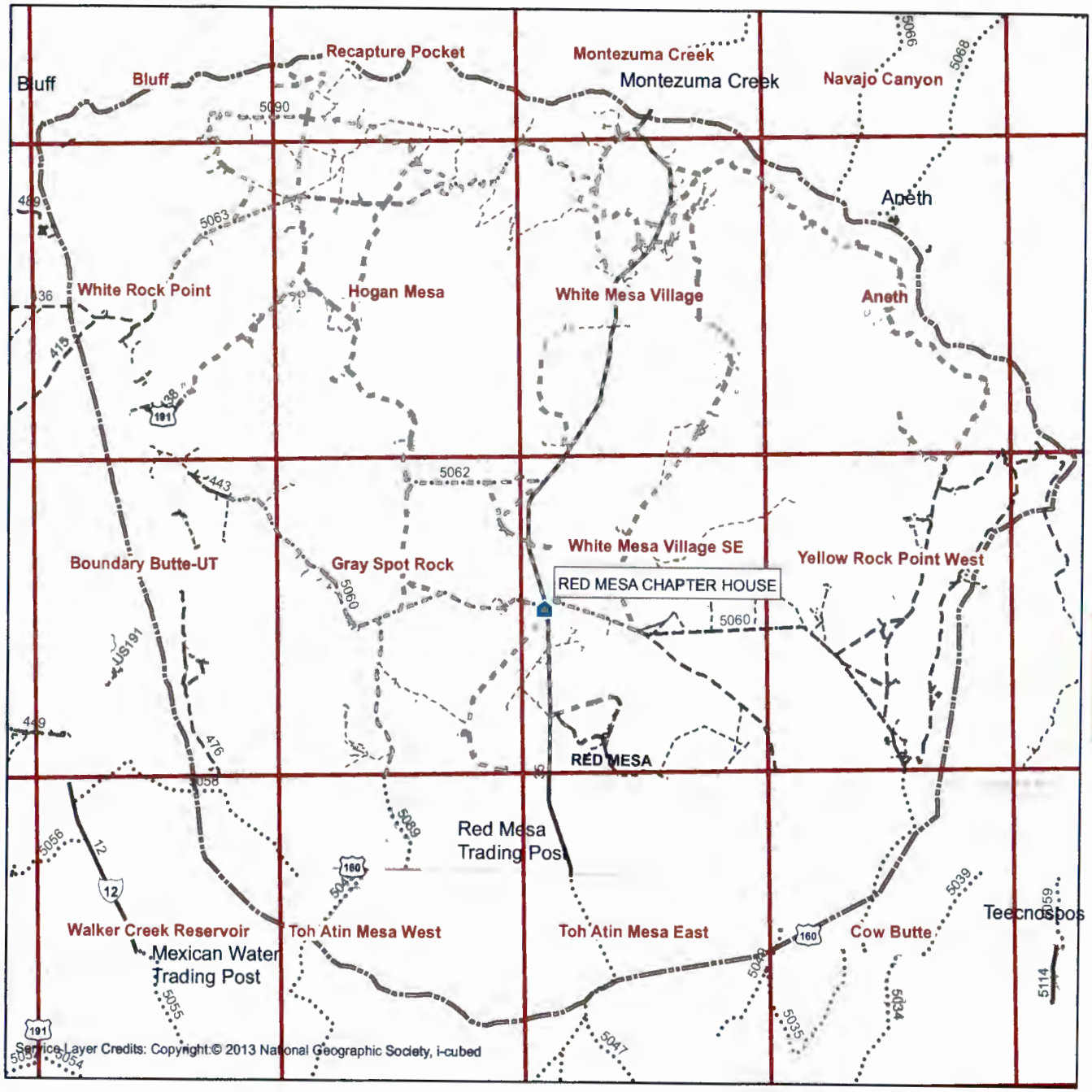

Legend

- Chapter House
- Planning Area
- Stateline

Roads

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

USGS

- 7.5 Minute Quadrangle

0 0.5 1 2 3 4 Miles

N W E S

MAP 7
USGS 7.5' Topographic Quadrangles

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

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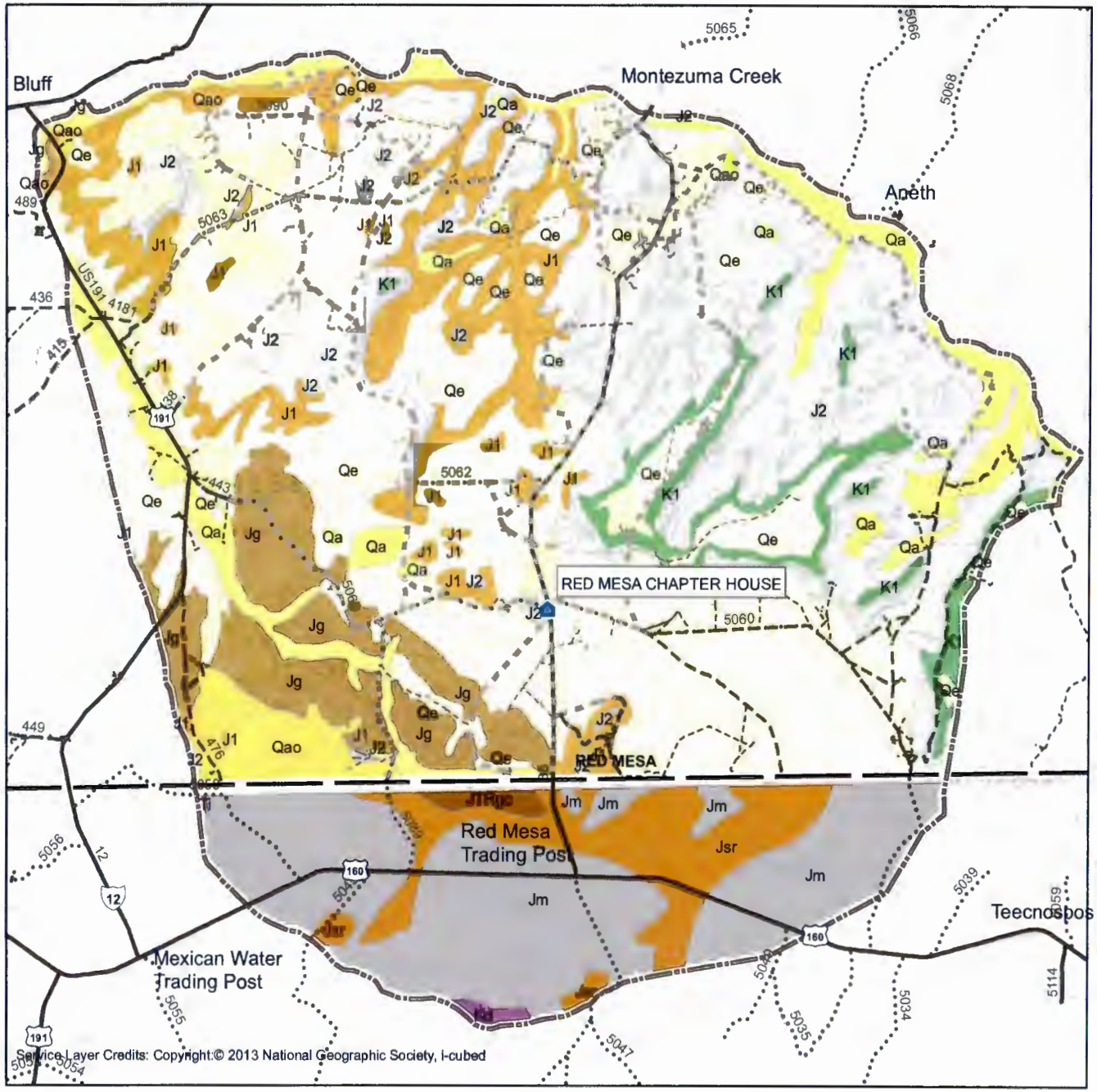

Legend

- Chapter House
- Planning Area
- Stateline

Roads

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

UT Unit

- J1 - Summerville, Entrada, Carmel, Arpien, Twin Creek and other Fms
- J2 - Morrison Formation
- Jg - Glen Canyon Goup (Navajo, Kayenta, Wingate, Moenave Frms)
- K1 - Dakota, Cedar Mountain, Kelvin and other Fms
- P - Morgan, Round Valley, Honaker Trail, Paradox, Ely and other Fms
- P1 - Cedar Mesa, Diamond Creek, Arcturus and other Fms
- PP - Oquirrh Group, Wells, Weber Ely, Callvill and other Fms
- QT - High-level alluvial deposits
- Qa - Surficial alluvium and colluvium
- Qao - Surficial older alluvium and colluvium
- Qe - Surfcial eolian deposits
- Ti - Intrusive Rock
- Tr1 - Moenkopi, Dinwoody, Woodside, Thaynes and other Frms
- Tr2 - Chinle, Ankareh Frms

AZ Unit

- JTRgc - Glen Canyon Group
- Jm - Morrison Formation
- Jsr - San Rafael Group
- Ti - Dikes, Silles and Plugs

0 0.5 1 2 3 4 Miles

N W E S

MAP 8 Geology

Red Mesa Chapter Community-Based Land Use Plan - November 2016

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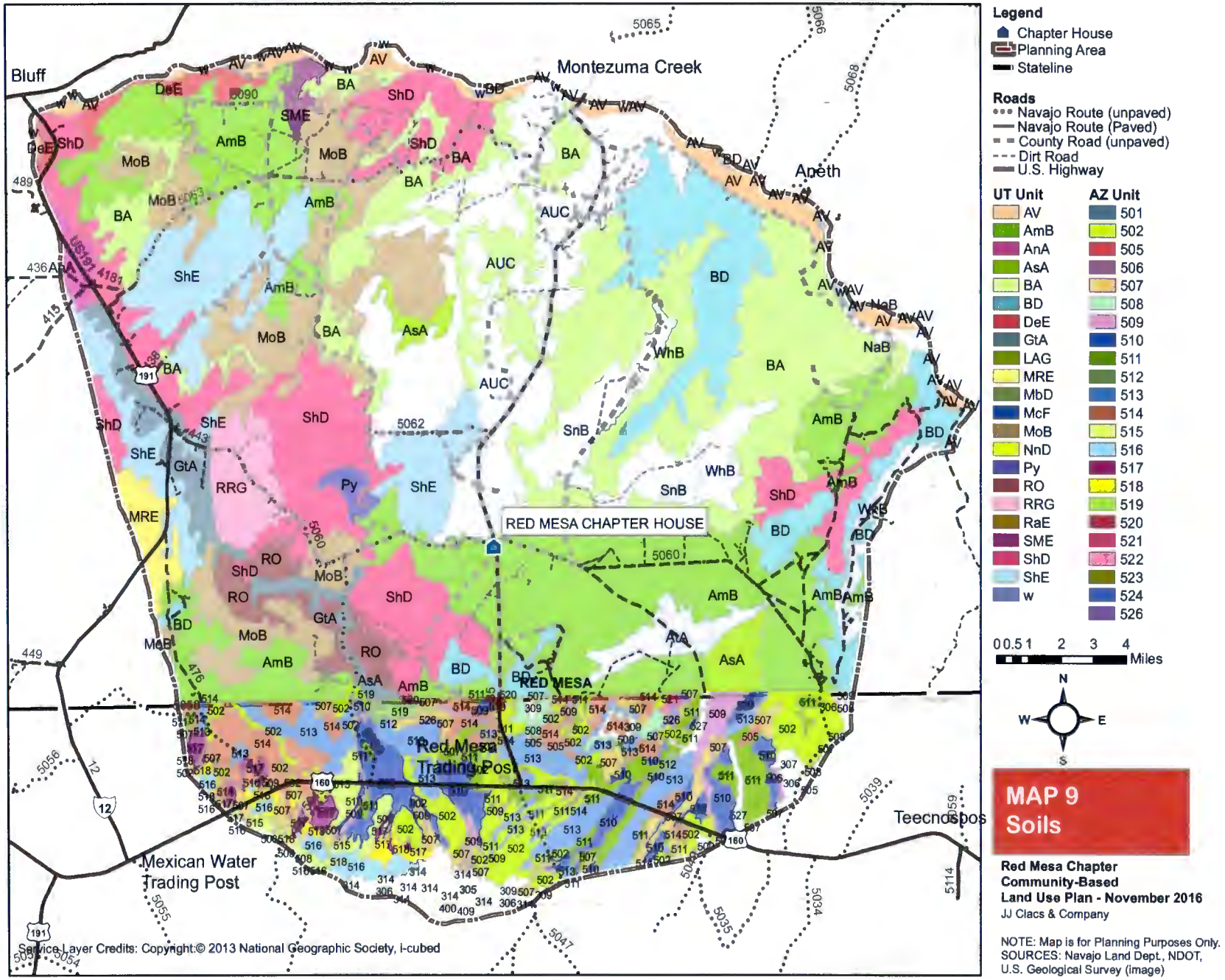
Bluff
Montezuma Creek
Aneth
RED MESA CHAPTER HOUSE
RED MESA
Red Mesa Trading Post
Mexican Water Trading Post
Teecnospos
Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed
Legend
Chapter House
Planning Area
Stateline
Roads
Navajo Route (unpaved)
Navajo Route (Paved)
County Road (unpaved)
Dirt Road
U.S. Highway
UT Unit
AV
AmB
AnA
AsA
BA
BD
DeE
GtA
LAG
MRE
MbD
McF
MoB
NnD
Py
RO
RRG
RaE
SME
ShD
ShE
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AZ Unit
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523
524
526
0 0.5 1 2 3 4 Miles
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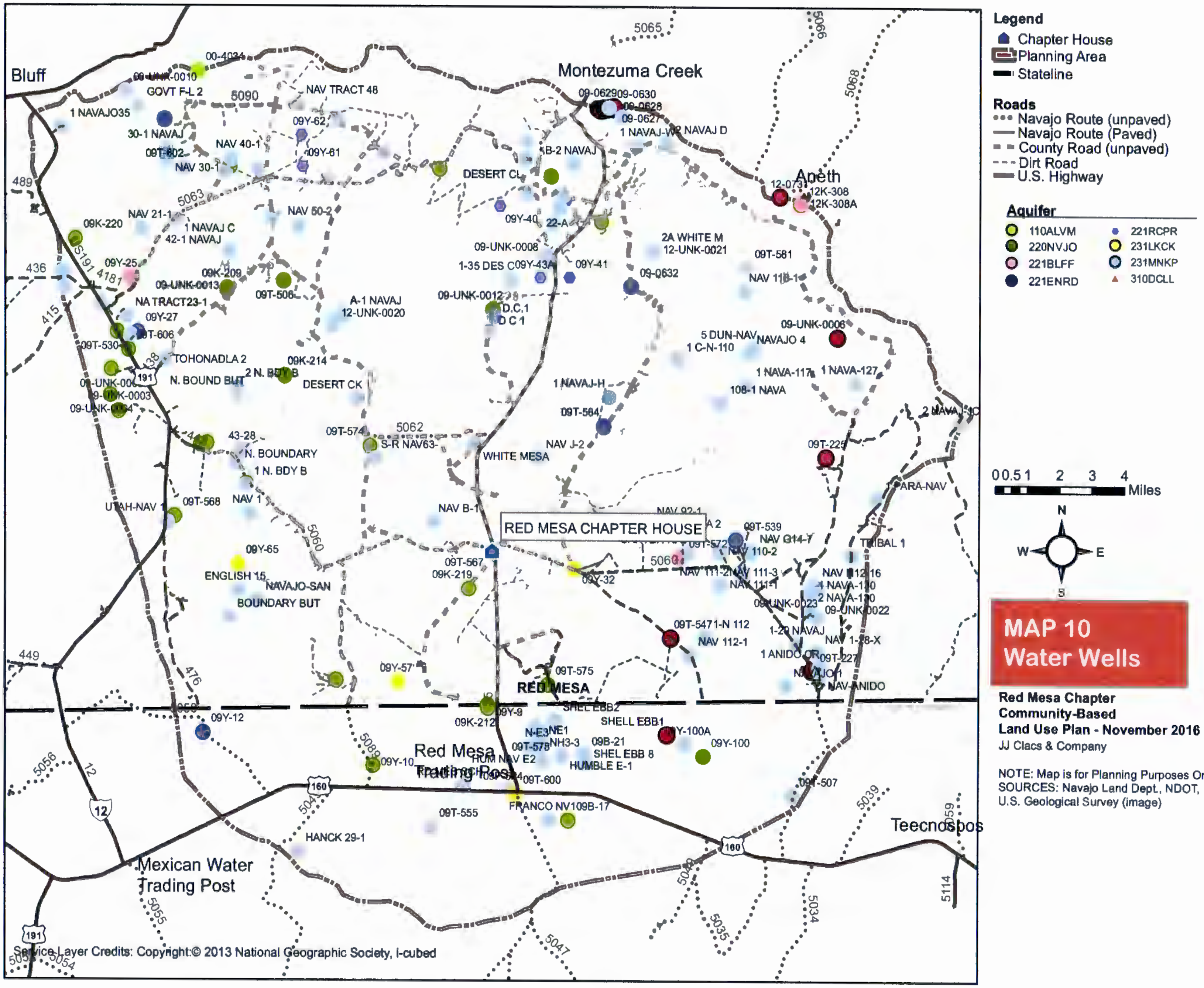
E
S
MAP 9
Soils
Red Mesa Chapter
Community-Based
Land Use Plan - November 2016
JJ Clacs & Company
NOTE: Map is for Planning Purposes Only.
SOURCES: Navajo Land Dept., NDOT,
U.S. Geological Survey (image)



MAP 10
Water Wells

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016
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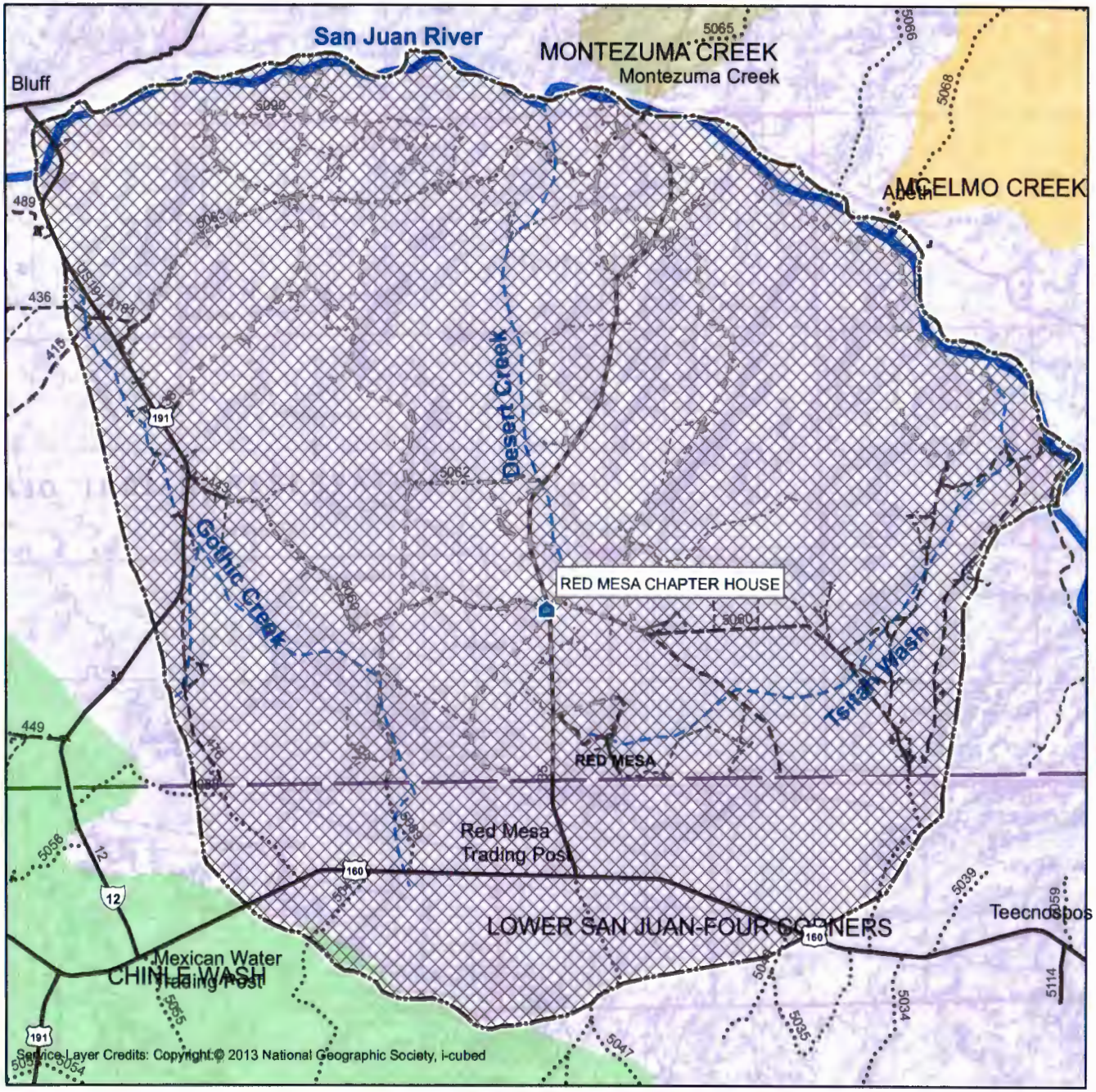


Legend

- 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

0 0.5 1 2 3 4 Miles

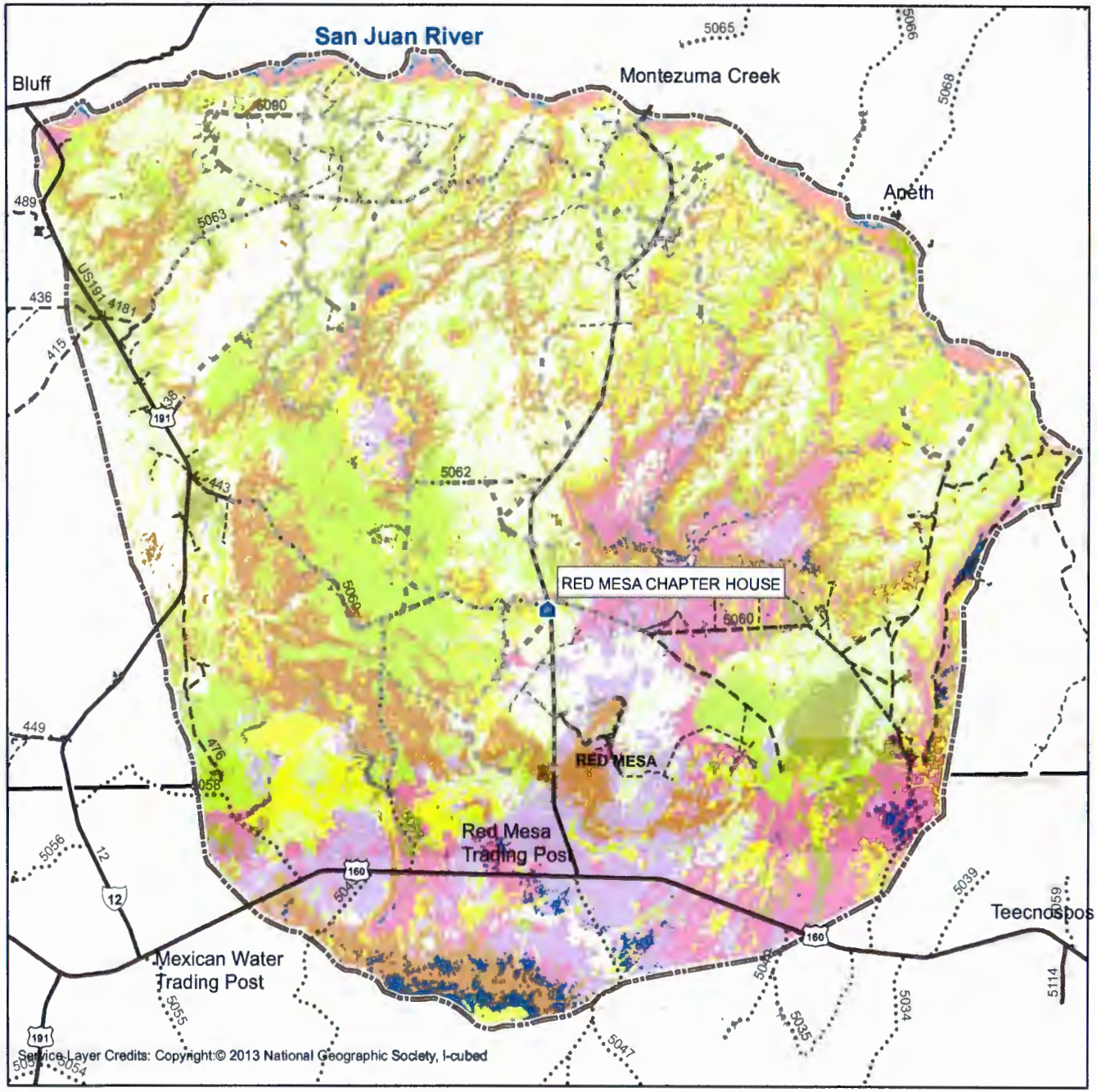
N W E S

MAP 11
Surface Water

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

JJ Clacs & Company

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



Legend

- Chapter House
- Planning Area
- Stateline

Roads

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

Vegetation

- D04
- D08
- N11
- N31
- S010
- S011
- S012
- S014
- S039
- S045
- S052
- S054
- S059
- S065
- S079
- S090
- S093
- S096
- S136

0 0.5 1 2 3 4 Miles

N W E S

MAP 12 Vegetation

Red Mesa Chapter Community-Based Land Use Plan - November 2016

JJ Clacs & Company

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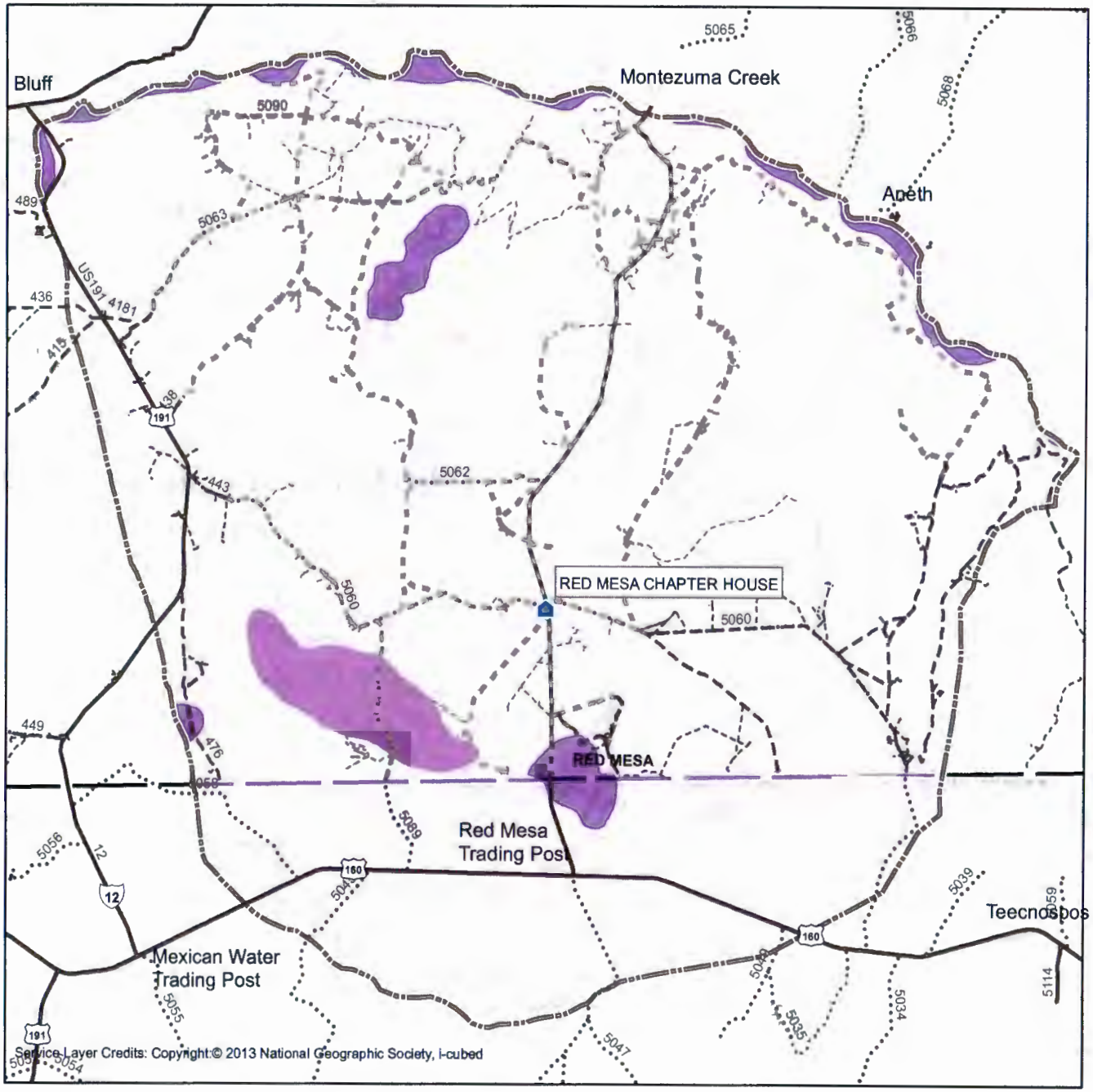
SOURCES: Navajo Land Dept., NDOT, U.S. Geological Survey (image)



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

0 0.5 1 2 3 4 Miles

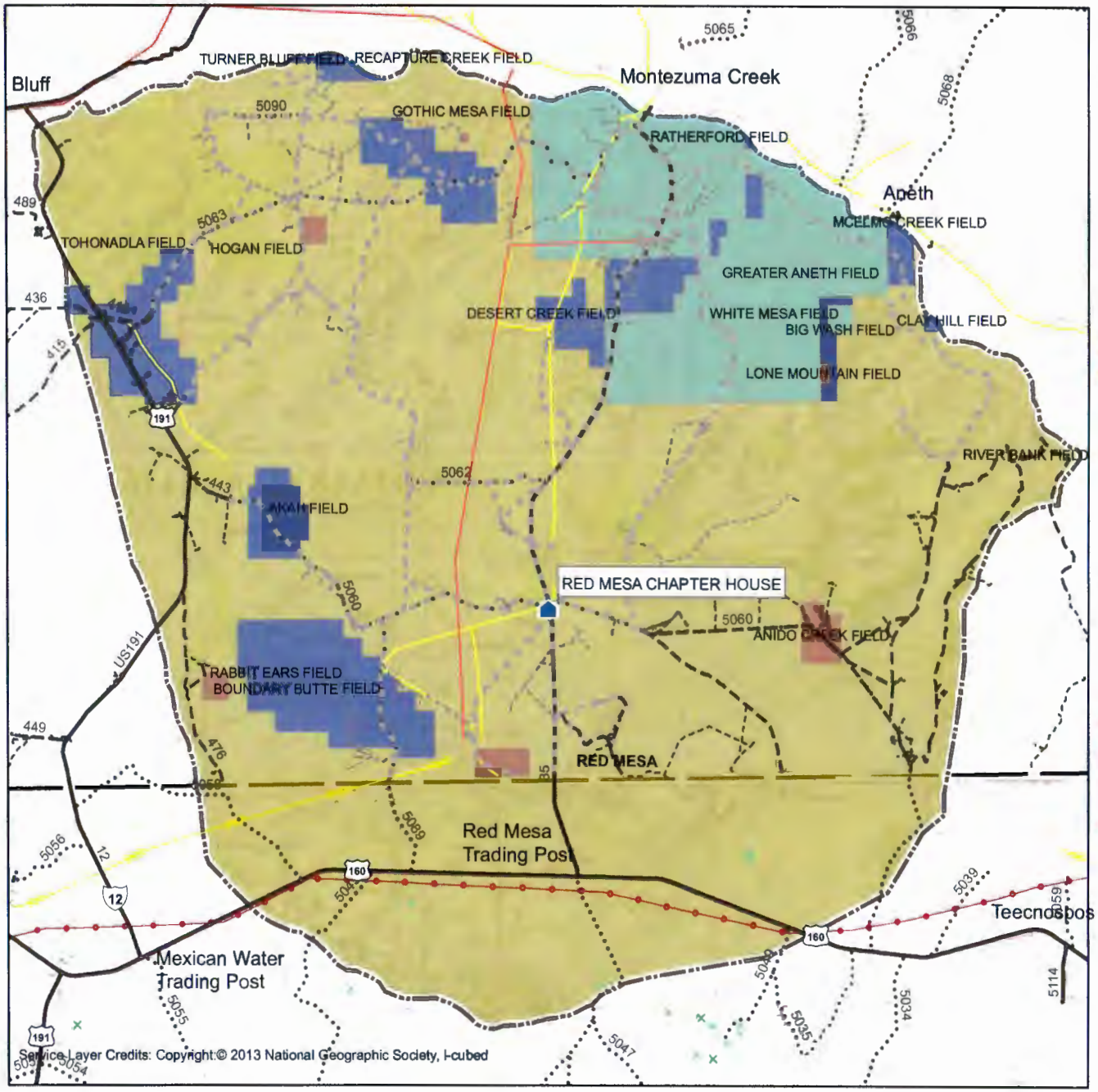
N W E S

MAP 13 Environmentally Sensitive Zones

Red Mesa Chapter Community-Based Land Use Plan - November 2016

JJ Clacs & Company

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



Legend

- Chapter House
- Planning Area
- Stateline

Roads

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

Transmission and Pipelines

- Electrical Lines
- Oil Gas Piplines

STATUS OF OIL AND GAS FIELDS

- ABANDONED
- ACTIVE
- COMBINED

- Mines

0 0.5 1 2 3 4 Miles

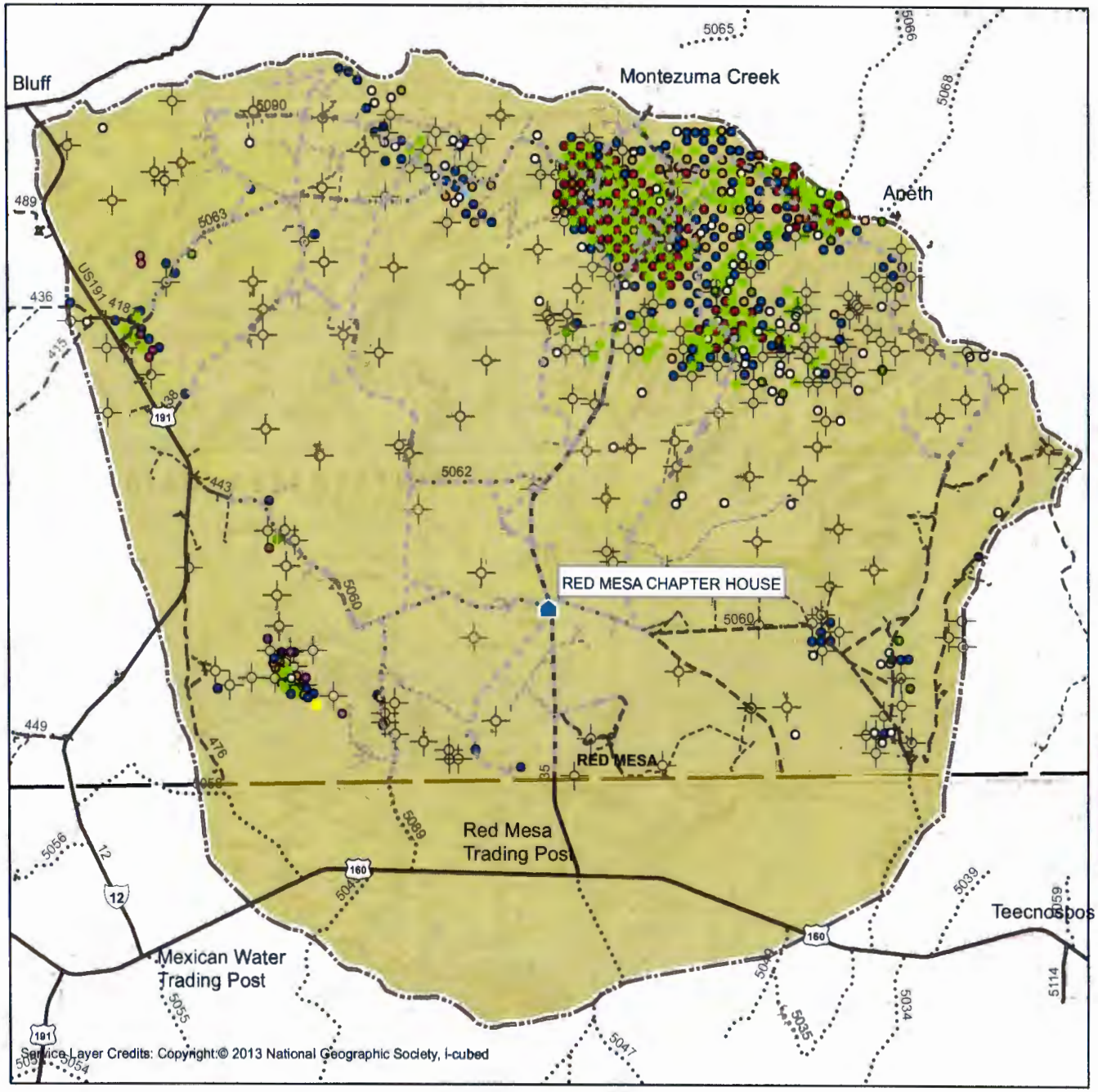
N W E S

MAP 14
Energy & Minerals

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

JJ Clacs & Company

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



Legend

- Chapter House
- Planning Area
- Stateline

Roads

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

Oil and Gas Wells

- Active, Water Dis
- Active, Water Inj
- Approved, Oil Well
- Inactive, Water Inj
- Location, Oil Well
- Plugged a, Dry Hole
- Plugged a, Gas Well
- Plugged a, Oil Well
- Plugged a, Unknown
- Plugged a, Water Dis
- Plugged a, Water Inj
- Plugged a, Water Sou
- Producing, Gas Well
- Producing, Oil Well
- Shut-In, Gas Well
- Shut-In, Oil Well

0 0.5 1 2 3 4 Miles

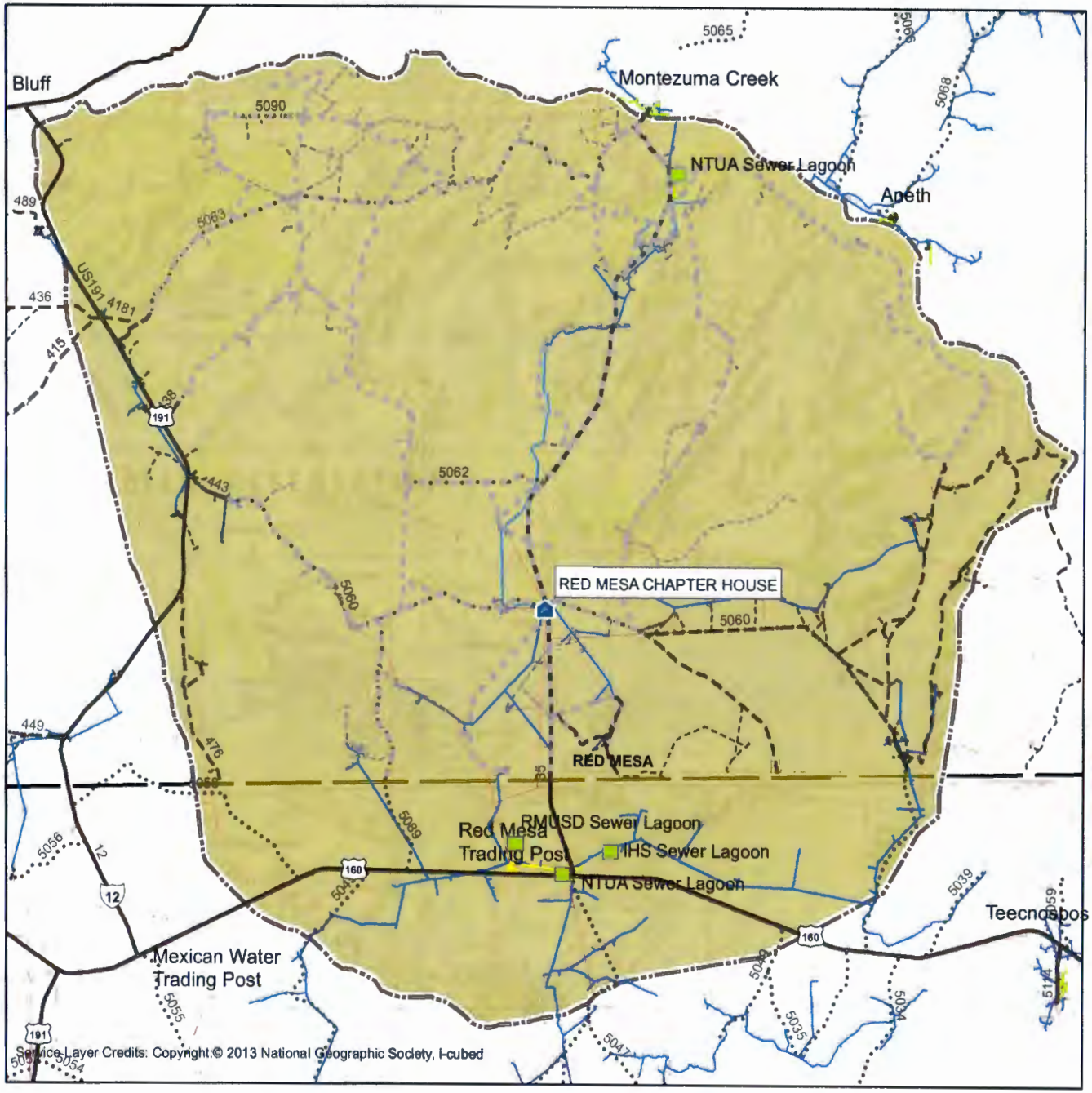
N W E S

MAP 15
Oil & Gas Wells

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

JJ Clacs & Company

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



Legend

- Chapter House
- Planning Area
- Stateline

Roads

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

Utilities

- Electric
- Water
- Natural Gas
- Sewer Lagoon

0 0.5 1 2 3 4 Miles

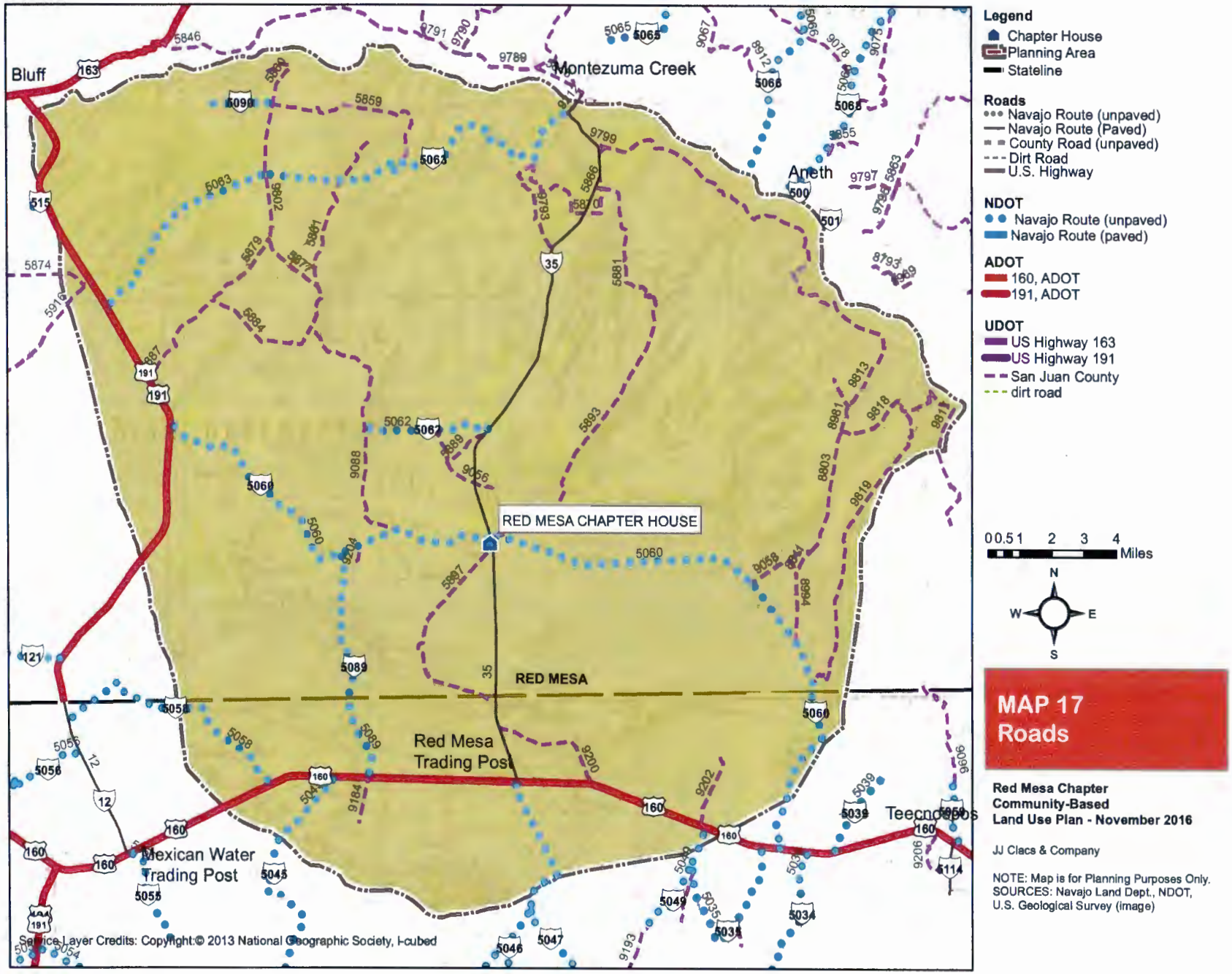
N W E S

MAP 16
Utilities

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

JJ Clacs & Company

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

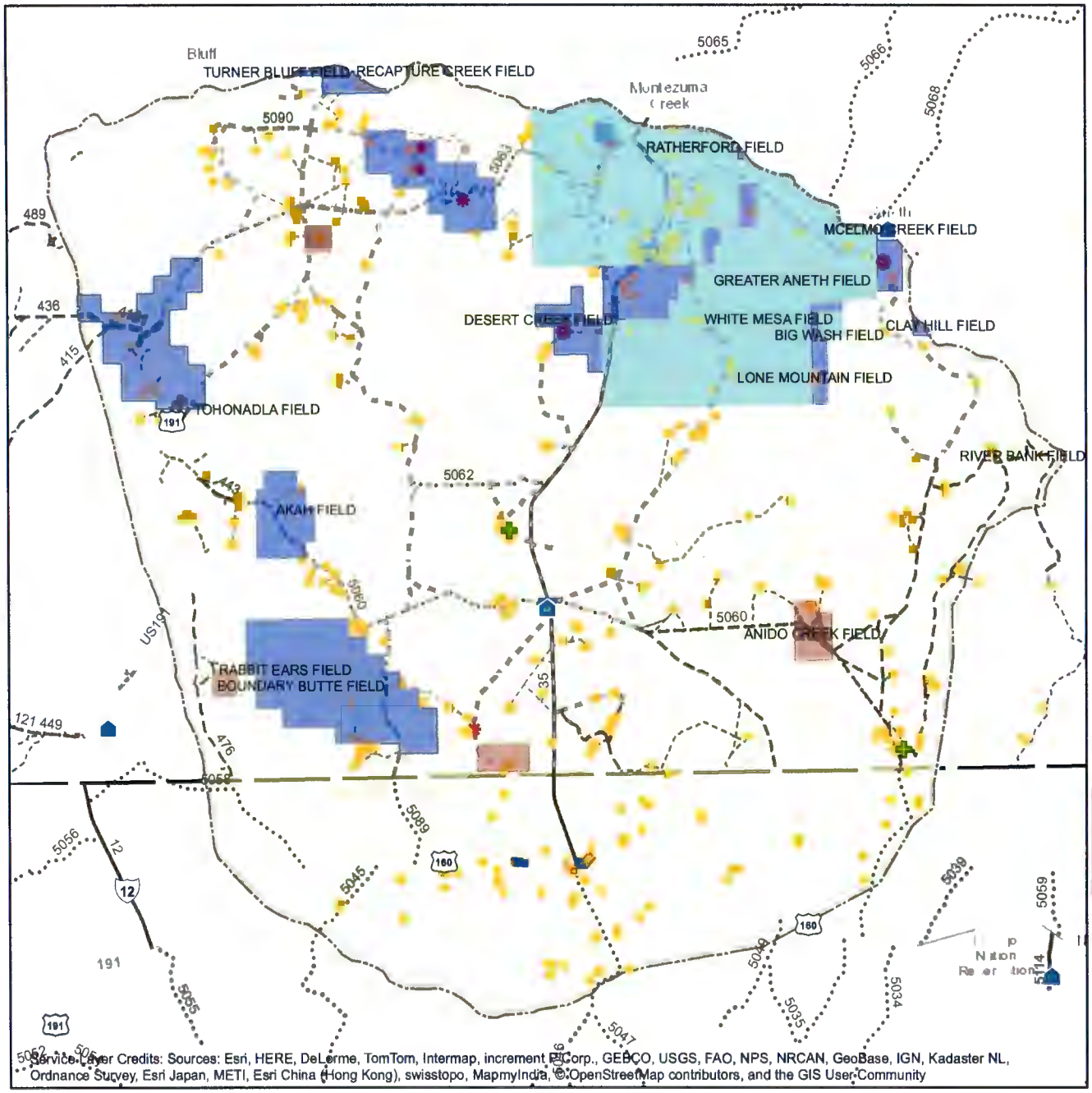


MAP 17
Roads

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

JJ Clacs & Company

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



Legend

Planning Area
Stateline

Roads

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

Residential Land Use

Residential

Community Facilities Land Use

Chapter House
Community Center
Health Clinic
School
Church

Commerical Land Use

Trading Post

Industrial Land Use

Oil and Gas Lease
Abandoned/Reclaimed Mines
Hazmat Site

Agricultural Land Use

Open Range / Open Grazing

0 0.5 1 2 3 4 Miles

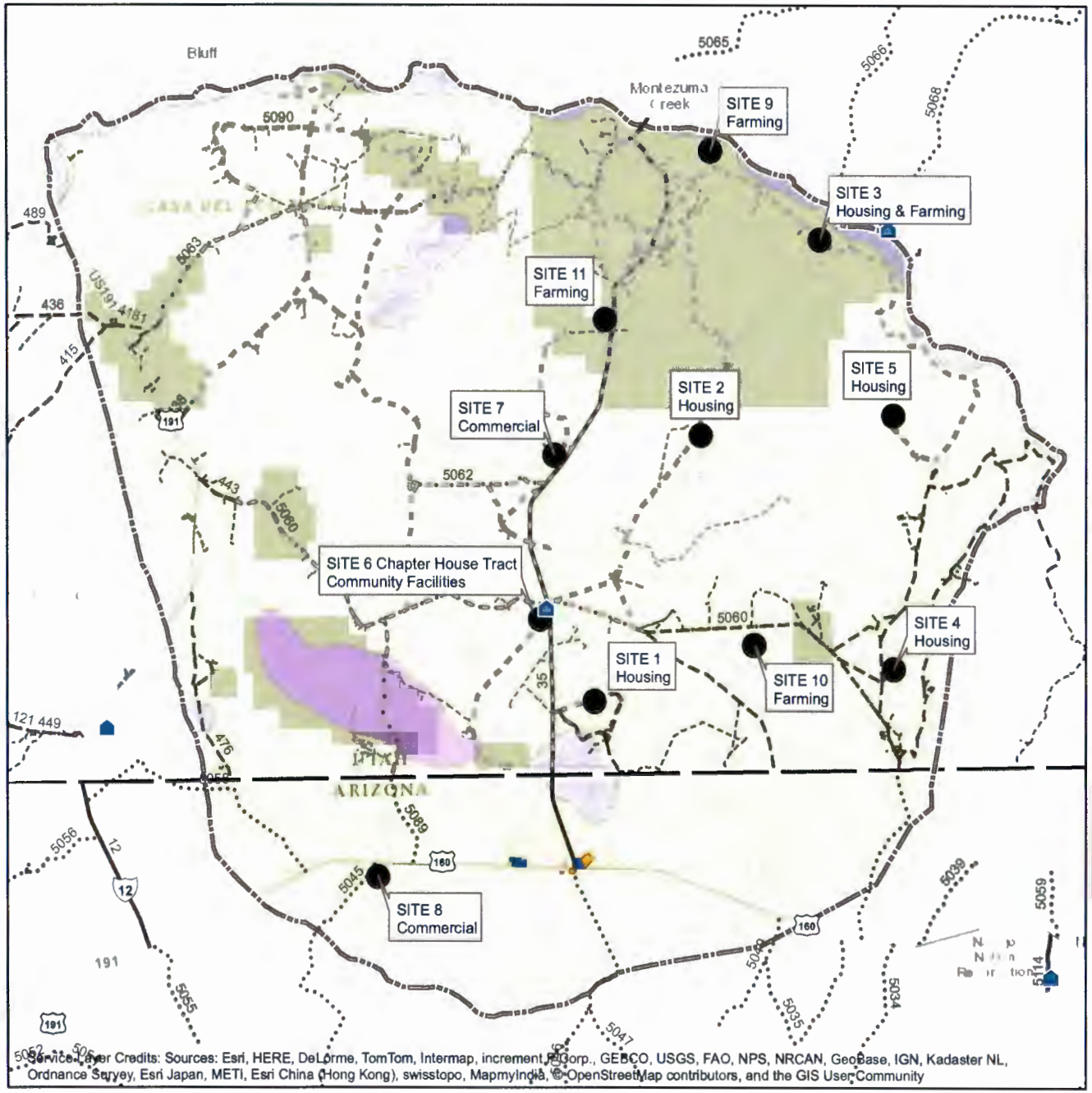
N W E S

MAP 18 Existing Land Uses

Red Mesa Chapter Community-Based Land Use Plan - November 2016

JJ Clacs & Company

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



Legend

Planning Area
Stateline

Roads

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

Residential Land Use

Residential

Community Facilities Land Use

Chapter House
Community Center
Health Clinic
School
Church

Commerical Land Use

Trading Post

Industrial Land Use

Oil and Gas Lease
Abandoned/Reclaimed Mines
Hazmat Site

Agricultural Land Use

Open Range / Open Grazing

0 0.5 1 2 3 4 Miles

N W E S

MAP 19 Future Land Uses

Red Mesa Chapter Community-Based Land Use Plan - November 2016

JJ Clacs & Company

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

Legend

Roads
- County Road (unpaved)
- Dirt Road

Utilities
- Electric
- Water

Existing Land_Use
- Residential

Proposed Land Use
- Residential

0 75150 300 450 600 Feet

N W E S

MAP 20
Yaa dez' ahi Development

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

JJ Clacs & Company

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

Legend

Roads
- County Road (unpaved)
- Dirt Road

Utilities
- Electric
- Water

Existing Land_Use
- Residential

Proposed Land Use
- Residential

0 75150 300 450 600
Feet

N
W E
S

MAP 21
Des Tsini Development

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

JJ Clacs & Company

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

Legend

Roads
- County Road (unpaved)
- Dirt Road

Utilities
- Electric
- Water

Existing Land_Use
- Residential
- Farming

Proposed Land Use
- Residential
- Farming

0 125 250 500 750 1,000 Feet

N
W E
S

MAP 22
Tall Mountain Development

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

JJ Clacs & Company

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

Legend

Roads
County Road (unpaved)
Dirt Road

Utilities
Water

Existing Land_Use
Residential

Proposed Land Use
Residential

0 75150 300 450 600
Feet

N
W E
S

MAP 23
Big Ben 1 Development

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

JJ Clacs & Company

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

Legend

Roads
County Road (unpaved)
Dirt Road

Utilities
Water

Existing Land_Use
Residential

Proposed Land Use
Residential

0 75150 300 450 600
Feet

N
W E
S

MAP 24
Big Ben 2 Development

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

JJ Clacs & Company

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

Legend

Roads
- County Road (unpaved)
- Dirt Road

Utilities
- Electric
- Water

Existing Land_Use
- Residential
- Community Facilities

Proposed Land Use
- Community Facilities

Oil Gas Piplines

0 75150 300 450 600
Feet

N
W E
S

MAP 25
Chapter House Development

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

JJ Clacs & Company

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

Legend

Roads
- County Road (unpaved)
- Dirt Road

Utilities
- Electric
- Water

Existing Land_Use
- Residential

Proposed Land Use
- Commercial

- Oil Gas Piplines

0 75150 300 450 600
Feet

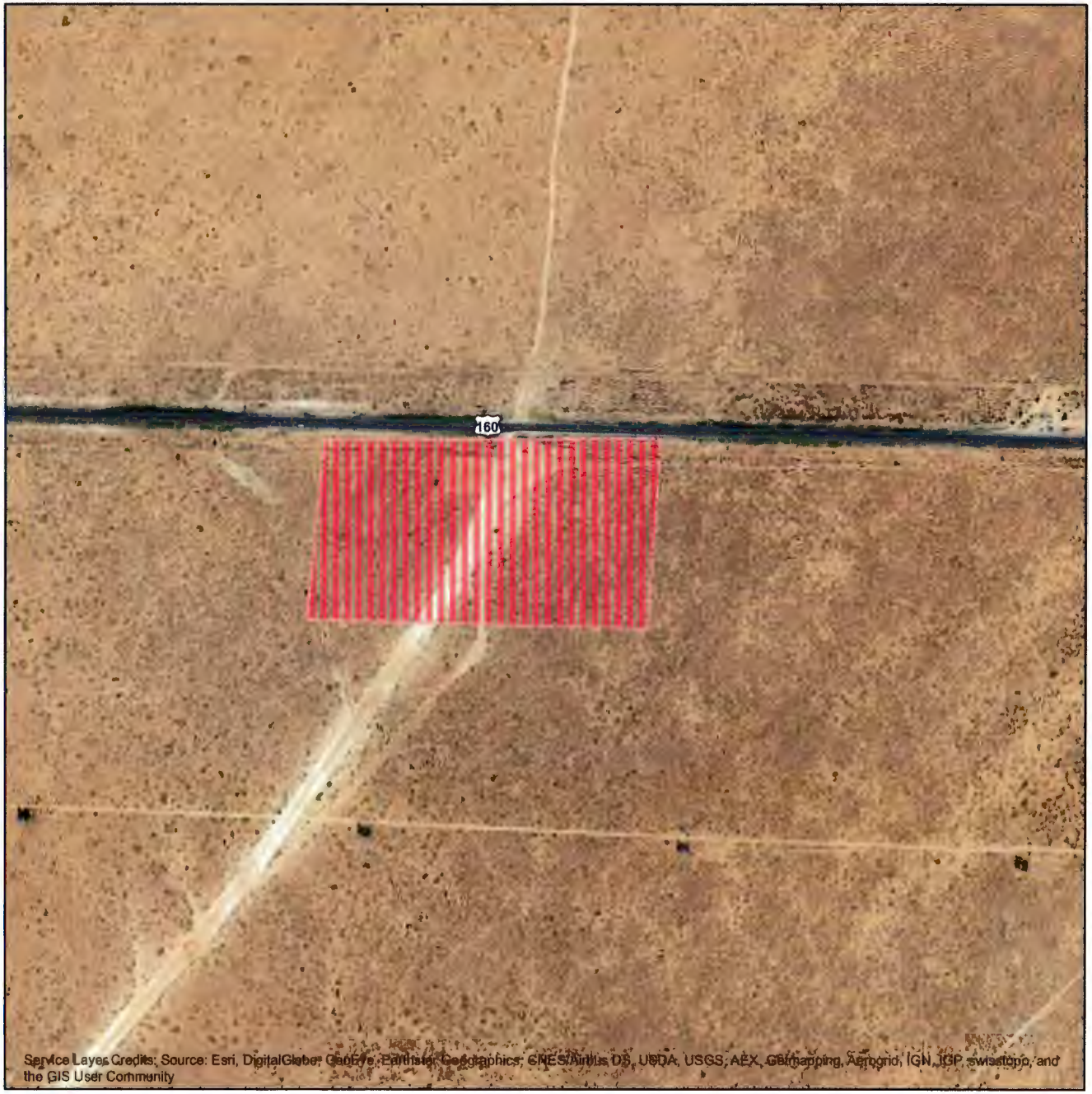
N
W E
S

MAP 26
White Mesa Marketplace

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

JJ Clacs & Company

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



Legend

Roads

Highway 160

Proposed Land Use

Commercial

0 75150 300 450 600

Feet

N

W E

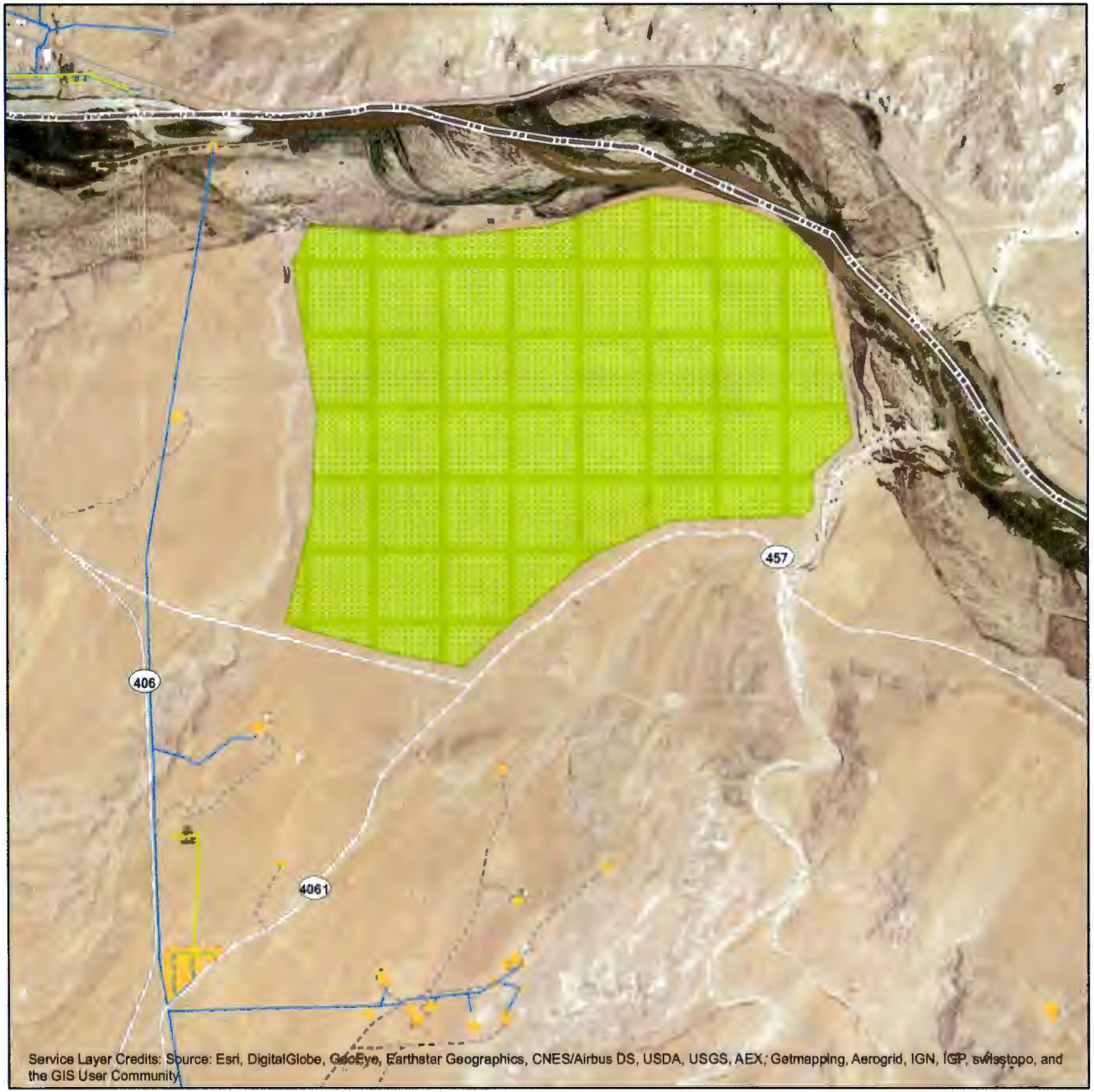
S

MAP 27
Tseta' Development

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

JJ Clacs & Company

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



Legend

Roads
County Road (unpaved)
Dirt Road

Utilities
Water

Existing Land_Use
Residential

Proposed Land Use
Farming

0 375750 1,500 2,250 3,000
Feet

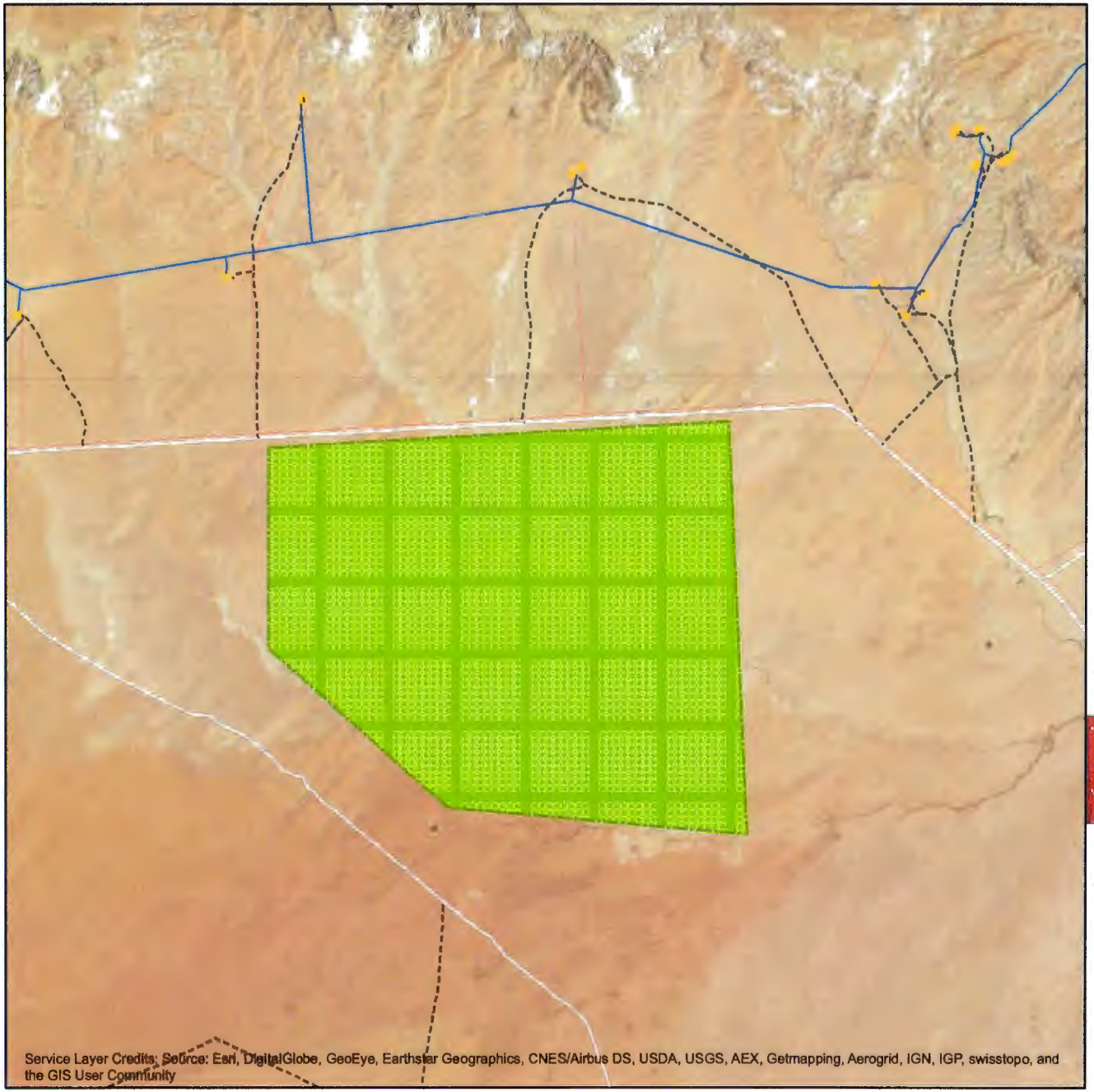
N
W E
S

MAP 28
San Juan River Farm

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

JJ Clacs & Company

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



Legend

Roads
- County Road (unpaved)
- Dirt Road

Utilities
- Electric
- Water

Existing Land_Use
- Residential

Proposed Land Use
- Farming

0 500 1,000 2,000 3,000 4,000 Feet

N
W E
S

MAP 29
White Mesa Farm

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

JJ Clacs & Company

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

Legend

Roads
- County Road (unpaved)
- Dirt Road

Utilities
- Water

Existing Land_Use
- Residential

Proposed Land Use
- Farming

0 75150 300 450 600 Feet

N
W E
S

MAP 30
Red Mesa Farm

Red Mesa Chapter
Community-Based
Land Use Plan - November 2016

JJ Clacs & Company

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

Appendix A Land Use Planning Resolutions

RED MESA CHAPTER
Red Mesa, Navajo Nation, Utah

Resolution # RM-003-01-14-08

Approving the Name Change from the Red Mesa Community Land Use Planning Committee to the Red Mesa Land Commissioners and Approving the Revised Plan of Operation

WHEREAS:

1. Pursuant to Resolution No. CAP-34-98, the Navajo Nation Council adopted the Navajo Nation Code (N.N.C.): Title 26 codified Navajo Nation Local Governance Act (LGA); and
2. Pursuant to 26 N.N.C., Section 1, (B), (1), (2) and Section 103, (B), the Red Mesa Chapter is recognized as a local government entity and delegated certain authorities and responsibilities with respect to local matters consistent with Navajo Nation laws; and
3. Pursuant to 2 N.N.C., Section 4028 (a), the Red Mesa Chapter has the authority to review all matters affecting the community and make appropriate recommendations to the Navajo Nation, County and State government agencies; and
4. Pursuant to 26 N.N.C., Section 2004, (C), (1), the Red Mesa Chapter established the Red Mesa Chapter Community Land Use Planning Committee and Plan of Operation at a duly called chapter meeting by passing a resolution on April 14, 2003; and
5. The Red Mesa Chapter Community Land Use Planning Committee with the assistance of the Shiprock Local Governance Office reviewed and revised its Plan of Operation to more accurately reflect its purpose, roles and responsibilities; and
6. The Red Mesa Chapter Community Land Use Planning Committee changed its name to the Red Mesa Land Commissioners and adopted a new plan of operation on December 17, 2007 (Exhibit A);

NOW THEREFORE BE IT RESOLVED THAT:

1. The Red Mesa Chapter supports and approves the name change from the Red Mesa Chapter Community Land Use Planning Committee to the Red Mesa Land Commissioners.
2. The Red Mesa Chapter Official and community membership strongly support this resolution to implement with the best interest in serving our community area.

CERTIFICATION

We hereby certify that this foregoing resolution was duly considered by the Red Mesa Chapter membership at a duly called meeting at which a legal quorum was present and was motioned by **Harrison Nakai**. Seconded by **Louis Patterson** and that it was passed by a vote of 35 in favor, 0 opposed and 0 abstention this 14th day of January 2008.

Russell Gould, President

Victor Dee, Vice-President

Luci Begay, Secretary/Treasurer

Council Delegate

RED MESA CHAPTER
Red Mesa, Navajo Nation, Utah

Resolution RM -002-07-07-08

Supporting and Approving resolution for Ratification of new appointed Red Mesa Land Commissioners

WHEREAS:

1. Pursuant to Resolution No. CAP-34-98, the Navajo Nation Council adopted the Navajo Nation Code (N.N.C.): Title 26 codified Navajo Nation Local Governance Act (LGA); and
2. Pursuant to 26 N.N.C., Section 1, (B), (1), (2) and Section 103, (B), the Red Mesa Chapter is recognized as a local government entity and delegated certain authorities and responsibilities with respect to local matters consistent with Navajo Nation laws; and
3. Pursuant to 2 N.N.C., Section 4028 (a), the Red Mesa Chapter has the authority to review all matters affecting the community and make appropriate recommendations to the Navajo Nation, County and State government agencies; and
4. Pursuant to 26 N.N.C., Section 2004, (C), (1), the Red Mesa Chapter established the Red Mesa Chapter Community Land Use Planning Committee and Plan of Operation at a duly called chapter meeting by passing a resolution on April 14, 2003; and
5. The Red Mesa Chapter Community Land Use Planning Committee changed its name to the Red Mesa Land Commissioners and adopted a new plan of operation on December 17, 2007 (Exhibit A);
6. Pursuant to 26 N.N.C., Section 1001, (B), (1), (d), the Red Mesa Chapter President recommends correction and ratification of the appointment of the presiding Land Commissioners.

NOW THEREFORE BE IT RESOLVED THAT:

1. The Red Mesa Chapter approves the correction and ratification of the appointment of the presiding Land Commissioners to serve in the best interest of the community.
2. The appointees are:

   Kenneth Joe
   Lloyd Toney
   Marilyn S. Holly
   Charley Lee Begay
   Tully Lameman

CERTIFICATION

We hereby certify that this foregoing resolution was duly considered by the Red Mesa Chapter membership at a duly called meeting at which a legal quorum was present and was motioned by **Kenneth Maryboy**, Seconded by **Louis Patterson** and that it was passed by a vote of 37 in favor, 0 opposed and 0 abstention this 07th day of July 2008.

Russell Gould, President

Victor Dee, Vice-President

Luci Begay, Secretary/Treasurer

Council Delegate

PLAN OF OPERATION
RED MESA CHAPTER LAND COMMISSIONERS

ARTICLE 1. PURPOSE OF THE LAND COMMISSIONERS

Red Mesa Chapter Community Based Land Use Plan was revised and adopted by the Chapter on July 7, 2008.The Chapter Officials and Community Based Land Use planning Committee changed the committee's name to Red Mesa Land Commissioners and expanded it's duties and responsibilities to exercise authority of LGA section 103 to develop Chapter ordinances, develop ordinances, develop rural addressing, utilize eminent domain, plan for infrastructure, housing, community facilities, thoroughfare plan, open space plan and conduct public hearings for all future land use plans or make amendments to land use plan every five(5) years, due to changing circumstances. The Commissioners are to develop master land use plans that will eventually integrate into comprehensive land use plan and manage community growth patterns in the best interest of safety, health and general welfare of community residents.

ARTICLE 2. PUBLIC PARTICIPATION/PUBLIC HEARINGS

Red Mesa Chapter Land Commissioners shall ensure public participation through community public hearings to allow equal opportunity to all community members to review, discuss and approve all land withdrawals for any proposed plan such as development of community facilities, infrastructure, and major thoroughfare plan, open space, housing and recreational development in the community. All zoning ordinances and chapter ordinances shall be developed according to the Local Governance Act mandated by the Navajo Nation Council. The Commissioners shall be responsible to provide public notice on all public hearings of time, location and date of the public hearings by verbal announcement at the Chapter meetings, advertisement in local newspaper, local radio station in the Navajo and English language. The Commissioners shall record all statements, written or oral testimonies from public hearings, collect signatures by registration, and provide adequate information through written documents, maps and visual presentation on any proposed project. The Chapter Administration may provide assistance in carrying out these assignments.

ARTICLE 3. GENERAL DUTIES AND RESPONSIBILITIES

The general duties and responsibilities of the Commissioners is to provide community assessment every five(5) years, or as needed to identify the needs of the community for planning purposes and provide long and short range goals for community improvements, establish capital improvement plans for community facilities, and implement land use plan for the community. The commissioners will communicate and coordinate with Indian Health Service, Bureau of Indian Affairs, Navajo Housing Authority, Navajo Tribal Utility Authority, Counties and State Governmental agencies. (See attached exhibits). The primary responsibility is to meet, assist and plan with the Chapter officials and administration staff to implement land management practices, plan for the general welfare of community growth, comply with environmental laws, and the overall economic development to secure employment

Section 9. Technical Assistance

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

Section 10. Ethics

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

Section 11. Amendments

The CLUPC Plan of Operation may be amended from time to time, as needed. By the Red Mesa Chapter membership.

Community Land Use Planning Committee
Plan of Operation

Section 1. Establishment

There is hereby established the Red Mesa 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, and, after thorough review and analysis, present a community land use plan to the Red Mesa Chapter membership for consideration.

Section 3. Committee Duties and Responsibilities

The CLUPC shall exercise the following duties and responsibilities consistent with the Navajo Nation Local Governance Act, 26 N.N.C. Section 2004

A. Educate the community on the concepts, needs, and process for planning 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 N.N.C. 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 approve a public participation plan.
D. Shall work closely with the membership and, if applicable, the designated planner as planning progresses.
E. Upon approval of the community land use plan by the Chapter membership and by the Transportation and Community Development Committee, the CLUPC shall develop recommendations for the implementation of the land use plan.

Section 4. Committee Selection; Membership

A. The selection of members to the CLUPC 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 in a certified written resolution.
B. The members of the CLUPC shall be compromised of (five) 05 voting members of the Chapter that have expertise to provide valuable contributions

Continue resolution-**SUPPORTING THE NAHASDA LAND USE PLANNING PROJECT AND APPROVING THE ESTABLISHMENT OF THE RED MESA CHAPTER COMMUNITY LAND USE PLANNING COMMITTEE AND PLAN OF OPERATION.**

CERTIFICATION

We hereby certify the foregoing Chapter Resolution was duly considered by the Red Mesa Chapter membership at a duly called meeting at Red Mesa, Navajo Nation, Utah at which a quorum was present and the same was passed by the vote 57 in favor, 0 opposed and 0 abstained on this 14th day of April, 2003.

Russell Gould, President
Red Mesa Chapter

Victor Dee, Vice President
Red Mesa Chapter

Luci Begay, Secretary/Treasure
Red Mesa Chapter

Mark Maryboy, Council Delegate
Red Mesa Chapter

Kenneth Maryboy, Council Delegate

Chapter File

RED MESA CHAPTER
Red Mesa, Navajo Nation, Utah

RESOLUTION

SUPPORTING THE NAHASDA LAND USE PLANNING PROJECT AND APPROVING THE ESTABLISHMENT OF THE RED MESA CHAPTER COMMUNITY LAND USE PLANNING COMMITTEE AND PLAN OF OPERATION.

WHEREAS:

1. Pursuant to 26 N.T.C., Section 1, (B), (1), (2) and Section 103, (B), the Red Mesa Chapter is recognized as a local government entity and delegated certain authorities and responsibilities with respect to local matters consistent with Navajo Nation Laws; and
2. Pursuant to 2 N.T.C. Section 4028 (a), the Red Mesa Chapter has the authority to review all matters affecting the community and make appropriate recommendations to the Navajo Nation, County and State government agencies: and
3. Consistent with the LGA, and 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 areas, the Red Mesa Chapter determines that, in the best interest of the community, 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 Red Mesa Chapter supports the NAHASDA Land Use Planning Project and hereby approves the establishment of the Red Mesa Chapter Community Land Use Planning Committee. The Red Mesa Chapter further hereby selects the following individuals to serve on the CLUPC. The list is attached herein as Exhibit "A".
2. The Red Mesa Chapter further hereby approves the Community Land Use Planning Committee Plan of Operation attached hereto as Exhibit "B".

P.O Box 422, Montezuma Creek, Utah. 84534 * Phone: (928) 656-3655 * Fax: (928) 656-3658

compensated for temporary assignment. Under incidental circumstances, when the appointment has been made and confirmed by a vote, the pro temp shall preside the rest of the meeting and regular member may attend the remainder of the meeting, but not compensated for the meeting.

ARTICLE 10. HIRING OF CONSULTANTS

The Commissioners may recommend the hiring of consultants for any project that is related to land use planning, study or architectural design of community facilities, roads, housing and needed infrastructure for preliminary planning purpose and engineering cost estimates. Technical services for Arc View, GIS, or mapping, hydrology study for community facilities, Communications lines, plat analysis, sewer lagoons, road designs parks, commercial, industrial, large residential plots or economic feasibility study may be contracted. Tribal procurement and purchases shall be used to contract any service agreement.

ARTICLE 11. SPECIALIZED TRAINING COURSES

The Commissioners may meet with the Community Service Coordinator to identify funds to set-aside specifically for training purposes. The Commissioners may appoint one or two members to attend conferences to obtain and secure information that will be useful for land use planning and other tools needed to make quality decision on community planning. All training and conference associate with planning principles may be scheduled for all members, based on available funds. The Commissioners shall contact, and coordinate with Land Administration, Office of Business Regulatory, Regional Business Development Office with Economic Development, Design/Engineering Department, Navajo Housing Authority, Navajo Tribal Utility Authority, and Community Development for information related to community development.

ARTICLE 12. TAXATION REVENUES & COLLECTION WITHIN RED MESA CHAPTER JURISDICTION

The Chapter Administration, upon certification shall meet with the Tax Commissioner to determine what role and jurisdiction the Community Service Coordinator and Red Mesa Land Commissioners are allowed to empowered with. The issue of Chapter boundary may be resolved among land owners, Commissioner and Officials for discussion and negotiation with legal advisors and traditional settings in local communities.

ARTICLE 13. AMENDMENTS

Red Mesa Land Commissioners may make amendments every five (5) years or as needed through county assessments, conduct Public hearings and secure approval from chapter membership on this plan of operation and community based land use plan. On an annual basis, the Grazing Officer shall submit the tally count of livestock, and number of home site leases, information of business site leases to the Commissioners, to utilize for future planning activities.

provide equal opportunity to all community members to serve and understand the role of land Commissioners and to ensure that equal representation is complied with. This process shall provide public education of land issues, tribal laws, sociology, and different components of planning principles to community member and representatives. Three members shall be appointed for three(3) years and two members shall be appointed for two(2) years. Thereafter members shall be appointed for three(3) years. The Commissioners shall be appointed from five different geographical areas within the community boundary to obtain equal representation on the standing committee. If a vacancy occurs, from that particular area, another community member shall be appointed from that area.

ARTICLE 7. QUORUM

The Commissioners shall consist of five(5) members and three(3) will constitute a quorum to start and conduct an official meeting, unless the Commissioners and Chapter Officials make the necessary amendments and the Community Service Coordinator identifies funds to cover additional members. The grazing official shall be a mandatory member, due to his job and responsibility to cover land disputes, and dealing with home site leases and his knowledge of the Chapter's history of land use.

ARTICLE 8. REMOVAL OF COMMISSIONERS

The removal of an appointed member shall be official, when the chair of the Commissioners signs a resolution stating the reason listed below. The resolution shall be presented to the Chapter President to declare a vacancy for the position and request letters of interest. The President shall appoint and submit his or her recommendations to the Chapter membership for confirmation within a reasonable time. The Chapter President shall review the letters of interest and make his or her determination on his or her choice, based on background information associated with planning and experienced leadership in the community.

a.) Excessive absences (or) missing two(2) meetings.

b.) Neglect of duties and responsibilities and creating discord among members.

c.) By voluntary resignation.

d.) Expiration of a term.

e.) Excessive indulgence in alcohol beverages (or) drugs.

f.) Felony conviction by the tribal, state and federal courts.

ARTICLE 9. OFFICERS

Commissioners shall appoint the Chairman, Vice Chairman, and Secretary by nomination procedures. Any time, the Chairman is absent, late, or on leave, the Vice Chairman will take over the duties and responsibilities. Pro temp appointment may be done to conduct a meeting. Pro temp shall be

and services in the community. Ensure that all developments in the community are organized and designed in such fashion for safety, health standards and accessible for handicapped individuals. Oversee responsibilities in resource management, agricultural activities associated with livestock and vegetation protection through land rotation practices. The Commissioners shall analyze the population growth, needs, land availability, water resources, animal population, existing natural resources, and progress in community development, economic growth and environmental balance in the community. The Commissioners shall review the existing Navajo Nation Tribal Codes and ensure that development and establishment of Chapter ordinances and zoning ordinances does not conflict with existing laws of the Navajo Nation Government.

ARTICLE 4. MONTHLY/QUARTERLY MEETING

The Commissioners shall meet with Chapter officials and Administration on a monthly basis until such time all major issues are resolved; thereafter they shall meet on a quarterly basis or as needed, to discuss issues and problems affecting community membership and existing circumstance that requires resolutions with community planning and development. The Commissioners shall develop an agenda, take minutes, tape recording and registration sheet for all meetings, including public hearings sessions. The quarterly meetings shall coincide with the fiscal year quarterly schedule. The Commissioners shall provide a progress report intermediately following the end of the fiscal year, accomplishment of all assignments or community goals established by the Chapter Officials and Commissioners. A priority list of community goals may be used to identify the sequence of priorities and time frame for completion. An evaluation of performance may be conducted by the Community Service Coordinator to measure the progress and performance of the Commissioners. Based on the evaluation, the Commissioners may amend the plan of operation to reduce unnecessary activities and improve the Commissioners' role and responsibilities.

ARTICLE 5. STIPENDS

The Commissioners shall receive $75.00 per meeting, (regular & special), Public Hearings and work sessions as approved by the Chapter. A minimum of three(3) hours shall be reasonable for full compensation, if any excuse of emergency circumstances arises and justified, only then the Chapter Manager may have discretionary policy to compensate a member or officers by the time spent at the meeting. Example ($25.00 per hour) if a member stays for the full three(3) hours, he or she may be compensated a full $75.00. If a member is tardy, the compensation shall be based on the time of arrival and exit from the meeting by registration indicating time of arrival and exit from the meeting. All Chapter Officials shall not be compensated, due to elected status and shall not serve as officer on the Commission.

ARTICLE 6. TERMS

Under the Local Governance Act, Section 101, under Chapter 2, the Chapter President is authorized to appoint and recommend community members to any standing committee to the next Chapter meeting for community endorsement and approval of the appointed person. The term of the Commissioner shall not exceed the years recommended from the date of appointment. The purpose of the appointment years is to

PLAN OF OPERATION
RED MESA CHAPTER LAND COMMISSIONERS

ARTICLE 1. PURPOSE OF THE LAND COMMISSIONERS

Red Mesa Chapter Community Based Land Use Plan was revised and adopted by the Chapter on July 7, 2008.The Chapter Officials and Community Based Land Use planning Committee changed the committee's name to Red Mesa Land Commissioners and expanded it's duties and responsibilities to exercise authority of LGA section 103 to develop Chapter ordinances, develop ordinances, develop rural addressing, utilize eminent domain, plan for infrastructure, housing, community facilities, thoroughfare plan, open space plan and conduct public hearings for all future land use plans or make amendments to land use plan every five(5) years, due to changing circumstances. The Commissioners are to develop master land use plans that will eventually integrate into comprehensive land use plan and manage community growth patterns in the best interest of safety, health and general welfare of community residents.

ARTICLE 2. PUBLIC PARTICIPATION/PUBLIC HEARINGS

Red Mesa Chapter Land Commissioners shall ensure public participation through community public hearings to allow equal opportunity to all community members to review, discuss and approve all land withdrawals for any proposed plan such as development of community facilities, infrastructure, and major thoroughfare plan, open space, housing and recreational development in the community. All zoning ordinances and chapter ordinances shall be developed according to the Local Governance Act mandated by the Navajo Nation Council. The Commissioners shall be responsible to provide public notice on all public hearings of time, location and date of the public hearings by verbal announcement at the Chapter meetings, advertisement in local newspaper, local radio station in the Navajo and English language. The Commissioners shall record all statements, written or oral testimonies from public hearings, collect signatures by registration, and provide adequate information through written documents, maps and visual presentation on any proposed project. The Chapter Administration may provide assistance in carrying out these assignments.

ARTICLE 3. GENERAL DUTIES AND RESPONSIBILITIES

The general duties and responsibilities of the Commissioners is to provide community assessment every five(5) years, or as needed to identify the needs of the community for planning purposes and provide long and short range goals for community improvements, establish capital improvement plans for community facilities, and implement land use plan for the community. The commissioners will communicate and coordinate with Indian Health Service, Bureau of Indian Affairs, Navajo Housing Authority, Navajo Tribal Utility Authority, Counties and State Governmental agencies. (See attached exhibits). The primary responsibility is to meet, assist and plan with the Chapter officials and administration staff to implement land management practices, plan for the general welfare of community growth, comply with environmental laws, and the overall economic development to secure employment

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 Text

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

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 Text

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

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 Text

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

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 Text

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

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 Text

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

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 Text

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

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 Text

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

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 - Dwellings & 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.

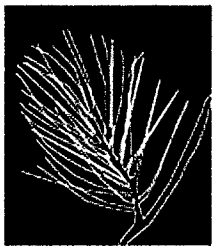
Appendix D Vegetative Landcover

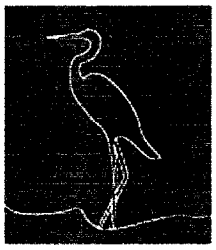
USGS
science for a changing world

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 ...

gap





KEEPING COMMON SPECIES COMMON

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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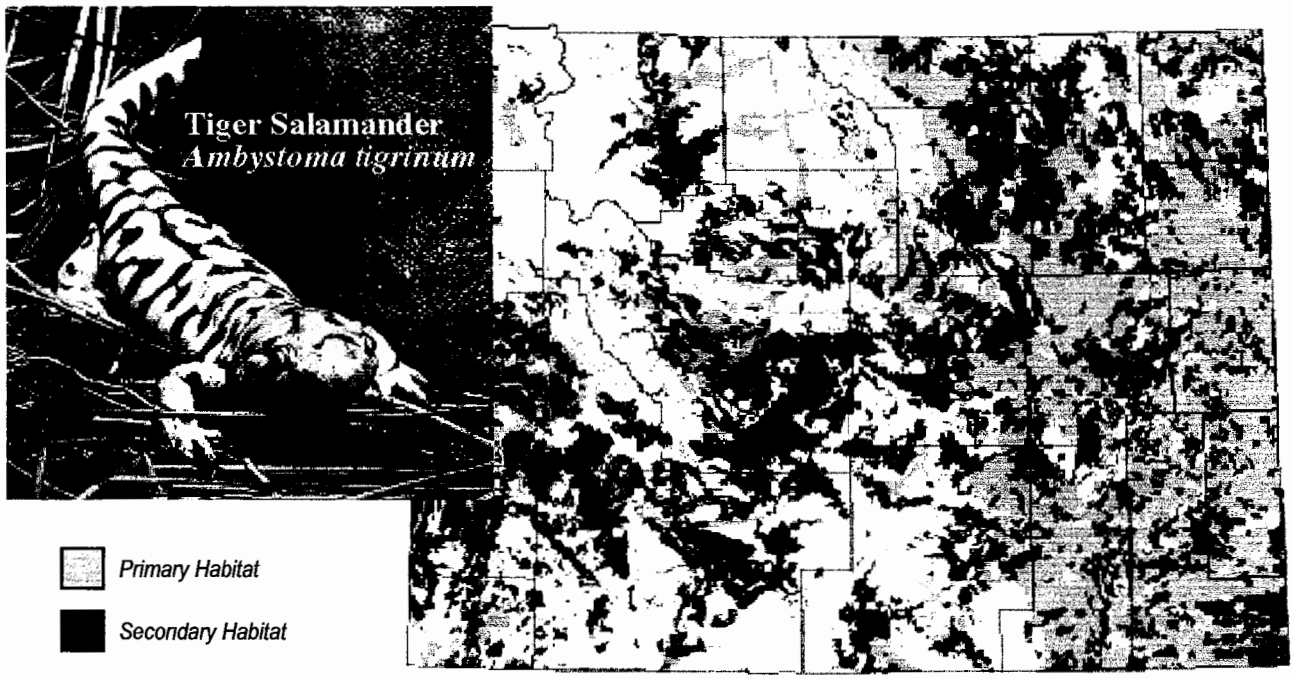
E-mail: gergely@uidaho.edu



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 Red Mesa planning area
May 2008

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 - Horsebush (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

Last updated: 20 Feb 2003 **Stakeholders:** WCS, MCS, CAN

Concept Author: NatureServe Western Ecology Team **LeadResp:** WCS

Appendix E Aneth Oil Fields - Detailed Oil & Natural Gas Well Production Data

Oil and Natural Gas Well Production Data

Production data for 1984 thru latest complete report period: February 2008

Source: http://oilgas.ogm.utah.gov/Data_Center/LiveData_Search/production.htm

API_NUM	OPERATOR	WELL NAME	STATUS	TYPE	TOTAL CUM OIL (bbl)	TOTAL CUM GAS (mcf)	TOTAL CUM WATER	FIELD NAME	QTR_QTR	SECT	T_R	ELEV	TD
43-037-15	ELM RIDGE	GOTHIC ME	Active	Water Dis	35,237	6,620	1,089	GOTHIC MESA	NWNW	16	41S-23E	4562	5603
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	553,729	455,298	4,964,610	GREATER ANETH	SWNW	28	41S-24E	0	5860
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	221,103	269,936	55,022	GREATER ANETH	SWNW	29	41S-24E	0	6789
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	1,540,866	964,102	567,059	GREATER ANETH	SWNE	29	41S-24E	5012	6797
43-037-15	RESOLUTE	NAVAJO B-	Active	Water Inj	326,019	279,000	735,392	GREATER ANETH	NENE	30	41S-24E	0	5793
43-037-15	US OIL &	WMU 34-21	Active	Water Inj	154,940	176,854	125,745	GREATER ANETH	NENW	34	41S-24E	0	5650
43-037-15	US OIL &	WMU 34-12	Active	Water Inj	607,282	619,460	200,301	GREATER ANETH	SWNW	34	41S-24E	4733	5649
43-037-15	US OIL &	WMU 34-32	Active	Water Inj	728,105	1,353,372	1,116,198	GREATER ANETH	SWNE	34	41S-24E	0	5690
43-037-15	US OIL &	WMU 34-43	Active	Water Inj	509,426	837,506	529,354	GREATER ANETH	SESE	34	41S-24E	0	5830
43-037-15	US OIL &	WMU 33-34	Active	Water Inj	470,520	380,180	1,574,030	GREATER ANETH	SWSE	33	41S-24E	4764	5695
43-037-15	US OIL &	WMU 34-14	Active	Water Inj	457,328	433,672	770,696	GREATER ANETH	SWSW	34	41S-24E	4969	5897
43-037-15	US OIL &	WMU 34-34	Active	Water Inj	324,505	265,572	220,565	GREATER ANETH	SWSE	34	41S-24E	5078	5967
43-037-15	US OIL &	WMU 3-21	Active	Water Inj	524,974	407,600	154,614	GREATER ANETH	NENW	3	42S-24E	0	6039
43-037-15	US OIL &	NAVAJO C-	Active	Water Inj	933,446	1,092,315	162,252	GREATER ANETH	SWNW	3	42S-24E	0	5873
43-037-15	RESOLUTE	MCELMO CR	Active	Water Inj	1,080,045	989,416	802,520	GREATER ANETH	SENW	12	41S-24E	0	5595
43-037-15	RESOLUTE	NAVAJO 11	Active	Water Inj	740,923	1,344,351	904,437	GREATER ANETH	NWNW	18	41S-25E	0	5438
43-037-15	RESOLUTE	NAVAJO 11	Active	Water Inj	538,468	245,702	726,735	GREATER ANETH	NWNE	18	41S-25E	0	5454
43-037-15	RESOLUTE	MCELMO CR	Active	Water Inj	1,286,863	1,486,903	2,000,455	GREATER ANETH	NWSE	18	41S-25E	0	5435
43-037-15	RESOLUTE	MCELMO CR	Active	Water Inj	256,612	330,519	113,420	GREATER ANETH	NWNE	19	41S-25E	0	5466
43-037-15	US OIL &	WMU 35-12	Active	Water Inj	528,792	744,059	729,401	GREATER ANETH	SWNW	35	41S-24E	5092	5956
43-037-15	US OIL &	NAVAJO 10	Active	Water Inj	411,726	389,123	203,094	GREATER ANETH	NENW	2	42S-24E	0	5640
43-037-15	RESOLUTE	16-12	Active	Water Inj	822,378	568,996	1,517,124	GREATER ANETH	SWNW	16	41S-24E	4667	5698
43-037-15	RESOLUTE	16-14	Active	Water Inj	616,093	708,217	494,628	GREATER ANETH	SWSW	16	41S-24E	4713	5727
43-037-15	RESOLUTE	NAVAJO A-	Active	Water Inj	478,093	340,000	1,030,558	GREATER ANETH	NESW	16	41S-24E	4694	5729
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	706,633	574,681	1,528,657	GREATER ANETH	SWNW	17	41S-24E	0	5735
43-037-15	RESOLUTE	17-14	Active	Water Inj	651,230	517,485	370,689	GREATER ANETH	SWSW	17	41S-24E	4740	5720
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	231,924	245,900	30,104	GREATER ANETH	NESW	17	41S-24E	0	5700
43-037-15	RESOLUTE	17-34	Active	Water Inj	540,333	430,608	1,355,058	GREATER ANETH	SWSE	17	41S-24E	0	5747
43-037-15	RESOLUTE	17-41	Active	Water Inj	1,557,821	848,017	9,682,513	GREATER ANETH	NENE	17	41S-24E	0	5656
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	417,518	589,998	237,568	GREATER ANETH	SWSW	18	41S-24E	4676	5595
43-037-15	RESOLUTE	18-W-32	Active	Water Inj	485,355	551,070	261,208	GREATER ANETH	SWSE	18	41S-24E	0	5814

API_NUM	OPERATOR	WELL NAME	STATUS	TYPE	TOTAL CUM OIL (bbl)	TOTAL CUM GAS (mcf)	TOTAL CUM WATER	FIELD NAME	QTR_QTR	SECT	T_R	ELEV	TD
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	594,554	611,154	3,550,805	GREATER ANETH	SWSE	18	41S-24E	0	5785
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	866,425	696,526	2,064,051	GREATER ANETH	SWNW	19	41S-24E	4736	5660
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	162,465	178,000	9,786	GREATER ANETH	NENW	19	41S-24E	4715	5663
43-037-15	RESOLUTE	DSRT A-26	Active	Water Inj	317,267	489,000	878,095	GREATER ANETH	NESW	19	41S-24E	4723	5687
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	446,151	403,411	373,674	GREATER ANETH	SWNE	19	41S-24E	4777	5795
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	444,061	432,806	29,807	GREATER ANETH	SWSE	19	41S-24E	4792	5750
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	769,659	540,603	71,092	GREATER ANETH	SWSW	20	41S-24E	4854	6400
43-037-15	RESOLUTE	DESERT A-	Active	Water Inj	337,767	350,000	463,459	GREATER ANETH	NESW	20	41S-24E	0	5801
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	545,944	378,306	58,606	GREATER ANETH	SWNE	20	41S-24E	4780	6165
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	1,019,550	786,340	1,548,577	GREATER ANETH	SWSE	20	41S-24E	4948	6752
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	143,195	113,000	10,302	GREATER ANETH	NENE	20	41S-24E	4740	5743
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	1,088,197	644,545	45,730	GREATER ANETH	SWSW	21	41S-24E	0	5952
43-037-15	RESOLUTE	24-Jan	Active	Water Inj	696,374	1,100,504	1,679,071	GREATER ANETH	SESW	1	41S-23E	0	5608
43-037-15	RESOLUTE	Nov-42	Active	Water Inj	664,773	1,213,496	10,695	GREATER ANETH	SENE	11	41S-23E	0	5460
43-037-15	RESOLUTE	Nov-44	Active	Water Inj	179,933	430,014	15,574	GREATER ANETH	SESE	11	41S-23E	0	5580
43-037-15	RESOLUTE	11-Dec	Active	Water Inj	1,165,227	1,440,947	854,142	GREATER ANETH	NWNW	12	41S-23E	0	5542
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	696,205	593,395	2,160,883	GREATER ANETH	SENW	12	41S-23E	0	5554
43-037-15	RESOLUTE	31-Dec	Active	Water Inj	891,450	1,075,097	5,025,159	GREATER ANETH	NWNE	12	41S-23E	0	5670
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	1,037,836	1,526,253	247,828	GREATER ANETH	NWSE	12	41S-23E	0	5545
43-037-15	RESOLUTE	Dec-42	Active	Water Inj	823,704	781,839	3,940,793	GREATER ANETH	SENE	12	41S-23E	0	5610
43-037-15	RESOLUTE	13-W-13	Active	Water Inj	1,113,598	1,550,744	1,210,549	GREATER ANETH	NWSW	13	41S-23E	0	5500
43-037-15	RESOLUTE	13-22	Active	Water Inj	649,109	723,441	1,617,150	GREATER ANETH	SENW	13	41S-23E	0	5555
43-037-15	RESOLUTE	13-24	Active	Water Inj	561,557	774,999	2,505,432	GREATER ANETH	SESW	13	41S-23E	0	5489
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	586,792	863,224	21,765	GREATER ANETH	NWSE	13	41S-23E	0	5568
43-037-15	RESOLUTE	13-42	Active	Water Inj	479,536	605,429	1,168,322	GREATER ANETH	SENE	13	41S-23E	0	5640
43-037-15	RESOLUTE	RATHERFOR	Active	Water Inj	799,729	1,215,773	157,998	GREATER ANETH	SENE	14	41S-23E	0	5524
43-037-15	RESOLUTE	24-31	Active	Water Inj	826,058	1,071,154	1,413,830	GREATER ANETH	NWNE	24	41S-23E	0	5567
43-037-15	RESOLUTE	24-42	Active	Water Inj	489,546	696,982	85,811	GREATER ANETH	SENE	24	41S-23E	0	5605
43-037-15	RESOLUTE	14-Jun	Active	Water Inj	311,203	290,918	228,993	GREATER ANETH	SWSW	6	41S-24E	0	5754
43-037-15	RESOLUTE	12-Jul	Active	Water Inj	877,945	711,000	7,483,789	GREATER ANETH	SWNW	7	41S-24E	0	5510
43-037-15	RESOLUTE	14-Jul	Active	Water Inj	414,417	565,000	1,346,244	GREATER ANETH	SWSW	7	41S-24E	0	5607
43-037-15	RESOLUTE	Jul-34	Active	Water Inj	682,168	805,968	1,213,874	GREATER ANETH	SWSE	7	41S-24E	0	6067
43-037-15	RESOLUTE	14-Aug	Active	Water Inj	695,797	511,683	818,958	GREATER ANETH	SWSW	8	41S-24E	0	6000
43-037-16	RESOLUTE	NAVAJO 2-	Active	Water Inj	66,233	61,014	44	GREATER ANETH	NENE	10	41S-24E	4471	5490
43-037-16	RESOLUTE	NAVAJO E	Active	Water Inj	77,984	492	110,337	GREATER ANETH	NENE	14	41S-24E	0	5505

API_NUM	OPERATOR	WELL NAME	STATUS	TYPE	TOTAL CUM OIL (bbl)	TOTAL CUM GAS (mcf)	TOTAL CUM WATER	FIELD NAME	QTR_QTR	SECT	T_R	ELEV	TD
43-037-16	RESOLUTE	NAVAJO E	Active	Water Inj	9,196	255	25,274	GREATER ANETH	NESE	14	41S-24E	0	5636
43-037-16	RESOLUTE	NAVAJO J-	Active	Water Inj	99,571	76	93,265	GREATER ANETH	NESW	12	41S-24E	0	5460
43-037-16	RESOLUTE	NAVAJO E	Active	Water Inj	98,794	302	129,588	GREATER ANETH	NESW	13	41S-24E	0	5484
43-037-16	RESOLUTE	MCELMO CR	Active	Water Inj	183,918	210,778	306	GREATER ANETH	NENW	24	41S-24E	0	5574
43-037-16	RESOLUTE	MCELMO CR	Active	Water Inj	110,365	1,227	136,134	GREATER ANETH	NESE	13	41S-24E	0	5454
43-037-16	RESOLUTE	MCELMO CR	Active	Water Inj	-	-	-	GREATER ANETH	NENE	24	41S-24E	0	5522
43-037-16	RESOLUTE	NAVAJO 11	Active	Water Inj	365,073	162	499,539	GREATER ANETH	SESW	18	41S-25E	0	5455
43-037-16	RESOLUTE	N DESERT	Active	Water Inj	102,010	122,000	3,355	GREATER ANETH	SESE	2	41S-23E	0	5550
43-037-16	RESOLUTE	NAVAJO B-	Active	Water Inj	542,043	421,000	29,439	GREATER ANETH	NENW	7	41S-24E	0	5875
43-037-16	RESOLUTE	NAVAJO B-	Active	Water Inj	255,160	250,000	2,491	GREATER ANETH	NESE	7	41S-24E	0	6060
43-037-16	RESOLUTE	NAVAJO 23	Active	Water Inj	188,650	197,000	460,940	GREATER ANETH	NESW	9	41S-24E	0	5650
43-037-16	RESOLUTE	N DESERT	Active	Water Inj	-	-	-	GREATER ANETH	NWSW	12	41S-23E	0	5515
43-037-16	RESOLUTE	N DESERT	Active	Water Inj	510,012	510,000	3,674	GREATER ANETH	SESE	13	41S-23E	0	5618
43-037-16	RESOLUTE	RATHERFOR	Active	Water Inj	180,916	128,000	252	GREATER ANETH	NESE	16	41S-24E	4698	5761
43-037-16	RESOLUTE	RATHERFOR	Active	Water Inj	355,856	297,000	39	GREATER ANETH	NENW	17	41S-24E	0	5729
43-037-16	RESOLUTE	RATHERFOR	Active	Water Inj	260,521	181,000	119,362	GREATER ANETH	NESE	17	41S-24E	0	5717
43-037-16	RESOLUTE	DESERT A-	Active	Water Inj	439,096	540,000	31	GREATER ANETH	NENW	18	41S-24E	0	6084
43-037-16	RESOLUTE	DESERT A-	Active	Water Inj	229,264	258,000	57	GREATER ANETH	NESE	19	41S-24E	0	5776
43-037-16	RESOLUTE	RATHERFOR	Active	Water Inj	554,196	389,000	55,307	GREATER ANETH	NENW	20	41S-24E	4749	5574
43-037-16	RESOLUTE	RATHERFOR	Active	Water Inj	110,167	76,000	-	GREATER ANETH	NENW	21	41S-24E	0	5662
43-037-16	RESOLUTE	NAVAJO A-	Active	Water Inj	82,047	90,000	-	GREATER ANETH	NENW	28	41S-24E	0	5682
43-037-16	RESOLUTE	RATHERFOR	Active	Water Inj	409,439	491,000	-	GREATER ANETH	NENW	29	41S-24E	5084	6030
43-037-16	RESOLUTE	NAVAJO B-	Active	Water Inj	353,280	340,000	30,858	GREATER ANETH	NENE	29	41S-24E	0	5770
43-037-16	RESOLUTE	NAVAJO B-	Active	Water Inj	229,831	307,000	107	GREATER ANETH	NESE	29	41S-24E	0	5804
43-037-16	US OIL &	WMU 34-23	Active	Water Inj	282,707	254,697	587,958	GREATER ANETH	NESW	34	41S-24E	0	5885
43-037-30	RESOLUTE	MCELMO CR	Active	Water Inj	-	-	-	GREATER ANETH	SENW	18	41S-25E	4450	5266
43-037-30	RESOLUTE	MCELMO CR	Active	Water Inj	5,848	6,548	1,237	GREATER ANETH	NENW	13	41S-24E	0	0
43-037-31	RESOLUTE	RATHERFOR	Active	Water Inj	12,564	22,192	253	GREATER ANETH	SESW	12	41S-23E	4599	5470
43-037-31	RESOLUTE	RATHERFOR	Active	Water Inj	5,707	11,413	248	GREATER ANETH	NWNW	13	41S-23E	0	5424
43-037-31	RESOLUTE	RATHERFOR	Active	Water Inj	15,119	46,961	857	GREATER ANETH	SWNW	18	41S-24E	0	5545
43-037-31	RESOLUTE	RATHERFOR	Active	Water Inj	5,955	4,467	1,367	GREATER ANETH	SESE	12	41S-23E	0	5570
43-037-31	RESOLUTE	RATHERFOR	Active	Water Inj	53,437	36,007	35,592	GREATER ANETH	NESW	20	41S-24E	4790	5790
43-037-31	RESOLUTE	RATHERFOR	Active	Water Inj	12,165	4,374	3,653	GREATER ANETH	NWNE	14	41S-23E	4558	5600
43-037-31	RESOLUTE	RATHERFOR	Active	Water Inj	-	-	-	GREATER ANETH	NESE	18	41S-24E	4784	5750
43-037-31	RESOLUTE	RATHERFOR	Active	Water Inj	-	-	-	GREATER ANETH	NWSW	21	41S-24E	4757	7862

API_NUM	OPERATOR	WELL NAME	STATUS	TYPE	TOTAL CUM OIL (bbl)	TOTAL CUM GAS (mcf)	TOTAL CUM WATER	FIELD NAME	QTR_QTR	SECT	T_R	ELEV	TD
43-037-15	NACOGDOCH	ENGLISH 1	Producing	Gas Well	413	10,169,537	57,015	BOUNDARY BUTTE	SENE	21	43S-22E	0	6129
43-037-30	NACOGDOCH	ENGLISH 3	Producing	Gas Well	-	1,102,107	59,433	BOUNDARY BUTTE	SWSE	22	43S-22E	5350	5260
43-037-15	BOWERS OI	N BOUNDRY	Producing	Oil Well	525,720	475,440	2,032,820	AKAH	SWNE	33	42S-22E	0	5975
43-037-20	NACOGDOCH	ENGLISH W	Producing	Oil Well	395,880	-	511,962	BOUNDARY BUTTE	SENE	21	43S-22E	5380	1600
43-037-20	NACOGDOCH	ENGLISH W	Producing	Oil Well	153,377	-	2,224,107	BOUNDARY BUTTE	SWSE	16	43S-22E	4948	4802
43-037-20	NACOGDOCH	ENGLISH W	Producing	Oil Well	174,135	-	339,129	BOUNDARY BUTTE	NWNE	21	43S-22E	4975	1300
43-037-20	NACOGDOCH	ENGLISH W	Producing	Oil Well	179,814	-	1,104,418	BOUNDARY BUTTE	SWNE	21	43S-22E	5344	1636
43-037-20	NACOGDOCH	ENGLISH W	Producing	Oil Well	207,725	-	713,960	BOUNDARY BUTTE	NWSW	22	43S-22E	5310	1555
43-037-20	NACOGDOCH	ENGLISH W	Producing	Oil Well	203,926	43	1,968,189	BOUNDARY BUTTE	NWSW	22	43S-22E	5375	1600
43-037-30	NACOGDOCH	ENGLISH W	Producing	Oil Well	486,156	-	1,910,023	BOUNDARY BUTTE	SESE	16	43S-22E	4975	1300
43-037-30	NACOGDOCH	ENGLISH W	Producing	Oil Well	1,282,205	-	2,165,163	BOUNDARY BUTTE	NENE	21	43S-22E	5359	1575
43-037-15	ST OIL CO	DESERT CR	Producing	Oil Well	686,124	542,626	14,647	DESERT CREEK	SESE	35	41S-23E	4895	7230
43-037-31	RIM SOUTH	BLUE HOGA	Producing	Oil Well	378,763	384,430	3,096	DESERT CREEK	NWSE	1	42S-23E	4996	5613
43-037-31	RIM SOUTH	BROWN HOG	Producing	Oil Well	283,925	324,539	632	DESERT CREEK	NENE	1	42S-23E	0	5727
43-037-31	RIM SOUTH	MULE 31K	Producing	Oil Well	40,372	51,383	15,528	DESERT CREEK	NESW	31	41S-24E	4939	7044
43-037-31	RIM SOUTH	BURRO 31I	Producing	Oil Well	106,422	27,248	381	DESERT CREEK	NESE	31	41S-24E	4997	5921
43-037-31	RIM SOUTH	MULE 31M	Producing	Oil Well	504,793	342,797	39,416	DESERT CREEK	SWSW	31	41S-24E	0	5853
43-037-15	ELM RIDGE	GOTHIC ME	Producing	Oil Well	344,498	295,601	22,447	GOTHIC MESA	NENE	7	41S-23E	4788	5725
43-037-15	ELM RIDGE	GOTHIC ME	Producing	Oil Well	258,510	146,537	14,095	GOTHIC MESA	SWSE	6	41S-23E	4752	5745
43-037-31	ELM RIDGE	GOTHIC ME	Producing	Oil Well	62,290	71,142	24,035	GOTHIC MESA	NESE	6	41S-23E	4708	5730
43-037-13	RESOLUTE	21-23	Producing	Oil Well	1,237,846	901,534	4,540,797	GREATER ANETH	NESW	21	41S-24E	0	5632
43-037-15	RESOLUTE	14-Sep	Producing	Oil Well	150,583	167,135	453,319	GREATER ANETH	SWSW	9	41S-24E	0	5680
43-037-15	RESOLUTE	29-34	Producing	Oil Well	715,822	1,364,362	40,104	GREATER ANETH	SWSE	29	41S-24E	0	6064
43-037-15	RESOLUTE	30-32	Producing	Oil Well	439,032	377,733	1,543,056	GREATER ANETH	SWNE	30	41S-24E	0	5785
43-037-15	US OIL &	WMU 27-12	Producing	Oil Well	205,436	191,639	351,301	GREATER ANETH	SWNW	27	41S-24E	0	5580
43-037-15	US OIL &	WMU 27-43	Producing	Oil Well	188,437	372,399	95,582	GREATER ANETH	NESE	27	41S-24E	0	5500
43-037-15	US OIL &	WMU 27-23	Producing	Oil Well	819,915	1,373,850	45,624	GREATER ANETH	NESW	27	41S-24E	0	5584
43-037-15	US OIL &	WMU 32-23	Producing	Oil Well	552,652	561,978	21,988	GREATER ANETH	NESW	32	41S-24E	4825	5802
43-037-15	US OIL &	WMU 32-34	Producing	Oil Well	31,811	26,882	6,030	GREATER ANETH	SWSE	32	41S-24E	4750	5724
43-037-15	US OIL &	WMU 3-41	Producing	Oil Well	105,994	106,323	35,020	GREATER ANETH	NENE	3	42S-24E	5083	5996
43-037-15	US OIL &	WMU 4-21	Producing	Oil Well	310,228	207,423	697,725	GREATER ANETH	NENW	4	42S-24E	0	5875
43-037-15	US OIL &	NAVAJO C-	Producing	Oil Well	724,548	1,635,727	27,181	GREATER ANETH	SWNE	4	42S-24E	4748	5688
43-037-15	US OIL &	WMU 3-32	Producing	Oil Well	771,738	766,641	252,455	GREATER ANETH	SWNE	3	42S-24E	0	6275
43-037-15	US OIL &	WMU 10-32	Producing	Oil Well	10,816	7,146	734	GREATER ANETH	SWNE	10	42S-24E	5472	6327
43-037-15	RESOLUTE	MCELMO CR	Producing	Oil Well	1,162,975	861,934	1,976,019	GREATER ANETH	NWSW	18	41S-25E	4451	5450

API_NUM	OPERATOR	WELL NAME	STATUS	TYPE	TOTAL CUM OIL (bbl)	TOTAL CUM GAS (mcf)	TOTAL CUM WATER	FIELD NAME	QTR_QTR	SECT	T_R	ELEV	TD
43-037-15	RESOLUTE	MCELMO CR	Producing	Oil Well	2,121,033	1,603,138	2,675,576	GREATER ANETH	NWNW	19	41S-25E	4552	5548
43-037-15	RESOLUTE	MCELMO CR	Producing	Oil Well	637,530	409,869	177,540	GREATER ANETH	SESE	18	41S-25E	4464	5465
43-037-15	US OIL &	WMU 25-14	Producing	Oil Well	524,433	601,013	30,482	GREATER ANETH	SWSW	25	41S-24E	0	5513
43-037-15	US OIL &	WMU 36-21	Producing	Oil Well	509,386	884,290	12,988	GREATER ANETH	NWNW	36	41S-24E	4667	5565
43-037-15	US OIL &	WMU 36-12	Producing	Oil Well	37,071	25,858	33,732	GREATER ANETH	SWNW	36	41S-24E	0	5566
43-037-15	US OIL &	WMU 35-14	Producing	Oil Well	561,158	914,921	1,636,478	GREATER ANETH	SWSW	35	41S-24E	5215	6120
43-037-15	US OIL &	WMU 35-34	Producing	Oil Well	3,868	14,250	-	GREATER ANETH	SWSE	35	41S-24E	0	5658
43-037-15	US OIL &	WMU 2-12	Producing	Oil Well	647,418	948,598	334,710	GREATER ANETH	SWNW	2	42S-24E	0	5916
43-037-15	RESOLUTE	12-Mar	Producing	Oil Well	299,870	180,799	511,662	GREATER ANETH	SWNW	3	41S-24E	0	5455
43-037-15	RESOLUTE	MCELMO CR	Producing	Oil Well	770,625	616,916	2,253,821	GREATER ANETH	NESW	11	41S-24E	0	5472
43-037-15	RESOLUTE	MCELMO CR	Producing	Oil Well	1,257,678	1,003,322	3,520,653	GREATER ANETH	SENE	11	41S-24E	0	5520
43-037-15	RESOLUTE	MCELMO CR	Producing	Oil Well	1,103,222	705,622	2,593,292	GREATER ANETH	SWSE	12	41S-24E	0	5438
43-037-15	RESOLUTE	Sep-34	Producing	Oil Well	371,912	340,141	7,379,923	GREATER ANETH	SWSE	9	41S-24E	0	5558
43-037-15	RESOLUTE	12-Oct	Producing	Oil Well	286,152	198,018	1,394,562	GREATER ANETH	SWNW	10	41S-24E	0	5510
43-037-15	RESOLUTE	14-Oct	Producing	Oil Well	1,123,721	1,095,729	24,323,267	GREATER ANETH	SWSW	10	41S-24E	0	5742
43-037-15	RESOLUTE	Oct-32	Producing	Oil Well	548,856	375,277	5,689,831	GREATER ANETH	SWNE	10	41S-24E	0	5419
43-037-15	RESOLUTE	RATHERFOR	Producing	Oil Well	1,070,619	841,163	1,011,814	GREATER ANETH	SWNW	15	41S-24E	4667	0
43-037-15	RESOLUTE	15-32	Producing	Oil Well	962,716	806,175	1,058,992	GREATER ANETH	SWNE	15	41S-24E	4523	5511
43-037-15	RESOLUTE	15-33	Producing	Oil Well	117,686	177,971	2,275,038	GREATER ANETH	NWSE	15	41S-24E	4532	5588
43-037-15	RESOLUTE	15-41	Producing	Oil Well	1,536,367	1,084,155	5,154,143	GREATER ANETH	NENE	15	41S-24E	4520	5532
43-037-15	RESOLUTE	16-32	Producing	Oil Well	826,400	537,772	438,697	GREATER ANETH	SWNE	16	41S-24E	4688	5755
43-037-15	RESOLUTE	16-41	Producing	Oil Well	1,407,408	943,891	10,856,214	GREATER ANETH	NENE	16	41S-24E	4672	5710
43-037-15	RESOLUTE	17-44	Producing	Oil Well	558,054	346,216	552,823	GREATER ANETH	SESE	17	41S-24E	0	0
43-037-15	RESOLUTE	18-11	Producing	Oil Well	686,458	604,917	763,767	GREATER ANETH	NWNW	18	41S-24E	5143	6150
43-037-15	RESOLUTE	RATHERFOR	Producing	Oil Well	1,186,149	915,307	2,108,376	GREATER ANETH	NWSW	18	41S-24E	0	0
43-037-15	US OIL &	WMU 22-43	Producing	Oil Well	385,496	353,677	1,168,128	GREATER ANETH	NESE	22	41S-24E	0	5622
43-037-15	US OIL &	WMU 22-34	Producing	Oil Well	412,093	452,476	1,261,548	GREATER ANETH	SWSE	22	41S-24E	0	5623
43-037-15	RESOLUTE	RATHERFOR	Producing	Oil Well	1,344,922	1,487,868	7,362,379	GREATER ANETH	NWSE	12	41S-23E	0	0
43-037-15	RESOLUTE	RATHERFOR	Producing	Oil Well	765,145	789,111	2,572,725	GREATER ANETH	NENE	13	41S-23E	0	5680
43-037-15	RESOLUTE	14-32	Producing	Oil Well	780,781	776,788	3,016,364	GREATER ANETH	SWNE	14	41S-23E	0	5466
43-037-15	RESOLUTE	MCELMO CR	Producing	Oil Well	992,030	657,539	2,666,054	GREATER ANETH	SWNW	13	41S-24E	4468	5487
43-037-15	RESOLUTE	MCELMO CR	Producing	Oil Well	1,310,386	905,328	1,640,971	GREATER ANETH	SWNE	13	41S-24E	4449	5445
43-037-15	RESOLUTE	MCELMO CR	Producing	Oil Well	226,117	192,405	71,814	GREATER ANETH	SWNE	24	41S-24E	0	5570
43-037-15	RESOLUTE	MCELMO CR	Producing	Oil Well	1,463,479	813,039	1,918,619	GREATER ANETH	NENE	13	41S-24E	4453	5443
43-037-15	RESOLUTE	12-Aug	Producing	Oil Well	563,588	528,342	357,482	GREATER ANETH	SWNW	8	41S-24E	0	6008

API_NUM	OPERATOR	WELL NAME	STATUS	TYPE	TOTAL CUM OIL (bbl)	TOTAL CUM GAS (mcf)	TOTAL CUM WATER	FIELD NAME	QTR_QTR	SECT	T_R	ELEV	TD
43-037-15	RESOLUTE	21-Aug	Producing	Oil Well	558,417	410,831	1,959,169	GREATER ANETH	NENW	8	41S-24E	0	5600
43-037-15	RESOLUTE	23-Aug	Producing	Oil Well	1,693,433	1,258,990	11,070,376	GREATER ANETH	NESW	8	41S-24E	0	5600
43-037-15	RESOLUTE	Aug-34	Producing	Oil Well	1,633,024	1,099,677	9,435,585	GREATER ANETH	SWSE	8	41S-24E	0	5685
43-037-16	US OIL &	WMU 23-21	Producing	Oil Well	261,835	304,967	878,236	GREATER ANETH	NENW	23	41S-24E	0	5695
43-037-16	US OIL &	WMU 23-41	Producing	Oil Well	55,814	38,436	29,158	GREATER ANETH	NENE	23	41S-24E	0	5773
43-037-16	US OIL &	WMU 23-12	Producing	Oil Well	376,087	417,567	460,610	GREATER ANETH	SWNW	23	41S-24E	0	5600
43-037-16	US OIL &	WMU 23-14	Producing	Oil Well	380,061	391,577	1,633,564	GREATER ANETH	SWSW	23	41S-24E	0	5570
43-037-16	RESOLUTE	14-Apr	Producing	Oil Well	199,896	219,844	736,243	GREATER ANETH	SWSW	4	41S-24E	0	5474
43-037-16	RESOLUTE	Apr-34	Producing	Oil Well	333,950	222,982	682,793	GREATER ANETH	SWSE	4	41S-24E	0	5460
43-037-16	US OIL &	WMU 27-21	Producing	Oil Well	288,039	386,645	83,771	GREATER ANETH	NENW	27	41S-24E	0	5618
43-037-16	US OIL &	WMU 27-34	Producing	Oil Well	535,844	464,084	2,056,616	GREATER ANETH	SWSE	27	41S-24E	0	5629
43-037-16	RESOLUTE	RATHERFOR	Producing	Oil Well	282,495	236,687	1,305,098	GREATER ANETH	SWSE	1	41S-23E	0	5604
43-037-16	RESOLUTE	NAVAJO A-	Producing	Oil Well	161,096	136,593	264,005	GREATER ANETH	NENW	16	41S-24E	0	5644
43-037-16	US OIL &	WHITE MES	Producing	Oil Well	282,611	182,961	546,190	GREATER ANETH	NESW	33	41S-24E	4897	5848
43-037-20	RESOLUTE	MCELMO CR	Producing	Oil Well	451,639	410,389	484,596	GREATER ANETH	SWNW	12	41S-24E	0	5507
43-037-30	US OIL &	WMU 4-42	Producing	Oil Well	100,069	359,644	421,143	GREATER ANETH	SENE	4	42S-24E	0	5711
43-037-30	US OIL &	WMU 34-24	Producing	Oil Well	42,378	60,383	696,137	GREATER ANETH	SESW	34	41S-24E	0	5877
43-037-30	US OIL &	WMU 34-42	Producing	Oil Well	79,023	64,160	1,117,131	GREATER ANETH	SENE	34	41S-24E	4926	5833
43-037-30	RESOLUTE	MCELMO CR	Producing	Oil Well	261,630	113,097	1,529,165	GREATER ANETH	SWNE	11	41S-24E	0	5370
43-037-30	RESOLUTE	MCELMO CR	Producing	Oil Well	313,759	244,226	1,297,732	GREATER ANETH	SWNW	5	41S-24E	0	5740
43-037-30	US OIL &	WMU 4-33	Producing	Oil Well	86,422	185,940	105,215	GREATER ANETH	NWSE	4	42S-24E	4762	5700
43-037-30	US OIL &	WMU 3-11	Producing	Oil Well	67,900	373,724	624,477	GREATER ANETH	NWNW	3	42S-24E	4992	5870
43-037-30	US OIL &	WMU 34-22	Producing	Oil Well	79,946	74,315	95,666	GREATER ANETH	SENW	34	41S-24E	4746	5660
43-037-30	US OIL &	WMU 34-33	Producing	Oil Well	112,601	169,387	709,052	GREATER ANETH	NWSE	34	41S-24E	5998	5890
43-037-30	RESOLUTE	MCELMO CR	Producing	Oil Well	738,455	461,087	1,287,528	GREATER ANETH	NENW	18	41S-25E	4465	5291
43-037-30	US OIL &	WMU 4-31	Producing	Oil Well	39,975	186,909	29,109	GREATER ANETH	NWNE	4	42S-24E	4740	5698
43-037-30	US OIL &	WMU 35-13	Producing	Oil Well	72,111	394,124	555,261	GREATER ANETH	NWSW	35	41S-24E	5027	5971
43-037-30	RESOLUTE	MCELMO CR	Producing	Oil Well	480,569	390,403	3,482,409	GREATER ANETH	NESW	18	41S-25E	4459	5421
43-037-30	RESOLUTE	MCELMO CR	Producing	Oil Well	728,335	399,104	3,566,676	GREATER ANETH	SWSE	18	41S-25E	4462	5433
43-037-30	RESOLUTE	MCELMO CR	Producing	Oil Well	766,879	474,001	3,757,693	GREATER ANETH	SWNW	18	41S-25E	0	5422
43-037-30	RESOLUTE	MCELMO CR	Producing	Oil Well	1,193,555	611,403	5,159,901	GREATER ANETH	NWSE	18	41S-25E	4453	5501
43-037-30	RESOLUTE	RATHERFOR	Producing	Oil Well	445,892	264,077	580,611	GREATER ANETH	NWNW	28	41S-24E	0	5673
43-037-30	RESOLUTE	15-42	Producing	Oil Well	38,261	30,733	417,257	GREATER ANETH	SENE	15	41S-24E	4513	5547
43-037-30	RESOLUTE	15-22	Producing	Oil Well	126,222	81,877	434,561	GREATER ANETH	SENW	15	41S-24E	4516	5540
43-037-30	RESOLUTE	Oct-44	Producing	Oil Well	175,863	412,497	3,279,174	GREATER ANETH	SESE	10	41S-24E	0	5612

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43-037-30	RIM SOUTH	LONE MT C	Producing	Oil Well	524,594	876,081	86	GREATER ANETH	SESE	1	42S-24E	4682	5526
43-037-30	RIM SOUTH	LONE MT C	Producing	Oil Well	471,807	1,088,527	39	GREATER ANETH	SWSE	36	41S-24E	0	5499
43-037-30	RESOLUTE	RATHERFOR	Producing	Oil Well	758,419	568,018	3,544,532	GREATER ANETH	NWNE	29	41S-24E	5093	5172
43-037-30	RESOLUTE	RATHERFOR	Producing	Oil Well	882,634	578,382	1,604,421	GREATER ANETH	SESE	20	41S-24E	4820	0
43-037-30	RESOLUTE	19-42	Producing	Oil Well	336,167	174,040	75,904	GREATER ANETH	SENE	19	41S-24E	4818	5715
43-037-30	RESOLUTE	20-13	Producing	Oil Well	374,738	235,771	151,923	GREATER ANETH	NWSW	20	41S-24E	4799	5702
43-037-30	RESOLUTE	20-24	Producing	Oil Well	381,438	271,406	273,008	GREATER ANETH	SESW	20	41S-24E	4859	5751
43-037-30	RESOLUTE	20-22	Producing	Oil Well	163,641	104,723	57,138	GREATER ANETH	SENW	20	41S-24E	4787	5690
43-037-30	RESOLUTE	RATHERFOR	Producing	Oil Well	411,782	224,197	289,142	GREATER ANETH	NWSE	20	41S-24E	0	5727
43-037-30	RESOLUTE	29-33	Producing	Oil Well	72,197	74,216	57,149	GREATER ANETH	NWSE	29	41S-24E	0	5800
43-037-30	RESOLUTE	RATHERFOR	Producing	Oil Well	336,599	169,658	481,037	GREATER ANETH	SENE	29	41S-24E	0	5786
43-037-31	US OIL &	WHITE MES	Producing	Oil Well	110,279	201,849	344,926	GREATER ANETH	NWNW	2	42S-24E	4726	5634
43-037-31	US OIL &	WHITE MES	Producing	Oil Well	6,757	15,776	21,309	GREATER ANETH	SESW	4	42S-24E	0	6054
43-037-31	US OIL &	WHITE MES	Producing	Oil Well	78,726	41,485	526,154	GREATER ANETH	SENE	23	41S-24E	0	5781
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	211,048	194,514	88,039	GREATER ANETH	SESW	17	41S-24E	4723	5623
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	162,552	101,032	208,968	GREATER ANETH	SESE	18	41S-24E	0	5630
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	411,680	224,657	1,424,888	GREATER ANETH	SENW	19	41S-24E	4738	3456
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	268,441	181,325	669,470	GREATER ANETH	NWNE	19	41S-24E	4763	3456
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	142,083	71,063	1,193,718	GREATER ANETH	NWSE	19	41S-24E	0	5590
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	357,510	286,072	281,900	GREATER ANETH	NWNW	20	41S-24E	4789	5657
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	546,223	294,060	1,027,728	GREATER ANETH	NWNE	20	41S-24E	0	3255
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	404,682	169,892	147,075	GREATER ANETH	SENE	20	41S-24E	0	5650
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	129,466	104,186	84,428	GREATER ANETH	NWNW	29	41S-24E	0	5726
43-037-31	US OIL &	WHITE MES	Producing	Oil Well	88,135	57,172	1,363,535	GREATER ANETH	NWNE	34	41S-24E	4759	5673
43-037-31	US OIL &	WHITE MES	Producing	Oil Well	27,438	37,127	4,350	GREATER ANETH	SENW	27	41S-24E	0	5619
43-037-31	US OIL &	WHITE MES	Producing	Oil Well	57,490	80,477	79,102	GREATER ANETH	SESE	33	41S-24E	4915	5884
43-037-31	US OIL &	WHITE MES	Producing	Oil Well	50,180	68,326	347,203	GREATER ANETH	NWSW	34	41S-24E	0	5768
43-037-31	US OIL &	WHITE MES	Producing	Oil Well	164,416	181,835	299,039	GREATER ANETH	SESE	34	41S-24E	0	5960
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	254,670	149,265	43,108	GREATER ANETH	SESW	18	41S-24E	0	5561
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	256,201	131,189	211,964	GREATER ANETH	NWNW	19	41S-24E	0	5525
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	160,404	97,081	66,295	GREATER ANETH	SESE	19	41S-24E	0	5665
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	185,173	256,681	67,398	GREATER ANETH	SENW	29	41S-24E	0	5912
43-037-31	RIM SOUTH	LONE MT C	Producing	Oil Well	321,753	773,822	20	GREATER ANETH	NWNW	1	42S-24E	4712	5618
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	258,995	214,809	2,814,060	GREATER ANETH	SWSE	12	41S-23E	4665	5587
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	882,230	398,483	5,651,171	GREATER ANETH	SWNW	13	41S-23E	4556	0

API_NUM	OPERATOR	WELL NAME	STATUS	TYPE	TOTAL CUM OIL (bbl)	TOTAL CUM GAS (mcf)	TOTAL CUM WATER	FIELD NAME	QTR_QTR	SECT	T_R	ELEV	TD
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	729,133	250,631	1,434,498	GREATER ANETH	NESW	13	41S-23E	0	5467
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	1,258,922	541,976	8,919,007	GREATER ANETH	SWSE	13	41S-23E	4688	0
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	221,137	112,672	900,383	GREATER ANETH	NESE	13	41S-23E	0	5507
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	558,736	213,960	452,252	GREATER ANETH	NENE	24	41S-23E	0	5525
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	496,316	599,965	975,803	GREATER ANETH	NWSW	17	41S-24E	0	0
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	281,573	242,286	857,576	GREATER ANETH	NWSE	17	41S-24E	0	5542
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	404,316	274,522	1,189,721	GREATER ANETH	NWSE	18	41S-24E	0	0
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	220,218	132,969	752,028	GREATER ANETH	SWSW	1	41S-23E	0	5486
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	185,697	108,847	450,590	GREATER ANETH	NWNW	7	41S-24E	0	5607
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	163,733	142,571	76,691	GREATER ANETH	NWSW	7	41S-24E	0	5561
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	96,353	68,226	33,999	GREATER ANETH	SENW	7	41S-24E	0	5634
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	204,593	107,105	549,361	GREATER ANETH	SESW	7	41S-24E	0	5928
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	436,576	160,530	3,690,308	GREATER ANETH	NWSW	16	41S-24E	4693	0
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	226,719	184,027	751,469	GREATER ANETH	NWNW	17	41S-24E	0	5712
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	214,277	225,170	456,813	GREATER ANETH	SENW	17	41S-24E	4734	0
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	87,218	71,287	68,867	GREATER ANETH	SENE	17	41S-24E	0	5580
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	101,980	77,241	165,897	GREATER ANETH	NWNE	17	41S-24E	0	5535
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	496,018	303,432	1,162,487	GREATER ANETH	NWNE	18	41S-24E	0	0
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	170,570	144,850	234,352	GREATER ANETH	SENE	18	41S-24E	0	5649
43-037-31	RESOLUTE	MCELMO CR	Producing	Oil Well	402,708	734,255	2,855,333	GREATER ANETH	NENW	19	41S-25E	4466	5460
43-037-31	RESOLUTE	MCELMO CR	Producing	Oil Well	570,036	315,043	4,223,182	GREATER ANETH	SENE	13	41S-24E	0	5458
43-037-31	RESOLUTE	MCELMO CR	Producing	Oil Well	56,839	29,705	457,567	GREATER ANETH	SESW	12	41S-24E	0	5465
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	157,087	81,406	242,853	GREATER ANETH	SESE	7	41S-24E	0	5981
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	706,477	269,988	379,963	GREATER ANETH	SWNW	12	41S-23E	4475	5344
43-037-31	RESOLUTE	MCELMO CR	Producing	Oil Well	253,209	89,326	394,856	GREATER ANETH	NWNE	13	41S-24E	0	5465
43-037-31	RESOLUTE	MCELMO CR	Producing	Oil Well	266,180	109,895	1,563,795	GREATER ANETH	NWSE	13	41S-24E	0	5450
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	796,082	298,927	538,584	GREATER ANETH	NENW	12	41S-23E	0	5550
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	464,652	205,553	62,584	GREATER ANETH	NESE	12	41S-23E	0	5510
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	423,706	201,219	363,118	GREATER ANETH	SWNE	12	41S-23E	0	5515
43-037-31	RESOLUTE	MCELMO CR	Producing	Oil Well	219,813	188,656	1,597,901	GREATER ANETH	SWSW	18	41S-25E	0	5458
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	125,508	80,618	19,903	GREATER ANETH	SENW	18	41S-24E	0	5660
43-037-31	RIM SOUTH	SAHGZIE 1	Producing	Oil Well	680,715	438,000	43,014	GREATER ANETH	NENW	5	42S-24E	4771	6411
43-037-31	RIM SOUTH	ANASAZI 1	Producing	Oil Well	928,442	775,205	985	GREATER ANETH	SWNW	5	42S-24E	4778	5780
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	579,141	271,769	3,762,332	GREATER ANETH	NENE	11	41S-23E	0	5511
43-037-31	RIM SOUTH	LONE MOUN	Producing	Oil Well	87,806	213,347	2,132	GREATER ANETH	SENW	12	42S-24E	4666	5525

API_NUM	OPERATOR	WELL NAME	STATUS	TYPE	TOTAL CUM OIL (bbl)	TOTAL CUM GAS (mcf)	TOTAL CUM WATER	FIELD NAME	QTR_QTR	SECT	T_R	ELEV	TD
43-037-31	RIM SOUTH	ANASAZI 5	Producing	Oil Well	650,700	757,053	1,860	GREATER ANETH	NWSW	5	42S-24E	0	5761
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	330,418	114,445	1,960,964	GREATER ANETH	SWSW	13	41S-23E	4599	5456
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	178,551	172,507	237,155	GREATER ANETH	NWSW	20	41S-24E	4329	5780
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	638,906	431,388	3,501,681	GREATER ANETH	SWNW	20	41S-24E	4785	5067
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	110,673	48,443	1,177,938	GREATER ANETH	SWNE	24	41S-23E	4642	5526
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	69,671	65,109	504,577	GREATER ANETH	SENE	19	41S-24E	4813	5800
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	414,987	244,013	250,602	GREATER ANETH	NESE	11	41S-23E	4472	0
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	256,778	117,516	479,230	GREATER ANETH	NENE	14	41S-23E	4522	5515
43-037-31	RIM SOUTH	BIG SKY 6	Producing	Oil Well	75,004	193,287	4,788	GREATER ANETH	NWSW	6	42S-25E	4726	5712
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	326,984	236,128	1,124,038	GREATER ANETH	NWSW	19	41S-24E	4756	5666
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	480,153	407,194	1,859,432	GREATER ANETH	SESW	21	41S-24E	4670	0
43-037-31	RIM SOUTH	ANASAZI 6	Producing	Oil Well	32,896	83,058	1,071	GREATER ANETH	SENE	6	42S-24E	4872	5826
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	107,454	84,541	42,001	GREATER ANETH	SESW	19	41S-24E	4739	8151
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	276,815	194,007	2,592,845	GREATER ANETH	NWSE	21	41S-24E	4630	8195
43-037-31	RESOLUTE	RATHERFOR	Producing	Oil Well	217,439	69,763	2,004,672	GREATER ANETH	NESW	16	41S-24E	4705	0
43-037-15	ST OIL CO	NAVAJO TR	Producing	Oil Well	606,495	193,366	37,467	TOHONADLA	NENE	2	42S-21E	4665	5950
43-037-15	ST OIL CO	TOHONADLA	Producing	Oil Well	815,955	372,420	254,030	TOHONADLA	SWSE	35	41S-21E	0	6340
43-037-15	ST OIL CO	TOHONADLA	Producing	Oil Well	382,274	138,920	283,881	TOHONADLA	NESW	35	41S-21E	0	5022
43-037-31	ST OIL CO	TOHONADLA	Producing	Oil Well	22,411	6,645	12,217	TOHONADLA	S-NE	35	41S-21E	0	5850

EXHIBIT B

RED MESA CHAPTER
Red Mesa, Navajo Nation, Utah

Resolution-06-05-17-01

RESOLUTION
TO
RESOURCE DEVELOPMENT COMMITTEE OF THE NAVAJO NATION COUNCIL

APPROVING THE RED MESA CHAPTER'S REVISED COMMUNITY-BASED LAND USE PLAN AND REQUESTING THE NAVAJO NATION COUNCIL'S RESOURCE DEVELOPMENT COMMITTEE TO GRANT LOCAL GOVERNANCE CERIFICATION.

WHEREAS:

1. Pursuant to Resolution No. CAP-34-98, the Navajo Nation Council adopted the Navajo Nation Code (N.N..C.): Title 26 codified Navajo Nation Local Governance Act (LGA); and
2. Pursuant to the 26 N.N.C., Subchapter 3, Section 101 (B), Chapter wanting to administer land, pursuant to this Act, are required to develop a community based land use plan based upon the results of a community assessment; and
3. Pursuant to 26 N.N.C., Section 2004, (C), (1)m, the Red Mesa Chapter established the Red Mesa Chapter Land Commissioners (formerly Community Land Use Planning Committee) and Plan of Operation to oversee all land use planning activities by passing a resolution on August 11, 2008; and
4. Pursuant to 26 N.N.C., Section 2004, (C), (2), the Red Mesa Chapter retained JJ Clacs & Company to prepare the revision of Red Mesa Chapter's Community-Based Land Use Plan under the Supervision of the Land Commissioners and Chapter Officials; and
5. Pursuant to 26 N.N.C., Section 2004, the Red Mesa Chapter Land Commissioners with technical assistance from JJ Clacs & Company completed the Community-Based Land Use Plan with community involvement and conducting public hearings; and
6. The Red Mesa Chapter's updated Community-Based Land Use Plan was revised in the best of the community; and
7. The Red Mesa Land Commissioners reviewed and recommended to the Chapter approval of the revised and updated Community-Based Land Use Plan,, attached hereto as Exhibit "A"; and
8. Pursuant to 26 N.N.C., Section 2004, (D) (1), the Red Mesa Chapter shall by resolution vote to adopt the Community-Based Land Use Plan; and
9. Pursuant to 26 N.N.C., Section 2004, (D) (2), Resource Development of Committee of the Navajo Nation Council by resolution shall recertify the updated Community-Based Land Use Plan.

NOW THEREFORE BE IT RESOLVED THAT:

1. The Red Mesa Chapter's Land Commissioners hereby approves and adopts the revised updated Community-Based Land Use Plan in accordance with the requirements of the 26 N.N.C., Section 2004, (D) (1), attached hereto as Exhibit "A"; and
2. The Red Mesa Chapter's Land Commissioners further hereby requests the Resource Development Committee of the Navajo Nation Council to grant recertification of our Community-Based Land Use Plan pursuant to 26 N.N.C., Section 2004, (D) (2) for another 5 year term.

CERTIFICATION

We hereby certify that the foregoing resolution was duly considered by the Red Mesa Chapter of the Northern Navajo Agency at a duly called meeting in Red Mesa, Navajo Nation, Utah, at which a quorum was present that same passes by a vote of **04** in favor, **0** opposed, and **0** abstained on this **5th** day of **June,** 2017.

Motioned by: Henrico Benally Seconded by: Nelson Boyd

Floyd Tsinnijinnie, President

Chapter File