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M-2017-049/Transit Mix Concrete Co. - Ingersoll's Preliminary Witness List, Exhibit List, and Exhibits

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To Whom It May Concern:

Pursuant to the 3/19/2018 Order of Forrest Luke, attached for your filing and post on the division website, www.mining.state.co.us, please find the Barbara Ingersoll Marital Trust established by the Amended and Restated Trust Agreement of the Harold C. Ingersoll Revocable Trust dated August 11, 2008 ("Ingersoll")'s Preliminary Witness List, Exhibit List and Exhibits.

The exhibits are attached and available for download in this link: https://mullikenlaw.sharefile.com/d-sca4748426f64ba18

Thank you for your attention and cooperation. If you have any questions or concerns, please do not hesitate to contact us.

Respectfully,

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INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN 2013-2017

Fort Carson and the Piñon Canyon Maneuver Site











Integrated Natural Resource Management Plan, Fort Carson and the Pinon Canyon Maneuver Site

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN 2013-2017

Fort Carson and the Piñon Canyon Maneuver Site

APPROVAL

This Integrated Natural Resources Management Plan was developed in accordance with Army Regulation (AR) 200-1, Environmental Protection and Enhancement, paragraph 4-3d1(a), and meets requirements of the Sikes Act (16 USC 670a *et seq.*) as amended.

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for
9-18-13
Date

EXECUTIVE SUMMARY

This Integrated Natural Resources Management Plan (INRMP) links and integrates conservation management actions with Army military mission activities in order to maintain high-quality lands for military training, biodiversity, and recreation.

This INRMP is the guiding conservation and natural resource document for Fort Carson and the Piñon Canyon Maneuver Site (PCMS), Colorado. (Fort Carson is an Army installation. The PCMS is an Army training site under the administration of Fort Carson. In view of its size and geographic separation from Fort Carson, the PCMS is an important component of Fort Carson's conservation and natural resources management program. In this INRMP, for ease of reference, both Fort Carson and the PCMS will be referred to as installations.) This INRMP provides useful information for all organizations and individuals involved with or interested in the management or use of natural resources and lands on Fort Carson and the PCMS. This includes active duty units, reserve components, directorates, private groups, individuals, members of the public as well as local, state, and federal agencies.

All plans, goals and objectives regarding natural resources programs on Fort Carson and the PCMS, including those stated in this INRMP, are subject to the statutory mandate that they be "consistent with the use of these facilities to ensure the preparedness of the Armed Forces" (16 USC 670a). As stated in Department of Defense Instruction (DoDI) 4715.03, *Natural Resources Conservation Program*, paragraph 4a, "The principal purpose of DoD lands, waters, airspace, and coastal resources is to support mission-related activities." Thus, implementation of this plan is designed to:

- Achieve 100 percent compliance with environmental laws and regulations,
- Use an ecosystem-based approach to natural resources management, managing for values such as biodiversity, recreation, water quality, native species, and aesthetics,
- Practice adaptive management, improving our approaches and techniques using the best available science,
- Foster a sense of environmental stewardship among soldiers, employees, and neighbors who use or have in interest in natural resources on Fort Carson and PCMS,
- Improve communication, coordination, and participation among interested parties and partners in the region, and
- In conjunction with the Integrated Training Area Management (ITAM) program, facilitate sustainable training by education, managing the natural resources to meet the needs of the trainers, missionscape, and such.

This INRMP layout follows the U.S. Army Installation Management Command (IMCOM) format. Each chapter is briefly discussed below.

• Chapter 1 - **Overview:** This includes the purpose, scope, goals and objectives, responsibilities, authority, management strategy and plan integration.

• Chapter 2 - **Current Conditions and Use:** This chapter gives the general description of where the installations are, the surrounding regional land uses, past and current military mission land use, operations and activities that may affect the natural environment, constraints to training due to natural resources related issues, and a general description of the physical and biotic environments, wetland habitats, and flora and fauna.

• Chapter 3 - **Environmental Management Strategy and Mission Sustainability:** This chapter addresses integrating the military mission and sustainable land use through consultation with other federal and state agencies, partnerships and public access to the natural resources.

• Chapter 4 - **Program Elements**: Programs are addressed here that include the program goals, objectives and elements. Some of the programs included in this chapter are wildlife management, law enforcement (LE) of natural resources laws and regulations, wetlands protection, forest management,

threatened and endangered species, invasive species, fire management, vegetation management, migratory birds and Integrated Training Area Management (ITAM).

• Chapter 5 - **Implementation**: This chapter briefly discusses how this INRMP will be implemented. There is also a brief section on unresolved issues. The chapter includes discussion of funding, cooperative agreements and ensuring that discretionary activity results in no net loss of military training capability of the installations. All actions described herein are subject to availability of funds and thepriorities described herein.

•**Appendices:** There are nine appendices. Included are other management plans, surveys, the environmental assessment for this INRMP, research projects, migratory bird management, benefits to endangered species, critical habitat issues and the list of projects. The last appendix will change from year to year to reflect the INRMP's annual work plan. At the annual meeting with the United States Fish and Wildlife Service (USFWS) and the Colorado Division of Parks and Wildlife (CPW), those parties will have an opportunity to review the list of projects and provide comments.

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

Fort Carson and the Piñon Canyon Maneuver Site

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1. OVERVIEW

1.a. Purpose

This Integrated Natural Resources Management Plan (INRMP) links and integrates conservation management actions with Army military mission activities in order to maintain high-quality lands for training, biodiversity, and recreation.

1.b. Scope

The INRMP is the guiding natural resource document for Fort Carson and Piñon Canyon Maneuver Site (PCMS), Colorado. The INRMP provides useful information for all organizations and individuals involved with or interested in the management or use of natural resources and lands on these installations. This includes active duty units, reserve components, directorates, private groups, individuals, and state and federal agencies.

1.c. Goals

Further, Fort Carson intends to follow the major land management program goals stated in AR 200-1:

1. Integrate natural resources stewardship and compliance responsibilities with operational requirements to help achieve sustainable ranges, training areas, and other land assets.
2. Develop, initiate, and maintain programs for the conservation, utilization, and rehabilitation of natural resources on Army lands.

Further, Fort Carson intends, to the extent appropriate and applicable, to provide for no net loss in the capability of the installation lands to support the military mission, and to identify and address threats to mission land use as well as give high priority to management objectives that protect mission capabilities of installation lands.

All goals and objectives of the natural resources programs on Fort Carson and the PCMS have been developed in recognition of the fact that the military missions of the Army are the primary purposes for the existence of these installations. Specifically, we plan to:

- Conserve the environment for the purpose of supporting the military mission,
- Strive to achieve no net loss of capability of installation lands to support the military mission,
- Eliminate or minimize both permanent and temporary land restrictions on military training,
- Our primary value is shaping, to the greatest extent we can, the landscape to meet the training needs of the military,
- Achieve 100 percent compliance with environmental laws and regulations,
- Use an ecosystem-based approach to natural resource management, managing for values such as biodiversity, recreation, water quality, native species, and aesthetics,
- Practice adaptive management, improving our approaches and techniques using the best available science, and sound BMPs;
- Foster a sense of environmental stewardship among soldiers, employees, and neighbors who use or have in interest in natural resources on Fort Carson and PCMS, and
- Improve communication, coordination, and participation among interested parties and partners in the region.

- In conjunction with ITAM, facilitate sustainable training by education, recognition of training needs, comprehension of the ultimate mission requirements, and by generally promoting the coordination of various interests affecting the environment.

1.d. Responsibilities

There are numerous people and organizations involved in natural resources management on Fort Carson and PCMS. Below is a list of the different stakeholders along with a brief description of their responsibilities.

1.d.(1) Installation stakeholders

Garrison Commander — The Garrison Commander, Fort Carson, is responsible for his staff's actions to implement this INRMP. The Garrison Commander also makes final decisions concerning suspension of recreational privileges on Fort Carson and the PCMS. The Garrison Commander is responsible for providing training facilities such as maneuver training areas and ranges.

Directorate of Public Works (DPW) **—** The DPW is responsible for maintaining compliance with environmental laws and regulations and managing the natural resources on Fort Carson and PCMS. The DPW Operations Division conducts downrange road repair as well as building and grounds maintenance in the main post area (previously referred to as the 'cantonment' or 'garrison' identifying the built-up area of Fort Carson; the built-up area of the PCMS will still be referred to as the 'cantonment'). Operations Division and Environmental Division coordinate closely through the established Work Order and NEPA processes, by which proposed construction, maintenance, and other proposed actions are identified and vetted across organizational lines and by which subject matter experts have opportunity to review, comment, inject concerns and propose actions, to ensure timely and synchronized execution of Public Works projects and which .
Specifically, the Conservation Branch within the Environmental Division:

- Develops and implements programs to ensure the inventory, delineation, classification, and management of wetlands, threatened and endangered species, sensitive and critical habitats, and other natural resource areas,
- Recruits and trains qualified natural resources personnel,
- Implements the INRMP on behalf of the Garrison Commander,
- Reviews all environmental documents (such as NEPA documents, various management plans, etc.) and construction designs and proposals to ensure adequate protection of natural resources, and
- Coordinates with internal and external organizations on issues related to conservation and natural resources management for Fort Carson and PCMS.

Directorate of Plans, Training, Mobilization and Security (DPTMS) —The DPTMS provides training area and range access to accomplish provisions of this INRMP, assists in enforcing range regulations, repairs training damage through the ITAM program (Section 4.w.) and is directly responsible for evaluating how this INRMP impacts training. DPTMS and DPW work together to identify range reclamation needs in relation to military operations and overall conservation of ecosystems, watersheds, and wildlife habitat. DPTMS communicates the location of limited-use areas to all involved organizations, so that military training does not damage land reclamation efforts or sensitive areas. DPTMS personnel provide information on hunting seasons and "sensitive use" areas to preclude game violations and deterioration of land from recreational use. DPTMS personnel prepare the Range Complex Master Plan (RCMP), regarding operation of existing ranges and planning for future range needs. The RCMP also includes analyses of natural resource management as it relates to live fire ranges. Please see

also Section 3.a.(3) of this INRMP.

G3 —The G3 is responsible for planning military training and operations, and provides military training requirements for Fort Carson and PCMS ranges. The G3 coordinates with Fort Carson staff elements, as required, to ensure proper consideration of training requirements in all aspects of planning and execution of programs associated with natural resources management. (The G3 is a staff element of the mission headquarters, under the direction of the Senior Commander and his command group. The mission headquarters is the 4th Infantry Division (Mechanized) or, when this headquarters is deployed, the Mission Support Element (MSE).)

Directorate of Family, Morale, Welfare, and Recreation (DFMWR) — The DFMWR establishes procedures and governs various aspects of installation morale, welfare, and recreation activities and non-consumptive, wildlife-related activities (bird watching, wildlife photography, etc). Programs that have the potential to affect natural resources include equestrian programs, off-road activities, Turkey Creek Ranch recreation programs, and park activities. DFMWR responsibilities include supervising and maintaining outdoor recreation activities, and collecting fees for various outdoor recreation activities, including the sale of hunting, fishing, and recreation permits under the Sikes Act 10, USC 2671, and ARs 200-1 and 215-1.

Directorate of Emergency Services (DES) — The Fort Carson Conservation Law Enforcement Program, within the DES, is responsible for actively enforcing local, state, and federal environmental, natural and cultural resource laws and regulations. The Fire Department within DES is the primary proponent of the wildland fire program.

Public Affairs Office — The Public Affairs Office is responsible for promoting Fort Carson and PCMS activities to the public and providing professional public affairs advice and support to installation leaders and activities. The Public Affairs Office assists in distributing information related to the natural resources programs**.**

Staff Judge Advocate — The Staff Judge Advocate provides legal advice, counsel, and services to command, staff, and subordinate elements of Fort Carson. Specific Staff Judge Advocate responsibilities with regard to integrated natural resources management include:

- Conducting legal research and preparing legal opinions pertaining to interpretation and application of laws, regulations, statutes, and other directives,
- Coordinating with the Department of Justice, Environmental Law Division of the Office of The Judge Advocate General, and other governmental agencies on matters pertaining to litigation for the federal government,
- Advising DPW on compliance with environmental laws, and
- Advising the G3 and DPTMS on laws and regulations that affect training land use, management, and compliance.

1.d.(2) External stakeholders and Interested Parties

U.S. Army Forces Command - The U.S. Army Forces Command (FORSCOM), located at Fort Bragg, North Carolina, is the next higher headquarters for the 4th Infantry Division. FORSCOM has a requirement under AR 200-1 to review and concur with the INRMP. Among other things, FORSCOM recommends funding priorities for range construction, ITAM projects, and ACUB projects.

Central Region Installation Management Command (IMCOM Central) — located at San Antonio,

Texas, is responsible for providing command and technical guidance to the Fort Carson natural resources program by :

- Assisting with program implementation and conducting staff visits to Fort Carson,
- Ensuring that effective natural resources stewardship is an identifiable and accountable function of management,
- Budget and funding oversight and project review and validation,
- Facilitating communication between installations and higher headquarters, and
- Reviewing this INRMP.

IMCOM Central will conduct an onsite evaluation of the Fort Carson natural resources program at least once every three years.

Army Environmental Command (AEC) — The AEC, located in San Antonio, Texas provides oversight, centralized management, and execution of Army environmental programs and projects. With regard to natural resources management, AEC has specialized support capabilities in the areas of the National Environmental Policy Act (NEPA), endangered species, migratory birds, wetlands, forestry, cultural resources, pest management, environmental compliance, Army Compatible Use Buffer (ACUB) Program, and related areas.

U.S. Army Corps of Engineers (USACE) — USACE, Engineer Research and Development Center laboratories provide research, technical, administrative, and logistical support to Fort Carson. The USACE has the primary responsibility for administering Section 404 permits. The Engineer Research and Development Center has provided support to Fort Carson on diverse projects including erosion control, soil interpretation, and maneuver impacts to soils.

Regional Military Installations — Fort Carson's natural resources issues are similar to those of other military installations in the area, including the Air Force Academy, Cheyenne Mountain Air Force Station, Pueblo Chemical Depot, Peterson Air Force Base, Schriever Air Force Base, Buckley Air Force Base, and Francis E. Warren Air Force Base (in Wyoming). These installations participate in the Front Range Ecoregional Partnership (FREP).

U.S. Fish and Wildlife Service (USFWS) — The USFWS is the primary federal agency with which Fort Carson cooperates on natural resources management. Cooperative efforts with the USFWS have included federal-listed species management, migratory bird protection and management, recreation, fishing, wildlife law enforcement, and wetland inventories. The USFWS is responsible for enforcement and compliance with the Endangered Species Act (ESA) and Migratory Bird Treaty Act (MBTA), as well as other federal wildlife acts, laws and regulations. The USFWS cooperates in a multi-agency effort to manage prairie dogs in Colorado, which includes Fort Carson and the PCMS. Sustainable management of prairie dogs now will contribute to regional efforts to ensure the species does not require more intensive or less compatible conservation efforts in the future. In accordance with 16 USC 670a, DoDI 4715.03, and AR 200-1, this INRMP is to be developed and implemented in cooperation with the USFWS, and the USFWS is a signatory to it.

Natural Resources Conservation Service (NRCS) — The NRCS cooperates with Fort Carson on erosion control projects, soil surveys, ecological site surveys, plant materials studies, and rehabilitation efforts on disturbed lands. Numerous acres of bank sloping and rangeland seeding have also been accomplished with the technical support of the NRCS. NRCS has worked as part of a multi-agency team to alleviate a regional sediment pollution problem.

U.S. Forest Service (USFS) — The USFS manages lands adjacent to the PCMS (Comanche Grasslands)

and close to Fort Carson (Pike National Forest). Fort Carson and the USFS have mutual aid agreements for the suppression of wildfires. The USFS cooperates in a multi-agency effort to manage prairie dogs in Colorado, which includes Fort Carson and the PCMS, and in facilitating high altitude helicopter training opportunities.

U.S. Environmental Protection Agency (EPA) — The EPA is involved in various federal programs related to natural resources management, particularly in the wetlands permitting process, delegated nationally to the USACE, and in the regulation of stormwater on federal facilities on Colorado. The EPA cooperates in a multi-agency effort to manage prairie dogs in Colorado, including the management programs at Fort Carson and the PCMS.

U.S. Geological Survey (USGS) — The USGS is the principal federal agency with which Fort Carson cooperates on the management of watersheds and water resources on Fort Carson and the PCMS. With the support of the USGS, hydrological monitoring studies have been implemented to provide data for the proper management of water resources and watersheds on Fort Carson and the PCMS. The USGS is part of a multi-agency team that is working with Fort Carson to alleviate a regional sediment pollution problem. The USGS also supports the water rights program by collecting water diversion and use data and providing these data to the Colorado Water Commissioner. The Biological Resources Division, USGS has conducted research on Fort Carson and the PCMS. Activities have included Fort Carson providing Mountain Plover and raptor use of prairie dog colonies to the Division to support regional studies.

U.S. Bureau of Land Management (BLM) — The BLM cooperates in a multi-agency effort to manage prairie dogs in Colorado, including the management programs at Fort Carson and the PCMS. The Bureau of Land Management has assisted wildlife biologists on Fort Carson in researching the distribution and habitat of the Mexican Spotted Owl. The BLM manages land containing several sensitive plant species that also occur on Fort Carson and PCMS.

U.S. Animal and Plant Health Inspection Service, Wildlife Services (APHIS) — The Wildlife Services division of APHIS cooperates in a multi-agency effort to manage prairie dogs in Colorado, which includes Fort Carson and the PCMS. The agency is also involved in noxious weed control programs.

Colorado Division of Parks and Wildlife (CPW) — The CPW is responsible for management of fish and wildlife within the state, including those on federal lands. Specific cooperation with the CPW involves law enforcement, license/permit sales, special seasons and bag limits, check station operation, and compliance issues concerning state laws and regulations, which extend to state-listed species which are threatened, endangered, or species of concern. The CPW cooperates in a multi-agency effort to manage prairie dogs in Colorado, including the management programs at Fort Carson and the PCMS. In accordance with 16 USC 670a, DoDI 4715.03, and AR 200-1, this INRMP is to be developed and implemented in cooperation with the CPW, and the CPW is a signatory to it.

Colorado State Forest Service (CSFS) — The CSFS sells tree seedlings to Fort Carson, provides technical support to the tree planting program, assists with forest insect pest control, and has assisted in the establishment and maintenance of the windbreak around the PCMS cantonment area.

Colorado Division of Water Resources (DWR)(also known as the Office of the State Engineer) — DWR administers water rights, issues well permits, and is the state office responsible for dam construction and safety.

Other Colorado Agencies — The Colorado Department of Agriculture, Colorado Department of Natural Resources, Colorado State University Cooperative Extension, and Colorado State Board of Land

Commissioners cooperate in a multi-agency effort to manage prairie dogs in Colorado, which includes Fort Carson and the PCMS. Colorado State Parks owns and manages land containing several sensitive plant species that also occur on Fort Carson and PCMS. Exploring partnerships for coordinated management with state parks may help prevent rare species from declining and prevent the need for listing. The Colorado State Department of Agriculture is assisting with a study of the biological control of weeds on Fort Carson. The Colorado State University Agricultural Extension Service is a source of weed management information and expertise. The Colorado Division of Minerals and Geology provides general direction, guidance, and coordination concerning all reclamation projects, specifically the Stone City clay mine operation. The Colorado Department of Public Health and Environment (CDPHE) is delegated by the EPA to administer Clean Water Act, Section 303(d) impaired waters.

Native American Tribes — The United States has a unique legal relationship with Indian tribal governments as set forth in the Constitution of the United States, treaties, statutes, executive orders, and court decisions. Since the formation of the Union, the United States has recognized Indian tribes as domestic dependent nations under its protection. AR 200-1, DoDI 4710.02*: DoD Interactions with Federally-recognized Tribes* , and Executive Order 13175, *American Indian and Alaska Native Policy*,require regular and meaningful consultation and collaboration with Indian tribal governments. Fort Carson follows a process established by Department of Defense policy, pursuant to Section 106 of the National Historic Preservation Act (NHPA) as amended, that permits elected officials and other representatives of Indian tribal governments to provide meaningful and timely input on actions or policies that might be of tribal interest, such as those that affect Indian sacred sites or traditional cultural properties. Also, consultation is conducted as necessary under the National Environmental Policy Act (NEPA), the Native American Graves Protection and Repatriation Act (NAGPRA), and other laws and situations implicating concerns of the Native American community. Tribal organizations that will be consulted with regard to these issues include:

- ***Apache Tribe of Oklahoma***, Anadarko, OK,
- ***Cheyenne and Arapaho Tribes of Oklahoma***, Concho, OK
- ***Comanche Nation***, Lawton, OK,
- ***Jicarilla Apache Nation***, Dulce, NM,
- ***Kiowa Nation***, Carnegie, OK,
- ***Northern Arapaho Tribe***, Fort Washakie, WY,
- ***Northern Cheyenne Tribe***, Lame Deer, MT,
- ***Oglala Sioux Tribe of the Pine Ridge Reservation***, Pine Ridge, SD,
- ***Shoshone Tribe (Eastern Band)***, Fort Washakie, WY,
- ***Southern Ute Indian Tribe***, Ignacio, CO,
- ***Ute Mountain Ute Tribe***, Towaoc, CO, and
- ***Wichita and Affiliated Tribes of Oklahoma***, Anadarko, OK.

Universities and Colleges — Institutions of higher education partner with natural resources staff at Fort Carson and the PCMS on diverse projects. The following are examples of such partnerships.

- Colorado State University and Texas A&M University have supported research for biological control and alternative control of noxious weeds, range management/monitoring, forest inventories, and wildlife management/monitoring and surveys.
- The University of Wisconsin at Madison, Virginia Polytechnic University, Colorado State University, Utah State University, Oregon State University, University of Wyoming, University of Northern Colorado, University of Southern Colorado, University of Colorado at Colorado Springs, University of Denver, Pikes Peak Community College, University of Vermont, and Colorado College have supported natural resources management and research initiatives related to wildlife, watershed, and range conservation at Fort Carson and the PCMS.

- The Massachusetts Institute of Technology and Oxford University have assisted Fort Carson to better understand gullying processes.
- The University of Wyoming and the University of California – Riverside conducted selenium assessments on Fort Carson.
- The University of Colorado at Colorado Springs has collared mule deer to assess the effects of military training on deer fawning success and resource utilization.

Municipalities and Counties — Communities adjacent to or in proximity of Fort Carson and the PCMS are positively affected by natural resources management on the installations. Fort Carson and the PCMS provide opportunities for general public hunting, fishing, and other recreation, after deconfliction with military training schedules. Fort Carson has agreements with the Colorado Springs Fire Department and El Paso County to provide mutual aid for the suppression of wildland fires on Fort Carson and surrounding area. Fort Carson cooperates with the Fountain Creek Watershed Management Working Group of the Pikes Peak Area Council of Governments as well as other cooperative ventures that are established to deal with regional natural resources issues. The Upper Arkansas Weed Management Cooperative, an organization of eight southern Colorado counties, was formed to expedite and coordinate weed management efforts among agencies in the Upper Arkansas River drainage. Fort Carson coordinates with weed managers from El Paso, Pueblo, Fremont, and Las Animas Counties.

1.e. Authority

The Sikes Act, 16 USC 670a, requires a natural resources management plan to be written for every DoD installation having significant natural resources. The plans are developed cooperatively with the Installation, the United States Fish and Wildlife Service (USFWS), and the respective state wildlife agency (in Colorado the CPW). The law does not enlarge or diminish the existing responsibility of the USFWS or CPW, but the management plan provides for a coordinated approach to conservation, sustainable multipurpose use, and public access. The Act requires that the management plans be "consistent with the use of the military installation to ensure the preparedness of the Armed Forces." Since 2002, the installation's natural resources management has been conducted cooperatively with the CPW and the USFWS by actions agreed upon and prescribed in an INRMP. This statutory requirement has been implemented at the Department of Defense (DoD) level in DoDI 4715.03 and at the Army level in AR 200-1.

DoDI 4715.03, Section 4, states that it is DoD policy that the principal purpose of DoD lands, waters, airspace, and coastal resources is to support mission-related activities. All DoD natural resources conservation program activities shall work to guarantee the Department of Defense continued access to its land, air, and water resources for realistic military training and testing, as well as to sustain the long-term ecological integrity of the resource base. This is accomplished through management practices that facilitate long-term comprehensive range sustainability while demonstrating stewardship of natural resources by protecting and enhancing those resources for support of the military mission, and maintenance of ecosystem integrity to the greatest extent feasible.

Army Guidance for Implementation of the Sikes Act Improvement Act states, in part, that INRMPS shall be prepared to assist installation commanders in their efforts to conserve and rehabilitate natural resources consistent with the use of military installations to ensure the preparedness of the Armed Forces. INRMPS are intended principally to help installation commanders manage natural resources more effectively so as to insure that installation lands remain available and in good condition to support the installation's military mission.

Under the statute, each installation INRMP must, when appropriate and applicable, provide for:

- Fish and wildlife management, land management, forest management, and fish and wildlife-oriented recreation,
- Fish and wildlife habitat enhancement or modifications,
- Wetland protection, enhancement, and restoration where necessary for support of fish or wildlife,
- Integration of, and consistency among, the various activities conducted under the INRMP,
- Establishment of specific natural resources management objectives and time frames for proposed action,
- Enforcement of applicable natural resource laws (including regulations),
- No net loss in the capability of military installation lands to support the military mission of the installation,
- Public access to Army lands and waters when such access is compatible with military mission activities, safety, security, fiscal considerations, and ecosystem sustainability, and
- Such other activities as the Secretary of the military department considers appropriate.

The Sikes Act also requires or provides for:

- Regular review by the signers of this INRMP of its operation and effects, not less often than every five years,
- Provisions for establishing special hunting and fishing permits and collecting and spending the fees for the protection, conservation, and management of fish and wildlife, including habitat improvement and related activities in accordance with this INRMP,
- The management and conservation of natural resources under DoD control, including planning, implementation, oversight, and enforcement functions, are inherently governmental functions and shall not be contracted (via such mechanisms as Office of Management and Budget Circular A-76 or any similar circulars), and
- For contracts involving implementation of this INRMP, giving priority to state and federal agencies having responsibility for conservation or management of fish or wildlife.

1.f. Stewardship and compliance

The Army's *Strategy for the Environment*, published in 2004, establishes a long-range vision for the Army to meet its mission today and into the future. Sustainability is placed at the core of the *Strategy* and moves the focus beyond simple compliance with environmental regulations towards a focus on environmental stewardship. The *Strategy* applies a community, regional, and ecosystem approach to managing natural resources. The programs and actions in this INRMP not only achieve compliance with laws and regulations (e.g. Migratory Bird Treaty Act) but also outline a program that will sustain ecosystems on Fort Carson and the PCMS through active management and stewardship.

1.g. Review and revision process

Fort Carson, USFWS, and CPW will meet annually to review the accomplishments and planned natural resource projects. The Sikes Act requires the INRMP to be "reviewed as to operation and effect by the parties thereto on a regular basis, but not less often than every 5 years." Based on such review, a revision may be necessary, but the timeframe for publication of such revision is not mandated by statute. While the revision process proceeds, the current INRMP remains in effect for Fort Carson and the PCMS, and the responsibility and authority of the USFWS and the CPW towards applicable natural resource laws and regulations also remains in full effect. Also, if all three parties agree that this INRMP is effective and needs no significant changes, then it can be extended from year to year by signatures of all three parties. The annual review will discuss, at a minimum, the metrics specified in Department of Defense Instruction (DoDI) 4715.03 for assessing annually how well the INRMP applies conservation efforts in order to ensure no net loss of military training capability of the installation. The following spreadsheet lists the

seven focus areas, each having several questions to answer, specified in DoDI 4715.03. Since the questions and focus areas, in most cases, do not lend themselves to precise quantitative answers, the responses will be in the form of green/amber/red. The blank forms will be filled out each year in the annual review meeting among the signers. For each line item, the answer for that year will be circled. Then the color with the highest number of circles will be an indicator of the implementation status of the INRMP for that year.

Table 1-1

INRMP Metrics				
Focus area	**Question**	**Green**	**Amber**	**Red**
a. INRMP project implementation				
	1. Are INRMP projects, including follow-up inventory and monitoring, properly identified, developed and submitted for funding?	yes	partly	no
	2. Has project funding been received, obligated, and expended?	yes	partly	no
	3. Have projects been completed and do they meet expected objectives?	yes	partly	no
b. Listed species and critical habitat				
	1. Are conservation efforts effective?	yes	partly	no
	2. Does the INRMP provide conservation benefits necessary to preclude critical habitat designation?	yes	NA	no
	3. Are SAR identified and are steps being undertaken to preclude listing?	yes	partly	no
c. Partnerships' effectiveness				
	1. Has the INRMP review team (DoD, USFWS, and CPW) been effective in ensuring the INRMP's implementation?	yes	partly	no

	2. Are other partnerships needed to meet the INRMP goals?		yes	
	3. Have other partnerships been effectively used to meet INRMP goals?	yes	partly	no
d. Fish and wildlife management and public use				
	1. Are recreational opportunities such as hunting, fishing, and wildlife viewing available to post residents and employees?	yes	partly	no
	2. Are recreational opportunities such as hunting, fishing, and wildlife viewing available to the public?	yes	partly	no
e. Team adequacy				
	1. Is the installation's natural resources team adequately resourced and trained to fully implement the INRMP?	yes	partly	no
f. Ecosystem integrity				
	1. What percent of the installation's native ecological systems are currently intact?	100-65%	64-33%	32-0%
	2. What percent of the installation's various habitats are susceptible to change or damage from different stressors?		100%	
	3. Have any net acres of wetlands been lost?	no	NA	yes
g. INRMP impact on the installation mission				
	1. To what degree (high/medium/low) is the INRMP and its associated actions supporting the installation's ability to sustain the current and potential future military mission?	high	medium	low
	2. Have any net acres of training land been lost permanently due to natural resource issues?	no	NA	yes

Overall rating		green	amber	red

1.h. Management strategy

The programs and projects outlined in this INRMP are designed to maintain ecosystems and their components as well as facilitate sustainable military training on Fort Carson and PCMS. By focusing on the ecosystem level, we strive to maximize biodiversity, improve wildlife habitat, minimize invasive species, reduce accelerated erosion, maintain aesthetic landscapes for recreation, and improve ecosystem services (e.g. nutrient cycling). Good natural resources management creates healthy and resilient landscapes, which, consistent with the mandate of the Sikes Act, maintains or increases their availability for military training. Management decisions are made on the best available science and attempt, as practical, to mimic the natural historical disturbance regimes for the ecoregion. BMP are usually selected from a list of well established techniques, but on occasion new techniques will be tried. By mimicking the natural disturbance processes (e.g. fire) that shaped the evolutionary history of the landscape, we are able to design cost-effective and appropriate management programs.

As a major land-holder in Colorado, Fort Carson actively participates in regional conservation initiatives. By engaging with other stakeholders and interested parties in the region, Fort Carson works cooperatively towards ecosystem-level conservation goals. With this approach, the Army contributes to regional efforts to ensure species of concern do not require more intensive or less compatible conservation efforts in the future. The natural resource management programs and this INRMP are adaptive. Fort Carson will continually improve and evaluate goals, objectives, and management strategies as information improves and techniques are proven in the field.

This INRMP, especially the project list in Appendix 9, will be reviewed annually by the signatories to evaluate effectiveness and to look for improvement opportunities. Those annual reviews will satisfy the natural resource management objectives of the environmental management system (EMS).

1.i. Other plan integration and preparing prescriptions for projects

This INRMP serves as a foundation to the natural resources management goals on Fort Carson and the PCMS. All installation projects will be reviewed to ensure that they are consistent with this INRMP.

2. CURRENT CONDITIONS AND USE

2.a. Installation information

2.a.(1) General description

Fort Carson – Fort Carson is located in the east-central portion of Colorado, south of Colorado Springs, at the base of the Rocky Mountain Front Range. It occupies portions of three counties (El Paso, Pueblo, and Fremont) and lies between two major north-south highways: Interstate 25 to the east and Colorado 115 on the west. The City of Pueblo lies approximately 35 miles south of the main post area, and Denver lies about 65 miles to the north (Figure 2-1). Fort Carson encompasses 137,404 acres.

PCMS – The PCMS is located in Las Animas County in southeastern Colorado east of Highway 350, extending to the Purgatoire River and north from Van Bremer Arroyo to the Otero County line. Nearby cities include Trinidad to the southwest and La Junta to the northeast (Figure 2-1). The PCMS encompasses 235,896 acres.

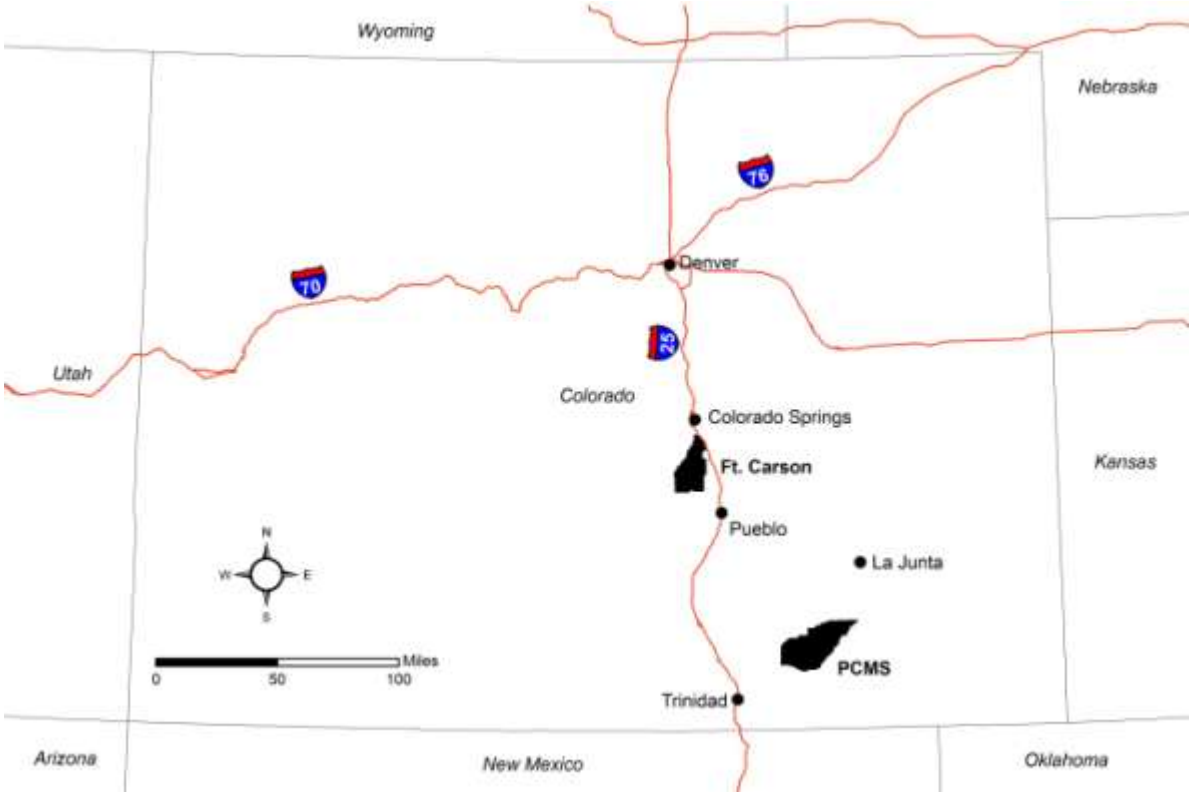


Figure 2-1. Location of Fort Carson and Piñon Canyon Maneuver Site (PCMS).

2.a.(2) Regional land use

Fort Carson – Land use adjacent to Fort Carson consists primarily of low-density residential housing with the exception of areas adjacent to the main post area, which are high-density residential housing. Development in the vicinity of Fort Carson is concentrated to the north (Colorado Springs) and east (Security-Widefield-Fountain) of the installation. Portions of the towns of Fountain, Widefield, and Security, located within one mile of the installation boundary, consist largely of dispersed residential areas. Areas bordering eastern, southeastern, southern, and southwestern boundaries of Fort Carson contain ranches, farms, and a few residences. Development is limited along the central western boundary and is increasing along the northwestern border.

PCMS – Areas bordering the PCMS contain ranches, farms, and a few residences, as well as the Comanche National Grasslands managed by the USFS on the northeastern border. Development is not occurring to any significant degree on any boundaries. Many tracts of private land along the northern border of PCMS have changed ownership from large ranches, controlled by only a few owners, to numerous smaller parcels (generally ~40 acres) that are individually owned.

2.a.(3) Historic land use

Fort Carson – A general historic regional setting and detailed history of Fort Carson are found in *Fort Carson, a Tradition of Victory*. Many Native American tribes used the land upon which Fort Carson is located over the past 12,000 years (e.g. Ute Mountain Ute, Southern Ute, Comanche, Kiowa, Cheyenne, Arapaho, Oglala Sioux, Jicarilla Apache, Pawnee). By 1869 most Native Americans had been forced from the area following years of fighting. In 1873 the first stage road to cross the future Fort Carson was built between Denver and Canon City. At least one railroad was constructed across the future fort site in the early 1930s. The site was owned by ranchers and used extensively for cattle grazing. By 1940 prominent local citizens were lobbying the War Department for an Army installation. The site for Camp Carson was selected on January 6, 1942. By November 4, 1942 construction was completed. Military training began in mid-summer 1942, with 104,165 Soldiers trained at Camp Carson during World War II. Camp Carson was officially designated Fort Carson August 27, 1954. In 1962 the Army's first mechanized infantry division (the 5th ID) was activated here. Air operations, which began in 1949 on a dirt strip on the edge of post, became a modern airfield in 1966 when Butts Field was completed. Between 1965 and 1966, 78,741 acres were added to accommodate requirements for mechanized training. By the end of 1967, activities at Fort Carson were the highest since World War II as a result of Vietnam requirements. The 4th Infantry Division arrived in 1970. Fort Carson was home to the 4th ID until 1995, when the Division, except for one brigade, was relocated to Fort Hood, Texas. In 1992 the 10th Special Forces Group (Airborne) arrived at Fort Carson. The 3rd Armored Cavalry Regiment (ACR) was relocated to Fort Carson from Fort Bliss, Texas, in 1995. In 1999 the 7th Infantry Division Headquarters was formed at Fort Carson, primarily providing command and control of three separate Reserve Component infantry brigades, and was based here for several years. In 2006, the 3rd ACR was relocated to Fort Hood, Texas, with a brigade combat team formed at Fort Carson at the same time. In 2008 an infantry brigade was transferred from Korea to Fort Carson, later becoming the 4th Brigade Combat Team of the 4th ID. The Headquarters, 4th ID, returned to Fort Carson in 2009, along with a heavy brigade combat team. As of 2010, Fort Carson was home to the Headquarters and four brigade combat teams of the 4th ID, the 10th Special Forces Group, the 43rd Sustainment Brigade, and a number of smaller support elements. In early 2011 the Army announced that a new combat aviation brigade would be assigned to Fort Carson.

PCMS – In the mid-1970s the Army began searching for additional land on which to conduct military maneuvers. The additional land was necessary for brigade-sized units of the 4th Infantry Division (Mechanized) and associated reserve units. An Environmental Impact Statement (EIS) was prepared in 1980 to evaluate potential environmental impacts from the proposed acquisition of training land. After the EIS process was completed, 245,000 acres were purchased by September 17, 1983. Subsequently, several thousand acres, not suitable for military training due to terrain or to being landlocked (no access), were turned over to the US Forest Service, Comanche National Grasslands. That transfer left the PCMS with approximately 236,000 acres. Prior to acquisition, the PCMS had supported large grazing operations and low human densities since it was first settled in the late 1870s. Military training began in August 1985. No troop units are permanently stationed at the PCMS. Training areas at Fort Carson and the PCMS have been viewed holistically in recent years, with a view to accommodating the needs of increased numbers of Soldiers and units assigned to Fort Carson. There are a limited number of small arms ranges and specialty ranges such as the live-fire convoy range, but the PCMS's primary purpose is still mechanized maneuver training. There is a small permanent group of civilian employees at the PCMS, which is augmented during training exercises.

2.a.(4) Military mission

Fort Carson is one of the Army's Power Projection Platforms. As such, it has a high priority role in deploying and mobilizing units during wartime. Fort Carson military units must be prepared to quickly deploy while other units move to Fort Carson and the PCMS for mobilization training and continued

deployment. Fort Carson is home to the 4th Infantry Division (Mechanized), 43rd Sustainment Brigade, 10th Special Forces Group (Airborne), 71st Ordnance Group, and numerous smaller support units. The Army recently announced the decision to station a combat aviation brigade, or CAB, at Fort Carson. Some elements of the CAB could be on the ground at Fort Carson as early as 2013. Fort Carson and the PCMS also support the Colorado National Guard, Army Reserve units, and other military units. The mission of Fort Carson is to train, house, mobilize, deploy, and sustain combat-ready, multi-component integrated forces. Fort Carson and the PCMS provide facilities and service to U.S. Armed Forces that require land and airspace to practice combat skills and operations on a year-round basis. To accomplish this mission, realistic and quality training opportunities are necessary. The mosaic of natural communities, and the varied topography found on Fort Carson and the PCMS, as well as climate extremes ranging from hot summers to cold winters provides U.S. Armed Forces with a variety of training scenarios.

Fort Carson is used for live-fire gunnery and is best suited for squad- to battalion-sized maneuvers and lane training of both reserve and active components. However, brigade-size exercises are sometimes conducted at Fort Carson. Training is nearly continuous year-round.

The PCMS is best used for battalion- and brigade-sized maneuvers, lane training, small arms live fire ranges, and force-on-force exercises, usually by mechanized infantry. From 1985 to 2002, there were typically 1-3 brigade-sized rotations per year (3-5 weeks each) with up to 10 additional battalion- or smaller-sized exercises per year. Since 2002, military units have been deployed resulting in less training on PCMS. However, more military units are now stationed at Fort Carson, and deployment schedules are expected to slow down somewhat. Heavy maneuver training events will likely occur more regularly than in the past decade, but are not expected to increase beyond historically analyzed levels, although aviation operations will increase IAW the analysis in the environmental assessment for the Stationing Implementation of the Fort Carson Combat Aviation Brigade (CAB EA 2012).

2.a.(5) Military operations and activities

Current and/or potential military mission impacts on the environment

The following impacts on natural resources have been noted.

***Maneuver* —** Maneuver has perhaps the greatest potential to affect land condition on both Fort Carson and the PCMS. Tactical maneuvers reduce vegetative ground cover and may increase bare ground area. As a result, the potential for soil erosion increases due to the loss of vegetation and to soil compaction. Erosion can eventually affect water quality through accelerated sedimentation and alteration of the soil horizons, making subsurface minerals and elements available. Dismounted training seldom affects large acreages, but it can have long-term impacts on regularly used trails. Mounted training is difficult to quantify in terms of its effects on the land. General types of vehicles (tracked or wheeled), vehicle weight and its distribution on the land (i.e., tracked vehicles better distribute weight), and conditions under which a vehicle operates (e.g. wet weather increases the potential for damage) are important. Mounted maneuver can produce objectionable noise, particularly when heavy vehicles move close to boundaries at night. Both mounted and dismounted maneuver have potential to impact soils, vegetation, wildlife, and cultural resources through ground disturbance. Mounted maneuver operations have the potential to create pollution from spills of petroleum, oils, or lubricants. Normal vegetation monitoring by ITAM's Range and Training Land Assessment (RTLA) program, in conjunction with as-needed surveys of wildlife, cultural resources, and soils, provide the data needed to plan for the reseeding work, erosion control projects, etc. needed to maintain both installations in a usable condition for military training for the period covered by this INRMP and beyond.


Live fire training

Use of Firing Ranges **—** Live fire can use ammunition having projectiles that are not explosive (e.g. most rifle/pistol, machine gun, inert tank, and inert artillery rounds) in which case the impact portion of the range is not "dudded" with unexploded munitions. These impact areas can be used for other purposes when not in use for firing. Other weapons use ammunition having projectiles that are explosive and can create a "dud" (unexploded round). Access is restricted in these impact areas unless they are cleared of unexploded munitions. Most long-range weapon systems (e.g., artillery, tanks, Multiple Launch Rocket Systems) use the same impact area for explosive and inert rounds. Thus, these areas are generally not available for maneuver training or other uses.

Fort Carson has ranges and impact areas sufficient to allow firing of almost all weapons in the Army inventory, to include many types of explosive projectiles. However, at PCMS the only weapons that can be fired with live ammunition are .50 caliber machine gun and smaller (no exploding projectiles), and simulated munitions. No aviation firing is permitted at PCMS.

Surface danger zones and impact areas (large caliber, small caliber, and airburst weapons) occupy a considerable amount of land at Fort Carson. Thus, they reduce options to conduct other types of training. Also, to minimize space used and for safety reasons, live firing must be conducted from relatively close to boundaries, which increases off-post noise impacts. Types of munitions (e.g. high explosive duds virtually exclude other uses) also affect training options within impact areas and within the surface danger zones. Range locations and configurations can also reduce options for training. Range size, location, and configuration are often determined by training requirements and safety factors with few options with regard to siting. For example, the Live-Fire Maneuver Range at the PCMS affects maneuver training opportunities in a large portion of the PCMS when the range is operational.

Live firing certain munitions (e.g. incendiary, high explosive, tracer rounds) requires careful range management, since they can cause wildland fires with the potential to extend beyond the impact areas. Construction and upgrades of ranges often involves temporary soil disturbance, thus potentially impacting wildlife and vegetation. Ground disturbance and direct destruction from ordnance impact can also impact wildlife resources. There are a very few ranges where shotguns can be fired. The Army only authorizes #9 Shot and 00 Buckshot. Ranges where civilian shooting occurs, such as the Olympic range (new one in development off gate 20), shoot #2-9 with #7-9 being most common. There is limited potential for migration or leaching of this lead off firing ranges. Many research programs and site characterizations have occurred on Army ranges since the 1990s in order to both understand the fate and transport of lead associated with small arms ranges and manage that lead, keeping it on the small arms ranges and not migrating away from those ranges.

Use of Smoke **—** Many military operations involve using a cloud of smoke that is artificially generated in order to obscure the enemy's ability to observe friendly activities. Fog oil operations have the potential to create pollution from spills of fog oil or petroleum, oils, or lubricants used by vehicles in the operations. Procedures in support of air quality regulations must be followed to avoid smoke drifting off the installation.

***Bivouac* —** Bivouac sites (temporary encampments) can create damage, particularly if the activity is repeated in the same area, or the unit remains in the same bivouac area for an extended period of time. Often, the first steps in land degradation from bivouac activities are soil compaction and the loss of ground cover, which can be followed by localized erosion and possibly increases in down-watershed stream sedimentation. Ground disturbance associated with bivouac can also impact wildlife resources.

***Engineer operations* —** Engineer activities (e.g. digging fighting positions or tank ditches, obstacle removal, construction of forward operating bases [FOBs]) disturb soil, which can affect various natural resources. Demolition can cause noise and dust. Engineer operations have the potential for pollution from spills of petroleum, oils, or lubricants. Other combat engineer activities can be beneficial to natural resources. Combat engineers projects (*e.g.*, training land rehabilitation, erosion control structure construction, site hardening) also can protect the environment from damage in the future. Digging is prohibited in areas where known cultural resources may be disturbed.

***Aviation* —** Environmental impacts of aviation activities at Fort Carson and the PCMS, which consist mainly of helicopter flights, include aircraft noise, minor disturbance to landing and drop zones, potential dust issues at some landing zones, possible disturbance to nesting birds, and training activities of troops following air arrival. Some aviation operations have the potential to create pollution from spills of petroleum, oils, or lubricants. Live fire from helicopters can cause wildfires and wildlife risks. Compared to impacts of heavy units, however, the impacts of aviation operations are very light. Dust issues at landing zones (LZs) can be reduced by using compounds such as magnesium chloride, or various types of soil binding agents. Vegetation damage is usually minimal, since aviation support vehicles mostly travel on existing roads and two-tracks. SOPs require containment berms, etc. at forward area refueling setups, so the risk of water pollution from a spill is very low. Therefore, an increase in aviation assets, even as large as a CAB, is not expected to have a significant impact on environmental resources. Live fire from aviation is allowed on Fort Carson, but not at the PCMS.

***Combat support and combat service support* —** Support units often have similar impacts to land as described for bivouac since they use the same sites repeatedly. Support units also have potential to adversely affect land resources via petroleum product spills, improper sanitation, digging activities, and other effects of intensive use of small areas by units with a wide variety of tasks. Ground disturbance associated with many support activities can impact natural resources and air quality.

***Construction* —** Impacts to the environment from construction depend largely on the location of the construction. In main post and cantonment areas, construction generally occurs on previously disturbed soil and in areas in which wildlife have either already departed or accommodated to human activity. There is generally the possibility of temporary dust and runoff during construction periods, and new construction may contribute to stormwater runoff. Construction in training areas generally involves a change in the land use and has the potential for greater impacts on wildlife. Erosion may also result temporarily. In both areas, there is a temporary increase in noise during the construction period.


Helicopter training

Natural Resource management impacts on the military mission. For a discussion of the impacts of natural resource management on the military mission, please see Section 3.a.(2).

Future military mission impacts on natural resources

Units may change in the future, but there are no known plans to change the general types of military training activities these troops conduct at Fort Carson and the PCMS. However, the intensity may vary, depending on training needs, world conditions, and budgetary constraints. Currently, the Army is in the process of increasing the dwell time (time on duty at home station rather than deployed) of all units, and expanding training to cover all of its units' potential missions, not just the limited scope required in the current theater of operations. Assuming that this process is implemented, and assuming that training is not curtailed by budgetary pressures, this may mean a gradual increase in training at both installations, which could cause greater impact on vegetation, soils, etc. Such impacts would be especially noticeable, since the vegetation on both Fort Carson and the PCMS has recovered quite well over the past nine years. Heavy maneuver training events will likely occur more regularly than in the past decade, but are not expected to increase beyond historically analyzed levels. Also, in terms of both installations, the ITAM program as well as the DPW Conservation Branch programs are scalable; i.e. they can be expanded as the need arises, if funding and position authorizations are made available by higher headquarters.

2.a.(6) Constraints to training

There are some restrictions to training as a result of natural resource issues such as limitations on the use of wetlands; i.e., dismounted training only and driving vehicles only on established roads and trails. There are also some naturally-occurring restrictions to training that are related to safety as well such as steep slopes that could erode if used repeatedly by vehicles. However, such steep slopes would be avoided anyway because of danger of rollover. Temporary restrictions may occur because of nesting eagles, or issues with other species of conservation interest (see Section 4.a.). Other temporary constraints to training may be enacted if there is significant habitat degradation in training lands (see *limited use program* in Section 3.a.(2)). Finally, temporary restrictions may be enacted to allow for recovery time needed because of natural occurrences such as heavy precipitation, but only in coordination with the senior commander on the ground. Decisions will implement the Commander's intent and reflect an informed balance of interests with consideration of reasonable alternatives and mitigation strategies.

2.a.(7) Opportunities for training

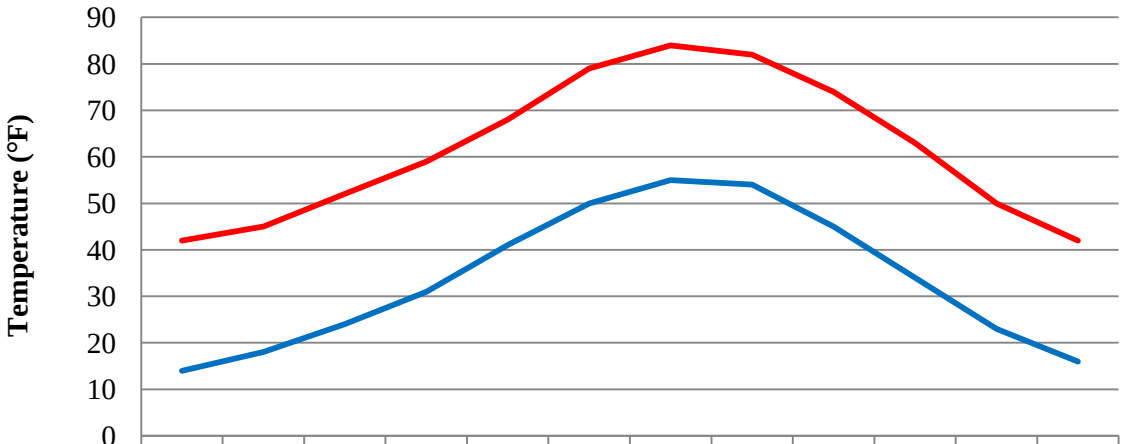
Fort Carson and the PCMS are largely available for at least some type of military training, with the exception of the main post and cantonment areas and the constraints listed above.

2.b. General physical environment and ecosystems

2.b.(1) Climate

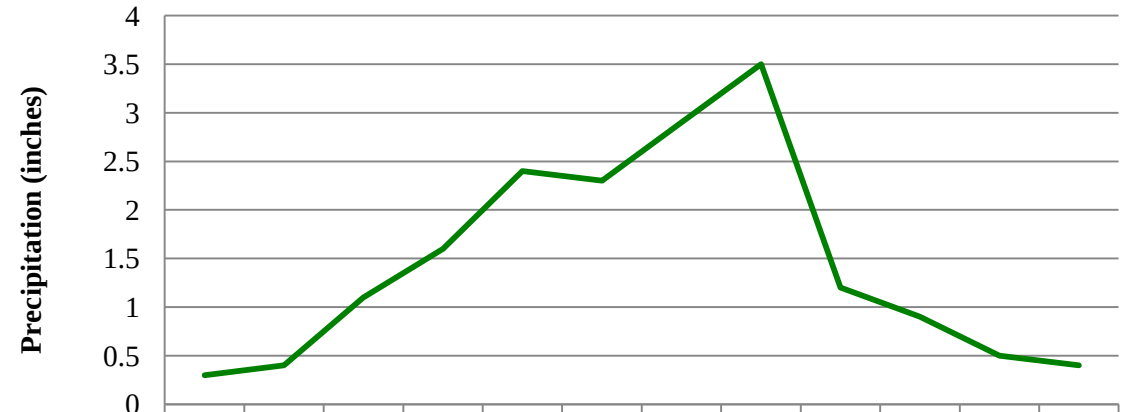
Fort Carson – The region in which Fort Carson is located is classified as mid-latitude semi-arid, characterized by hot summers, cold winters, and relatively light rainfall. July is the warmest month, and January is the coldest (Figure 2-2). Precipitation occurs in the Fort Carson area as rain, snow, and intermediate forms, such as hail. The quantity of precipitation is affected significantly by the rain shadow effect of the nearby Rocky Mountains. Mean annual precipitation on Fort Carson increases toward the northwest. Colorado Springs averages 17.5 inches of precipitation annually with about 80% falling between 1 April and 1 September in the form of thundershowers, which occur in the region about 50 days per year, generally involving heavy showers, gusty winds, frequent thunder and lightning, and occasional hail (Figure 2-3). Average annual snowfall in the region is 42.4 inches. Snow and sleet usually occur from September to May with the heaviest snowfall in March and possible trace accumulations as late as June. During the 11-year period 2002 through 2012, the average total precipitation at Fort Carson was 11.15 inches (USGS communication 6 Feb 2013). There are approximately 93 days per year with a cloud

cover, generally 30 percent or less. The yearly average daytime relative humidity is 39 percent and rises to 62 percent at night. Prevailing winds are normally out of the southeast. Wind speeds range from 0 to 80 mph, with typical average speeds of about 10 to 20 mph. Peaks are usually associated with thunderstorms or frontal systems. At times during summer, westerly winds shift to the southwest and bring hot dry air from deserts of the southwestern United States. These winds bring the hottest weather of the year, but the hot spells are usually of short duration.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. High	42	45	52	59	68	79	84	82	74	63	50	42
Avg. Low	14	18	24	31	41	50	55	54	45	34	23	16

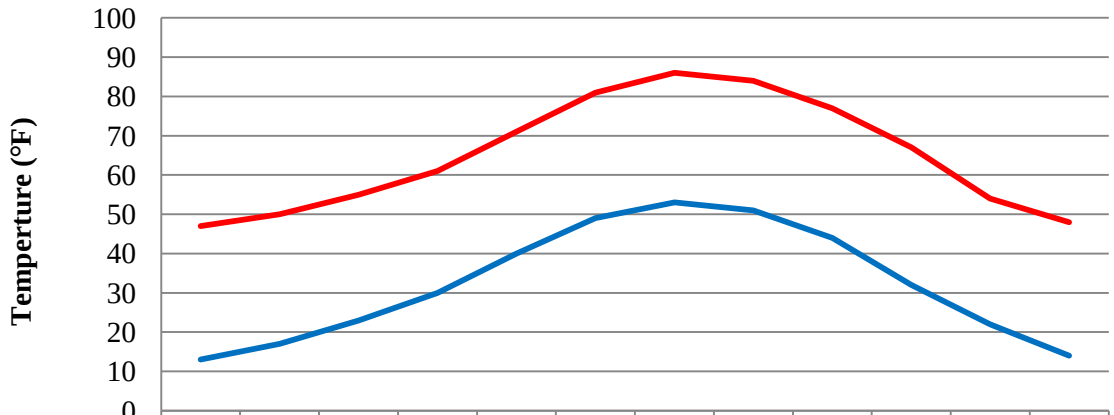
Figure 2-2. Average Temperature (°F) data by month for Colorado Springs, CO (U.S. Weather Service, www.weather.gov).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. Precip.	0.3	0.4	1.1	1.6	2.4	2.3	2.9	3.5	1.2	0.9	0.5	0.4

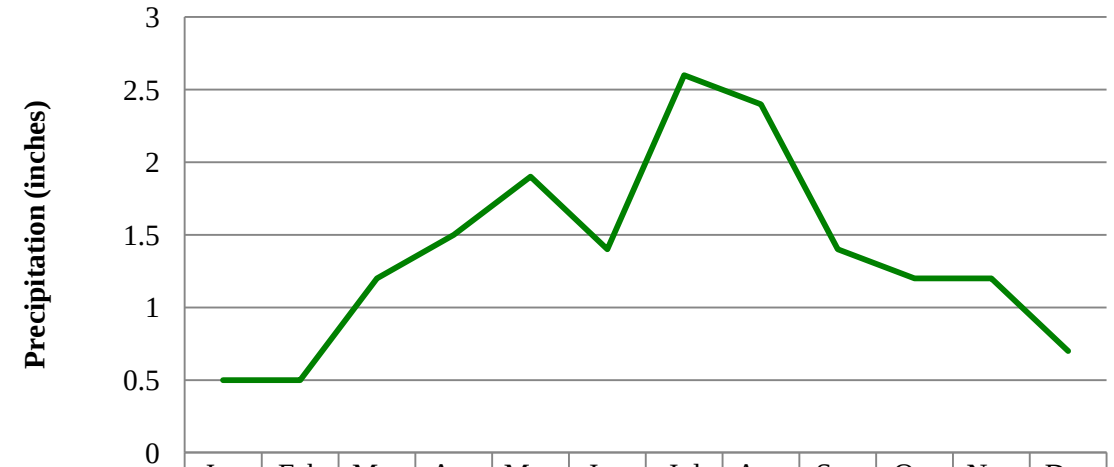
Figure 2-3. Average precipitation (inches) data by month for Colorado Springs, CO (U.S. Weather Service, www.weather. gov).

PCMS – The climate in the PCMS area is similar to Fort Carson. July is the warmest month, and December and January are the coldest (Figure 2-4). Annual precipitation averages approximately 16.5 inches, fluctuating widely from year to year and between areas of the installation (Figure 2-5). During the 12-year period 2001 through 2012 the average total precipitation was 11.28 inches (USGS communication 6 Feb 2013). Precipitation at the PCMS primarily results from either frontal storms or convective storms. Frontal storms can occur throughout the year and have varying strength and frequency; the largest quantities of precipitation are associated with periods of moist airflow from the Gulf of Mexico. Convective storms occur frequently during July through September.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. High	47	50	55	61	71	81	86	84	77	67	54	48
Avg. Low	13	17	23	30	40	49	53	51	44	32	22	14

Figure 2-4. Average Temperature (°F) data by month for Trinidad, CO (U.S. Weather Service, www.weather.gov).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. Precip.	0.5	0.5	1.2	1.5	1.9	1.4	2.6	2.4	1.4	1.2	1.2	0.7

Figure 2-5. Average precipitation (inches) data by month for Trinidad, CO (U.S. Weather Service, www.weather.gov).

2.b.(2) Changes in Climate

The effects of the change in climate on DOD installations may have the potential to impact the military mission. Healthy ecosystems are required to successfully contribute to core training missions and ensure military readiness. Fort Carson is dedicated to managing for healthy ecosystems that support the training mission. DoD driven direction and research that identifies metric standards and thresholds that require altered management practices may help us in maintaining Fort Carson's training lands in a healthy state.

2.b.(3) Ecoregion

Fort Carson and PCMS are in the Central Shortgrass Prairie (CSP) ecoregion (Figure 2-6). The CSP ecoregion encompasses approximately 56 million acres and includes parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, Texas, and Wyoming. The landscape includes plains and table lands dominated by shortgrass species such as buffalo grass (*Buchloe dactyloides*), blue grama (*Bouteloua gracilis*), and western wheatgrass (*Pascopyrum smithii*). The grasslands are dissected by streams (which are often ephemeral), canyons, buttes, and badlands. The CSP is characterized by limited precipitation, hot summers, and cold winters, with grazing, periodic fires, and drought being the primary historical natural disturbances that shaped the landscape and species present.



Figure 2-6. Fort Carson and Piñon Canyon are in the Central Shortgrass Prairie ecoregion.

2.b.(4) Physiography

Fort Carson – The eastern portion of Fort Carson is in the Colorado Piedmont section of the Great Plains Province. The western portion is in foothills of the Rampart Range section of the Southern Rocky Mountains Province. Primary landforms consist of low plains, high plains, and low hills. Fountain Creek and its tributaries dominate the eastern area of the installation, which is classified as low plains. High plains, consisting of gently rolling uplands to sharp-crested hills and rocky outcrops, are in the southeastern, west-central, and western portions of the installation. The main post area is located in the high plains. Elevations range from 5,400-6,200 feet above mean sea level in the low plains and from 5,400-6,400 feet above mean sea level in the high plains. The highest point on Fort Carson is near the western boundary about 2 miles north of the entrance to the Turkey Creek Recreation Area, and Beaver Creek valley is the lowest. The maximum relief on Fort Carson is 1,840 feet (Figure 2-7).

PCMS – The PCMS is located within the Raton Section of the Great Plains Province. The Raton Section contains topographic features such as mesas, cuestas, dissected plateaus, deep canyons, and volcanic

formations. The landscape on the PCMS is defined by four regions. Piñon pine and one-seeded juniper woodlands are found on limestone ridges in the north and northwest. The Hogback, a basalt dike, runs east and west near the southern boundary. Canyons draining into the Purgatoire River line the eastern side of PCMS. Grassy plains generally cover the area between the canyons, the Hogback, and piñon-juniper woodlands. Elevations on the PCMS range from 4,262 feet to over 5,576 feet (Figure 2-8). The highest point on PCMS is about 2 miles east of the Cantonment airstrip; the lowest is in the canyons at the northeast corner of the facility.

2.b.(5) Geology

There are three main fault lines in the region: Oil Creek, Ute Pass, and Rampart Range faults. The region is rated "zone one" for earthquake potential on a scale of zero to four, with a "four" having the greatest potential for earthquakes.

Fort Carson – Geologic units on Fort Carson range in age from Quaternary (one million years before present to recent) to Pennsylvanian (200-250 million years before present). Unconsolidated sediments deposited during the Quaternary consist of fluvial and alluvial sands, silts, and gravels and wind-deposited silts and sands. Consolidated units include shale, limestone, hard sandstone, siltstone, claystone, and conglomerate sandstone and shale (Dames and Moore 1978).

PCMS – Raton Mesa and Mesa de Maya, both prominent land features in the vicinity of Trinidad, are capped with basaltic rocks (Armstrong 1972). The Spanish Peaks are likewise of volcanic origin. The geological structure of the PCMS is generally associated with the Apishapa Uplift that trends southwest to northeast across the southern area of the site. These sedimentary rocks dip generally northeastward 1-3 degrees but may dip up to 36 degrees. Small faults associated with the Uplift are found in the northern edge of the PCMS. The major smaller structure within the PCMS is the Black Hills Monocline and two associated structures, Sheep Canyon and Muddy Creek monoclines. Several smaller synclines and anticlines are also associated with these monoclines, including the Model Anticline in the western portion of the PCMS.

2.b.(6) Soils

Fort Carson – Thirty-four soil categories and 65 soil associations have been identified on Fort Carson. Predominant soil associations are the Penrose-Minnequa Complex, Penrose-Rock Complex, Schamber-Razor Complex, and Razor-Midway Complex. A high shrink-swell capacity is the result of montmorillonitic clays dominating most soil complexes. Soil erosion, primarily from water runoff, is a significant problem on the installation. Soils of greatest concern for erosion control are clays, silty clays, and clay loams. Specific information concerning soils can be obtained from the soil surveys of El Paso, Pueblo, and Fremont counties, Colorado (available through the NRCS).

PCMS – There are 31 soil associations recognized on the PCMS. Specific information concerning soils can be obtained from the Soil Survey of Las Animas County, Colorado. The western part of the PCMS is dominated by a flat to gently sloping plain. Soils in this portion are formed in wind-deposited lifts with occasional small ridges of limestone outcropping in some areas. Soils are generally silty and weakly developed and are calcareous throughout. One small area of sand dunes crosses midway through this landscape type. Range sites dominating this landscape are Loamy Plains on upland flats, Saline Overflow in depressions and along intermittent drainages, and Sandy Plains in sand dunes. This range site generally has a medium stability rating and will experience moderate soil losses by water erosion and high soil losses by wind erosion if disturbed.

2.b.(7) Water resources

Fort Carson – Fort Carson lies within the Arkansas River basin. Fountain Creek is the major surface drainage feature that receives runoff from the northeastern portion of the installation. Streams flow from the northwest to the southeast. The intermittent streams of Rock Creek and Little Fountain Creek converge and drain into Fountain Creek 2-3 miles east of Fort Carson. Turkey Creek, Red Creek, and Beaver Creek flow through the Installation and enter the Arkansas River to the south (Figure 2-7). The combined inflow upstream from Fort Carson of Little Fountain, Little Turkey, Rock, and Turkey creeks is estimated to average 8.64 cubic feet/second. The actual inflow to Fort Carson is less than this quantity because of stream flow diversions for municipal and domestic water supplies. Pumping groundwater from alluvial aquifers upstream from Fort Carson also reduces the quantity of stream flow entering the installation. The average water flow on and near Fort Carson is about 2-5 cubic feet/second. Some streams can be expected to have no flow at some time during the year. There are approximately 146 surface acres in 12 reservoirs for fishery and wildlife resources. The closest surface waters to the main post area are man-made impoundments that are primarily used for recreational fishing, including Haymes, Townsend, Womack, and Northside reservoirs. Teller Reservoir, located in the southern portion of the installation (south of Range 143 - Multi-Purpose Range Complex), provides erosion and sediment control and recreational fishing when water is present.

PCMS – The PCMS also is in the Arkansas River basin. The PCMS has fewer drainages than Fort Carson (Figure 2-8). The Big Arroyo drainage system is located in the northwest region and flows into Timpas Creek, approximately three miles northwest of the PCMS. The Purgatoire River and numerous ephemeral, intermittent, or perennial tributaries are also located within and adjacent to the PCMS. The Purgatoire River, which flows in a northeasterly direction, is a seventh-order tributary of the Arkansas River. Elevation differences in the Purgatoire River basin cause climatic variations, which, in turn, affect stream flow. During years with average and above-average snowpack, such as occurred in 1984, 30-50 percent of the annual stream flow of the Purgatoire River occurs during April and May. During the rainfall-runoff period, May through October, flash floods occur intermittently. Releases from Trinidad Reservoir, located about 53 miles upstream from the stream flow gauging station on the Purgatoire River near Thatcher, affect stream flow on an intermittent basis (Von Guerard *et al.* 1987).

2.b.(8) Groundwater

Fort Carson – The availability, movement, and quality of groundwater is largely dependent on the distribution, permeability, and composition of the rock units that comprise the aquifers. Successively older sedimentary rock units uplifted with the Rocky Mountains are exposed from east to west in the installation. Groundwater at Fort Carson occurs in both alluvial and bedrock aquifers. Alluvial aquifers are formed from unconsolidated deposits of stream alluvium that are moderately permeable. However, their dependability is limited by their areal extent, thickness, and available recharge. The alluvial aquifers are capable of providing well yields from 10 to more than 100 gallons per minute.

The principal bedrock aquifer at Fort Carson is the Dakota-Purgatoire aquifer, which is comprised of massive bedded sandstones in the Dakota Sandstone and Lytle Sandstone Member of the Purgatoire Formation. This bedrock aquifer can yield 10 gallons per minute, but local fracturing can increase the permeability and yield to over 200 gallons per minute. Recharge of bedrock aquifers is from infiltration of precipitation and stream flow in areas where the aquifer is exposed at the land surface. Discharge occurs mostly from well pumping and leakage through overlying formations.

PCMS – The surface geology at the PCMS is predominantly sedimentary limestone, shale, and sandstone; basalt dikes occur along the southern boundary. The Dakota Sandstone and the Purgatoire Formation occur throughout a large part of the installation and are the principal source of groundwater in the area

(Von Guerard *et al.* 1987). Due to the climatic water regime, groundwater has been historically the predominant source of water for the PCMS. This water supply was obtained through a series of wells or springs for the decreed usage of domestic or livestock water. Inspection of drillers' logs and on-site inspection during a well inventory indicated that most wells were completed in the Dakota-Purgatoire aquifer. From 1967 through the early 1980s, a system of pipelines that originated at more productive springs and wells was installed to improve the efficiency and areal distribution of the domestic and stock-water supply. Some of those are now used for watering wildlife. (Water at the PCMS cantonment is purchased from the City of Trinidad.) Primary sources of groundwater on the installation are the Dakota Sandstone Formation and the Cheyenne Sandstone Member of the Purgatoire Formation (Von Guerard *et al*. 1987).

Groundwater movement in the northeastern parts of the PCMS generally is toward the northeast, and groundwater movement throughout the remainder of the PCMS is toward the east and southeast. Recharge of the aquifer is primarily from precipitation and subsurface inflow from adjoining areas. Where outcrop areas are traversed by ephemeral streams, occasional flood flows provide some local recharge of very limited areal extent. Wells in the Dakota-Purgatoire aquifer have reported yields that range from less than 10 to 500 gallons/minute. Well yield in unfractured parts of the Dakota-Purgatoire, which are known to occur at the installation, are likely to be less than 300 gallons/minute (Von Guerard *et al.* 1987).

2.b.(9) Landcover

Shortgrass prairie *grasslands* comprise about 48% of Fort Carson and 41% of the PCMS (Figures 2.09, 2.10). Major grasses include blue grama, western wheatgrass, galleta, sideoats grama, dropseeds, buffalo grass, little bluestem, and needle and thread grass. Various shrubs scattered throughout the grasslands are prickly pear cactus, cholla cactus, yucca, four-winged saltbush, rabbitbrush, and skunkbush sumac.

Shrublands, which typically contain a grass understory, comprise about 15% of the vegetation of Fort Carson and 33% of the PCMS. Deciduous shrubland, whose species include Gambel oak, salt cedar, and willow, is found along major drainages

Forest/Woodlands constitute about 37% of Fort Carson and 17% of the PCMS. Ponderosa pine, piñon pine, and one-seed juniper are the dominant species of higher elevation woodlands on rocky and steeper slopes, and cottonwood, willow, and cherry dominate woodlands near or along drainages.

The *Fort Carson, Colorado: Terrain Analysis* (Dames and Moore 1978) and *Plant Community Associations of Fort Carson, Colorado* (Polzin 2000) have additional descriptions of Fort Carson floral resources. Polzin recognized 45 vegetation communities on Fort Carson. *Plant Communities, Ecological Checklist and Species List for the U.S. Army Pinon Canyon Maneuver Site, Colorado,* (Shaw et al. 1989) recognizes 26 vegetation communities.

2.b.(10) Ecological Sites

Fort Carson –The NRCS identified 16 ecological (range) sites on Fort Carson. An ecological (range) site is defined as "*a distinctive kind of land with specific soil and/or other physical characteristics that differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation and in its ability to respond to management actions and natural disturbances.*" These sites are: Alkaline Plains, Gravelly Foothills, Gravel Breaks, Limestone Breaks, Loamy Plains, Overflows, Sandstone Breaks, Salt Flats, Saline Overflows, Sandy Plains, Shaly Plains, Sandy Bottomlands, Loamy Foothills, Shallow Foothills, Clayey Foothills, and Sandy Foothills.

PCMS –The NRCS has identified 15 ecological (range) sites on the PCMS. These sites are: Alkaline Plains, Basalt Breaks, Gypsum Breaks, Limestone Breaks, Loamy Plains, River Bottom, Sandstone Breaks, Salt Flats, Saline Overflows, Sandy Plains, Shaly Plains, Sandy Bottomlands, 80% Loamy Plains/20% Gravel, Shaly Plains/Loamy Plains, 75% Shaly Plains/25% Limestone Breaks, and Unknown. Loamy Plains is the most common (40%) range site type on the PCMS.

2.c. General biotic environment

2.c.(1) Species of conservation concern

The Mexican Spotted Owl is the only federally listed threatened or endangered species (T&E) on Fort Carson, although it does not nest here. No T&E species occur on the PCMS. See sections 4.a., 4.d., 4.g.,4.n., and 4.x. for more information on other species of conservation concern.

2.c.(2) Wetlands and deep water habitats

See section 4.b. for information on wetlands.

2.c.(3) Fauna

Information related to species and management of animals on Fort Carson and PCMS can be found in the following locations:

- 4.a Species of conservation concern
- 4.d. Fish and wildlife management
- 4.g Migratory birds
- 4.i. Pest management
- 4.m. Outdoor recreation (hunting and fishing)
- 4.n. Wildlife aircraft strike hazard (WASH)
- Appendix 2 WASH Plan; Memorandum of Understanding about Wildlife Related Incidents
- Appendix 4 List of documented vertebrate species

2.c.(4) Flora

Information related to species and management of vegetation on Fort Carson and PCMS can be found in the following locations:

- 2.b. General physical environment and ecosystems
- 4.e. Forestry management
- 4.h. Invasive species management
- 4.i. Pest management
- 4.t. Urban forest management
- Figs 2-9, 2-10 General vegetation cover
- Appendix 2 Forest management plan; Invasive plants management plans
- Appendix 4 List of plant species

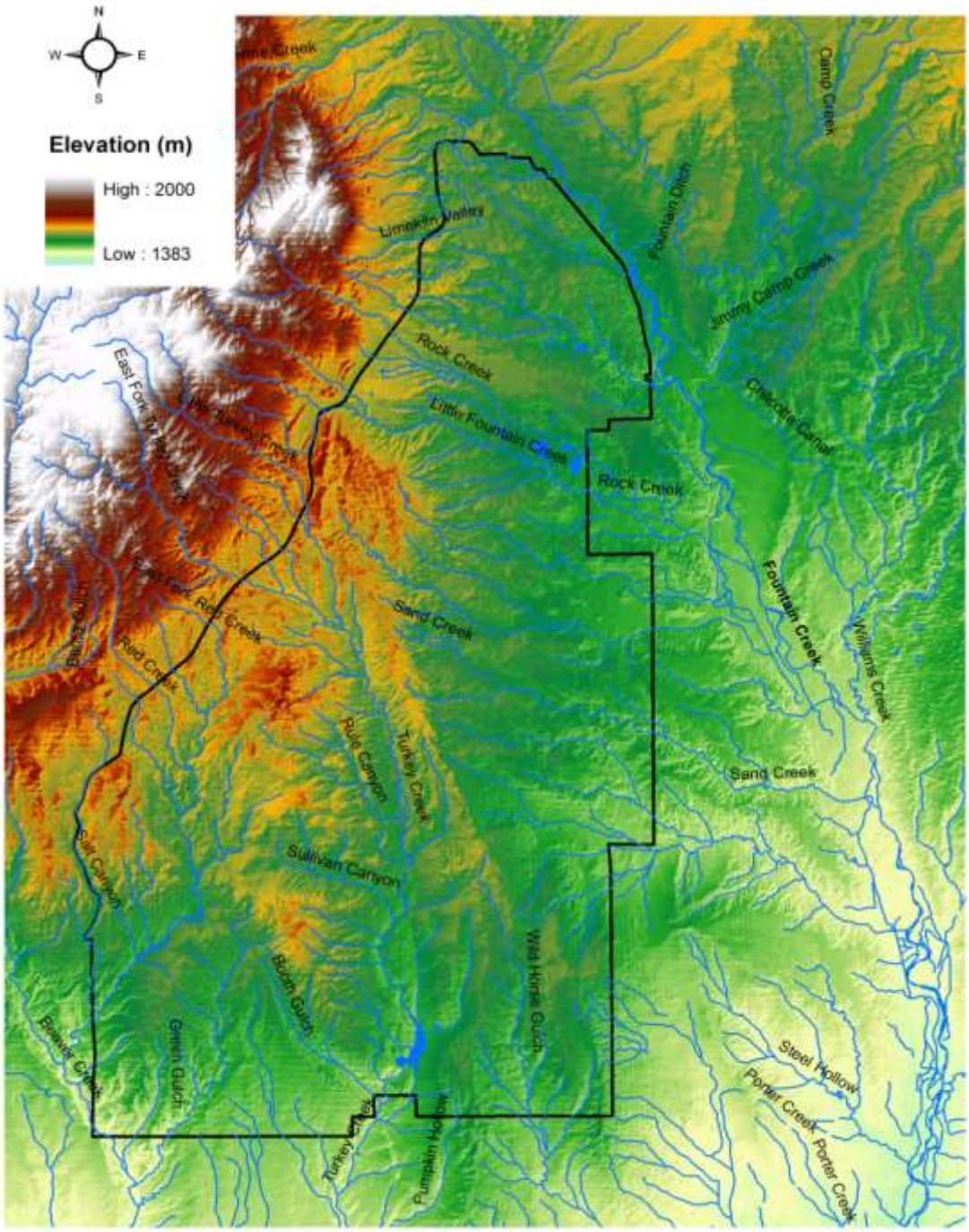


Figure 2-7. Surface waters and elevations on Fort Carson

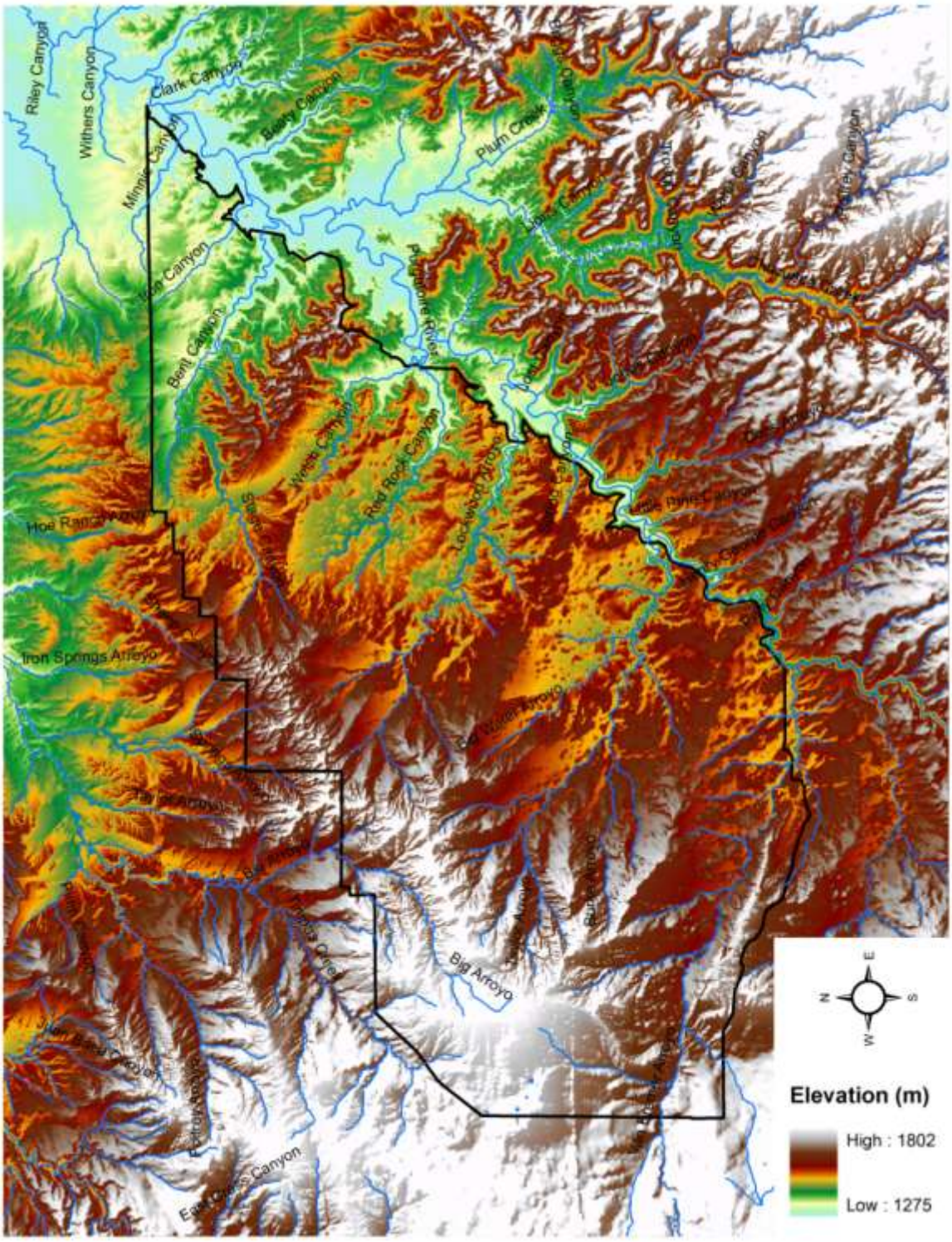


Figure 2-8. Surface waters and elevations and Piñon Canyon Maneuver Site.

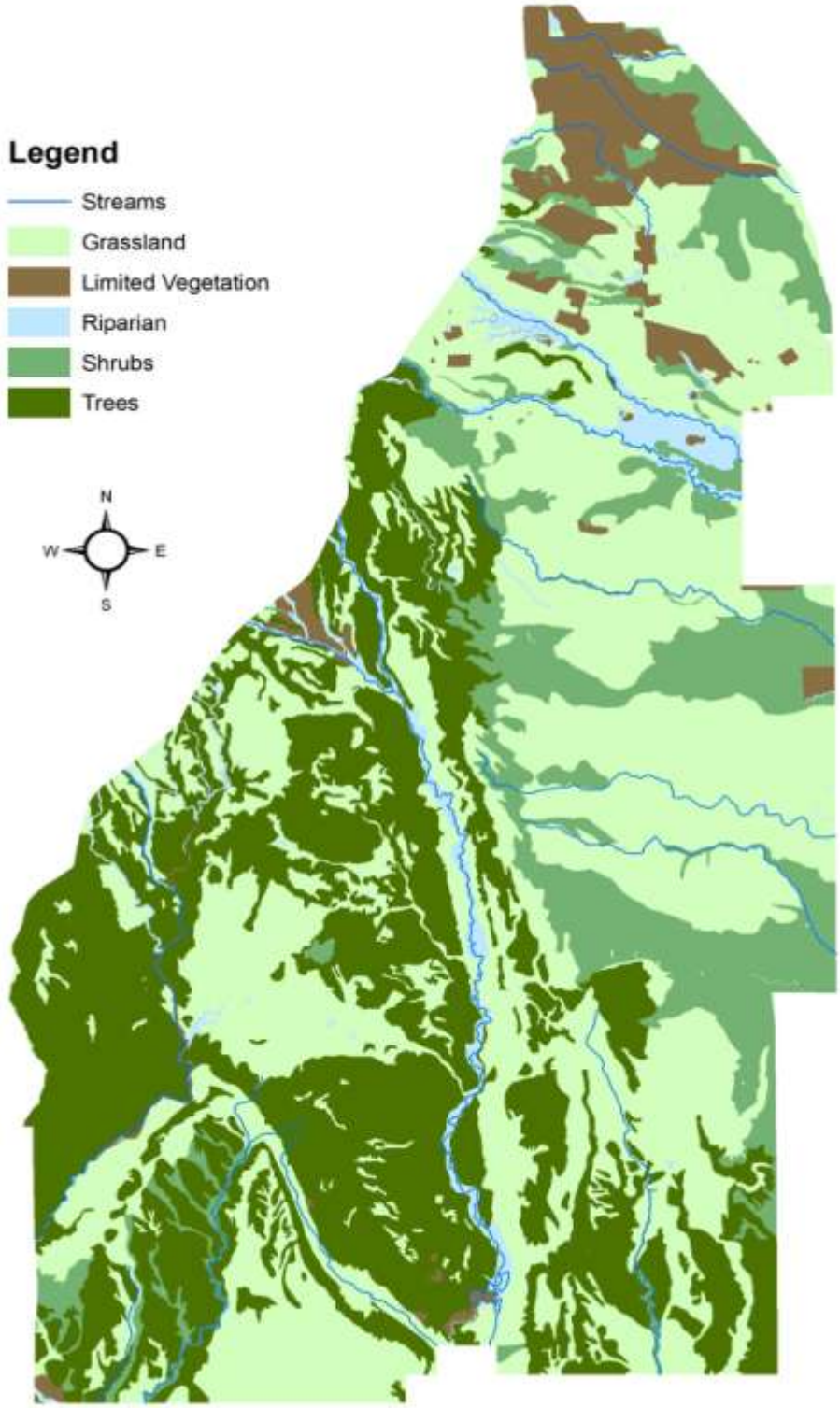


Figure 2-9. General vegetation classes for Fort Carson. Areas with limited vegetation include urban, rocky, or bare soil areas.

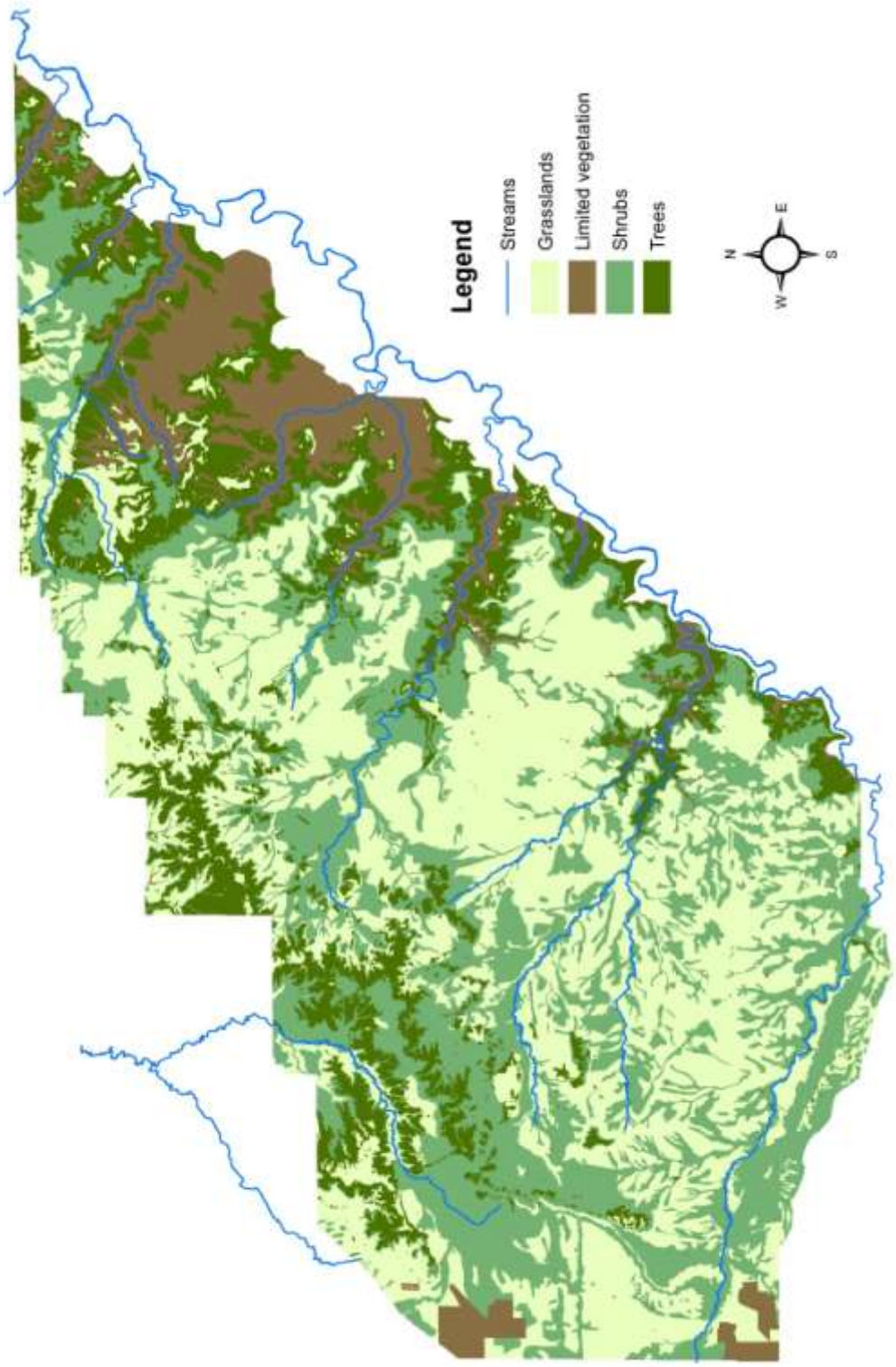


Figure 2-10. General vegetation classes for Piñon Canyon Maneuver Site. Areas with limited vegetation include urban or rocky areas.

3. ENVIRONMENTAL MANAGEMENT STRATEGY AND MISSION SUSTAINABILITY

3.a. Supporting sustainability of the military mission and the natural environment

3.a.(1) Integrating military mission and sustainable land use

This INRMP supports the Army mission by prescribing ways to conserve and enhance training lands upon which the mission is critically dependent, describing recreational opportunities associated with natural resources that are available to Fort Carson personnel as well as others, and describing impacts of the military mission upon natural resources and vice versa. For the impacts of natural resource management on the military mission, please see Section 3.a.(2) below.

In concert with this INRMP, the Training Requirements Integration (TRI) component of the ITAM program is the integration of training requirements, range facilities, and environmental management requirements. Several program areas within DPW also help to integrate the military mission and sustainable land use. For example, the forest management program conducts thinning of pinon-juniper woodlands to improve forest ecosystem health and reduce vulnerability to wildland fire, while at the same time increase the area available for wheeled maneuver. The invasive weeds program seeks to control and minimize invasives in compliance with federal, state, and local laws and regulations, in order to maximize lands available for military training, and to allow native species more opportunities to establish. Coordination and communication between DPTMS and DPW also helps to integrate mission and land use requirements.

3.a.(2) Impacts of natural resource management on the military mission

Natural resource management staff personnel, both from DPW and DPTMS, strive to minimize or eliminate both permanent and temporary restrictions on military training, by means of the following activities.

Mission Safety

Some environmental restrictions and programs enhance mission safety. For example, bank sloping to reduce erosion also reduces rollover risk for maneuvering vehicles. The prescribed fire program reduces the potential effects of wildfires, which can injure troops or damage equipment and training facilities.

Training Restrictions

Restrictions on training are sometimes necessary for long-term sustainment of training capabilities and ecosystem protection. Restrictions on troop training on Fort Carson and the PCMS are found within FC Regulation 350-10 (*Maneuver Damage Control Program*), FC Regulation 385-63 (*Firing Ammunition for Training, Target Practice, Administration and Control of Ranges and Training Areas*), FC Regulation 350-1 (*Mountain Post Training*), FC Regulation 350-4 (*Training at the PCMS)*, and supplemental maps of both installations which delineate off-limits and limited-use areas and are updated periodically. Other documents, such as Fort Carson Regulation 350-1, *Mountain Post Training*, also contain some training restrictions.

Troop units using either Fort Carson or the PCMS must coordinate with DPTMS for site-specific restrictions needed for safety and compliance purposes (e.g. permission to dig large excavations, precluding hitting buried utilities and archeological sites). Troops are briefed regarding current training

restrictions, such as a no-fly buffer if an eagle nest is occupied, via regularly scheduled Maneuver Damage Control classes and/or informed during the scheduling process.

Limited-use (Rest/Rotation or Deferment) program

Range Control operates a limited-use program to accomplish specific objectives. For example, a training area that has been heavily degraded by military training may be temporarily included in the limited-use program to allow for recovery (under the ITAM program, Section 4.w). All limited use areas are reviewed regularly to determine their recovery status and evaluate whether and when they can be returned to the training cycle. The limited use area program is a flexible tool that can be used on both Fort Carson and the PCMS to conserve soils and restore native vegetation in specific areas, especially as troop units return from current theaters of war and training loads ramp back up to normal, peacetime levels. See also Section 4.w., ITAM in this INRMP. DPW may request that certain areas be placed in a limited use status in order to accomplish natural resource management goals, such as rare species habitat improvement or invasive species control. DPW coordinates such requests with DPTMS and G3, and requests their concurrence. The Garrison Commander makes the decision unless he delegates that authority.

Examples of training support

The state of Colorado has been looking at establishing Total Maximum Daily Loads (TMDLs) for selenium in our drainages that are tributaries of Fountain Creek. DPW staff personnel participated in those discussions, and were able to show, based on a previous study, that selenium is both naturally occurring and very abundant in this area, and that our banksloping efforts on the eastern portions of Fort Carson had reduced the amount of sediment, and thus selenium, that was entering Fountain Creek. To date, the State has not imposed a selenium TMDL.

Critical habitat was proposed for the Mexican Spotted Owl in 2000. Fort Carson biologists developed management guidelines for protecting the owl, precluding the need to designate critical habitat on the installation. In response to USFWS concerns of the owl entering live fire areas, Fort Carson biologists conducted day and night telemetry demonstrating the species did not leave Booth Mountain and that live fire in adjacent ranges did not change the behavior of the owl. Booth Mountain is the primary location where the owls have been seen. They are only known to be present during the winter, and they are not present every year.

Military training on the southern portion of Fort Carson was threatened by the presence of several sensitive, candidate, and proposed species. The only site for nesting Mountain Plovers was at the base of Range 123, a live fire jet bombing range. Fort Carson biologists studied the relationship between the plover and jet fly-over and determined the short-term behavior of the plover did not change in response to the jets.

Four species of rare endemic plants occur near the southern boundary of the installation. Fort Carson biologists, in cooperation with the Colorado Natural Heritage, surveyed for the species on Fort Carson, and determined these species were widely distributed on the installation and located at several locations not likely to be impacted by maneuvers. Biologists also surveyed portions of the adjacent buffer zone properties for the plant species and candidate and proposed wildlife species. By acquiring the buffer zone under the ACUB program, the Army can continue to train on our southern Training Areas, because the Walker Ranch contains habitat for those species and other sensitive species.

Banksloping and construction of erosion control (EC) dams, whether done by DPTMS or by DPW, usually enhances training by allowing maneuver in directions that may have been previously unavailable due to gullies.

The above examples, along with others, translate into the fact that no acres on either Fort Carson or PCMS are permanently restricted due to natural resource issues.

3.a.(3) Relationship to the Range Complex Master Plan

The Range Complex Master Plan (RCMP) covers multiple topics related to the operation of existing ranges and planning for funding and construction of needed ranges or range upgrades. It also describes the Army Compatible Use Buffer (ACUB) effort (to establish a buffer zone around Fort Carson in which development incompatible with military training on Fort Carson is avoided or minimized), restrictions to training, ITAM, shortfalls of training land, throughput capacity, funding, and infrastructure downrange. The RCMP is coordinated with the installation Real Property Master Plan. The purpose of the RCMP is to guide the actions of DPTMS in support of the military mission on Fort Carson and the PCMS.

Within the RCMP, under the heading of *Restrictions to Training*, known friction points between environmental considerations and military training are discussed. Three programs ensure that both organizations, DPTMS and DPW, properly coordinate in order to support the military mission to the maximum extent possible. Those processes are the NEPA program; the Army Alternatives Analysis Study (AAS) process; and the Encroachment Condition Module (ECM) process. The NEPA and AAS processes are set in motion by the project proponent submitting a work order or a Military Construction Project Data form (DoD Form 1391). The ECM is a questionnaire or data call received from time to time from higher headquarters, and it is filled out jointly by DPW Environmental and ITAM/Range Control.

Preparation of the RCMP and the annual reviews is somewhat analogous to preparation of the INRMP and its annual reviews. Both require input from the other organization, and thus function to some extent as a system of checks and balances, to help insure that Fort Carson and PCMS achieve a rational balance between the military mission, which is primary, and environmental requirements.

3.b. Natural resources consultation requirements

Federal agencies shall utilize their authorities in furtherance of the purposes of the Endangered Species Act (ESA) by carrying out programs for the conservation of endangered species and threatened species. Under Section 7 of the ESA, Fort Carson is required to (1) consult with the USFWS to insure that any authorized action funded or carried out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat unless granted an exemption by the USFWS, and (2) consult if there is reason to believe that an endangered or threatened species may be present and likely to be affected by the action. Due to the infrequency of protected species at Fort Carson, not very many proposed projects or actions require consultation; in fact, formal consultation is rarely needed. Only those actions that may affect a listed species or a majority portion of a migratory bird population would require formal consultation. The Mexican Spotted Owl is the only listed species on Fort Carson. There are no listed species on the PCMS. Consultation with the USFWS may be needed to deal with specific issues related to the Eagle Protection Act or Migratory Bird Treaty Act.

There is regular communication with the CPW regarding game management, hunting regulations, and monitoring. Fort Carson staff meets annually with CPW biologists to determine game populations, set license numbers, and season dates. In addition, nuisance wildlife issues usually require consultation with CPW law enforcement personnel.

3.c. NEPA compliance

The purpose of NEPA review is to ensure that potential environmental consequences of proposed actions are considered before decisions to proceed with those actions are made, and that those decisions include, to the extent practical, measures to avoid, minimize, or mitigate adverse environmental impacts.

DPW is responsible for ensuring that the appropriate level of NEPA analysis, including public involvement when appropriate, and subsequent documentation is completed before decisions are made to execute all applicable Fort Carson actions (e.g. significant changes in military training, introduction of new technology/equipment testing, construction projects, and real property actions).

3.d. Partnerships and collaborative resource planning

This INRMP has been prepared in cooperation with the USFWS and CPW, as mandated by AR 200-1, paragraph 4-3d(1)(a); DoDI 4715.03, Enclosure 3, and the Sikes Act. Fort Carson collaborates with other entities (see Section 1.d.) on natural resource issues. Natural resources staff collaborate with others through organized groups such as the Front Range Ecoregional Partnership (FREP), a working group of other DoD installations, as well as the Central Shortgrass Prairie Partnership, a group consisting of nonprofits, state and federal agencies, academic institutions, and private landowners focused on conservation in the shortgrass ecoregion. By working towards common conservation goals in the region, Fort Carson reduces the likelihood that restrictions implemented to protect populations and habitats of rare species will negatively impact the training mission.

3.e. Public access and outreach

3.e.(1) Public access and outdoor recreation

Hunting and fishing are allowed on Fort Carson and PCMS at designated times and locations. Access to training lands is under the authority of DPTMS. See section 4.m. (*outdoor recreation*) for more information.

3.e.(2) Public outreach and education

Installation personnel occasionally participate in public outreach and education programs in regard to Natural Resource management. Examples include visiting local schools and universities for programs or leading education programs on the installations; Earth day; public hearings; wildlife law enforcement efforts; and ITAM's Sustainable Range Awareness (SRA) program are all examples of interaction with the public.

3.f. Encroachment management

Critical habitat was proposed for the Mexican Spotted Owl in 2000. Fort Carson biologists developed management guidelines for protecting the owl, precluding the need to designate critical habitat on the installation. In response to USFWS concerns of the owl entering live fire areas, Fort Carson biologists conducted day and night telemetry demonstrating the species did not leave Booth Mountain and that live fire in adjacent ranges did not change the behavior of the owl. Booth Mountain is the primary location where the owls have been seen. They are only known to be present during the winter, and they are not present every year. Appendix 2 of this INRMP provides information on how a reader may review the Biological Assessment and Management Plan for the Mexican Spotted Owl on Fort Carson.

The ACUB Program is an innovative tool to address encroachment, both physical and biological, and to achieve local, regional, and federal conservation objectives. Title 10, Section 2684a of the United States Code authorizes the DoD to enter into cooperative agreements with states, local governments, or private conservation organizations with a purpose of:

- Preserving habitat in a manner that is compatible with environmental requirements and may eliminate or relieve environmental restrictions that may otherwise restrict, impede, or otherwise interfere with military training, testing, or operations on a military installation, or
- Limiting development or use of property that would be incompatible with the training mission of the installation.

Currently, the ACUB program is funded at DoD level through the Readiness and Environmental Protection Initiative (REPI) and other available Army funds. ACUB efforts may also be authorized under a section of the Sikes Act, 10 USC 670c-1(a)(2). Under that provision, Fort Carson may enter into cooperative agreements with state or local governments, nongovernmental organizations, and individuals, to provide for the maintenance and improvement of natural resources outside an installation. The purpose of such agreements must be to relieve or eliminate current or anticipated challenges that could restrict, impede, or otherwise interfere with, whether directly or indirectly, current or anticipated military activities.

The mission of the ACUB program is to establish buffer areas around Army installations to limit the effects of encroachment and maximize land inside the installation that can be used to support the installation's mission. Under the ACUB program, Fort Carson works with partners to encumber neighboring land, without acquiring ownership interests in that land. The program allows the Army to contribute funds to a partner's purchase of easements or properties from willing landowners. The partner finds potential properties, negotiates purchases of the real estate interests, and manages the subsequent interests to ensure that the purposes of the program are carried out. These partnerships limit incompatible development around Fort Carson, and some also preserve habitat. Lands covered by an ACUB are not used for military training.

Fort Carson's ACUB program has involved cooperative agreements with The Nature Conservancy and with El Paso County. Acquisitions under both agreements have mitigated incompatible development around Fort Carson. Acquisitions under the TNC agreement have also preserved open space, protected rare plant communities, safeguarded the habitat of threatened animal species, and protected contiguous key properties within the Central Shortgrass Prairie ecoregion (Figure 2-6). The program provides for protected habitat adjacent or in close proximity to Fort Carson for sensitive species such as the Mountain Plover, black-tailed prairie dog, and Arkansas Valley evening primrose, thereby reducing pressure on these and other species to emigrate to training lands on Fort Carson, which would, in turn, reduce Fort Carson’s training capabilities.

Since early 2003, over 22,290 acres of permanent conservation easements along the south and southeastern Fort Carson perimeter have been acquired by The Nature Conservancy through Fort Carson’s ACUB program. This has created a permanent 2-mile-wide conservation buffer for nearly 18 miles along Fort Carson’s boundary. At the time of this writing, 923 acres of undeveloped lots within the unincorporated El Rancho Development have been purchased by El Paso County from willing sellers. Individual property owners directly adjacent to Fort Carson's eastern perimeter continue to be identified for future participation in the installation's ACUB program.

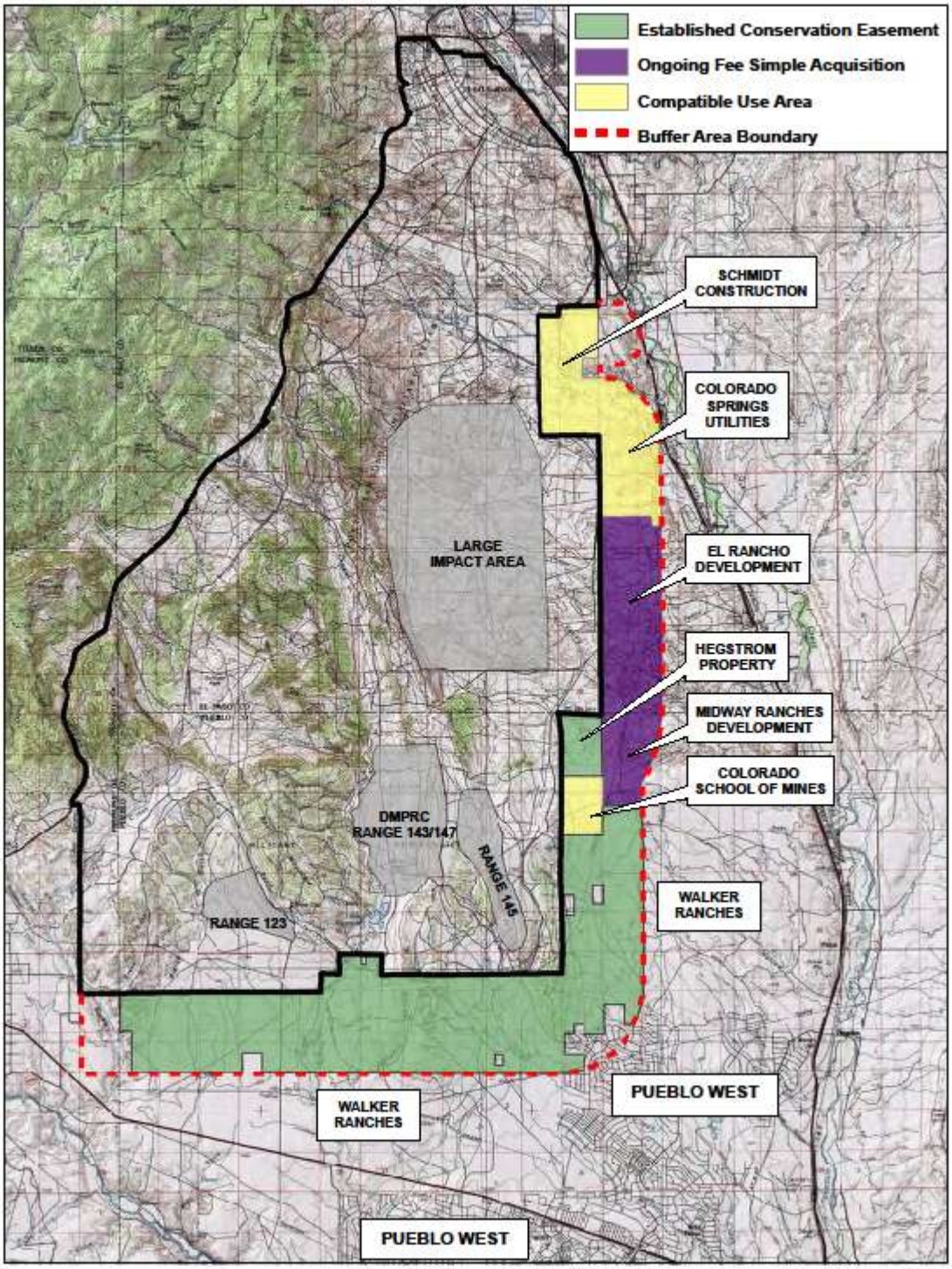


Figure 3-1. ACUB Map as of October 2012

3.g. State comprehensive wildlife plan

This INRMP and the natural resources programs on Fort Carson and the PCMS work in concert with the *Colorado Comprehensive Wildlife Conservation Strategy* (available on the CPW website). As previously mentioned, promoting the conservation of rare species throughout the state reduces the likelihood that future restrictions will be placed on training lands, thus limiting the ability of the Army to fulfill its mission.

4. PROGRAM ELEMENTS

4.a. Species of conservation concern

This section includes an overview of species that are rare or declining and are a conservation concern to federal and state agencies. The goal of management for these species is to benefit the Army by reducing the likelihood that the presence of these species or their habitat could limit Soldier training. Species of conservation concern include: 1) federal listed, proposed, candidate, and petitioned species, and critical habitat, 2) Army Species at Risk, 3) state listed species, 4) USFWS Birds of Conservation Concern, and 5) Colorado Natural Heritage and CPW species of special concern. Please note that management of migratory birds is discussed in Section 4.g of this INRMP, and management of Bald and Golden eagles is discussed in Section 4.x of this INRMP. Please see also Appendix 4 of this INRMP.

Federal species of concern

The USFWS is responsible for administering the Endangered Species Act (ESA). Species protected under ESA are listed as endangered or threatened. An endangered species is one that is likely to become extinct throughout all or a large portion of its range. A threatened species is likely to become endangered in the near future. Candidate species are those that are being considered for listing under ESA. Proposed species are those candidate species that were found to warrant listing as either threatened or endangered. A petitioned species is one requested for listing as threatened or endangered by an interested person or group. Critical habitat, which may or may not be included with a federal listing of a species, is protected habitat required for the recovery of a species.

Federal threatened and endangered species.

The Mexican Spotted Owl (MSO) is the only species protected by the ESA known to occur on Fort Carson. The MSO is a threatened species known to winter in the rugged mountainous terrain located in the south central part of Fort Carson, which includes Booth Mountain. The owl is managed according to provisions specified in the MSO management plan (Gene Stout and Associates 2002b, currently under revision). Protections for the owl include limiting the types of training, resource management, and recreational activities that can occur in immediate areas occupied by the owl. There are no federally listed species on the PCMS.

Federal candidate species for listing.

The Arkansas darter is the only candidate species known to occur on Fort Carson. The darter is primarily distributed in the northern third of the installation. Spring-fed streams are the primary habitat of this species, but it also inhabits perennial streams and pools. There are no known federal candidate species on the PCMS. While candidate species are not directly addressed by the ESA, it is within the spirit of the Act to consider project impacts to sensitive candidate species. It is the intention of Fort Carson to protect these species before they are adversely impacted to the degree that they would need to be listed and,

therefore, protected by the ESA. The darter is also a Colorado threatened species and protected by state regulation. Specific protection measures for the Arkansas darter are not required, primarily because the known current (pending a formal survey in conjunction with the CPW) darter populations are not in areas that support mechanized training.

Federal proposed species.

There are no federally proposed species occurring on Fort Carson and the PCMS.

Federal petitioned species.

The northern leopard frog was petitioned for federal listing in 2006. The USFWS determined that listing the frog is not warranted at this time. (Federal Register Vol 76, No. 193, Wednesday October 5, 2011.) The frog is known to occur in ponds and permanent streams in the northern third of Fort Carson, including cantonment ditches. Petitioned species are not protected by the ESA, but are protected by state regulation and FC Reg 200-6. Fort Carson conducts inventory surveys for the leopard frog at known and new sites annually depending upon staff availability and access to training lands. There are no federal petitioned species on the PCMS.

Critical habitat.

Critical habitat is not designated on Fort Carson or the PCMS for any species.

Army species at risk (SAR).

Army SAR are species that can significantly impact the Army training mission if listed as threatened or endangered. The objective of the Army SAR initiative is to conserve species prior to listing. On Fort Carson and the PCMS, SAR species are one species of reptile, Triploid checkered whiptail (*Cnemidophorus neotesselatus*), and four plant species: Dwarf milkweed, Golden blazingstar, Arkansas feverfew, and Roundleaf four o'clock (*Asclepius uncialis, Mentzelia chrysantha, Bolophyta tetraneuris, and Oxybaphus rotundifolius*). Except for Dwarf milkweed, the plant species are narrowly regional endemics restricted to shale barrens. The reptile is a narrowly endemic species of southeast Colorado. On Fort Carson, these species are primarily distributed in the southeast and southwest parts of the installation. Populations of Arkansas feverfew and Roundleaf four o'clock occur in the shale barrens habitats at the PCMS. Each of these plant species are former federal candidates for ESA listing. These species are not currently protected by state or federal regulations. However, in order to minimize the possibility that they would ever become candidates again, there is a section of FC Regulation 200-6 that prohibits recreationists from collecting them. Training restrictions are not warranted at this time to protect populations of Army SAR on Fort Carson or the PCMS. Approximately 70% of the known habitat for these species has been surveyed on Fort Carson. Inventory surveys for Army SAR are conducted at known and new sites annually depending upon staff availability and access to training lands.

State listed species.

There are three state listed species on Fort Carson: southern redbelly dace (endangered), Arkansas darter (threatened), and Burrowing Owl (threatened). The primary dace population occurs in Quarry Pond; smaller populations occur in the golf course and other ponds on Fort Carson. The darter occurs at several sites on Fort Carson, with the largest populations occurring in Cottonwood Springs and Lytle Pond. The Fort Carson dace and darter populations have been instrumental in recovery efforts for these species in Colorado, since Fort Carson has provided dace and darters to the CPW for establishing or augmenting populations and breeding stock for state fish hatcheries. These two species of fish are not protected by

the ESA, but are protected by state regulation and FC Reg 200-6. The dace and darter do not occur on the PCMS. The Burrowing Owl is widely distributed across Fort Carson and the PCMS but occupies only a small percentage of available habitat. The owl is present on both installations March-October and is primarily restricted to prairie dog colonies during the nesting season. The owl is not protected by the ESA but is protected by the MBTA and state regulation. The Burrowing Owl is the only state-listed species known to occur at the PCMS. Breeding surveys are conducted annually, in conjunction with Mountain Plover and black-tailed prairie dog surveys.

Birds of Conservation Concern.

Several bird species of conservation concern occur on Fort Carson and the PCMS. Included in this group are USFWS Birds of Conservation Concern, Colorado Natural Heritage watch-listed and tracked species, and CPW Species of Special Concern. These species are detailed in Migratory Bird Management, section 4.g. In addition, Fort Carson personnel annually conduct grassland point-count surveys and annually record observed nesting locations of Burrowing Owls and Mountain Plover, in order to monitor nesting trends. Also, prior to construction projects, clearing surveys are conducted; for example, Burrowing Owl surveys are conducted year-round for three days in accordance with CPW protocol.

The Bald and Golden Eagle Protection Act (BGEPA) protects eagles. Both species occur on Fort Carson and the PCMS. Details regarding eagle management for both installations are found in the Bald and Golden Eagle Management, section 4.x

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Colorado Natural Heritage and CPW species of special concern

This group includes amphibians (2 species), reptiles (6 species), mammals (10 species [including 4 species of bats]), and vascular plants (15 species). Fort Carson biologists record and map all sightings of these species. The black-tailed prairie dog, a keystone species of conservation concern integral to the survival of other sensitive species, is monitored annually for persistence in the training environment and the presence of plague. Species dependent on prairie dogs on Fort Carson and the PCMS are Golden and Bald Eagles, Ferruginous Hawk, Mountain Plover, and the Burrowing Owl. Prairie dogs are the primary prey of eagles on both installations, and modify grassland habitat making it suitable for Burrowing Owl and Mountain Plover nesting.

In 2011, Fort Carson and the CPW installed bat gates on abandoned mine entrances to protect maternal and wintering areas of bats, including the Townsend's big-eared bat. In 2013, Fort Carson plans to conduct a post-wide inventory for bats using ultrasound detectors and mist nets. We also intend to monitor physical characteristics of the mines and their use by bats (subject to availability of funds and/or personnel).

Recurring actions for managing species of conservation concern on Fort Carson
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Continue monitoring plague status annually of the black-tailed prairie dogs and for the presence of nesting Burrowing Owls and Mountain Plovers.

2. Continue evaluation, at three-year intervals, of MSO roost tree buffer zones for compliance with restrictions specified by the USFWS.

3. Continue dusting as needed to prevent plague in prairie dog colonies important to nesting and wintering eagles and the Ferruginous Hawk, and nesting Burrowing Owls.

4. Continue Arkansas darter and southern redbelly dace population monitoring and inventory annually, as scheduled around training.

5. Continue inventory of northern leopard frog populations annually, as scheduled around training.

6. Continue to inventory Army SAR populations and evaluate persistence and relationship to training annually, as scheduled around training.

7. Continue to assist the USFWS and CPW with relocating Arkansas darter and redbelly dace to new and existing sites in Colorado, annually, if requested by other agencies.

8. Continue mapping distribution of sensitive species, annually as encountered.

9. Continue protection and monitoring of Townsend's big-eared bat maternal colonies, hibernacula, and fringed myotis roost sites, annually.

10. Maintain bat gates to prevent disturbance and the spread of white-nose syndrome from anthropogenic sources (annual inspection).

11. Create cover for sensitive species of reptiles, amphibians, and small mammals by leaving non-diseased, felled tree trunks in place during forestry operations. Logs are an important component of Mexican Spotted Owl habitat and should be left in place following forestry operations in owl habitat.

12. Create slash brush piles at sites where not increasing spread of wildland fire.

13. Sustain sensitive small mammal and bird populations in woodland areas by preferentially leaving large trees with natural and bird created cavities and crevices.

Recurring actions for managing species of conservation concern on the PCMS
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Continue to inventory Army SAR populations and evaluate persistence and relationship to training, annually, as scheduled around training.

2. Continue protection and monitoring of Townsend's big-eared bat maternal colonies, hibernacula, and Fringed myotis roosts, at three year intervals.

3. Create cover for sensitive species of reptiles, amphibians, and small mammals by leaving non-diseased, felled tree trunks in place during forestry operations.

4. Sustain sensitive small mammal and bird populations in woodland areas by preferentially leaving large trees with natural and bird created cavities and crevices.

5. Create slash brush piles at sites where not increasing spread of wildland fire.

6. Monitor for the presence of nesting Burrowing Owls and Mountain Plovers.

4.b. Wetlands management

Wetland management on Fort Carson and the PCMS consists of all elements related to compliance with the Clean Water Act, Section 404, as well as applicable executive orders, Army regulations, and state laws. The wetlands management program adheres to provisions of the Clean Water Act to ensure protection from irresponsible and unregulated discharges of dredged or fill material that could permanently alter or destroy valuable water resources on Fort Carson and the PCMS. Executive Order 11990, *Protection of Wetlands* (1977) and the Clean Water Act require no net wetland losses on federal lands in the United States. The goal of the Wetlands management program is no net loss of wetlands on Fort Carson or the PCMS.

Fort Carson – Fort Carson and the PCMS were included in the 1992 National Wetlands Inventory (NWI), and in another NWI completed in 2004. The 2004 NWI map is included in the DPW GIS. The 1992 data showed 487.9 acres of wetlands on Fort Carson. There has been considerable confirmation of sites to improve the quality of the original data. The current estimate of wetlands on Fort Carson, based on the 2004 NWI, is 1,028 acres.
Wetlands on Fort Carson are generally characterized as linear (*e.g.*, streambeds) or small and isolated. Linear wetlands occur along intermittent and perennial stream channels and tributaries, primarily Rock, Little Fountain, Turkey, Little Turkey, Red, Sand, and Wild Horse Creeks. Isolated wetlands usually occur where an erosion control dam has been built for erosion control or for water storage; most are only 1-2 acres in size. The largest downrange wetland is on the upper reaches of Teller Reservoir, encompassing about 100 acres. In addition to cattails, common wetland species are cottonwood and willow. There are also a number of wetland areas scattered throughout the main post area, typically in natural or stormwater runoff drainages and in the wildlife management area south of Butts Army Airfield.

PCMS – The current estimate of wetlands on the PCMS, based on the 2004 NWI, is 361 acres compared to the 1992 NWI estimate of 4,776-acres. This significant reduction is the result of the administrative transfer of the Purgatory River section from Army management to the USFS. Most wetlands on the PCMS are associated with side canyons that are tributary to the Purgatoire River, and water developments.

Wetland protection

Proposed projects or activities that may impact wetlands and the Waters of the United States (often referred to as 'jurisdictional wetlands') must be reviewed for compliance with the Clean Water Act (CWA) Section 404, and with the Storm Water Discharge General Permit for construction sites in accordance with provisions under the National Pollutant Discharge Elimination System (NPDES) permitting process. Review is accomplished through the DPW work order/service order process. Projects that may impact or be in close proximity to wetlands or Waters of the United States must be reviewed whether going through the Work Order or the Service Order process.

Per the CWA, Section 404 (b)(1), there are three tiers of procedures for reducing or eliminating potential net losses of wetlands. The three tiers are: 1) Avoidance of impacts whenever possible; 2) minimization when impacts cannot be avoided; and 3) mitigation for impacts that cannot be minimized.

There are three types of permits that may be used based on the level and type of impact. They are the Regional General Permit (RGP) for Fort Carson and PCMS, the Nationwide Permit (NWP) and the Individual Permit. The proponent must factor into their project timeline up to 180 days, under normal circumstances, for USACE review if the latter two permits are used. Modifications during the review

process, or anything that might cause the review process to be elevated, may delay the review even more. Projects requiring an EIS may take as long as three years to obtain a CWA permi

The RGP for Fort Carson and PCMS (2008-2013) was developed by Fort Carson and the USACE for standard erosion control work. This permit includes the construction and modification of erosion control dams, check dams, diversions, etc. Specific restrictions are identified in the permit, such as acreage limits per project, time limits for completion, submission of quarterly reports, etc. Fort Carson is required to report all completed activities covered under this RGP to the USACE on a quarterly basis. The Conservation Branch of the DPW Environmental Division collects this information and submits it to the USACE in Pueblo.

Activities not covered by the RGP may be covered by one of 52 NWPs. The project proponent, in coordination with the DPW, may identify the permit that fits the project and follow the guidelines of that permit. Based on these guidelines the proponent may be required to submit a request in writing to the USACE in Pueblo for a permit. Even if a proposed project or activity is covered by a NWP, in most cases the proponent must provide a pre-construction notification to the USACE in Pueblo, and await their confirmation of coverage. To avoid any confusion over the interpretation of the permits, the proponent should prepare a short description of the project with the location and area of disturbance and submit it to the USACE office for their direction. This will reduce the guess work and get the USACE involved early in the process.

For activities not covered by the RGP or a Nationwide Permit, the proponent must obtain an Individual Permit.

Once the permit is obtained the proponent must follow the requirements in the permit. This includes the placement of BMPs, monitoring of the site and regular reporting to the USACE.

If a permit is required, but not obtained, work must stop until the permit is obtained. The USACE may deem it necessary to issue a Notice of Violation to stop the work and seek restoration or mitigation of the site.

All proposed projects should go through the DPW work order/service order process. However, each project proponent needs to be aware that they will have to remain involved throughout the process. The following is a list of the main steps a project proponent must complete.

1. Submit the project for DPW work order/service order review.
2. If project is covered by the RGP, report the completed work to the DPW Conservation Branch POC for inclusion in the quarterly report to the USACE.
3. If the project may be covered by one of the NWPs, submit a pre-construction notification to the Pueblo USACE, with a courtesy copy to the DPW Conservation Branch POC.
4. If the project is not covered by the RGP or an NWP, apply to the Pueblo USACE for an Individual Permit, with a courtesy copy to the DPW Conservation Branch POC.
5. Comply with the terms of the permit.
6. Coordinate any changes to the project with the Pueblo USACE and the DPW Conservation Branch POC.
7. Implement mitigation measures if required by the permit or NEPA.
8. Monitor the success of mitigation measures for the period of time specified in the permit or NEPA document.

Water quality

Sediment — Erosion is a natural process in the semi-arid region of Colorado. Gullies transport sediment during flash flood events. At Fort Carson and the PCMS, DPW and DPTMS are focused on minimizing accelerated erosion – erosion which occurs above the natural level. Erosion can be accelerated by construction, and by training activities that damage the vegetation cover. When vegetation is removed, soil is exposed and more likely to be moved. This reduces the long-term ability of the training lands to support vegetation and the military mission. Projects that involve constructing BMPs (e.g. erosion control dams, check dams, bank-sloping) down-range to repair maneuver damage are constructed primarily under the ITAM program (Section 4.w.).

A survey of sediment loading at over 40 Fort Carson sites was conducted during 1998-2000 in cooperation with the Agricultural Research Service. In addition to the network of 40 sites, monitoring stations on an erosion-control reservoir and a stream draining the western portion of Sullivan Park (Red Creek) were operated. The program with Agricultural Research Service was concluded during 2002. The previously operated, continuous-record, erosion-control reservoir was added to the network of three erosion-control reservoirs monitored (semi-annual or as-needed visits) by the USGS. The seasonally-operated, continuous-record, stream flow-sediment gauging station on Red Creek was converted to a seasonally-operated, peak-flow only gauging station. These sites continue to be operated by the USGS in support of limited erosion and sediment production assessment of Fort Carson.

The USGS continues to monitor a network of more than 70 erosion-control reservoirs (semi-annual or as-needed site visits), a main-stem streamflow-gauging station on the Purgatoire River, and five seasonal, continuous-record, streamflow-sediment gauging stations on tributaries draining more than 60 percent of the PCMS. Monitored erosion-control reservoirs are used in assessing sediment and streamflow yields from small watersheds within the PCMS, and streamflow-sediment gauging stations are used to quantify streamflow and sediment outflows from the PCMS. These sites continue to be monitored and/or operated by the USGS in support of erosion and sediment-production assessment of the PCMS, subject to availability of funding from the Army.

Selenium — Fort Carson and the PCMS have some of the highest naturally occurring, documented levels of selenium in the United States. Naturally occurring selenium can create problems when land disturbances, such as military mechanized maneuvers and excessive erosion, occur. Selenium that has leached into lower soil profiles over millions of years is exposed, and plants that act as selenium receivers then invade disturbed sites. Selenium can enter directly into aquatic systems when selenium-loaded soils are exposed to water. Selenium can also be redistributed onto ground surfaces by deep-rooted, selenium receptor plants. Both aquatic and terrestrial wildlife can be acutely and chronically affected. No government standards/regulations exist for terrestrial and non-point source selenium. Banksloping projects on the eastern portions of Fort Carson have been shown to reduce the amount of sediment, and thus the amount of selenium, that enters Fountain Creek.

Stormwater — DPW-Environmental operates a stormwater program which is focused on mitigating the effects of development (e.g. buildings, roads) on hydrology. This program facilitates the stormwater permitting process for new construction projects and includes regular water quality sampling and analysis



Bank sloping before and after

in the main post area of Fort Carson. For more information on the program and the EPA-issued Municipal Separate Storm Sewer System (MS4) permit, see the Fort Carson Stormwater Management Plan (http://www.carson.army.mil/DPW/environmental/stormwater/documents/20130401-SWMP.pdf).

Protection of water quality – Under an Army-wide program, all ranges on Fort Carson and the PCMS have been qualitatively evaluated for the presence, and possible migration pathways, of lead and other munitions constituents. Several ranges at Fort Carson are also being quantitatively monitored. At all PCMS ranges, sufficient evidence was found to show no known releases or source-receptor interactions that could present an unacceptable risk to human health or the environment. All ranges will be re-evaluated periodically. Also, SOPs require that spill containment measures be put in place when temporary refueling points are set up downrange during training exercises. Drip pans are used, as needed, under every military vehicle while it is stationary.

Impaired waters

Section 303(d) of the Clean Water Act (33 USC 1313(d)) requires the State of Colorado to classify waters that do not meet designated water quality standards as "impaired" water bodies. Colorado's Water Quality Control Commission within the CDPHE is required to present this information in a list to the EPA for review and approval. This list is known as the "Section 303(d) List of Impaired Waters".

As part of this listing process, the CDPHE is required to prioritize waters/watersheds for future development of Total Maximum Daily Load (TMDL). Colorado and the Regional Water Quality Control Board have ongoing efforts to monitor and assess water quality, develop the Section 303(d) List, and develop TMDLs with associated priorities of High, Medium, or Low. The 303(d) list is regularly updated and can be downloaded through the EPA or CDPHE websites. Portions of Fountain Creek and Wild Horse Creek are listed as impaired for selenium and / or *e-coli*. Sections of the Purgatoire River have been listed as impaired for selenium. Fort Carson will continue to coordinate with the CDPHE to monitor and comply with regulations associated with impaired waters.

Recurring actions for wetlands management
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and

fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Ensure no-net-loss of wetland acreage on Fort Carson and the PCMS.
2. Use the NEPA process to evaluate impacts on wetlands, which could result from new construction or other activities, and assist with coordination between proponent and USACE.
3. Submit quarterly RGP reports, and review/update the RGP on a 5 year basis.
4. Maintain/update database of Waters of the US delineations with the USACE.

4.c. Conservation Law enforcement

The Fort Carson Conservation Law Enforcement Program is responsible for actively enforcing local, state, and federal environmental, natural and cultural resource laws and regulations. 16 USC 670e-1, a part of the Sikes Act, states, "All Federal laws relating to the management of natural resources on Federal land may be enforced by the Secretary of Defense with respect to violations of the laws that occur on military installations within the United States." 10 USC 2671, *Military reservations and facilities: hunting, fishing, and trapping*, mandates the Secretary of Defense to require that all hunting and fishing on an installation be in accordance with the fish and game laws of the state in which it is located. This statute also says that an act or omission committed on the installation that would have been punishable under state law be subject to a like punishment.

Pursuant to the Garrison Commander's inherent responsibility to provide for the safety and security of the installation, Fort Carson Conservation Law Enforcement Officers (CLEOs) are duly commissioned law enforcement officers specially trained and delegated the authority to enforce all natural and cultural resource laws, statutes and regulations on Fort Carson and the PCMS. CLEOs are assigned to the Directorate of Emergency Services (DES). As stated earlier, this INRMP does not enlarge or diminish the existing responsibilities of the USFWS or the CPW or the DoD. Certain details of law enforcement operations may evolve over time as part of the annual review process of this INRMP, and be captured in written mutual understandings or agreements. If appropriate, any such changes would be included in future updates of this INRMP.

The Fort Carson Office of the Staff Judge Advocate and the local federal magistrate approved a *Violations and Monetary Penalties List*. Violators are cited by Fort Carson CLEOs for misdemeanor offenses through the US Courts Central Violations Bureau. This list contains citable offenses and monetary fines that mirror USFWS and CPW violation penalties. Felony violations are coordinated with the US District Court for the District of Colorado through the Staff Judge Advocate's Special Assistant to the Assistant United States Attorney.

CLEOs may also suspend for up to five years the recreational privileges of any recreationist that has committed an offense involving willful criminality or gross negligence. Suspensions are recommended by the Chief, Law Enforcement, while the ultimate appeal authority is the Garrison Commander.

The goal of the Conservation Law Enforcement Program is to help ensure the safety and security of Fort Carson and the PCMS by enforcing all natural resource laws, statutes, and regulations on these installations.

Priorities

Conservation law enforcement activities are prioritized based upon the impact violations may have on state and federally mandated requirements, animal species and habitat identified as critical, and on the operations of the installation. The following list of priorities is not inclusive and may encompass other concerns as the mission dictates. Enforcement emphasis will change seasonally or with the deployment or redeployment of military units, but these priorities will not change:

Priority 1 – Endangered Species Act (ESA)
Archeological Resource Protection Act (ARPA)
Native American Graves Protection and Repatriation Act (NAGPRA)
Bald and Golden Eagle Protection Act (BGEPA)

Priority 2 – Migratory Bird Treaty Act (MBTA)
Lacey Act (combats trafficking in illegal wildlife, fish, and plants)
Game law compliance inspections

Priority 3 – Hazardous Waste Disposal Violations
Clean Water Act
Clean Air Act

Operations

CLEOs support Fort Carson's mission by conducting law enforcement patrols and investigations; providing for the safety of recreationists and military users of the land; maintaining a proactive environmental and wildlife education program to deter intentional or inadvertent violations of the law; and assisting the installation's requirement to meet natural resource objectives as outlined within this Plan. The CLEOs accomplish this by:

Investigating violations of natural and cultural resource laws, citing offenders and pursuing prosecution. Fort Carson CLEOs must inform the CPW of all violations of State wildlife statutes in a timely manner and provide the CPW the opportunity to collaboratively investigate all violations. Copies of post adjudication misdemeanor citations written on Fort Carson, regardless of jurisdiction, will be sent to the CPW for assessment of points against a violator's hunting and fishing privileges. Copies of citations written by the CPW on Fort Carson or the PCMS, regardless of jurisdiction, will be provided to the Supervisory CLEO either via e-mail or may be dropped off at the Military Police Desk at building 2700.

Ensuring violations of the ESA, BGEPA and ARPA are coordinated with the USFWS Office of Law Enforcement to foster an exchange of criminal information and expedite prosecutorial efforts.

Proactively enforcing provisions of Federal laws to ensure compliance and help avoid violations by official and recreational users of military lands.

Ensuring that important habitat, waterways, nesting sites and culturally sensitive areas are identified by the Natural Resource Manager and program managers, and routinely monitored via patrols, surveillance and the strategic placement of motion activated cameras.

Actively patrolling ranges, particularly during hunting seasons, to prevent conflicts and ensure the safety of recreationists and military personnel training.

Conducting federal and state license compliance inspections to ensure recreational users are properly authorized to hunt and fish on the installation and comply with all wildlife related laws and regulations. Law enforcement personnel from the CPW (in areas of concurrent and State jurisdiction) and USFWS are allowed unfettered access to the installation to the greatest extent possible, as determined by Range Control based on live-fire activities and/or secure or classified activities, to conduct license compliance inspections and patrols. Prior to conducting any other law enforcement operations or activities on the installation, coordination is required to be effected with the DES through the Supervisory CLEO.

Advising and assisting commanders, directorates and residents to resolve problems with nuisance wildlife. Bears or lions on Fort Carson or on the PCMS that pose an immediate threat to human health and safety may be humanely euthanized. The entire carcass will be provided to the CPW for disposition. Other bears deemed simply a nuisance may be hazed from populated areas and the CPW can be notified to assist with conflict prevention and control measures. Prior to trapping, tranquilizing, and translocating any bear or lion, coordination will be effected with CPW to ensure compliance with the state's black bear and mountain lion policies, such as CPW administrative directive W-2. Per Directive W-2, all translocated bears will be ear-tagged with yellow ear tags by CPW personnel. The phrase "do not consume if harvested before XXXX date" and a withdrawal date from the controlled sedation drug will be clearly labeled on the ear tag. All complaints of bear or lion activity will be reported to the CPW for record-keeping and identification of areas for proactive management strategies.

Assisting DPW with providing education classes to soldiers, commanders, recreationists, school age children, and the general public concerning natural resource laws, urban wildlife encounters, and environmental concerns.

Recurring Actions for Law Enforcement
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Ensure military and civilian personnel and activities are in compliance with natural, cultural and environmental laws and regulations on Fort Carson and the PCMS.

2. Coordinate enforcement activities with other stakeholder agencies and organizations.

3. Assist in providing education and awareness classes to various groups that use Fort Carson and the PCMS.

4.d. Fish and wildlife management

Fort Carson and the PCMS lands support a broad array of wildlife and ecosystems that are integral to the Army training mission and to landscape scale natural resources management in eastern Colorado. Ensuring Army lands meet current and future training needs for realistic training through the sustainment of biological diversity of terrestrial and aquatic ecosystems is the overall goal for wildlife management on Fort Carson and the PCMS. The species included in this section are vertebrate game and nongame species with regionally or nationally secure populations that are not covered in the Species of Conservation Concern, Migratory Birds, and Eagle Protection sections.

The big game management goal for Fort Carson and the PCMS are species management within an ecosystem context that includes water development, control of invasive species, large-scale habitat

improvement with prescribed fire and reseeding, and regional CPW management objectives for private and public lands.

Big game populations in Colorado Game Management Unit (GMU) 591 Fort Carson and GMU 142 PCMS are managed by seasonal hunting to attain population and sex ratio targets set by the CPW. Harvest objectives are cooperatively established annually, and the CPW sets the final season dates and the numbers of licenses sold. Big game hunting on both installations encompasses archery, muzzleloading, and rifle seasons, which begin in late August and end in January. Hunting and fishing regulations specific to Fort Carson and the PCMS are detailed in FC Reg 200-6.

The major big game seasons, in terms of the number of participants, are deer, elk, and pronghorn. Lion, bear, sheep, and waterfowl seasons attract fewer hunters annually. Turkey, dove, coyote, bobcat, and rabbit are the important small game seasons. Management of big game populations presents significant challenges related to ensuring adequate law enforcement and security, safety of training Soldiers, and mitigating hunting season conflicts with military training. Hunting season conflicts are less problematic on the PCMS than on Fort Carson due to how training is scheduled and the number of hunters. The number of hunters in the field at the PCMS is typically 20-25% less than at Fort Carson and training frequency and duration is currently considerably greater at Fort Carson.

The primary focus of big game population management on both installations is development of supplemental water sites, prescribed fire, and the reducing the incidence of Chronic Wasting Disease (CWD).

Deer

Deer and elk aerial surveys are conducted periodically on Fort Carson and the PCMS to derive population estimates and ratios of the number of bucks per 100 does, yearling bucks per 100 does, two-year old buck per 100 does, mature bucks per 100 does, and fawns per 100 does. Harvest levels are set cooperatively by Fort Carson and the CPW to meet Data Analysis Unit (DAU) population and sex ratio goals. The DAU is a CPW management area and represents the year-round geographic range of a big game herd and is composed of one or more GMU. GMUs 591 and 142 are part of DAUs which include multiple adjacent GMUs for all game species. For example, GMU 591 is part of deer DAU D-50, which includes GMUs 59, 511, 512, and 591. Big game population and sex ratio objectives are established by the CPW for individual DAU. Reducing the spread of Chronic Wasting Disease (CWD) from Fort Carson to adjacent private and public land is also an objective factored into population objectives. CWD is a transmissible neurological prion disease affecting deer, elk, and moose. The disease produces spongiform changes in the brain, abnormal behavior, progressive weight loss, and eventually death.

The prevalence of CWD is a significant deer management concern on Fort Carson and regionally. The CPW recognizes Fort Carson as a “CWD hot spot" due to a high number of animals testing positive for the disease. Starting in 2011, testing for CWD will be mandatory for deer harvested on Fort Carson so biologists at Fort Carson and CPW can quantify disease prevalence at the installation. Disease testing will also be conducted in the surrounding GMU’s as a baseline comparison for overall disease prevalence in the deer herd which includes Fort Carson. In wild deer herds, CWD prevalence is thought to have a positive relationship with deer density. Within deer herds, middle age class bucks (5 and 6 year olds) have the highest rate of CWD. Reducing deer density and harvesting middle age class bucks may be one way to reduce the prevalence of the disease on Fort Carson. Accordingly, the CPW and Fort Carson have agreed to allocate more deer hunting licenses on the installation in an effort to reduce deer densities. The effectiveness of this approach will be evaluated by the CPW monitoring the proportion of deer testing positive for the disease.

Fort Carson, Air Force Academy, and University of Colorado at Colorado Springs are cooperatively investigating the relationship between deer movements and habitat use and military training. Forty female deer were fitted with satellite GPS collars. Fieldwork began in March 2010 and will be completed in late 2012.

Elk

The Fort Carson elk population is estimated to be fewer than 300, a significant reduction from the previous decade when the estimate was 800 to 1,000. The two largest herds, numbering 60-90 animals are found along the installation border, and the elk move between the installation and private lands. In 2008, 60 elk were counted during aerial surveys and four were seen on the 2009 surveys. The low count for 2009 is due, in part, to movement of elk off Fort Carson onto adjacent private property during the survey. The number of elk on the PCMS is unknown due to the lack of surveys, observers on the ground, and significant movements of elk between private lands and the installation. Harvest levels are set cooperatively by Fort Carson and the CPW to meet DAU population goals to reduce regional game damage on private lands.

Pronghorn

The 2011 pronghorn population of Fort Carson was estimated to be fewer than 125 animals. The largest herds, ranging from 20 to 40 individuals, are found along the southern border and in and along the north and east side of the Large and Small Impact Areas. Pronghorn are frequently associated with prairie dog colonies and cholla fields, and herds move frequently between Army lands and adjacent private lands. The numbers of licenses for Fort Carson pronghorn have been low due to the small population size. At the PCMS, harvest objectives for pronghorn in GMU 142 Pinon Canyon are captured in the regional CPW objective to maintain a steady population. Pronghorn surveys are conducted annually on the PCMS by CPW personnel.

Bighorn sheep

The PCMS is located within Sheep Management Unit S61. Hunters with a license for this unit frequently hunt on and adjacent to the PCMS. Three licenses are issued for this unit annually. Sheep occasionally occur on Fort Carson, but are not hunted. Fort Carson, CPW, and the Rocky Mountain Bighorn Sheep Society are cooperatively developing supplemental water sites for sheep at the PCMS.



Bighorn sheep

Nongame species

Nongame species inventory and monitoring are conducted annually on Fort Carson and the PCMS. Species of conservation concern are the primary focus of all nongame inventory and management. Surveys for sensitive and rare species are generally conducted at the community level and are therefore

inclusive of species groups identified in this section, e.g. inventory of northern leopard frogs includes all amphibians.

Native fish

Nine species of native fish are known to occur on Fort Carson (Appendix 4) and 11 species on the PCMS (Appendix 4), which includes species of conservation concern and state threatened and endangered species. A monitoring program initiated at Fort Carson in 1995 was replicated in 2006. Since 2006, multiple sites of interest, including the 1995 monitoring sites, were surveyed cooperatively by DPW, Colorado State University, and CPW. These sites were surveyed primarily for evaluating the potential effects of actions executed in and adjacent to wetlands and CPW monitoring objectives. Native fish management on Fort Carson includes (1) enforcing regulations prohibiting use of minnows as live bait (although other forms of live bait are permitted) to prevent introductions of non-native fish; (2) ensuring sensitive species of native fish persist at current sites through best management practices (3) removing non-native predator fish; and (4) working with DPW to protect native fish populations during construction and other actions. DPW will continue to provide native fish from Fort Carson to CPW to assist with breeding programs and establishing populations at locations in eastern Colorado.

Extensive aquatic inventories have been conducted on the PCMS, but populations are not monitored by DPW. At PCMS, the primary native fish management tool is enforcing the regulation prohibiting fishing.

Amphibians

A comprehensive inventory, i.e. Army Planning Level Survey, of amphibians has not been conducted on either installation. Most species records are opportunistic sightings reported by biologists during execution of other field projects. A partial two-year inventory for amphibians was conducted on Fort Carson in the northern third of the installation in conjunction with an inventory for the northern leopard frog. Seven native amphibian species are known to occur on Fort Carson, including the New Mexico spadefoot, a species of special concern. The bullfrog is an introduced species and is spreading into new areas on Fort Carson, threatening leopard frog populations, a federal petitioned species for listing. The status of the bullfrog on the PCMS and threats to the plains leopard frog, a species of conservation concern, are unknown. Native amphibian management includes (1) enforcing regulations prohibiting take of amphibians; (2) ensuring native sensitive species persist at current sites through best management practices; (3) working with DPW to protect amphibian habitat during construction and other actions, e.g. ditch and storm water management; and (4) in accordance with FC Reg 200-6, the taking, collecting, capturing, or possessing of bullfrogs are authorized with a Fort Carson recreational permit and in accordance with state regulations.

Reptiles


Bull snake

A comprehensive inventory, i.e. Army Planning Level Survey, of reptiles has not been conducted on either installation. Species records are opportunistic sightings reported by biologists during execution of other field projects. Between 1991 and 2010, the triploid checkered whiptail was identified at 43 locations while conducting surveys for other taxa. The triploid checkered whiptail, an endemic Army Species at Risk (SAR) on the PCMS, occurs on both installations. Except for continued inventory, no management actions are planned for reptiles. There is no indication that management actions are required to maintain stable populations at

Fort Carson or the PCMS. Populations are primarily associated with landscape features where mechanized training is not practical.

Other mammal species

Sixty-one species of mammals are known to occur on Fort Carson (Appendix 4), including three species of conservation concern. The status and distribution of small mammals in the major habitats on Fort Carson are fairly well known, but not for vegetation communities having limited distribution, particularly wetlands, ponderosa pine forests, and sites within Mexican Spotted Owl (MSO) winter habitat.

Numerous small mammal community level surveys on Fort Carson were conducted in recent years. The Niobrara Chalk Barrens, which supports several endemic SAR species of plants and an endemic reptile, were inventoried in 2007 (Peyton 2008). Surveys involving DPW and UCCS were conducted in and adjacent to Butts Army Airfield in support of a wildlife hazard inventory. Small mammal trapping in partnership with University of Colorado at Colorado Springs (UCCS) continues to contribute to knowledge about distribution and habitat use on Fort Carson. Small-medium mammal management consists of plague management through lethal and prophylactic means, i.e. insecticide dusting of prairie dog colonies to reduce the incidence of plague. Plague was recently discovered in Mexican woodrats in the Fort Carson MSO wintering areas, which could affect the winter survival of MSO; woodrats are the primary food source for the owl.

Hazard management of bear, coyote, red fox, and raccoon falls largely within the Pest Management and Conservation Law Enforcement sections of DPW and DES, respectively. The primary objectives are the control of wildlife diseases, public safety, and to prevent property damage. Wildlife office personnel assist with management of these species, particularly at Butts Army Airfield where conflicts present hazards to aircraft and personnel. Mountain lion activity is increasing at the periphery of the urbanized areas on Fort Carson. In 2010, lions killed deer near occupied buildings and recreational fishing areas. The abundance and distribution of mountain lions on Fort Carson is unknown.

Currently, DPW and the University of Colorado at Colorado Springs are investigating use of water guzzlers by wildlife. Information from this study can be used to identify sites where supplemental water locations would be the most beneficial.

Forty-seven species of small mammals are known to occur on the PCMS (Appendix 4) including four species of conservation concern. Exclusive of the major habitats, (e.g., grasslands and pinyon-juniper), the status, and distribution of small mammals are largely unknown. One species of interest include southern plains woodrat.

Except for mine inspections and mist netting at a few sites, a comprehensive inventory of bats has not been conducted on either installation. Most species records are opportunistic sightings by biologists during execution of other field projects. Recent surveys of abandoned mines on Fort Carson revealed the presence of six hibernating species including Townsend's big-eared bat and fringed myotis, both species of conservation concern. A maternal Townsend’s big-eared bat colony was discovered in 2010, one of the few colonies known in Colorado (personal communication, Kirk Navo 2011).

Current management for bats on Fort Carson includes closing abandoned mines and installing bat gates. Bat gates are installed for human safety and to minimize the potential for anthropogenic spread of White Nose Syndrome (WNS). WNS is a disease devastating bat populations in the eastern U.S. that is rapidly spreading westward from northeastern states. The disease was recently discovered near the Colorado border, in western Oklahoma.

Recurring actions for wildlife management at Fort Carson
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Continue conducting post-hunting deer population composition surveys. Fort Carson will provide CPW copies of survey data, which will be integrated into the CPW population models for the DAUs that include Fort Carson.

2. Continue CWD surveillance and require mandatory testing of harvested deer on Fort Carson.

3. Operate a hunter check station to facilitate CWD specimen collection, aging harvested deer, collecting location data for deer testing positive for CWD, and tracking recreational use of Fort Carson training lands.

4. Continue cooperative management of big game populations with the CPW.

5. Conduct bat planning level surveys, particularly in pinyon-juniper and riparian habitats.

6. Participate in academic partnerships and regional and national working groups to increase technical knowledge and expertise needed to develop alternative management options facilitating both military training and conservation.

7. Continue developing and maintaining water resources for mitigating movements of big game species related to effects of military training.

8. Identify, burn, and monitor areas to improve forage for big game species. Due to the importance to pronghorn in winter, cholla grasslands will be excluded or burned in a mosaic pattern to preserve integrity of the resource.

9. Organize and operate a Fort Carson hunting and fishing working group to facilitate communication among sportsmen for improving hunting and fishing opportunities for Soldiers.

10. Integrate installation management practices, e.g., prescribed fire, revegetation, pest management, storm water management, and invasive species management to enhance and protect biological diversity.

11. Continue monitoring native fish populations on Fort Carson.

12. Conduct amphibian planning level surveys.

13. Develop monitoring program for northern leopard frogs on Fort Carson.

14. Conduct reptile planning level surveys.

15. Conduct planning level surveys of small mammals in wetland and ponderosa pines vegetation communities, and sites within MSO winter habitat.

16. Create cover for sensitive species of reptiles, amphibians, and small mammals by leaving non-diseased, felled tree trunks in place during forestry operations. Logs are an important component of Mexican Spotted Owl habitat and should be left in place following forestry operations in owl habitat.

17. Continue to review projects and installation activities to identify and mitigate effects on biological communities.

18. Sustain sensitive small mammal and bird populations in woodland areas by preferentially leaving large trees with natural and bird created cavities and crevices.

19. Create slash brush piles at sites where this would not increase intensity spread of wildland fire.

Recurring actions for wildlife management at the PCMS
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Continue developing and maintaining water resources for mitigating movements of big game species related to effects of military training.

2. Continue conducting post-hunting deer population composition surveys. Fort Carson will provide CPW copies of big game survey data, which will be integrated into the CPW population models for the DAUs that include Fort Carson.

3. Identify, burn, and monitor areas to improve forage for big game species. Due to the importance to pronghorn in winter, cholla grasslands will be excluded or burned in a mosaic pattern to preserve integrity of the resource.

4. Continue cooperative management of big game populations with the CPW.

5. Operate a hunter check station for the purpose of aging and scoring harvested deer, and tracking recreational use of training lands.

6. Integrate installation management practices, e.g., prescribed fire, revegetation, pest management, storm water management, and invasive species management to enhance and protect biological diversity.

7. Conduct amphibian planning level surveys.

8. Conduct reptile planning level surveys.

9. Continue to review projects and installation activities to identify and mitigate effects on biological communities.

10. Create cover for sensitive species of reptiles, amphibians, and small mammals by leaving non-diseased, felled tree trunks in place during forestry operations.

11. Create slash brush piles at sites where this would not increase intensity or spread of wildland fire.

12. Sustain sensitive small mammal and bird populations in woodland areas by preferentially leaving large trees with natural and bird created cavities and crevices.

4.e. Forest management

The primary goal of the Forestry Program is to implement sound silvicultural practices for multiple use that promote healthy, sustainable forests that contribute to the biological diversity and ecosystem stability, while supporting the military mission by maintaining healthy, realistic, and resilient training lands. The vision for the future forest is a mosaic of wooded areas of varying densities and age classes leaving them in clumps with occasional scattered trees, with a large percentage of the wooded acreage being savannah-like woodland of pinon-juniper interspersed with native grasses, which supports biological diversity and ecosystem stability and supports military training by providing concealment along with maneuver access.

Forests on PCMS and Fort Carson provide wildlife habitat, ecosystem services (e.g. erosion control, carbon storage), military training options, and contribute to the overall diversity of the installations. There are about 50,355 acres of forests and woodlands on Fort Carson and about 39,960 acres on PCMS. These forested areas are composed of ponderosa pine, piñon and juniper woodlands, and riparian woodland communities. Colorado State University conducted an inventory of forest resources at Fort Carson and the PCMS in 2001 (Colorado State University 2001). Peak densities for both installations fall in the well-overstocked category (Colorado State University 2001).

Ecosystem management

All natural resource programs, including forestry, are focused on managing ecosystems. The forestry program is working to restore the structure and function of the ponderosa pine forest by thinning excess trees, removing ladder fuels, reducing crown connectivity and reintroducing low-intensity fire that improves the long term health of the forest. The forestry program will continue to treat pinon and juniper woodlands in order to reduce stand densities and maintain uneven-aged stand conditions. Foresters are also looking at managing and understanding the encroachment of juniper trees into prairie grasslands and developing treatments using current scientific evidence and technology.

Ponderosa Pine: Historically these stands would have been 40-50 square feet (SF) of basal area (BA)/acre with periodic low-intensity fires. The threshold above which stand vigor suffers enough to increase the risk of bark beetle attack is approximately 90 SF of BA/acre. Maintaining stocking levels below this level will help ensure sufficient tree health and vigor to provide some level of insurance against bark beetles. Heavier thinning to a lower stocking level will further enhance individual tree vigor, and improve the natural resistance to beetle attack. Nearly any reduction in BA will reduce wildland fire fuel hazard.

Recommended basal areas for Colorado Front Range Ponderosa pine stands is dependent on age of the stand, overall stand objectives, and whether the stand is being managed as an even-aged or uneven-aged stand. For instance, a younger stand of 20-30 year old Ponderosa would best be kept at 70-80 SF of BA. An older stand of 150 plus year old mature "yellow bark" pines might be better served by a BA of 30-40 SF. It also depends on the silvicultural objective. A seed tree cut leaving only mature yellow bark trees for seed production to create a new stand underneath should leave about 30-40 SF of BA.

However, the general objective here is to achieve and then maintain uneven-aged stand conditions (consisting of a variety of tree age and size classes) through single-tree selection prescription, or

diameter-limit prescription. Therefore, we strive for a general, overall stocking level of approximately 40-70 SF of BA/acre. This may be increased in proximity to stream channels and along roads. Residual basal area may also be increased on north slopes, which tend to have less competition for moisture and typically support higher stocking levels. To enhance stand diversity, healthy pinion pine or junipers should be retained when feasible. Treatment will work towards or maintain a healthy, uneven-aged forest that includes a strong component of large mature pines. Highest priority for removal is diseased and insect-infested trees of all sizes, followed by trees that are suppressed or low in vigor. Third priority would be trees of poor form, such as those with forked tops that could present a structural weakness as they grow. Snag retention to meet wildlife habitat needs will be addressed in individual stand silvicultural prescriptions. Intermediate thinning entries or "improvement cuts" focus on improving stand health while working towards the desired uneven-aged structure.

Pinon and Juniper Woodlands: Most natural stands have an uneven-aged structure due to rare and intense (stand-replacing) fires. Maintaining low stocking levels will help ensure sufficient tree health and vigor to provide some level of insurance against bark beetles (*Ips confusus*) for pinon pine. Heavier thinning to a lower stocking level will further enhance individual tree vigor, and increase understory grasses. Nearly any reduction in basal area will reduce wildland fire fuel hazard.

The general objective for forest management in pinon and juniper woodland ecosystems on FCMR and the PCMS is to maintain uneven-aged stand conditions (consisting of a variety of tree age and size classes) through single-tree selection prescription, diameter-limit prescription, and reducing stand density to 30-50 trees per acre. Treatment will work towards or maintain a healthy, uneven-aged forest that includes a strong component of large mature pinon pines and junipers. Highest priority for removal is diseased and insect-infested trees of all sizes, followed by trees that are suppressed or low in vigor and species preference. Snag retention to meet wildlife habitat needs will be addressed in individual stand silvicultural prescriptions. Intermediate thinning entries or "improvement cuts" focus on improving stand health while working towards the desired uneven-aged structure.

At present juniper encroachment into native grasslands is not an issue, since some of these areas had large wildfires or seasonal prescribed burns, and most are still small enough to be run over by military vehicles. To maintain grassland ecosystems where juniper encroachment is clear, the invading trees will be clear-cut with machinery or fall/spring burns, with the exception of a few older juniper (150+ years), which will be retained. These older junipers, being open-grown, provide good concealment for military training.

Insects and disease

Forest insect and disease problems are managed using an integrated pest management program (Section 4.i.). Overall objectives are to keep the loss from insects and disease to a minimum, by using good silvicultural practices to improve ecosystem health, regular monitoring, and quick reaction to any new pest problems that might arise.

Insect and parasite threats to forests on Fort Carson and PCMS include Ips beetles (*Ips pini* and *Ips calligraphus*), mountain pine beetle, pine pitch mass borer, pinon cone beetle, pinon pitch nodule moth, pinon needle scale, twig beetle, and dwarf mistletoe infestations. There are Ips beetle and mountain pine beetle infestations in ponderosa pine at Camp Falcon Scout Camp and at Turkey Creek Ranch on Fort Carson. The Camp Red Devil vicinity has Ips and twig beetle infestations. Control is primarily via thinning and removal of affected trees to achieve a residual density of about 30 to 50 trees per acre in PJ, or a residual basal area in Ponderosa of 50 to 70 square feet per acre. Fort Carson is part of an MOU between the Department of Defense and the U.S. Forest Service, Forest Health Management section,

which enables DPW Environmental to request assistance regarding forest entomology and pathology issues, with potential funding for these efforts.

American elm wood cannot be sold due to Colorado Springs and Colorado Department of Agriculture ordinances, which prohibit the storage of elm wood to reduce breeding sites for the European elm bark beetle (*Scolytus multistriatus*). This beetle is a vector for the Dutch elm disease that infects most elm species and kills the tree. Elm wood may be sold after the bark is stripped off. This is no longer a significant issue as most native American elms are gone from the Installation.

The pinon pitch mass borer commonly infests pinon pines at PCMS. Recently, staff has seen an increase in twig beetle and Ips beetle infesting pinon pines at PCMS. Expertise from other agencies may be used if new or more serious insect or disease problems are detected.

Fire management / fuel reduction

The forestry program thins targeted forested area on boundaries of FCMR and PCMS to reduce escape risks of wildfires, which are likely to increase due to increased training activities and new live fire ranges. Interior areas are thinned as well, in order to reduce the fuel load and improve access for military vehicles and fire suppression vehicles. Challenges in forest management on Fort Carson and the PCMS involve balancing the need for wildfire suppression with known benefits of allowing fire to provide for continued sustainment of the native forest ecosystem. Section 4.o describes the use of wildfire control to protect forest resources and prescribed burning as a management tool.

Forestry and Woodland products

There are approximately 90,315 acres available for forest and woodland product harvest in the forested areas of both installations. There is no commercial timber management due to the limited commercial forestry potential of the area; however, there is a potential for non-commercial harvesting of fuelwood.

Currently, the feasibility of individuals cutting firewood downrange for personal use is being considered on a trial basis. A firewood cutting by permit program will be used as a management tool to remove dead/dying and down trees as well as selected live trees, as identified by staff to improve the condition of the forest.

There is some demand for firewood from the general public in the surrounding areas. The forestry staff has managed a firewood sales program since 1992 using by-products of the Fort Carson tree/shrub maintenance program and trees removed from construction sites. Fort Carson active duty, retired, and civilian personnel are eligible to participate in the sales. Prices for firewood and wood chips are regularly compared with local prices. Sales are announced in the Fort Carson *Mountaineer* (the installation's weekly newspaper). The forestry department sells an average of 50 cords of wood per year generating less than $5,000 in annual revenues. Proceeds are deposited in the Reimbursable Account of the Army Forestry Program. A limited local market exists for wood chips and mulch and there have been exploratory conversations about the potential use of woody biomass for biofuel.

Recurring actions for forest management
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Manage the forests and woodlands at FCMR and PCMS to improve forest health through thinning, individual tree selection and sanitation salvage thinning.

2. Restore ponderosa pine forests by thinning, removing ladder fuels, reducing crown connectivity, and then reintroducing low-intensity fires.

3. Aggressively manage against forest insect and disease pests to prevent widespread tree mortality.

4. Reduce the number of trees per acre and remove understory fuel loads to minimize the risk of catastrophic wildfire and create zones of defensible space.

5. Complete 400 acres of insect and disease survey annually and update inventory in Geographical Information System layer.

6. Complete 100 acres of forest inventory annually and update in Geographical Information System layer.

7. Restore native grassland habitats by reducing piñon-juniper (P-J) encroachment into prairie habitats.

8. Initiate reforestation efforts after human and natural disturbances, preferably using local seed sources.

9. Identify and remove hazard trees annually using the U.S. Forest Service Hazard Tree Rating system.

10. Continue to submit proposals to the U.S. Forest Service and US Army Environmental Center for insect and disease management projects.

11. Work cooperatively with other Directorates, agencies, and the Colorado State University on forest management issues.

12. Develop programs which generate income from the sale of forest products such as firewood, woodchips, and fence posts which support standard forest management practices.

13. Investigate potential forest product markets, including firewood, fence posts, woodchips, biomass for biofuel, and innovative use of forest and woodland tree species.

Refer to Appendix 2 for information on how to review the Forest Management Plan for a detailed description of forest management practices.

4.f. Vegetation management

See the following sections for information related to vegetation management:

- 2.b. Vegetation communities
- 4.a. Species of conservation concern
- 4.b. Wetlands management
- 4.e. Forest Management
- 4.h. Invasive species
- 4.w. Vegetation monitoring (Range and Training Land Assessment (RTLA) program)
- Appendix 4 Documented plant species

4.g. Migratory birds management


Burrowing owl

The goal for this program is to manage migratory birds in accordance with 1) Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds), 2) the MOU Between the U.S. Department of Defense and the U.S. Fish and Wildlife Service to promote the Conservation of Migratory Birds, 3) DOD guidance to implement the MOU to promote conservation of migratory birds, 4) Interim Guidance-Unintentional take of Migratory Birds for Actions Other than Military Readiness Activities (U.S. Department of the Army IMAE-CO Memorandum, 2008), and the 5) Migratory Bird Treaty Act (MBTA).

Protection of migratory birds is mandated by the MBTA, a criminal statute prohibiting the taking, killing, or possessing of migratory birds unless permitted by regulation. The MBTA protects birds from intentional and incidental (unintentional) take and imposes civil penalties for violations by individuals and organizations.
DoD is committed to strive to protect, restore, enhance and manage the habitat of migratory birds and to develop and implement procedures and conservation measures that will avoid the take of such birds. However, if the taking of a bird is incidental to a military readiness activity, the matter is addressed in 50 CFR 21.15 and discussion at Volume 72 of the Federal Register, pages 8931 through 8950. In 2007, Congress authorized incidental take of migratory birds without a take permit for any Military Readiness Activity (MRA) conducted by members of the Armed Forces. Except for MRA, incidental take of migratory birds in the execution of an otherwise lawful management action, (e.g., prescribed fire, construction, installation support functions, and range, timber, and pest management) is a violation of the MBTA. The policy regarding an incidental take for non readiness activities is controlled by the 2008 interim Guidance which is included in Appendix 6 of this INRMP. Fort Carson will implement this guidance and to the greatest extent practical delay activities and avoid or minimize adverse impacts on migratory birds. This policy includes guidance concerning actions that cannot be delayed until after the nesting season or modified to minimize impacts on migratory birds because of the activity's direct and essential support of MRA or vital military support activities, or when necessary due to concern for the Public Health or for untenable damage to structures. As such guidance is further extended or superseded, Fort Carson will work with USFWS and CPW to ensure implementation is well coordinated.
The USFWS enforces the MBTA and manages a permit program for the 'taking' of migratory birds. Such a permit is required even for the proposed relocation of a protected bird from a nuisance location. On Fort Carson and the PCMS, 289 species of migratory birds are protected by the MBTA, including hunted and non-game species, USFWS Birds of Conservation Concern, and federally listed species. The DPW wildlife office reviews project proposals for potential conflicts with the MBTA, identifies species present in the action area, and identifies permits, documents, collaboration, and recommendations for an action to proceed and remain in compliance with the MBTA. The wildlife office will prepare migratory bird environmental documents and the elements required by DOA guidance.

For a summary and discussion of the Bald and Golden Eagle Protection Act (BGEPA), please see Section 4.x. of this INRMP.

General migratory bird management on both installations includes 1) habitat management by seeding, prescribed fire, insecticide dusting of key prairie dog colonies for supporting Burrowing Owl and eagles,

and erecting artificial raptor nest structures; 2) informally consult with the USFWS regarding the limited use of poison grain for lethal control of prairie dogs; 3) prohibiting the application of above ground pesticides that could affect nesting migratory birds; 4) conducting protected species pretreatment surveys at sites identified for lethal control of prairie dogs; and 5) managing woodlands to enhance value to migratory birds, to reduce insect related diseases, and to improve wildlife habitat.

Significant natural resource management actions, e.g., prescribed fire, forest thinning, and seeding, will continue to be conducted during the non-breeding season for migratory birds. Fort Carson will adhere to USFWS management guidelines (Klute et. al. 2003) for the Burrowing Owl and other federally sensitive species of migratory birds when and where feasible.

Twenty-one species of grassland and pinyon-juniper birds occurring on Fort Carson and the PCMS are identified in the Colorado Wildlife Action Plan (2006) as species of greatest conservation concern in the state. Due to the importance of pinyon-juniper woodlands and grasslands to declining species of migratory birds, Rocky Mountain Bird Observatory BMPs will be incorporated into natural resources management projects.

Recurring actions for managing migratory birds at Fort Carson
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Continue annual Burrowing Owl monitoring.

2. Continue annual grassland bird monitoring.

3. Continue annual Mountain Plover monitoring.

4. Continue to review projects and installation activities to identify and mitigate conflicts with the MBTA and/BGEPA.

5. Conduct compliance-monitoring surveys at project sites and coordinate required mitigation with action proponents and/or law enforcement.

6. Continue DOD Partners In Flight membership and support.

7. Assess the extent of hawk, eagle, and owl electrocutions on Fort Carson to include identification of known sites of electrocutions of birds, identification of pole configurations and landscape features influencing pole selection, and estimating level of pole use by raptors. Post-assessment recommendations to retrofit problematic utility poles will be provided to DPW operations.

8. Map grasslands important to nesting birds with declining populations for input into the development of annual prescribed fire plans.

9. Continue migratory bird outreach and education through personal contacts, Environmental Protection Officer Training, and through media available on Fort Carson.

10. Plant shelterbelts to replace loss of owl nesting and wintering habitat.

11. Pistillate-flowered oneseed and Rocky Mountain junipers will be retained during woodland thinning operations to sustain birds wintering in pinyon-juniper woodlands.

12. Pinyon pine will be retained over juniper, and old growth juniper will be retained over younger trees during woodland thinning operations.

13. Continue managing artificial cavity nesting project in the Bird Farm as mitigation for tree loss due to fire, forestry practices, and training.

14. Mitigate loss of owl nest sites using artificial structures.

15. Leave standing snags at a rate of 1-4 snags per acre, during forest management or post fire management, for bats, small mammals, and cavity nesting birds.

16. Deploy wildlife escape ladders in open water tanks developed for wildlife.

17. Continue investigating effects of off-road vehicle use on ground nesting birds.

Recurring actions for managing migratory birds at Pinon Canyon
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Continue Burrowing Owl monitoring.

2. Continue Mountain Plover monitoring.

3. Continue to review projects and installation activities to identify and mitigate conflicts with the MBTA and/or BGEPA.

4. Continue to conduct compliance-monitoring surveys at project sites and coordinate required mitigation with action proponents and/or law enforcement.

5. Assess the potential for hawk, eagle, and owl electrocutions on Pinon Canyon, to include identification of killer poles, identification of pole configurations and landscape features influencing pole selection, and estimating level of pole use by raptors.

6. Improve shelterbelts to replace loss of owl nesting and wintering habitat due to extensive fires at the PCMS.

7. Mitigate loss of raptor and Chihuahuan Raven nest sites using artificial structures.

8. Pistillate-flowered oneseed and Rocky Mountain junipers will be retained during woodland thinning operations to sustain birds wintering in pinyon-juniper woodlands.

9. Pinyon pine will be retained over juniper, and old growth juniper will be retained over younger trees during woodland thinning operations.

10. Leave standing snags at a rate of 1-4 snags per acre, during forest management or post fire management, for bats, small mammals, and cavity nesting birds.

11. Continue managing artificial cavity nesting project outside of training areas as mitigation for tree loss due to fire, forestry practices, and training.

12. Deploy wildlife escape ladders in open water tanks developed for wildlife.

4.h. Invasive species management

DEFINITIONS


Russian knapweed

Invasive Species are generally defined as alien (non-native) organisms that are directly or indirectly detrimental to economic crops or native plant communities and injurious to livestock or wildlife and the resources they utilize. Invasive species found on the Fort Carson military reservation and the PCMS are most commonly noxious weeds that threaten wetland ecosystems, complicate land restoration projects, add to the cost of pest management, and in general, threaten ecosystem functionality. More recently, aquatic nuisance species (ANS) of plants and animals have become of more concern to invasive species managers such as zebra mussels (*Dreissena polymorpha*) and the giant salvinia (*Salvinia malesta*). At the time of this writing no ANS species are known to exist on either the Fort Carson military reservation or the PCMS. Noxious weeds are designated as such by State or Federal law. The terms noxious and invasive are often used interchangeably.

REGULATORY PROGRAMS

Fort Carson is dedicated to the prevention of introduction of invasive species as well as their control, per Executive Order 13112, *Invasive Species*. The Noxious Weed Management Program on Fort Carson and the PCMS is under the Conservation branch of the DPW.

The Federal Noxious Weed Act (§2814 of 7 USC 360), part of the Plant Protection Act of 2000, mandates federal agencies to (i) have an office or person trained to coordinate an undesirable plant management program, (ii) adequately fund the program, (iii) implement cooperative agreements with state agencies, and (iv) conduct integrated pest management techniques for managing undesirable plant species.

Executive Order 13112 (1999) directs agencies to (i) prevent the introduction of invasive species, (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner, (iii) monitor invasive species populations accurately and reliably, (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded, (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species, and (vi) promote public education on invasive species and the means to address them. It also prohibits federal agencies from authorizing, funding, or carrying out actions that are likely to cause or promote the introduction or spread of invasive species in the United

States or elsewhere unless the benefits of such actions clearly outweigh the potential harm caused by invasive species.

State of Colorado House Bill 90-1175, Section 1, Title 35, Article 5.5 (*Undesirable Plant Management*) (i) mandates the control of invasive species an all public and private lands and (ii) empowers counties and municipalities to enter into cooperative agreements with federal agencies. The Colorado Department of Agriculture, via the 2004 revised Colorado Noxious Weed Act, (i) created List A, B and C type weeds; (ii) mandated the eradication of 18 species of weeds (List A); (iii) mandated the statewide, phased eradication of five List B species with additional List B species elevated to eradication status each year.

Other relevant legislation includes the Carlson-Foley Act of 1968, Endangered Species Act, Federal Insecticide, Fungicide and Rodenticide Act, Federal Land Policy and Management Act, National Environmental Policy Act, and the Noxious Weed Control and Eradication Act of 2004.

DoDI 4150.07, and AR 200-1 also contain guidance on invasive species management.

Current Conditions

There are currently 71 state-listed weed species designated for containment, control or eradication. At least 30 of these state-listed noxious weeds have invaded both natural and urbanized landscapes at Fort Carson and PCMS. The state "A" list is comprised of species of the highest concern, to be eradicated immediately upon detection. There has been one "A" list species found at PCMS and one found at Fort Carson. Both have been eradicated but are being monitored as per their respective eradication plans (see Appendix 2 of this INRMP for information on how to review those Plans). Of the 39 species on the Colorado Department of Agriculture "B" list there are 20 plant species found on Fort Carson and PCMS with the majority being found only on Fort Carson. List "C" species are considered to be lower priority for control based on the high populations found within the state. Of the 14 species on this list, 8 are found on Fort Carson and/or the PCMS.

Recently, a member of the knotweed complex (*Polygonium sp*.) was detected in the main post area of Fort Carson. Notification has gone out and a management plan is currently being developed. This management plan will be distributed to the state and county weed officials within jurisdiction of the infestation.

There is currently (Oct 2010) no aquatic nuisance species known to be found on either the PCMS or Fort Carson military reservation.

There are several notable differences between Fort Carson and the PCMS that directly or indirectly affect the ability of invasive plants to invade and spread on the Installations. Other conditions will also have some bearing on the weed control strategies employed to achieve effective control.

- Fort Carson currently supports more species of invasive plants that are mandated for control, and these species tend to infest larger areas.

- There is more military and recreational traffic, and more access roads and trails on Fort Carson; therefore the potential for spreading invasive plants via vehicles is greater.

- Military training maneuvers are conducted year-round at Fort Carson, but the PCMS is currently utilized less frequently.

- There are significantly more staff resources available at Fort Carson than at the PCMS to identify, treat, and monitor weed infestations.

In general, weed populations are more widespread at Fort Carson than the PCMS. This may be due, in part, to the significantly more ground disturbing training as well as the higher frequency of training that occurs at Fort Carson. Other factors may include Fort Carson's proximity to a large population center (Colorado Springs), its proximity to I-25, and precipitation and availability of water which is a limiting factor for some weed species.

Noxious Weed Species Priorities

Outlined below are priorities for weed control on Fort Carson and the PCMS. Species addressed include only those that are known to occur on the Installations

- Weeds designated by the State of Colorado as "A" list species will be highest on the priority list.
- Weed populations designated by the State of Colorado for eradication will also be high on the priority list.
- Small, newly identified populations of any noxious weed on the state list will receive immediate management priority for control over all other weed species (*e.g.*, African rue, knotweed, and leafy spurge).
- Weed sites closest to Installation boundaries and on main routes will be of higher control priority than interior sites.
- Weed sites that are rapidly expanding (based on monitoring information) will be controlled at a higher priority than more stable sites; at this time this includes 3 of the state listed knapweeds.
- Weeds growing in Training Areas that routinely experience higher training impacts, especially ground-disturbing activities, will have a high priority for control.
- Weeds that are a threat to public and soldier safety will receive higher priority than those that do not, such as Scotch thistle and leafy spurge. Control efforts at Fort Carson will be focused initially on spotted knapweed, tamarisk, diffuse knapweed, leafy spurge, Russian olive, and Canada thistle. At PCMS, spotted knapweed, Canada thistle, Russian knapweed, and tamarisk will receive the greatest management attention.
- Weeds growing in ecologically sensitive habitats (e.g., wetlands, rare species habitats) will be given a high management priority.
- Weeds on the Colorado Department of Agriculture "A" list receive higher management priority than those found on list "B". List "B" will receive higher priority than list "C".

The PCMS priority species for management include: Russian knapweed (*Acroptilon repens*), Canada thistle (*Cirsium arvense*), spotted knapweed (*Centaurea acanthium*), and if found, African rue (*Peganum harmala*), and Scotch thistle (*Onopordum acanthium*).

On Fort Carson, species such as dalmation toadflax, (*Linaria dalmatica*), Scotch thistle (*Onopordum acanthium*) leafy spurge (*Euphobia esula*), absinth wormwood (*Artemisia absinthium*), and Russian knapweed (*Acroptilon repens*) are among the program's highest priorities at the time of this writing. This is due, in part, to the limited populations currently established within and around the installation. These species also pose a significant health risk. Yellow toadflax (*Linaria vilgaris*), diffuse knapweed (*Centaurea diffusa*), and spotted knapweed (*Centaurea maculosa*) are considered the next highest priority due to limited populations and threat to ecological integrity of the installations training lands. There are no known invasive species that pose a significant impact to training on Fort Carson and the PCMS.

Noxious Weed Management Plan

The DPW has prepared the *Invasive Plants Management Plan, Fort Carson & Pinon Canyon Maneuver Site* (Linn 2007), as mandated by the Plant Protection Act of 2000. The prevention of noxious weeds from populating disturbed areas is Fort Carson's first line of defense.

The control of noxious weeds on Fort Carson and the PCMS is of critical importance from both a natural resources management and military readiness perspective. Implementing a comprehensive, long-term weed management program will help promote and sustain the military mission and protect the natural environment. Primary elements of this program are:

- maintaining soil, water, and vegetation resources that provide ecological stability
- minimizing the impact of construction and military training activities on the spread and establishment of noxious weed species within and outside Fort Carson and PCMS boundaries;
- cleaning vehicles prior to departing from the PCMS and Fort Carson of possible plant propagules as well as the dirt/mud that helps transport them.
- actively participating on County and regional weed boards; and
- fostering a "good neighbor" relationship with adjacent land owners.

Implementation of the Invasive Plants Management Plan (Linn 2007) includes:

- identifying the extent of infestations;
- preventing the encroachment of weeds into uninfested areas;
- detecting and eradicating new weed species introductions;
- containing and controlling large-scale infestations; and
- monitoring treated areas to gauge management efficacy and plan for the future.

The Invasive Plants Management Plan (Linn 2007) has species descriptions and control techniques for each noxious weed species. Each weed management strategy (control, eradication, and prevention) is being employed on Fort Carson and PCMS as part of an integrated plan. The plan is due for revision and update beginning in 2012.

Control Programs

Noxious Weed Biological Control Program - The noxious weed biological control program is an important component of the Invasive Plants Management Plan. This work is performed in cooperation with the Texas A&M Agricultural Experiment Station in Amarillo, U.S. Department of Agriculture-Animal and Plant Health Inspection Service, U.S. Department of Agriculture -Beltsville, CABI Bioscience, and the Colorado State Department of Agriculture. The project also includes the U.S. Air Force Academy, Buckley Air Force Base, Monument Fire Center, Rocky Flats Environmental Technology Site, and F.E. Warren Air Force base (Michels *et al*. 2010).

Biocontrol does not achieve total eradication. Biocontrol is integrated into a total vegetation management program, which means using other methods, such as mowing and chemicals, when necessary. Noxious weed populations can be maintained at tolerable levels with the inclusion of biocontrol practices.

Chemical Control Measures - Herbicides are the most widely used method for controlling weeds, and are generally considered the most economical and effective. However, herbicides can pose environmental risks such as water contamination, animal or human toxicity, development of herbicide resistant weeds,

and the loss of native plant diversity. Closely following herbicide labeling instructions and carefully using standard application techniques can greatly reduce or eliminate the possibility of these risks. The Army has developed guidance calling for the reduced use of pesticides and herbicides, therefore widespread herbicide application may not be feasible on Fort Carson and the PCMS. An effective noxious weed program will require that herbicide measures be combined with other control techniques to bring about the desired level of control. In some cases, herbicides may be the only feasible control method depending on the target species, terrain, population density, availability of biocontrol agents, and acreage of area to be treated. At least initially, herbicides will have a high priority for use on the Installations to bring about rapid and effective control of both small and large weed infestations. The high priority use of herbicides may be modified as infestations are reduced and become easier to manage with alternative techniques. Currently, herbicides are applied using ground application methods. An alternative method for larger areas of infestation involves aerial applications. Aerial application may be feasible in some areas.

Cultural Control Measures - Cultural weed control methods include land management practices that maintain and promote healthy native plant and soil communities. For example, reseeding disturbed areas with native vegetation can limit or prevent weed infestations by providing competition for available resources. Burning, fertilization, and irrigation can also be used to stimulate native plant communities and thereby increase competition with weed species. The Fort Carson and the PCMS program already has in place an active re-vegetation and erosion control program called the Land Rehabilitation And Maintenance (LRAM) program which is designed to mitigate training related impacts. Minimizing the extent and severity of ground disturbance resulting from military training activities is beneficial for sustaining healthy plant communities and restricting the opportunities for weed establishment. Goat or sheep grazing is another cultural tool which was used at PCMS with limited success.

Physical/Mechanical Measures - These measures, which physically disrupt weed growth and reproduction, include practices such as tillage, hoeing, hand-pulling, mowing, and burning. Depending on the target weed species, many of these measures can be ineffective and labor intensive. In addition, soil disturbance and the fragmentation of plant parts, resulting from these measures, can often actually stimulate an invasive plant population. However, with careful timing and application, and in combination with other control measures, these practices may be useful for weed control. Weed control using these methods is normally achieved by reducing the seed source or removing other reproductive plant parts (e.g., root buds, rhizomes). Burning can often be effectively used as a "set-up" treatment for areas to be sprayed with herbicide. Burning may stimulate the production of weed seedlings from the soil seed bank and also removes litter and vegetation that could intercept the herbicide from making contact with the target weeds. Burning can also benefit the native vegetation by increasing nutrient availability, reducing weed competition, removing litter accumulation, and stimulating native seed production. Where feasible, the above physical/mechanical measures will be employed on Fort Carson and the PCMS.

Reclamation Rehabilitation

While the LRAM program's focus is on repairing training damages, the noxious weed program must also recognize the importance of reclaiming areas subjected to noxious weed management. There are two basic forms of rehabilitation. Active rehabilitation is the process of planting restorative species of plants to out compete possible weed invaders. Care must be taken in this process; planting too soon after an herbicide application will simply waste valuable resources when seeds fail. Waiting too long may allow the same weeds or another species to invade the same site. Passive rehabilitation is preferred when appropriate populations of desirable species remain in the area of treatment to repopulate the affected area. Passive rehabilitation is the preferred method when possible firstly for the cost savings and secondly because species are composed of naturally occurring plants already well adapted to the site.

The Fort Carson noxious weed program works closely with the range management program to decide on BMPs for rehabilitation on a site by site basis. There is also equipment and materials such as seed available for small projects to be done "in house". This is important due to time constraints for such efforts.

African Rue Control
In 2004 DPW Environmental developed and implemented the African Rue Management Plan, and it was later updated in 2007 (Linn 2007; see Appendix 2 of this INRMP for information on how to review the Plan) for PCMS. Eradication efforts were successful on the PCMS and monitoring will continue for 10 years (through 2014). If additional plants are found, supplementary coordination with the Colorado State Weed Coordinator will be undertaken to ensure compliance with the Colorado Noxious Weed Act. To date no new populations have been found.

Myrtle Spurge Control
In 2007 DPW Environmental developed and implemented the Myrtle Spurge Management Plan – Fort Carson, Colorado (Invasive Species Program 2007; see Appendix 2 of this INRMP for information on how to review the Plan). Eradication efforts were successful at Fort Carson and monitoring will continue for 10 years (through 2016). If additional plants are found, supplementary coordination with the Colorado State Weed Coordinator will be undertaken to ensure compliance with the Colorado Noxious Weed Act. To date no new populations have been found.

Tamarisk Control
Due to the recent establishment of the tamarisk leaf beetle (*Diorhabda elongata*) at Fort Carson from populations established off post, tamarisk management on Fort Carson has been adapted to take into account this new condition. As the beetles continue to spread Northward through the installation, monitoring by both Texas Agrilife and the DPW natural resources team will track progress and make adjustments to management strategies as needed. Care must be taken that as tamarisk populations are reduced, that Russian olive populations do not "fill the niche" and create a more serious problem for the installation.

As of the time of this writing, there are no established populations of tamarisk beetles at the PCMS. Monitoring will continue at the PCMS as well and communications with the state agriculture department as well as Las Animas county weed officials will be critical to keep informed as to the beetles' progress.

Tamarisk management on the PCMS will likely continue in the Timpas Creek watershed on the installation's northern side. As work is completed, progress will continue eastward in the Bear Springs Hills area of PCMS.

Russian Knapweed Control
In 2003 DPW Environmental personnel began treating Russian knapweed at PCMS with ground-sprayed herbicide. Since 2005 this program has been accomplished by contract. In 2010 this contract was extended and the contract may be expanded to include tamarisk and Canada thistle control at the PCMS. Efforts to introduce a USDA approved biological control agent are ongoing.

Partners
Fort Carson personnel hold memberships in multiple weed management societies and associations. The installation has memberships in the Upper Arkansas Weed Management Association, the North American Weed Management Association, the Colorado Weed management Association, and the Weed Science Society of America.

Data is shared openly when available with organizations such as Tamarisk.org and surrounding counties in an effort to reach out to the local interests outside of our boundaries. Only through coordinated efforts can Fort Carson fulfill its role as a regional leader in weed management.

Outreach
DPW-Environmental has implemented a program to prepare informational and educational materials on noxious weeds for use in military briefings, school programs, and public meetings. This program includes the development of a noxious weed environmental awareness program for military trainers, Army construction components, and other users.

Future of the program
As control efforts continue, more and more emphasis will be placed on monitoring those control and restoration projects in an effort to evaluate various management strategies. This process will allow Fort Carson staff to make decisions on future management direction. Techniques that show the most promise with the least environmental impact will be expanded and those that are less effective will be phased out. Management direction is a constantly evolving process. Weed infestations that respond well to a treatment in one area may respond in a completely different fashion in another area due to differences in soils or available moisture as well as a number of other biotic and abiotic factors.

One tool used to identify trends in invasive plant populations is Geographic Information Systems (GIS). This tool will allow Fort Carson managers to analyze weed populations and discover trends in spread of weeds as well as successful management operations in control and restoration. This GIS system also facilitates data sharing across jurisdictional boundaries. Reporting on weed populations will be made simple to county and state weed officials.

More emphasis on prevention
Fort Carson and Pinon Canon experience some of the most traumatic soil disturbance as a result of normal Army training. As more soldiers return from overseas campaigns and Fort Carson's population of actively training soldiers increases, more disturbance will result. Funding for a vehicle wash rack on the PCMS will be pursued and eventually secured. This will allow units training on the PCMS to be sure to arrive clean of plant propagules as well as depart clean of seeds, roots and other mechanisms of weed spread.

Through the NEPA process, projects being conducted on Fort Carson and the PCMS need to conform to standards set by other large federal land management agencies. Requirements for clean soil and gravel need to be enacted and enforced. Certified weed free hay and straw for soil stabilization projects and minimizing non-training related soil disturbances will also go far in preventing the spread and introduction of noxious weeds within and between the two installations.

Recurring actions for invasive species program, for both installations:
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.)

1. Continue to implement the Invasive Plants Management Plan and update the plan on a 5 year cycle;

2. Treat selected invasive species using an integrated approach (biological, chemical, cultural and mechanical);

3. Continue to monitor the original population of myrtle spurge at Fort Carson annually through calendar year 2016;

4. Actively participate with state, county, local and other federal agencies in the management of invasive species;

5. Continue to monitor the original population of African rue at PCMS annually through calendar year 2014;

6. Implement a systematic inventory program to identify new invasive species populations and to document the size and abundance of existing populations. Report occurrences of new species to county and state officials;

7. Implement a systematic monitoring program on treated populations to document the results and to assess for further action;

8. Rehabilitate areas treated for invasive species control, where necessary.

9. Identify and implement measures in the prevention of new infestations;

10. Continue to work with Texas A&M University, Colorado State Insectary and U.S. Department of Agriculture – APHIS to release, redistribute and monitor biological control agents for noxious weed control

11. Continue to be involved in education and outreach efforts.

13. Continue to work with Fort Carson CLEOs to preclude introduction of ANS to our waters by not allowing gasoline power boats on our ponds.

4.i. Pest management

AR 200-1 and DoDI 4150.07 require all installations to have a well-planned and implemented pest management program. Inadequately planned pest management operations can result in pesticide exposures that threaten human health and natural resources while polluting the environment. The main goal of the pest management program is to maintain and safeguard the health, environmental quality, aesthetic values, and ecological balance of the military community by protecting real estate investments from depreciation by pests, while complying with environmental protection and improvement policies.

This section includes noxious weed control performed in conjunction with routine weed control within the main post area at Fort Carson or the cantonment at PCMS, but does not include the management of noxious weeds downrange. Noxious weed control is discussed in Section 4.h. Wildlife diseases are discussed in Section 4.d.

Fort Carson recognizes seven general categories of pests that cause significant damage and require control or management (7th ID and Fort Carson 2001):

- Disease vectors and medically important pests (e.g., mosquitoes, black widow spiders, fleas, wasps, certain rodents),
- General household and nuisance pests (e.g., cockroaches, flies, beetles, crickets, spiders, ants),

- Undesirable vegetation (e.g. weeds in ornamental rock areas and turf grass, along fence lines, and on road shoulders and paved surfaces),
- Stored product pests,
- Real property pests (structural/wood-destroying pests such as carpenter ants, termites),
- Pests that destroy beneficial plants (e.g. tussock moths, ash sawfly larvae, golf course pests), and
- Vertebrate pests (e.g. birds, snakes, rodents, raccoons, skunks, bats, and road-killed animals).

Pest management activities on Fort Carson and the PCMS are under the supervision of the DPW, with all actions subject to the approval of the Installation Pest Management Coordinator and the Army Environmental Command. Assistance is required from other organizations and agencies, for example Military Police – stray and feral domestic animals; Preventive Medicine - pest surveillance and disease surveillance; golf course - pest surveillance and control; Natural Resources – disease surveillance, pre-treatment surveys, and coordination with USFWS Division of Migratory Birds.

Integrated Pest Management Plan (IPMP)

The *Integrated Pest Management Plan, Fort Carson Mountain Post* (7th ID and Fort Carson 2001) identifies and prioritizes pests and their destructive effects to determine particular levels of protection. Objectives of the IPMP are to:

- Identify integrated pest management planning requirements listed in AR 200-1,
- Describe program elements for health and environmental safety, pest identification, pest management and pesticide storage, transportation, use and disposal,
- Reduce reliance on pesticides, where possible,
- Enhance environmental protection, and
- Maximize the use of integrated pest management techniques.

The Fort Carson pest management program is consistent with the Presidential Memorandum, Environmental Practices on Federal Grounds (Office of the President 1994) to reduce pesticide use by using integrated pest management (IPM). Typically a combination of IPM techniques is required to resolve a problem on a sustained basis. IPM includes the implementation and coordination of optimum sanitation, good structural design and maintenance of facilities, and the use of mechanical, cultural, and biological control. The IPM comprehensive approach to pest management or prevention, using methods of pest management in a compatible manner, avoids damage and minimizes adverse side effects to nontarget organisms and the environment.

Pest surveys are used to determine the type of pest, extent of the problem, and pest management technique most appropriate for safe, effective, and economic control. Chemical control is used only when non-chemical techniques are inadequate or impractical. Furthermore, chemical control is not used as a substitute for good sanitation practices or proper building maintenance. The IPMP discusses many aspects of pest management that are not directly within the scope of this INRMP, such as control of most disease vectors (fleas, cockroaches, etc.), protection of facilities, and storage of pesticides. The following discussions of animal and plant control primarily involve the management of natural resources on Fort Carson and the PCMS.

The 2001 Fort Carson IPMP is current but is scheduled for a revision. Due to an expansion in training activities and changes in the State's noxious weed laws, Fort Carson is not expected to significantly reduce pesticide use. All pesticide applicators meet certification requirements. Changes contributing to the potential increase in the use of pesticides include:

- Expansion of facilities due to the addition of about 10,000 troops as a result of Army transformation activities such as Base Realignment and Closure, and Global Defense Posture Review,
- A likelihood of increased facility construction at PCMS to accommodate additional troop training requirements,
- Increased command emphasis on the control of weeds in rocked areas, and
- Increased emphasis on control of invasive species, resulting in a greater need for pest management services on the installation.

Fort Carson employs various means to minimize pesticide usage, such as the following:

- Initiated an intense surveillance program that substitutes military and civilian personnel surveillance time for pesticides and combats insect pests with reduced quantities of pesticides early in the infestation cycle,
- Established a system to monitor insect population threshold levels and adopted threshold standards,
- Replaced algaecide use in ponds with mechanical oxygen-inducing devices,
- Worked with local bee keepers to remove and relocate honey bee swarms and hives,
- Initiated one of DoD's most comprehensive biocontrol programs for invasive weeds, and
- Eliminated mosquito fogging operations until a threshold of 30 adult females per trap night is reached to further reduce insecticide requirements.

Animal Pests


Coyote

The Wildlife and the Pest Management sections, along with the Fort Carson CLEOs, collaborate to control nuisance pests on the installation, in accordance with a Memorandum of Understanding (MOU) between DPW and DES (see Appendix 2 for information on how to review this agreement). The Pest Management Section primarily deals with wildlife pests, such as skunks, porcupines, raccoons, foxes, mice/rats, prairie dogs, squirrels, rabbits, birds, and snakes. Wildlife diseases are discussed in Section 4.d. Rock Dove, European Starling or English Sparrow populations occasionally reach numbers that present health risks to military and civilian personnel. At such times pest control personnel will either trap and euthanize or shoot individuals from the roost to reduce populations to a manageable number.

Nuisance plants

Weeds in ornamental rock areas and turf grass, along fence lines and on road shoulders and paved surfaces require control using appropriate herbicides. The control of weeds in turf and rock areas helps beautify the installation and adds greater usefulness to recreational areas and public grounds. Control of weeds is extremely important to the overall aesthetics of the installation and receives high priority from the Command (7th ID and Fort Carson 2001). Noxious weed management is described in Section 4.h.

Species of conservation concern

Sensitive areas listed on pesticide labels are considered before pest management operations are conducted. No pesticides are applied directly to wetlands or water areas unless use in such sites is specifically approved on the label and the proposed application is approved by the Installation Pest Management Coordinator.

The Installation Pest Management Coordinator periodically evaluates ongoing pest management as well as new pest management operations to ensure compliance with the ESA, Clean Water Act, BGEPA, and the MBTA. Pest management operations that are likely to have a negative impact on endangered or protected species or their habitat require prior approval from the AEC Pest Management Consultant and the Wildlife Office. Pest management operations will also be required to prepare management prescriptions for pest management operations when the USFWS issues new species listings. Fort Carson implemented management prescriptions/actions to reduce the chance of secondary poisoning of American Peregrine Falcons, Bald and Golden Eagles, and species protected by the MBTA by 1) informally consult with the USFWS regarding the limited use of poison grain for lethal control of prairie dogs, 2) prohibiting the application of above ground pesticides that could affect nesting migratory birds, and 3) conducting protected species pretreatment surveys at sites identified for lethal control of prairie dogs.

Installation conservation goals include protection of prey resources of the Bald Eagle and Golden Eagle, and protection of the Burrowing Owl and Mountain Plover. Prairie dog colonies are frequently decimated by plague outbreaks. However, wide-scale epizootic events are uncommon, and some colonies in the region remain intact each year. It is not possible to predict which colonies will be impacted. To avoid complete decimation of the prairie dog population, Fort Carson Pest Control controls prairie dogs only when human health or physical damage to facilities is an issue. The use of rodenticides to control prairie dogs is restricted to the main post area south to MSR 2, Butts Airfield, Tent City, and in the vicinity of buildings and foxholes on ranges where troops are likely to encounter prairie dogs. A similar policy is enforced at the PCMS. Prairie dog colonies are surveyed for the Burrowing Owl and Mountain Plover prior to any chemical application. The Installation Pest Management Coordinator and the Wildlife Office meet annually to develop guidelines for controlling prairie dogs at sites where human health is at risk.

Recurring actions for IPM
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Control those plant and animal species that affect human health, quality of life, natural resources management (e.g. reduce ecosystem functionality, displace native species) or the military mission, exclusive of noxious weeds.

2. Maintain and implement the IPMP on a five-year cycle, including an update in 2013.

3. Emphasize integrated pest management techniques to minimize the use of pesticides.

4. Use chemical control as a last resort to control pests; cultural, mechanical, and biological control methods are first priority. When chemical control is required, use the least environmentally toxic pesticide. Utilize new technology, educational opportunities, and the judicious and professional use of chemicals to reduce chemical pesticide use.

5. Ensure pesticide applicators are fully certified or under the necessary direction of a certified applicator.

6. Conduct preventive maintenance and surveillance inspections for pests.

7. Ensure pest management personnel receive adequate formal, as well as on-the-job, training to achieve required pest management certification and to operate at the most efficient level.

8. Procure, maintain and properly store adequate supplies of pesticides and pesticide dispersal equipment.

9. Implement a safety program that provides for the safety and well being of all pest management personnel.

10. Coordinate with the Wildlife Office for the protection of wildlife (particularly listed or sensitive species) during pesticide operations.

11. Work with other installations in the region to include the Fort Carson pest management program within the Front Range Ecoregional Management Team.

14. Participate in Directorate and Garrison level working groups to ensure pest management activities are represented and are in agreement with Fort Carson goals and objectives.

4.j. Land management

Information related to land management on Fort Carson and PCMS can be found in the following sections:

- 4.b. Wetlands management
- 4.e. Forest management
- 4.h. Invasive species management
- 4.o. Wildland fire management
- 4.t. Urban forest management
- 4.w. ITAM program

4.k. Agricultural / grazing outleasing

Grazing on PCMS is currently being considered. This potential action will be evaluated, before implementation, to include compatibility with military training, to determine the capacity of the natural resources to support grazing without degrading the resources and to assess the costs versus benefits of having such a program.

4.l. Geographic information systems (GIS) management

The goals of GIS on Fort Carson are to provide customer support to the staff and military troops by providing data, analysis for the enhancement of decision-making purposes, and hard copy documentation/representation to sustain Fort Carson and the PCMS training and environmental missions. The DPW maintains a common server to share GIS files. Sensitive data (e.g. cultural sites) are not commonly shared but are maintained by the individual program. The ITAM GIS coordinator maintains the GIS data for that program. Currently, DPW does not have a staff member dedicated to GIS within natural resources. GIS data is shared between DPW and ITAM, with only a few program-specific exceptions. Efforts should continue to more effectively store this data, share it with all installation

organizations needing to use it, ensure that data is consistent among all personnel relying on it, and to eliminate duplication of data.

Recurring actions for GIS management
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Provide maps and spatial analyses to support natural resources management as well as other missions.
2. Work cooperatively with all GIS users to share GIS data and products.
3. Maintain up-to-date software and data.

4.m. Outdoor recreation

The principal use of Department of Defense lands and waters is to support mission related activities; all other land uses are subordinate. Fort Carson lands and waters are available for non-military purposes in accordance with Army Regulation 200-1 (Environmental Protection and Enhancement), the installation Integrated Natural Resources Management Plan (INRMP), Sikes Act, and Army directives and policies when compatible with the military mission, installation safety and security, ecosystem sustainability, natural resources management, and fiscal responsibility. Possession of a recreation permit and a state hunting license does not guarantee access to Fort Carson or the PCMS. Consistent with limitations of applicable federal and state law, the Garrison Commander (GC) may develop a system providing priority access to Fort Carson Soldiers for hunting and other recreation pursuits. The Commander can limit public access for reasons of safety, security, ecosystem needs, sustainment, or interference with military mission. The outdoor recreation program goal is to provide quality outdoor experiences for Soldiers, their families, and the public while sustaining ecosystem integrity.

Recreationists are charged a nominal permit fee, but the fees vary, based on military affiliation. The current fee structure is in Appendix B of FC Reg 200-6. Stocking fish in the reservoirs is the primary use of the funds collected from permit sales.

All recreationists interested in travelling downrange are required to attend a safety briefing and obtain a downrange pass. Access is limited to a day-to-day basis due to military use of training lands, which preempts recreation. Except for the main post area, impact areas, safety fans of active ranges, and other sensitive areas, the entire installation is available for recreation. The percent of land available on any given day is determined by military use of the installation for training, construction, maintenance, or similar activities.

State and federal hunting and fishing laws and regulations apply and are enforced, and recreationists are required to obtain and carry the appropriate Fort Carson, state, and federal licenses. A state fishing license is not required to fish on Fort Carson. The state of Colorado manages hunting through Game management Units (GMU) and Data Analysis Units (DAU). Fort Carson and the PCMS constitute state GMUs 591 and 142, respectively, and there are several major big game hunting seasons on Fort Carson and the PCMS. Public and soldier participation in these seasons is frequently interrupted, limited geographically, or sometimes precluded due to conflicts with the military training mission. Both

installations can be closed for part or the entire duration of one or more seasons when conflicting with training.

Hunters and recreationists at the PCMS are required to camp in a field at the Hill Ranch area near Highway 350. This makes hunters check in and out each day, because of safety concerns the PCMS has. The Army is looking at options to improve the campground. However, at present the Army is experiencing significant budget constraints.

Three reservoirs on Fort Carson are stocked with catchable fish. Trout and catfish are the primary species stocked, but largemouth bass and bluegill are found in each reservoir. Training conflicts with the fishing program are rare because access to the stocked reservoirs is not restricted at anytime unless reserved for special military training events. To preserve native fish populations, game fish are not stocked at the PCMS, and fishing on the installation is not permitted.

Currently, recreational access to Fort Carson and the PCMS is managed by multiple installation Directorates.

1. The DFMWR sells wildlife recreation permits and provides the proceeds to DPW for wildlife management as stipulated in the Sikes Act and FC Reg 200-6.

2. The DES enforces DOD, state and federal natural resources regulations, performs search and rescue, and registers firearms.

3. The DPTMS determines days and times for recreation, provides recreationist downrange safety briefing, and issues downrange passes.

4. The DPW manages populations and cooperatively establishes hunting seasons and the number of licenses with the CPW, operates a hunter check station, and manages gate access at PCMS during major big game seasons.

Beginning in 2012, an automated web-based system for permit sales and issuing downrange passes will be implemented. Primary changes to the current operation will include:

1. Permits will be sold online, eliminating requirement for DFMWR support.

2. Downrange passes will be issued online instead of at Range Control.

Recurring actions for wildlife recreation at Fort Carson
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Continue management of recreational fishing on Fort Carson, to include stocking fish, improving fish habitat, and managing irrigation water to maximize angling opportunities on Fort Carson.

2. Maintain public access areas (Bird Farm, Wildlife Demonstration Area, and fishing reservoirs).

3. Continue consulting with the state and installation activities to resolve hunter access restrictions during big game seasons.

4. Continue operation of hunter check stations during big game seasons for collecting harvest data.

5. Fully implement and maintain an automated, web based recreational control system

6. Develop warm-water sport fishing on Fort Carson.

Recurring actions for wildlife recreation at the PCMS
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Continue consulting with the state and installation activities to resolve hunter access restrictions during big game seasons.

2. Continue operation of hunter check stations during big game seasons for collecting harvest data.

3. Fully implement and maintain an automated, web based recreational control system.

4.n. Wildlife Aircraft Strike Hazard (WASH)

Please note that many people are familiar with the term Bird Aircraft Strike Hazard, or **BASH**. The Army uses Wildlife Aircraft Strike Hazard.

The goal of the Fort Carson WASH program is to minimize the probability and the severity of a wildlife strike at Butts Army Airfield (BAAF). BAAF is utilized primarily by Fort Carson rotary aircraft. The number of daily operations (take offs or landings) varies throughout the year according to Fort Carson or visiting unit training requirements. During peak training periods the number of operations at the airfield can be as high as 300 operations daily. Stationing of a Combat Aviation Brigade on Fort Carson will increase the probability of a wildlife strike at Fort Carson and the PCMS due to an increased number of training flights.

Reducing the probability of a wildlife-aircraft strike at the airfield will be accomplished primarily through eliminating or modifying wildlife attractants and removing or discouraging hazardous wildlife. Management prescriptions can be found in the Fort Carson WASH. Appendix 2 has information on how to review the Plan. The plan prescribes actions for reducing the probability of a wildlife strike.

The Migratory Bird Treaty Act (MBTA) protects birds from intentional and incidental (unintentional) take and imposes civil penalties for violations by individuals and organizations taking protected species. In 2007, Congress authorized incidental take of migratory birds without a take permit for military readiness activity (MRA) conducted by members of the Armed Forces. Except for military readiness training, incidental take of migratory birds in the execution of an otherwise lawful management action, (e.g., prescribed fire, mowing, timber management, maintenance, and construction) is a violation of the MBTA.

Lethal control of wildlife may be required to eliminate hazards to aircraft. Intentional take of protected species of wildlife requires state and/or federal permits. Take permits will be obtained prior to take of any protected species, including mammals and birds.

Incidental take may occur during habitat management. Management of airfield grasslands to reduce attractiveness to wildlife are conducted during the bird-nesting season. To reduce the attractiveness to wildlife, airfield grasslands will be maintained at heights between 6 and 12 inches in accordance with AR

95-2. This activity cannot be delayed until after the nesting season due to threats posed to aviators. Setting mower blade height to 10 inches will reduce the probability of unintentional take of a protected bird species. The species potentially affected by grassland mowing are Horned Lark, Western Meadowlark, and Vesper Sparrow. Mower blade height is subject to pending informal consultation with the USFWS.

Prairie dog colonies are discouraged from colonizing in and around the airfield. Prairie dogs that are found in these areas will be eradicated in accordance with approved pest control methods. To avoid violations of the MBTA and state law, pretreatment surveys will be conducted prior to lethal control of prairie dogs. The Burrowing Owl, a state threatened species and a USFWS species of conservation concern, is often present at the airfield in association with prairie dogs. Pretreatment surveys will be conducted March-October in accordance with protocol established by the CPW (CDOW 2008).

Due to substantial risks to Bald and Golden Eagles and other non-target species, Fort Carson intends to informally consult with the USFWS regarding the limited use of poison grain to control prairie dogs. Prairie dogs are important prey for eagles and the Ferruginous Hawk year-round. Golden Eagles nesting west of Fort Carson are frequently observed hunting in colonies in the vicinity of and at the airfield. The Bald and Golden Eagle Protection Act (16 USC 668-668c) generally prohibits the disturbance of protected eagles. Actions which may disturb eagles must be avoided or fully coordinated in advance with USFWS.

Recurring actions for WASH at Fort Carson
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Conduct pretreatment surveys for Burrowing Owl prior to lethal control of prairie dogs.
2. Consult with the USFWS regarding migratory birds and eagles as related to airfield operations.
3. Participate in the BAAF WASH Working Group.
4. Continue participation in the National Military Fish and Wildlife Association WASH working group.
5. Continue to manage wildlife at BAAF to reduce the probability of a strike.
6. Conduct small mammal trapping to determine if population densities are likely to increase the number of raptors hunting at or near the airfield. Increased seasonal raptor activity would be filed as a Notice to Airmen (NOTAM) for pilot briefings.
7. Continue to perform quarterly inspection of boundary fence for evidence of mammal encroachment and identify sites for repair.
8. Consult with the CPW regarding big game issues related to airfield operations.

Recurring actions for WASH at the PCMS
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Evaluate WASH hazards at downrange PCMS aircraft landing sites

4.0. Wildland fire management



Wildland Fires generated by military training activities occur on a regular basis due to the nature of the munitions used. The elevated frequency and shortened regenerative growth cycle created by these wildland fires has a potential to cause damage to natural resources. The Fire Management program on Fort Carson and the PCMS is focused on containing and responding quickly to these wildland fires and using prescribed fires to reduce the chances of catastrophic wildland fires while managing natural resources. The Fort Carson Fire Department (FCFD) is the primary proponent of the wildland fire program. Personnel from DPW actively assist the FCFD with wildland fire suppression and prescribed fire planning and management. Resource experts within DPW serve as on-site advisors to the Incident Commander and recommend fire suppression options as they relate to natural resource protection. Natural resource personnel also suggest areas to burn to accomplish objectives related to this INRMP (e.g., invasive weed control, ecosystem management, forestry).

Wildland Fires

Wildfires may be started by military training (e.g. tracer rounds, flares) or other causes (e.g. lightning, arson) and may burn with intensities capable of causing loss of life, property, or detrimental impacts to natural resources. In areas where a high level of protection is identified, fire suppression consists of responses that usually completely suppress or control the fire. Other fires in areas that do not pose a risk to structures, training, life, natural or cultural resources, or escape of installation boundaries, may be used to accomplish defined fuel management objectives, as per a written Incident Action Plan.

Prescribed Fire

Prescribed fire is defined as the "controlled application of fire to wildland fuels in either their natural or modified state, under specific environmental conditions which allows the fire to be confined to a predetermined area, and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives (National Wildfire Coordinating Group (NWCG))." Prescribed fire strategies differ from wildland fire suppression strategies in that the primary goal is to use fire to achieve predetermined fuels management objectives within a given set of fire behavior constraints. Prescribed fires occur within a defined area having identified control boundaries, a written prescribed fire plan, and a permit from the Colorado Department of Public Health and Environment Air Quality Control Division.

Prescribed fire is used to reintroduce the natural fire regime that is a necessary component of the shortgrass prairie and ponderosa pine ecosystems. This natural fire regime provides for the reduction of hazardous fuel loading on the training ranges of Fort Carson and the Pinon Canyon Maneuver Site. The reduction of hazardous fuels provides protection to the high value natural resources on these installations by reducing the risk of a catastrophic landscape scale wildland fire.

Prescribed Fire Plan

The FCFD, in coordination with DPW, develops an annual prescribed burning plan for Fort Carson and the PCMS. The plan includes proposed burn areas to accomplish multiple fuel management objectives, including natural resources management. This plan is assessed through the NEPA process to identify potential issues, including impacts to natural and cultural resources. At the time of this writing, the goals for FY 13 are to burn 9,000 to 12,000 acres at Fort Carson, plus 12,000 to 15,000 acres at the PCMS. The annual Prescribed Fire Plan, as well as the Integrated Wildland Fire Management Plan, may be reviewed by calling the FCFD at 526-5737.

Fire monitoring

Operational monitoring can be defined as the systematic process of collecting and recording data on fuels, topography, weather, air quality, fire behavior, and fire effects to provide a basis for evaluating and adjusting current and future fire management programs. The primary intent of wildfire monitoring is to gain information necessary to make daily decisions regarding fire suppression actions, meet agency requirements, and provide sufficient information for documentation of fire management decisions and to evaluate the success of accomplishing the fire objectives.

Firebreaks

Approximately 72 miles of graded firebreaks encompass Fort Carson. They are maintained by DPW by mechanically removing the vegetation 3-4 times annually. A firebreak is currently being developed along the northern boundary of the PCMS.

Forested area thinning

In cooperation with the forestry program (Section 4.e.), thinning operations are conducted in heavily-timbered areas to reduce the risk of fires leaving installation boundaries and to protect man-made structures. Thinning also provides the added benefit of enhancing military training options in the thinned areas.

Fire-related training

Firefighters meet National Wildfire Coordinating Group standards for training. Regular training opportunities are provided by FCFD staff and other agencies (e.g. USFS Forest Service) in the region or state.

Fire management coordination

Fort Carson personnel coordinate and consult with federal, state, and local agencies, universities, or local land owners on concerns regarding wildland fire management or the use of prescribed fire. Applicable permits, such as an air quality burning permit from CDPHE or Section 404 permit from the USACE, are acquired prior to any fire management activity. Fort Carson has cooperative fire protection agreements with the Colorado Springs Fire Department, El Paso County Sheriff's Office, USFS, and 36 other agencies and organizations to provide mutual aid for the suppression of wildland fires on or off of the Installations.

Recurring actions for the wildland fire program
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and

fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Request funding to replace PPE, to maintain/replace equipment such as 2 brush trucks, 2 tenders, 1 utility vehicle and 1 ATV, and to purchase supplies.

2. Support fire department personnel in suppressing wildfires resulting from training or other sources.

3. Annually assist Fort Carson Fire and Emergency Services in preparing the Prescribed Fire Burn Plan covering both Fort Carson and PCMS.

4. Ensure Prescribed Fire Burn Plan and Burn Permits are in compliance with CDPHE requirements.

5. Suppress wildfires in MSO habitat. Prescribe burn a buffer zone between Booth Mountain and training ranges to keep military mission-related fires from entering MSO habitat.

6. Ensure wildlife and endangered species habitat enhancement and protection are considered during fire management activities.

7. Use prescribed burning to support the Forestry and Invasive Plants Management programs.

8. Coordinate with cultural resource personnel during wildfires and prior to conducting prescribed burns.

9. Describe fire use benefits in education and outreach programs such as Environmental Protection Officer training and Earth and Arbor Days for local schools.

10. Maintain and improve approximately 72 miles of firebreaks which encompass Fort Carson.

11. On active firing ranges create a minimum of a 100-foot strip of burn along all perimeters where feasible, which will be sufficient to contain any unintentional starts and assist in maintaining planned training schedules.

4.p. Training of personnel

The natural resource programs on Fort Carson and the PCMS are dedicated to recruiting and retaining highly qualified professionals. Personnel are encouraged to continue their professional development by participating in regional and national conferences and training opportunities.

Recurring actions for training of personnel
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. For government employees, include in Individual Development Plans refresher training needed to fulfill job requirements (e.g., enforcement, GIS, NEPA, endangered species documentation/consultation, firefighter, pesticide application) and ensure that they get the training.

2. Provide funding for personnel to attend annual workshops or professional conferences.

3. Encourage personnel to join and be active in professional societies and cooperative groups.

4.q. Coastal / marine management

This section is not applicable to Fort Carson or the PCMS.

4.r. Floodplains management

The overall goal of floodplains management is to minimize potential damage and associated costs that might be incurred due to future flooding of Fort Carson and the PCMS. Fort Carson completed two independent studies (2001 and 2008) to determine the 100-year floodplain in the drainages of the main post area. The study in 2001 was initially completed in support of the planned development under Base Realignment and Closure (BRAC) and to assess the capacity of the existing stormwater conveyance system to support the development. The 2008 study was completed as part of the Phase II MS4 permit requirements and to also assess more recent and planned development under the Grow the Army initiative. The results have not been verified or validated for either study, and the respective floodplain maps differ significantly. Consequently, the limits of the flood plain are still in question and Fort Carson is currently working with the USACE to develop a work plan to review, modify, and ultimately verify and validate the latest floodplain model. The current draft floodplain maps are included in Fort Carson's Stormwater Management Plan (http://www.carson.army.mil/DPW/environmental/stormwater/documents/20130401-SWMP.pdf). The SWMP will be periodically updated to include the most current floodplain maps. All future construction of buildings downrange should be reviewed by the Stormwater program as part of the NEPA review of the plans, in order to avoid placing expensive facilities in a floodplain.

Recurring actions for floodplains management
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Review, via the NEPA process, all projects proposed for the Fort Carson main post area for impacts to floodplains and risks to life and property; propose mitigation measures for any such risks.

4.s. Mineral resources

The DPW, in consultation with the Colorado Division of Reclamation, Mining, and Geology, ensures that the clay mines at Stone City on Fort Carson are properly maintained under their operating permits and that reclamation efforts by mining companies are in accordance with approved plans. All reclamation plans have been coordinated with the DPW and approved by the state. Fort Carson retains options to mine sand or gravel from its quarries if required by the military mission, or if quarrying benefits the government during the course of installation construction projects.

Fort Carson — The Stone City Mining District is near the southern border of Fort Carson in TA 45. Mining in the District started in the 19th Century and continued into the 1950s, producing refractory clay, and sandstone block. Mineral rights for one section were not included in the Army's expansion of Fort Carson in the 1960's that included the surface rights to the District. A section of Stone City Mining District, Section 36, has minerals that are owned by the State of Colorado (School Trust Section). Two

leases have been issued by the State to mine refractive clay in Section 36. Under lease M-91-003 for 240 acres, the Robinson Brick Company may mine clay three months each year and has often done so. Also, under lease M-90-143, DFC Ceramics, Inc. (lease sold to Thermal Ceramic in 1991) may mine 400 acres, although it has not done so. The mine sites are located near the Stone City site near the southern boundary of Fort Carson. Fort Carson has several inactive sand and gravel borrow pits that were used for road base material and building foundations. Over fifty abandoned mines exist at Fort Carson and the PCMS. The State of Colorado funded a contract to close the entrances to all the old Fort Carson mines; that work was completed in early 2012. Approximately twenty of the Fort Carson mines have locked access doors that allow access for wildlife biologists for bat and wildlife assessments.

PCMS — Historically, coal was mined in limited quantities on the PCMS. Today, there are no active mines on the installation.

At the time of this writing, we are not aware of any other leases pertaining to natural resources.

Recurring actions for minerals management
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Certain lands included within Fort Carson and the PCMS must be withdrawn from public availability for mining every few years. In 2007, as part of the Transformation EIS, the Army requested that Congress withdraw those lands for another 15 years. That process is now complete. The Federal Register of Friday, 23 September 2011, pages 59157 and 59158, noted the extension of the withdrawals for 15 years. Therefore, the Army will have to once again request that Congress renew the withdrawal of those lands, beginning the process prior to the year 2026.

4.t. Urban forest management

The Urban Forest Resource on Fort Carson is located within the main post area. The cantonment area at PCMS is limited but is defined by a treed windbreak. Both areas are typical and have similar challenges for growing trees as compared with most communities on the Front Range of Colorado.

The Army manages the Urban Forest Resource on Fort Carson primarily to improve the quality of life for the soldiers, families and civilians who live or work on the installation. A functional urban landscape is aesthetically pleasing while also protecting the residents from harsh winds, blowing snows, extremes in temperature and noise. The urban forest is further managed to improve wildlife habitat, air quality and protect water resources by minimizing erosion and controlling storm water run-off. The urban forest is also managed for its effects on energy and water conservation, pollution control, extending the life of paved surfaces and lastly to improve sociological benefits. The leadership of Fort Carson has vigorously supported this program. In 2012 the National Arbor Day Foundation recognized Fort Carson as a ”Tree City USA” participant for 25 consecutive years. Fort Carson also earned the prestigious ”Tree City Sterling Award” for 10 consecutive Growth Awards.

The urban forest program involves coordination among DPW, Colorado State University, Colorado State Forest Service, City of Colorado Springs Forestry Department, and other local agencies involved in urban forest management. This coordination is designed to implement and improve urban forest planning and implementation, while ensuring adherence to all federal, state and local laws and regulations. Natural

resources staff advises commands, DPW, USACE, Directorate of Contracting (DOC), DFMWR, and individual residents on all aspects of applied urban forestry, such as species selection, planting, site selection, xeriscaping, and proper pruning. Natural resources personnel support the DOC as subject matter experts and provide guidance for the development of work specifications and other aspects of contract documentation. Upon request, personnel interact directly with contractors providing interpretation and/or clarification as deemed necessary by the DOC.

The urban forestry team plants, waters, and maintains new and transplanted trees on Fort Carson and the PCMS. Trees, shrubs, and ground covers are drought-tolerant species recommended by the Colorado State University Extension Service for Fort Carson and the PCMS. The *Installation Design Guide* (available on the Fort Carson web site) includes information related to urban landscape management including pruning guidelines, watering guide, landscape specifications for low maintenance seeding, sod establishment, non-irrigated seeding, and irrigated turfgrass maintenance. The DPW completed a Xeriscape Master Plan in 2003 in response to growing requirements to conserve water.

Recurring actions for urban forestry
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Prevent damage or loss of valuable resources from insects, disease, wind, construction, and/or neglect.

2. Provide technical advice to the grounds maintenance contractor to ensure all turfgrass and landscaped areas are properly maintained.

3. Provide guidance on how to plant and maintain trees and shrubs on Fort Carson main post and the PCMS cantonment area to enhance aesthetics and provide benefits, such as visual barriers, windbreaks, decreased heating costs, reduced soil erosion, and safety enhancements; ensure a two-year survival rate of 80%.

4. Provide guidance on proper pruning of shrubs and trees and remove dead plants as an essential objective for the long-term health of trees and shrubs on the installation and to ensure the safety of people and structures.

5. Annually plan, organize, and participate in Arbor Day celebrations and meet standards established by the National Arbor Day Foundation to achieve recognition as a ‘Tree City USA”, depending upon available funding.

6. Work with DPW, DOC, and USACE to include improved urban forestry requirements in solicitations for new contracts.

7. Provide support in the implementation of the Xeriscape Master Plan.

8. Encourage implementation of practices listed in the 1994 White House Memorandum on federal landscaped grounds.

4.u. Water rights management

The Constitution of the State of Colorado, under Article XVI as added in 1876, *Mining and Irrigation*, establishes that the waters of every natural stream, except those previously appropriated, within the state are property of the public and that they are to be administered under the doctrine of prior appropriation. Colorado Revised Statutes, Title 37, *Water and Irrigation*, contains the statutes through which water rights are to be implemented, managed, and enforced. To be effective against other appropriators, water rights must be adjudicated and decreed for stated beneficial uses. Except for certain water rights set apart for the military installation, water rights must be put to the decreed beneficial uses or they can be subject to being ruled by the state as abandoned. Accordingly, the DPW is responsible for managing Installation water rights for beneficial use. Military training activities may be dependent on these rights, and their loss could have a significant impact on Fort Carson and the PCMS.

Water rights on Fort Carson and the PCMS directly support the training mission by providing water bodies for amphibious vehicles, 10th Special Forces scuba exercises, and training on use of water purification units. These water rights also assure adequate water supplies for the support and rehabilitation of natural resources on Fort Carson and the PCMS, and for fire suppression. The loss of a water right could cause a significant impact on the native resources that utilize that water for survival. The purpose of DPW water rights management is to maintain compliance with all applicable laws, regulations, and policies.

The Army owns approximately 50 surface and subsurface water rights on Fort Carson. The surface rights include diversion ditches and reservoir storage rights. The subsurface rights include both wells already installed and future wells, which will not be installed until required.

The Army owns approximately 120 surface and subsurface water rights on the PCMS. Of the 113 known wells, only about 30 are active.

Maps showing the approximate locations of most of these water rights can be observed in the offices of the DPW Operations Division.

Surface Water

Surface water rights include a decreed amount of water that may be applied to the decreed beneficial use(s). Surface water rights must be measured. Records obtained through the monitoring phase of the water rights program support the utilization requirements of water rights. These records are provided monthly by the United States Geological Survey (USGS) to the Colorado Division of Water Resources, also known as the Office of the State Engineer, the agency that implements and enforces Colorado water law. Fort Carson has an Intragovernmental Support Agreement with the USGS that provides a means for the monitoring and reporting.

Fort Carson — Streams entering and originating on Fort Carson are intermittent. Stream flow is diverted under authority of adjudicated water right decrees. Actual water use has been for the following:

- Recreation
- Fish management
- Firefighting
- Irrigation
- Military use

Water rights for Fort Carson are administered by Water Division Number 2, Water Districts 10, 12, and 14. These rights are on tributaries that originate generally to the west of Fort Carson; however, some tributaries originate within the installation. The tributaries involved are as follows:

- Little Fountain Creek
- Little Turkey Creek
- Red Creek
- Rock Creek
- Sand Canyon Creek
- Turkey Creek
- Wild Horse Creek

The combined inflow upstream of Fort Carson from Little Fountain, Little Turkey, Rock, and Turkey creeks is estimated to average 8.64 cubic feet/second, or 6,240 acre-feet/year. The actual inflow to Fort Carson is less than this quantity because of stream flow diversions for municipal and domestic water supplies. Pumping groundwater from alluvial aquifers upstream from Fort Carson also reduces the quantity of stream flow entering the installation (Leonard 1984). In years when streamflow is less than normal, available water is distributed according to priority – the senior right is satisfied first, then the next earliest right, and so on. Some of Fort Carson's water rights are quite senior, while others are not. Therefore, in any given year, flows in the various tributary drainages may or may not be sufficient to support Fort Carson's right to divert or to store flows.

PCMS — Water rights for the PCMS are judicially administered under Water Division Number 2, Water Districts 17 and 19. Water rights are administered on arroyos and canyons that originate on the installation proper, or, in the case of the Van Bremer, that originate west of the installation. Arroyos and canyons that supply water to the installation and are administered by Water Division Number 2 are as follows:

- Bent Canyon
- Big Arroyo
- Van Bremer Arroyo
- Lockwood Arroyo
- Red Rock Canyon
- Stage Canyon
- Taylor Arroyo
- Welsh Canyon

There are a few surface water rights at PCMS, but they are inactive currently. Most of the Army's water rights on PCMS are subsurface rights (wells).

DPW has the responsibility to monitor, operate, and maintain water rights, with legal support from the Fort Carson Office of the Staff Judge Advocate, as supported by the Environmental Law Division at Headquarters, Department of the Army, and the Environmental and Natural Resources Division, U.S. Department of Justice. Each water right, with the exception of some early rights, for Fort Carson and the PCMS contains the following information:

- Appropriation date - the date the water was first diverted
- Adjudication date - the date the court recognizes for priority assignments
- Decreed use (beneficial use) - a decreed amount of water measured in either cubic feet per second or acre-feet

- Point of diversion - the location of the point of appropriation in a township and range grid coordinate system

As a result of personnel turnover and institutional reorganization, the DPW's water rights expertise and record-keeping require improvement as funding and personnel authorizations permit.

Subsurface water rights

Colorado has applied the doctrine of prior appropriation to subsurface (well) water (otherwise called "groundwater" or "underground water") rights, although that application occurred much later than with surface water. Statutes pertaining to underground water and wells are in Colorado Revised Statutes, Title 37, Articles 90 through 91. Because ground water rights are often junior to the controlling rights and because wells have a lagged effect on stream flow, specific rules have been adopted to ensure that the use of wells does not injure more senior water rights. These rules and regulations do not apply to exempt domestic, stock, or fire protection wells. Also, wells that are permitted and/or decreed as non-tributary are exempted from these rules. See the Division of Water Resources' *Guide to Colorado Well Permits, Water Rights, and Water Administration, January 2008, at* http://water.state.co.us/DWRIPub/Documents/wellpermitguide.pdf.

To allow the use of wells without injury to senior water rights, the Colorado State Engineer has developed the "*Amended Rules and Regulations Governing the Diversion and Use of Tributary Ground Water in the Arkansas River Basin*". These Rules require that wells cease use unless they are used in accordance with an "*Augmentation Plan*" approved by the state and State Engineer or a "*Substitute Water Supply Plan*" approved by the State Engineer. Augmentation water can be water that is imported from another basin or a non-tributary source or water from a right in priority that is not diverted, but rather is left in the stream so that it is available to other rights. Such augmentation water must be made available to the stream in the appropriate amount, time, and place so as to offset any injury to a senior water right caused by well use. Fort Carson adheres to these "*Amended Use Rules*" by maintaining membership in the Colorado Water Protective Development Association (CWPDA) and by paying annual fees in lieu of procuring water for augmentation.

To determine the amount of augmentation water needed for each well, accurate measurements of well use are necessary. The "*Amended Rules Governing the Measurement of Tributary Ground Water Diversions Located in the Arkansas River Basin*" was developed for this purpose. These Rules require that the well owner install a totalizing flow meter or that a power coefficient be determined that allows the amount of water diverted to be calculated using the electrical consumption of the pump.

All wells (seven wells, with two of these wells having two meters) classed as tributary and active on Fort Carson have totalizing flow meters to measure use. Measurements are reported monthly to the CWPDA. A person certified by the State Engineer must verify every four years that these flow meters are in accurate working condition. For wells that are not being used and are not connected to a power source, these metering requirements can be avoided by submitting a Notice of Inactive Well. Fort Carson has two inactive wells falling into this category.

The following are wells on Fort Carson that are classed by the State Engineer as tributary and therefore fall under jurisdiction of the *Amended Rules Governing the Measurement of Tributary Ground Water Diversions Located in the Arkansas River Basin*. They are all adjudicated for non-irrigation uses.

Fort Carson Tributary Wells - monthly meter reports and meter calibration rules required

- Well # 1005880 – Wildlife Well (aka Well # 1; Mary Helen Ranch well; Rod & Gun club well)

- Well # 1005881 – ARA Well (aka Well # 2; Wilderness well)
- Well # 1005882 – ASA Well (aka Well # 3)
- Well # 1005884 – Turkey Creek Ranch Well (aka Well # 5; Stroebel spring or well)
- Well # 1005886 – South Recondo Well (aka Well # 7; Red Creek well; Red Devil South well)
- Well # 1005887 – MPRC Well (aka Well # 8; Tank Table VII well)
- Well # 1005888 – Range 145 Well (aka Well # 9; Tank Table VIII well)

Fort Carson Tributary Wells - inactive

- Well # 1005883 – ASA Well #2 (aka Well # 4)
- Well # 1005885 – Red Devil Well (aka Well # 6; Recondo well)

Over 100 wells are known at PCMS, almost all of which were drilled prior to Army ownership. Most are inactive at present. Efforts are underway to repair 21 of those wells for future use. More wells will be repaired and monitored in the future, subject to availability of funding. The PCMS does not have any wells classed by the State Engineer as tributary.

Recurring actions for water rights management
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Monitor flows (by USGS);

2. Send quarterly reports to State (by USGS);

3. Send monthly well reports to CWPDA

4. Maintain some of the windmills at PCMS.

4.v. Cultural resources

Information about management of cultural resources on Fort Carson and the PCMS can be found in the Integrated Cultural Resources Management Plan (ICRMP), which is available from the Cultural Resources Management Section, part of the DPW, Building 1219 at Fort Carson.

The Natural Resources Management program takes into account cultural resources considerations by means of NEPA review of proposed projects or actions, prior to start of the project or action. Since neither Fort Carson or the PCMS has been 100% surveyed for cultural resources, NEPA review of proposed natural resource projects will include coordination with the Cultural Resources section prior to implementation of the project.

4.w. Integrated Training Area Management (ITAM)


Vegetation plots

The ITAM Program is an Army-wide program to provide quality, sustainable training environments to support the Army's military mission and help ensure no net loss of training capability (a Sikes Act requirement). The ITAM program was initiated with the realization that Army training lands were being degraded to the point where their capabilities to sustain military missions were in jeopardy. In other words, training lands are long-term assets that have to be managed so that they are available for both present and future training needs. Proper management to support both the military mission and other activities is a challenge unique to Defense among managers of public lands.

ITAM provides Army range officers with the capabilities to manage and maintain training lands and support mission readiness. ITAM integrates mission requirements derived from the Range and Training Land Program with environmental requirements and environmental management practices. It establishes policies and procedures to achieve optimum, sustainable use of training and testing lands by implementing a uniform land management program. Several documents provide policy and procedural guidance for the ITAM program.

Army-wide Goal. The Army-wide goal for ITAM is to: "*achieve optimum, sustainable use of training lands by inventorying and monitoring land condition, integrating training requirements with land capacity, educating land users to minimize adverse impacts, and providing for land rehabilitation and maintenance*" (Department of the Army 1995).

ITAM Program Strategy (Department of Army 1995). The strategy describes roles, responsibilities, and relationships among the functional proponent and supporting organizations, provides an overview of the ITAM policy and guidance, and describes the four ITAM components. The ITAM Program Strategy, along with input provided by Army conservation staff and RTLA outcomes, provided the foundation and guidance for the ITAM Regulation (AR 350-19) and the Procedural Manual (Department of the Army 1999).

AR 350-19, The Army Sustainable Range Program (Department of the Army 2005). This regulation assigns responsibilities and provides policy and guidance for the Army ITAM program. The regulation includes support for sustainable ranges, assessment of range sustainability, and management of automated and manual systems that support sustainable ranges.

ITAM Procedural Manual (Department of Army 1999). This document defines Headquarters, Department of the Army, Major Army Command, and installation roles, responsibilities, and Army-wide guidance to implement ITAM. Policies, procedures, and guidance in this manual are essential to achieve and maintain the Army ITAM program. Army mechanisms for program management, review, and information exchange include Program Management Reviews, quarterly newsletters published online by the AEC, the Sustainable Range Program (SRP) website, and the annual Training Service Support (TSS) workshop.

Program Management at Fort Carson and the PCMS

Fort Carson Regulation 350-9, *Integrated Training Area Management (ITAM)* was generated based upon the above documents. This regulation defines roles and responsibilities of Fort Carson applicable parties.

As part of the ITAM budgetary and planning process, Fort Carson is designated as a Category 1 installation (with the PCMS considered an off-site training location). Category 1 installations are the largest installations, with most critical training missions and/ or greatest environmental sensitivities to missions.

Primary goals of the ITAM Program at Fort Carson and the PCMS are to:

- align Fort Carson and the PCMS training land management priorities with the training needs and readiness priorities on Fort Carson;
- facilitate training to current military standards while advocating tactically responsible conservation and land management practices;
- achieve optimal sustained use of lands for the execution of realistic training and testing by maximizing ITAM efforts;
- Support a management and decision-making process, which integrates training and other mission requirements for land use with sound natural resource management on Fort Carson and the PCMS;
- sustain lands for training readiness and multiple use in accordance with Department of Defense policy;
- ensure cost-effective and technically sound land management methods are applied to LRAM projects;
- educate land users in reasonable and sound land use practices and environmental stewardship; and
- aid in sustaining the installation through sound land management practices and environmental stewardship.

The ITAM program includes the following five component areas (modified from *Integrated Training Area Management (ITAM) Program Strategy* (Department of the Army 1995)):

- The RTLA is used to inventory and monitor specific physical and biological resources to meet the sustainable multiple-use demands of Fort Carson.
- The Training Requirements Integration (TRI) component integrates Fort Carson military training requirements for land use with natural resources conditions and capabilities to support these requirements.
- The Sustainable Range Awareness (SRA) component improves land user understanding of the impacts of their activities on the environment and how to use the land more efficiently.
- The LRAM component includes programming, planning, designing, and executing land rehabilitation and maintenance projects to support and sustain the military mission.
- The Geographic Information System (GIS) supports planning decision processes to effectively manage land use and natural resources.

Goals and objectives specific to ITAM are found in the *ITAM Program Strategy*, Section 2.1 (Department of Army 1995). These are incorporated into objectives within this INRMP. ITAM planning involves developing projects and providing input into the ITAM budget process.

Range and Training Land Assessment

RTLA is designed to organize and improve past training lands monitoring processes, incorporate training area management goals, and develop useful assessments to achieve and/or maintain these goals.

In short, the RTLA component is a centralized, installation-level program that focuses first and foremost on installation needs and may provide information to major commands and Headquarters, Department of the Army, as requested. For greater detail, refer to the *Handbook of Effective Practices for RTLA Coordinators* (Colorado State University 2006).

The RTLA component acquires data and assesses information to maximize the capability and sustainability of the land to support live training and testing activities. Installations use RTLA data and information to:

- develop conceptual models to define those thresholds in terms of suitability for training for each ecotype including all possible land uses;
- establish specific assessments to determine the status of the training lands with respect to those thresholds as well as success of rehabilitation efforts once implemented;
- recommend boundaries and training load distribution for newly acquired and existing training land, so that the capacity of training land can best support a new or changing training mission and a new intensity load;
- identify potential LRAM project sites;
- ensure that biological considerations are part of the LRAM project prioritization process;
- determine the effectiveness of LRAM projects;
- work with the GIS component to create maps that depict the availability, suitability, accessibility, and capacity of training lands;
- conduct internal encroachment assessments by routinely reviewing plans, such as the INRMP, Integrated Cultural Resources Management Plan, annual burn plan, and Endangered Species Management Plans.

Background
Monitoring protocols have been developed to reflect the recent changes in the former program. RTLA monitoring efforts now focus more on assessing training land condition in support of installation mission and providing recommendations for the informed scheduling, usage, and rehabilitation of Army land. Protocols contain the installation's RTLA monitoring goals and objectives in support of the installation's training mission.

Methods
The original plot inventory employed standard methods, permanent field plots, and stratified random sampling and emphasized multiple applications of data collected. A herbarium collection (maintained by DPW) has been created, which includes a laminated sample of each plant species with pertinent information on each laminated sheet. New specimens are added as they are discovered.

On Fort Carson, 204 permanent plots were established by 1987, and 206 permanent plots were established on the PCMS by 1989. Sites were selected using a GIS that used satellite vegetation imagery and digital soil surveys. Vegetative cover and soil combinations (polygons) were identified, and 100-meter belt transect plots were allocated to these polygons through a stratified random process in proportion to the percent of land that they covered. Standard techniques were used to allocate and collect data from standard plots. DPWcollected data that are available in summarized tables and in computer files.

Eventually it was decided to allocate monitoring plots to each training area on Fort Carson and the PCMS with plots proportionally stratified by vegetation class. In 2001, 357 plots were established on Fort Carson. Each newly allocated plot was digitally photographed, located using a global positioning system, and digitized into the GIS. The 357 plots include 43 of the original plots. A total of 375 plots have been selected for the PCMS, including 62 of the original plots.

The baseline survey for the additional plots at Fort Carson was completed in 2002. The baseline survey for the additional plots at the PCMS was completed in 2005. In 2006 new methodologies were implemented to support monitoring goals and objectives of the specific assessments outlined in the RTLA Protocol. The current RTLA Protocol is maintained in the Fort Carson ITAM office.

Goal 1. Develop and refine conceptual models to define those thresholds in terms of suitability for training for each ecotype including all possible land uses and establish specific assessments to determine the status of training lands with respect to those thresholds, as well as success of rehabilitation efforts.

Goal 2. Improve combat engineer units' ability to train on excavation equipment, while protecting the environment.

Goal 3. Support location and development of additional FARPs and Landing Zones to support aviation units to include the stationing of a CAB on Fort Carson.

Land Rehabilitation and Maintenance

The LRAM component is a key enabler for sustaining realistic training conditions, supporting training, and satisfying the mission requirements for the military units using the installation (Department of Army 2005). The LRAM component includes programming, planning, designing, and executing land rehabilitation and maintenance projects based on requirements and priorities identified by TRI, RTLA, and LRAM components of ITAM, and others.

LRAM can be mitigation for and minimization of impacts of the military mission at Fort Carson and the PCMS. LRAM projects are specifically designed to:

- maintain quality military training lands;
- mitigate severe safety hazards limiting training opportunities;
- minimize long-term costs associated with land rehabilitation, vehicle maintenance, or additional land purchase;
- modify training areas to enhance training possibilities; and
- reduce erosion caused by, or unduly impacting, military training.

More specifically, LRAM can be used to achieve the following:

- improve vegetation cover and alter topography to enhance training, to reduce soil loss (caused by military training) and protect long-term soil productivity, and to comply with air quality standards by reducing fugitive dust
- control runoff to reduce soil loss, protect riparian resources, and comply with water quality standards,
- repair gullies and other watershed damage to reduce safety risk and to return land for training use, and

- construct such projects as hardened crossings, Heavy Equipment Transporter (HET) on/off loading pads, helicopter landing pads, and others that would enhance the possibilities for military training in the training areas of both installations.

LRAM project funding applies to damaged sites that are not out of environmental compliance and were damaged by training and/or are negatively impacting training. It also applies to projects in training areas that enhance training possibilities that fall within current training needs.
If environmental notices of violation are either pending or existing on a given site, a project there is not eligible for LRAM funding. Likewise, if a degraded site is not affecting training capability or is not caused by military activities, the project is not eligible for LRAM funding. If land is degraded through erosion and vegetative loss not caused by training and if it is either in noncompliance with environmental laws or not affecting training, it is eligible for environmental funding. LRAM cannot be used to conduct range modernization projects.

Installations are required to coordinate with the range modernization planning team members to identify, plan, and execute approved LRAM projects. The SRP web site provides detailed information to support the LRAM project life cycle.

Annual and longer-term LRAM project lists and the BMPs for implementation are modified as necessary and maintained in the Fort Carson ITAM office. This list remains flexible to react to immediate needs. LRAM projects are implemented on a proactive basis. Areas damaged to the point where they restrict military training or create safety hazards are high priorities.

Reseeding
Reseeding is used in areas that have been disturbed but do not require bank sloping or other intensive site preparation. These are areas with relatively flat slopes and more stable soils. A rangeland drill seeder is used for this operation. Some areas may be too rocky or steep to seed with a rangeland drill. In these areas, seed may be broadcast using an appropriate broadcast seeder. Critical areas are those where erosion is a significant concern, generally steeper slopes. These areas are seeded at twice normal rates.



All seed mixes are adapted to the southeastern Colorado region, but current efforts are underway to find native variants that are more resistant to fire and military impacts, for future use. The use of fertilizers is discouraged in all seedings. ITAM will continue to work closely with DPW to determine acceptable seed mixes for use on Fort Carson and the PCMS.

Erosion Control
Erosion control in its broadest definition includes most LRAM projects. LRAM's BMPs for erosion control usually involve bank sloping, various water flow control structures, and often the use of geotextile and/or rip-rap.

At Fort Carson and the PCMS, historical land use has caused degradation of the vegetation that normally traps, uptakes, and transpires rainfall and snowmelt. Reduction in plant cover results in soil loss by sheet and rill erosion, headcutting, and the formation of large gullies. Montmorillonite clays in the soils allow

the sides of erosion courses to remain steep instead of collapsing to a shallower angle of repose and form deep gullies that interfere with training activities.

Reduced plant cover and disturbed soil caused by military training activities can cause accelerated soil loss due to water and wind erosion. The amount of plant cover on the soil surface at the time of a rain or wind storm is the primary factor in preventing erosion. Canopy and basal cover, species composition, root structure, and distribution are all important factors to reduce erosion. Plants and litter form a protective cover that mitigates impacts of wind and water, promoting favorable surface conditions to improve water uptake.

Remediative bank sloping is the process of contouring the banks of gullies to an angle where vegetation can be successfully established, stabilizing and bringing an area into hydraulic balance. Bank sloping also enhances military training by facilitating maneuver and reducing safety hazards. Bank sloping, using various methods, has been conducted on a modest scale for years at Fort Carson and the PCMS.

Another BMP used to help curtail erosion due to military training at Fort Carson and PCMS is enhancing existing erosion control structures. Whereas previous design criteria were based solely on slowing surface water movement across the training areas, the current design criteria involve building up material on the back side of existing dams to widen the top of the dams (from 25 feet wide to a maximum of 40 feet wide) such that military vehicles can traverse them. Sides of dams are also reduced to no steeper than a 4:1 slope, allowing vehicles to climb and descend them with far less impact. Any damage to original erosion control dams is repaired at the time of enhancement. Enhanced dams are reseeded, and after vegetation recovery, are re-opened for military training use.

Bank sloping has been used in conjunction with other hydraulic controls, such as erosion control dams, aggressive plant material management, and other erosion control structures. Fort Carson has approximately 350 erosion control dams and numerous erosion control structures, and the PCMS has approximately 430 erosion control dams. Each dam is marked in the field with a project identification number on an aluminum cap. The cap was placed on rebar stock and driven into the dam. Each dam has been located using a global positioning system and digitized into the GIS.

DPW maintains the database for these dams, with ITAM providing data as new and enhanced erosion control dam projects are completed.

Road/Trail Management

Since first used for military training, the number and length of roads and trails on both facilities have been increasing. Unimproved roads and trails contribute to soil erosion and sedimentation by reducing infiltration and concentrating runoff. Eroded maneuver trails (the network of unpaved trails within a training area that is used by tactical vehicles and equipment for light or heavy maneuver training) can be improved with grading, the construction of drainage ditches and low water crossings, and certain erosion control structures. Duplicate or unnecessary maneuver trails are recovered by smoothing and reseeding.

Major, lettered Tank Trails downrange at Fort Carson, and major, numbered Main Service Routes at PCMS, are maintained by DPW.

Hardened Sites

Some staging areas, bivouac sites, helipads, wet area crossings, HET on/off-loading areas, etc. on Fort Carson and the PCMS are used repeatedly for training purposes. This repeated use has resulted in areas that are denuded of vegetation with compacted soils. As a result, these areas significantly contribute to fugitive dust and increased sedimentation. They also have very limited realistic training features. These areas cannot be easily rehabilitated in a cost effective manner to a sustainable state that can continue to

support heavy use, but they often can be hardened using layers of gravel, road base, and small rock to facilitate military use and reduce soil erosion and associated sedimentation into nearby drainages and waterways.

Coordination

Fort Carson. LRAM projects often require coordination with other Fort Carson organizations, particularly DPW . NEPA review is generally required. Prior to any construction activities that create any soil disturbance, NEPA review and an archaeological clearance is obtained. Other activities that require coordination include projects that affect wildlife or its habitat and similar activities.

U.S. Army Corps of Engineers. There may be instances where erosion control structures are planned to be placed in gullies that contribute water directly to existing drainages recognized by the USACE as being Waters of the United States, as identified in Section 404 of the Clean Water Act. Any construction of erosion control structures is coordinated with the USACE in Pueblo, Colorado, to determine if a 404 permit is necessary prior to construction. If a permit is required, it is processed prior to construction activities. Fort Carson has received Army Regional Permit No. SPA-2008-00058-SCO from the USACE, which allows most erosion control activities on Fort Carson and the PCMS to occur without separate permitting actions. Fort Carson anticipates obtaining a new 5-year regional permit sometime in 2013, after the current one expires.

Colorado State Permits. The State of Colorado requires that an application for every erosion control dam on Fort Carson or the PCMS be submitted and approved prior to construction. Required information is submitted to the Colorado Division of Water Resources along with a processing fee for approval and processing. This requirement is contained in the Erosion Control Act of Colorado, CRS 37-87-122.

Goal 1. Use LRAM efforts to restore and maintain lands to full training support capability.

Goal 2. Coordinate with adjoining private, state, and federal land managers to protect lands from the effects of military training by reducing fugitive dust, soil erosion, and sedimentation (caused by military training) within current land management strategies.

Goal 3. Reduce the safety hazards and improve FTX/maneuverability training for the mechanized units using Fort Carson and the PCMS.

Goal 4. Improve the maneuver trails network to facilitate the movement and resupply operations for all units training on Fort Carson and the PCMS.

Goal 5. Improve the line of sight and the capability for all units to provide Command and Control (C2) and assembly areas in the training areas.

Goal 6. Enhance the capability of dismounted and mounted units to train in preparation for operations in other areas of the globe.

Goal 7. Improve and/or sustain drop zones/landing zones.

Training Requirements Integration

The TRI component provides a decision support capability based on the integration of training requirements, land conditions, range facilities, and environmental management requirements. The installation ITAM Coordinator must consult with the DPTM Range Officer, other range organization personnel, trainers, environmental technical staff, natural and cultural resources managers, and other environmental staff members to integrate the following inputs:

- training requirements;
- land management, training management, and natural and cultural resources management data; and
- data derived from the RTLA and Army conservation program components, among others.

TRI provides input for developing and updating the INRMP. TRI also supports range modernization project siting, and training event scheduling and allocation.

Coordination
Close coordination between DPTMS and DPW is key to the successful implementation of the Fort Carson ITAM Program/TRI. ITAM, based upon recommendations from the LRAM and RTLA Coordinators, initiates processes to recommend land use design and management considerations to trainers and planners and coordinates with them on scheduling and allocating sustainable land use for military training with minimum environmental damage. Interfacing land rehabilitation actions with training needs helps ensure mission support.

Mission Safety
Some environmental restrictions and programs enhance mission safety. For example, the revegetation of bare landing zones reduces dangerous "brownouts" for helicopters. Proper road construction and maintenance improves driving safety. Bank sloping reduces rollover risk for maneuvering vehicles. Fire restrictions reduce the potential for wildfires, which can injure troops or damage equipment and facilities.

Training Restrictions
Restrictions on training are sometimes necessary for long-term sustainment of training and ecosystem protection, including environmental compliance. Restrictions on troops training on Fort Carson and the PCMS are within FC Regulation 350-1 (*Mountain Post Training)*, FC Regulation 350-10 (*Maneuver Damage Control Program*), FC Regulation 385-63 (*Firing Ammunition for Training, Target Practice, Administration and Control of Ranges and Training Areas*) and supplemental maps of both installations which delineate off-limits and limited-use areas and are updated periodically. Some restrictions are directly tied to compliance with various laws and regulations (*e.g*., cultural/archeological resource sites), but many are being implemented according to clear guidance from both Department of Defense and Department of the Army to manage natural resources for long-term sustained military use (*e.g*., limited-use areas, described below).

In some cases, troop units using either Fort Carson or the PCMS must coordinate with the DPTMS and DPW for site-specific restrictions needed for safety and compliance purposes (*e.g*., permission to dig large excavations, precluding hitting buried utilities and archeological sites). Troops are briefed regarding training restrictions via monthly (or as necessary) Sustainable Range Awareness classes and/or informed of expectations and rules during the scheduling process (see below).

Restrictions are often "invisible" to troops and are imposed during the scheduling process (*e.g*., training area not available; certain firing positions not available for live fire). Other restrictions can be incorporated into training scenarios. For example, military leaders can inform their units that fenced areas

represent "known mine fields." Restrictions on off-road travel, removal of vegetation, and the filling of holes can be tactically sound. Off-road travel leaves signs for the enemy to track units or determine unit strength. Removed vegetation and foxholes and other dug areas are indications of unit strength to enemy intelligence. This type of damage can also be defined as "tactical signature" - information produced by a unit's activities that can be seen and used by the enemy to determine where it is, where it has been, how big it is, the type of vehicles it has, and what it is doing. Reducing tactical signature can equate to reducing maneuver damage in the training areas, a concept taught at Fort Carson during Sustainable Range Awareness briefs. Thus, it is important to fit environmental restrictions into tactically-realistic training scenarios.

Limited Use/Rest Rotation/Deferment Program

The purpose of Fort Carson's limited-use area program is to recover key military terrain in as cost- and time-efficient a manner as possible. Downrange at Fort Carson, key terrain that has been heavily impacted by military training will be evaluated for possible inclusion in the limited-use area program. Areas impacted to the point of imminent critical erosion loss will be included, to provide rest from use, required by the rangeland resource to meet the essential biological and physiological requirements needed to maintain proper health and vigor for maintenance, growth and recovery of the area, while still providing for effective, sustainable military training. Placement in limited use status also provides the time and means to perform land rehabilitation and land maintenance operations in heavily degraded areas. In these designated areas, vehicles may drive through on roads and trails, and dismounted training may be conducted off the trails. However, it is not permitted to dig, to bivouac, or to drive vehicles off the roads in these areas. All limited use areas are reviewed on a three-year cycle, in order to determine their recovery status. Under optimum conditions, an area may be re-opened to training after approximately three growing seasons.

Goal. Improve communication between training and land management staff to facilitate the integration of Fort Carson's military training needs for land use on both Fort Carson and the PCMS with the sustained capability of the land to support such use.

Sustainable Range Awareness

The SRA component provides a proactive means to:

- develop and distribute educational materials to users of range and training land assets,
- integrate SRA into existing command and/or installation operational awareness activities and events, and
- initiate new events that maximize outreach for the command.

SRA materials relate procedures that reduce the potential for inflicting avoidable impacts on range and training land assets, including the local natural and cultural resources.

The Environmental Battle Book, prepared by DPW, is designed to provide commanders, unit leaders, and soldiers with an overview of Fort Carson environmental programs. The Handbook includes environmental training programs, pollution prevention and waste minimization, hazardous materials and wastes, spill prevention and response, air emissions, noise pollution, energy conservation, natural and cultural resources, public and agency involvement, and similar topics. ITAM, in conjunction with DPW, has produced a Soldiers Field Card, which lists some "do's and don'ts" of training area usage for military personnel.

The Maneuver Damage Control Program briefing is part of an exportable package, which can be transferred to off-post units, to be used to teach those units prior to their arrival for training on Fort Carson or the PCMS, thereby reducing travel costs and administration time on their arrival.

ITAM-supported environmental training that is available to military personnel who use Fort Carson and/or the PCMS include:

- monthly (or as needed) courses for maneuver damage control personnel,
- Leaders' walk-through courses for incoming unit commanders,
- National Guard/ Reserve Component pre-camp briefings, and
- SRA/ Maneuver Damage Control classes at units' home stations.

An education strategy encompasses the integration of educational materials with command support. Educational materials provide information about the problem, why it is everyone's problem, and how following existing rules and regulations will help alleviate it. Materials also address issues concerning combat effectiveness and the environment.

Information about environmental conservation and protection is provided in presentations, formal and informal briefings, pamphlets, videos, and instructional classes. Materials contain examples of appropriate and inappropriate training actions or vehicular movements along with their effects. The concepts of the Maneuver Damage Control Program are emphasized. The major theme stressed is that environmental deterioration affects overall success of the training and/or tactical mission. The following are also emphasized within the SRA program:

- Maneuver Damage Control Program;
- notification on the location of areas that are off limits as well as areas that are designated limited use areas (the limited-use Land Rest/Rotation Deferment Program);
- proper field operation tactics (to include tactical signature awareness), which minimize damage to land and vegetation;
- establishment of a conservation ethic that also promotes the accomplishment of the military training mission;
- adherence to federal, state, Fort Carson and Department of the Army/DoD laws and regulations, training procedures that best protect the environment, and training restrictions;
- safety hazards, such as gullying, etc., which can lead to the loss of personnel (*i.e.*, serious injury or loss of life), and/or to the loss of, or serious damage to equipment;
- badly damaged acreage in training areas reduces land available for quality training;
- minimize damage to trees, wetlands, and wildlife habitat (where necessary);
- costs resulting from damage to natural resources place added burdens on already strained budgets (*e.g.*, cleaning up roadways; construction, operation and maintenance of sediment basins; litigation from adjoining landowners; fines for violations of natural resource laws/regulations; lost training time; repair of damaged equipment); and
- damage to highly valued natural resources can discredit the Army in the minds of local citizenry (and others).

However, SRA also makes it clear that military and/or security considerations are sometimes more important than environmental issues, while still demonstrating that such environmental issues are being considered.

Goal 1. Improve communication between training and land management staff to facilitate the integration of Fort Carson's military training needs for land use on both Fort Carson and PCMS with the sustained capability of the land to support such use.

Goal 2. Facilitate the reduction of training restrictions on Fort Carson and PCMS.

Goal 3. Increase awareness of tactical signature, increasing combat effectiveness while decreasing environmental damage.

Geographic Information System

All aspects of the Fort Carson ITAM Program utilize GIS to support land use planning decision processes. RTLA data provides information to help effectively manage land use and natural resources. Resulting maps and other data are used to help prioritize potential LRAM projects. TRI utilizes the GIS information to ensure adequate, available training lands for military training. Problems due to improper land use are identified in GIS, to be communicated, along with acceptable tactical solutions, to land users during SRA briefings.

The ITAM GIS is a state-of-the-art information source for military decision makers. Accurate spatial information is available for map production or detailed site analysis.

There are three GIS operations that directly affect implementation of this INRMP. DPW has GIS databases that are needed to implement certain projects within this INRMP (*e.g*., utility lines, facilities, etc.). DPW has a decentralized GIS that contains a great deal of data on natural resources on Fort Carson and the PCMS. The following describes the GIS within the ITAM program.

Uses of the ITAM GIS include recording locations of RTLA plots, providing spatial analyses (soil types, slope, vegetation, etc.) for LRAM project design, showing environmentally sensitive areas, planning military training missions, etc. Given that the Army has evolved around the "Digital Division" concept, GIS technology has become a tool more prevalently used for decision-making and problem solving.

There is a need to monitor changes to the Fort Carson and the PCMS landscape on a regular basis, particularly to quantify impacts of military activities on the land. The acquisition of aerial photographs and other imagery on a regular basis of both Fort Carson and the PCMS has facilitated such change detection analyses.

It is important for ITAM to be able to directly assist military units planning training missions at Fort Carson and the PCMS. More effective prior planning, due to supplied SRA materials, GIS data and specialized map products, allows non-tenant units more field time during training periods at Fort Carson and the PCMS.

Fort Carson's ITAM Program is working closely with the military (geospatial) "Terrain Teams" on post, to share data, coordinate efforts and enhance each organization's decision-support systems, all in an attempt to promote more effective use of Fort Carson's and the PCMS' training lands.

Fort Carson is using virtual reality (simulated) training to more cost-effectively train its soldiers. This training requires GIS databases that accurately portray training features in a 3-D setting. The ITAM GIS has and is developing additional features that have assisted with database development for this type of training.

Goal. Provide spatial products and analyses to support ITAM program implementation, military mission planning and training, and land use decision-making.

Recurring actions for ITAM program
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Reseeding and erosion control downrange;
2. Know and understand the changing training requirements of military units;
3. Vegetation monitoring;
4. Prepare maps and provide decision support;
5. Educate military and civilian personnel.

4. x. Bald and Golden Eagle Management

The Bald and Golden Eagle Protection Act (BGEPA), which prohibits the taking of Bald or Golden Eagles, regulates protection of eagles. The statutory definition of take includes disturb as a form of take. In the Code of Federal Regulations, "disturb means to agitate or bother a Bald or Golden Eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." Additionally, Bald and Golden eagles are protected by the MBTA, by DoD policy expressed in the MOU with USFWS to promote the conservation of migratory birds, and by permit requirements at 50 CFR parts 13 and 22.

The Golden Eagle is a year-round resident of Fort Carson and is most abundant in winter. Several Golden Eagle eyries (nests) are present on Fort Carson and 2-3 of those are occupied annually, January-August. The Bald Eagle is present on Fort Carson in migration and winter, late October through March. Both species are present at the PCMS during the same time frames as Fort Carson, but are less abundant. Golden Eagles previously nested at the PCMS, but there are no recent records. The Bald Eagle does not nest on Fort Carson or the PCMS or within their region of influence, and has never been recorded during the breeding season at either installation.

When a Golden Eagle nest is known to be occupied at either installation, a buffer zone of 200 meter radius is applied until the young have fledged. The buffer zone is to exclude aircraft operations and foot traffic.

Both species depend on the prairie dog, a significant prey resource. On Fort Carson, the most important eagle hunting areas are Sullivan Park, Training Areas 9, 10, 16, and 54, Training Area Bravo, and colonies along the east boundary of the large Impact Area. Bald Eagles scavenge big game viscera and coyote carcasses during the hunting seasons, which can expose eagles to lead. Eagles nesting west of Fort Carson have been observed hunting and carrying prey from the installation.

The primary threats to eagles are risk of secondary poisoning, electrocution, disturbance during the breeding season, particularly low-level helicopter flights and human activity in the vicinity of an active eyrie, loss of prey to bubonic plague, and lead ingestion. Both species make extensive use of power poles for perching and there is a recent record of a Golden Eagle killed on Fort Carson by electrocution.

Recurring actions for managing eagles at Fort Carson
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Continue to review project proposals for potential conflicts with the BGEPA and identify permits, documents, collaboration, and recommend mitigation to avoid violations. Consultation with USFWS law enforcement and permit office may be required to ensure actions are adequately mitigated.

2. Continue to conduct compliance-monitoring surveys at project sites and coordinate required mitigation with action proponents and/or law enforcement.

3. Continue to conduct annual eagle eyrie surveys. Identify and map active eyries and provide locations to Range Control and Butts Army Airfield for protecting occupied sites. Active eyries will be protected January through the fledging season, generally in July. Protection is achieved by restricting ground and air activities within the buffer zone around an active eyrie, as recommended by the USFWS National Bald Eagle Management Guidelines, May 2007.

4. Continue assessment of risk of electrocution of hawks, eagles, and owls at Fort Carson, to include identification and mitigation of high-risk poles.

Recurring actions for managing eagles at the PCMS
(Please note: The following proposed actions are in priority order from 1 to n. They will be implemented beginning with 1 as funding and manpower become available. However, priorities can change for various reasons such as changes in military mission, and events such as storms and fires.) Appendix 9 of this INRMP has a column in the tables showing which projects are requirements and which are BMPs.

1. Continue assessment of risk of electrocution of hawks, eagles, and owls at the PCMS, to include identification and mitigation of high-risk poles.

2. Survey for Golden Eagle eyries and monitor nest success annually.

5. IMPLEMENTATION

5.a. Process of preparing management prescriptions

Management prescriptions are prepared by program managers and supporting staff. In addition to the recurring actions listed in Chapter 4, annual work plans are created, within the framework of the prescriptions, to accomplish specific objectives (Appendix 9). These projects are then reviewed by

appropriate DPW staff, to include NEPA review, and eventually approved by the Conservation Branch Chief. Once approved, projects are accomplished as funding permits.

The U.S. Fish and Wildlife Service and the Colorado Division of Parks and Wildlife will have opportunities to review the project list approved by the Conservation Branch Chief, as well as the list of projects approved by IMCOM, during the annual reviews of this INRMP.

ITAM projects go through a similar process of development, from prescription to projects, review by NEPA, and approval by the DPTMS/ITAM chain of command.

5.b. No net loss

This INRMP strives to ensure no permanent net loss of military training capability on Fort Carson and PCMS lands as a result of discretionary natural resource restrictions

Currently, there are no significant restrictions to training because of natural resource issues. We do avoid nesting eagles, but those nests are few, and the restrictions are temporary.

5.c. Cooperative agreements

Fort Carson has a cooperative agreement in place with the US Army Medical Research Acquisition Activity (USAMRAA), for forest management tasks. This Agreement allows relatively rapid access to several pre-qualified vendors in order to accomplish tasks such as handling of insect-infested trees, hazard trees, and other specialized forest management tasks. Efforts are underway to replace this agreement with an IDIQ contract throught the Fort Carson Directorate of Contracting.

Fort Carson has had an Intragovernmental Support Agreement with the USGS office in Pueblo, CO, for many years. The purpose of this agreement is to assist with management of water resources.

5.d. Funding process

In order to function effectively, the INRMP must be integrated with the funding cycle. Appendix 9 contains the annual work plan for natural resources programs. The specific projects listed in appendix 9 are prioritized and then funded as money is available. Natural resource management relies on a variety of funding mechanisms, some of which are self-generating and all of which have different application rules. Most require relatively long lead times, typically one to three years.

Below are general discussions about different sources of funding to implement this INRMP. As noted, not all of these are now used by Fort Carson. Funding requested by the directorates to execute their portions of this INRMP is distributed by IMCOM based on the General Fund Enterprise Business System (GFEBS) decision process. It enables successful uniform delivery of the Army's highest priority installation services, with available funds.

Forestry Funds

There are several sources of funds for forest management: Environmental; Army Reimbursable Account; Forestry Reserve Account; USFS pest control funds, and DoD Legacy Program.

At present, the main source of funds is Environmental funds. The focus is on forest ecosystem management. Funds can be used for such things as density management or thinning, inventories, marking, inspections, contract preparation, GIS work, personnel training, etc.

In order to receive funds from the Reimbursable Account, an installation must have contributed funds from the sale of forest products. Fort Carson and the PCMS typically contribute less than $5000 per year, and thus can expect to usually receive funds in approximately that amount. AR 200-1, Chapter 4, outlines collection and expenditure systems.

When the Reimbursable Account, managed centrally by AEC, has income in excess of its expenses, the excess goes into the Forestry Reserve Account. Any installation may apply and compete for those funds, whether that installation has sold forest products or not. The Reserve Account usually is used for forest management and wildland fire type projects or procurement, but it can also be used sometimes for other natural resource projects. Guidance is published annually.

If an installation is experiencing an outbreak of forest insect or disease pests, application can be made to the USFS for technical assistance as well as funding to control the pest(s).

Sikes Act Funds

Sikes Act funds are collected via sales of licenses to hunt or fish. They are authorized by the Sikes Act and regulated by AR 200-1 and AR 215-1. These funds may be used only for the protection, conservation, and management of fish and wildlife on the installation where they are collected, in accordance with this INRMP. These funds are available for obligation until expended; they are not annual funds. Fort Carson has averaged about $40,000 annually for fish and wildlife management from the sale of permits. Army policy encourages self-sufficiency with regard to managing game populations on military lands. Fort Carson will, from time to time, examine options to increase Sikes Act income to maintain its quality hunting and fishing program. Approximately 10% of receipts go to DFMWR to offset costs incurred in the sale of permits.

Agricultural Funds

Agricultural funds are derived from agricultural leases on installations. They are centrally controlled at Department of Army and Army Command levels with no requirements for spending where they were generated. AR 200-1, Chapter 4, outlines procedures for collecting and spending these funds. They are primarily intended to offset costs of maintaining agricultural leases, but they are also available for preparing and implementing INRMPs. These are the broadest use funds available exclusively to natural resources managers. Fort Carson is authorized to request agricultural funds since there is no requirement for funds to be generated at spending installations. However, due to base closures and other factors, agricultural funds are decreasing, so it is unlikely that DPW-Environmental will be able to effectively compete for them during 2013-2017.

Environmental Program Funds

The General Fund Enterprise Business System (GFEBS) provides the primary means for identifying the current and projected environmental requirements and resources needed to execute the Fort Carson natural resources program and achieve the Conservation Strategic Goal. GFEBS is used for a variety of purposes, such as planning, programming, budgeting, and forecasting costs; as well as tracking project execution, monitoring performance, and documenting expenditures.

Environmental funds are set aside by DoD for environmental purposes but are still subject to restrictions. Compliance with laws is a significant factor in prioritizing environmental funding. Environmental funds are most commonly used for projects that return the installation to compliance with federal or state laws, especially if noncompliance is accompanied by notices of violation or other enforcement agency actions.

"Must fund" classifications include mitigation identified within NEPA documents and items required within federal facilities compliance agreements. In addition, the Sikes Act requires implementation of INRMPs, which makes implementation of this INRMP a priority for funding. Most funding for this INRMP implementation is anticipated to come from environmental funds.

Operations and maintenance funds

Certain projects within this INRMP are either partially or fully funded with Operations and Maintenance Funds, through DPW. Invasive species management (Section 4.h), Urban forestry (Section 4.t.), Water rights (Section 4.u.), and Pest Management (Section 4.i) are in this category. Most general pest management is not a part of this INRMP.

Training funds

Fort Carson and the PCMS, combined, is a Category I installation with regard to ITAM implementation and funding (Department of the Army 1995). The Web-based Workplan Analysis Module is used to channel ITAM funding requests from Fort Carson, through IMCOM and the Army Training Support Center, to the Office of the Deputy Chief of Staff for Operations and Plans.

Natural resources enforcement funds

The DES is responsible for funding natural resources law enforcement.

Other Funding

The portions of the outdoor recreation program that are not directly involved with hunting and fishing are funded with non-appropriated funds and are not included within this INRMP's costs.

5.e. Staffing

The following staffing is currently authorized within DPW to implement this INRMP.

Table 5-1. DPW Environmental Division/Conservation Branch staffing

Position	**Number**	**Type**
Supervisory Natural Resources Specialist	1	GS-13
Natural Resources Specialist	1	GS-12
Natural Resources Specialist	1	GS-11
Wildlife Biologist (Program Manager)	1	GS-11
Wildlife Biologist	3	GS-11
Forester	1	GS-11
Forestry Technician	1	GS-9

Natural Resource Specialist	1	GS-9
Invasive Species Manager	1 (vacant)	GS-9
Rangeland Management Specialist	1 (vacant)	GS-9
Science Technician Biological	1	GS-7

5.f. Unresolved issues.

At the time of publication of this document, the following matters are not yet fully resolved and are the subject of continuing consultation and refinement. Significant developments, decisions or resolution should be noted or revisited during the annual review of this management plan.

One issue that is unresolved at this time is the optimum mower blade height for the fields surrounding Butts Army Air Field. There is conflicting guidance on the issue, as well as possible contracting aspects. The DPW intends to initiate informal consultation with the USFWS to resolve the issue

A second unresolved issue is whether or not to allow the limited use of poison grain to control prairie dogs. There appear to be conflicting laws and regulations concerning the issue. The DPW intends to initiate informal consultation with the USFWS to resolve the issue.

Third, there may be unresolved questions about certain details of wildlife law enforcement on Fort Carson that need to be resolved. If deemed appriate by the CPW and the DES, a series of meetings could be arranged to resolve the issues, and to capture the resolution in a writing such as a memorandum of understanding.

Fourth, grazing on PCMS is currently being considered. This potential action will be evaluated, before implementation, to include compatibility with military training, to determine the capacity of the natural resources to support grazing without degrading the resources and to assess the costs versus benefits of having such a program.

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APPENDIX 1

Acronyms used in this document

AAS	Alternatives Analysis Study
ACUB	Army Compatible Use Buffer
ACR	Armored Cavalry Regiment
AEC	Army Environmental Command
AOA	Aircraft Operating Area
APHIS	U.S. Animal and Plant Health Inspection Service
AR	Army Regulation
ARPA	Archeological Resources Protection Act of 1979
BAAF	Butts Army Airfield
BASH	Bird Aircraft Strike Hazard
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BMP	Best Management Practice
BRAC	Base Realignment and Closure
CPW	Colorado Division of Parks and Wildlife
CFR	Code of Federal Regulations
CLEO	Conservation Law Enforcement Officer
CLS	Common Levels of Support
CRM	Cultural Resources Manager
CRS	Colorado Revised Statutes
CSFS	Colorado State Forest Service
CSP	Central Shortgrass Prairie
CX	Categorical exclusion (NEPA process)
DECAM	Directorate of Environmental Compliance and Management
DES	Directorate of Emergency Services
DoD	Department of Defense
DPTMS	Directorate of Plans, Training, Mobilization and Security
DPW	Directorate of Public Works
DFMWR	Directorate of Family, Morale, Welfare, and Recreation
EA	Environmental Assessment
ECM	Encroachment Condition Module
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FC	Fort Carson (used in regulation titles)
FCFD	Fort Carson Fire Department
FNSI	Finding of No Significant Impact
FOB	Forward Operating Base
FREP	Front Range Ecoregional Partnership
GIS	Geographic Information System
ICRMP	Integrated Cultural Resources Management Plan
ID	Infantry Division
INRMP	Integrated Natural Resources Management Plan

IPM	Integrated Pest Management
ITAM	Integrated Training Area Management
LRAM	Land Rehabilitation and Maintenance
MBTA	Migratory Bird Treaty Act
MOU	Memorandum of Understanding
MS4	Municipal Separate Storm Sewer System
MSO	Mexican Spotted Owl
NAGPRA	Native American Graves Protection and Repatriation Act of 1990
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act of 1966
NOI	Notice of Intent
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NWCG	National Wildfire Coordinating Group
NWI	National Wetlands Inventory
P-J	Piñon – juniper woodlands
PCMS	Piñon Canyon Maneuver Site
PL	Public Law
RCMP	Range Complex Master Plan
REPI	Readiness and Environmental Protection Initiative
RTLA	Range and Training Land Assessment
SAR	Species at Risk
SHPO	State Historic Preservation Office
SRA	Sustainable Range Awareness
SWMP	Stormwater Management Plan
T&E	Threatened and Endangered
TCP	Traditional Cultural Property
TRI	Training Requirements Integration
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WASH	Wildlife Aircraft Strike Hazard

APPENDIX 2

Other natural resource management plans

The following management plans and other documents, mentioned in Chapters 1 through 5 of this INRMP, were too large to be included here. They may be reviewed in the offices of the Fort Carson DPW. To arrange such a review, please call 719-526-2752.

Forest Management Plan;
Invasive Plants Management Plan;
Memorandum of Understanding between DPW and DES, Subject Wildlife Related Incidents;
The Integrated Pest Management Plan;
African Rue Management Plan;
Myrtle Spurge Management Plan;
Wildlife Aircraft Strike Hazard Plan;
Biological Assessment and Management Plan for the Mexican Spotted Owl on Fort Carson;
Environmental Assessment for Erosion and Sediment Control Program at Fort Carson, Colorado.

The management plan for the black-tailed prairie dog is being prepared and will be provided to partners and agencies upon completion.

ITAM/LRAM BMPs January 2012 (this document may be reviewed in the office of the ITAM Manager, by calling 719-526-6374);

The Fort Carson and PCMS Integrated Wildland Fire Management Plan, as well as the Prescribed Burn Plan, may be reviewed by calling the Fort Carson Fire Department at 526-5737.

APPENDIX 3

Environmental Assessment

DRAFT FINDING OF NO SIGNIFIGANT IMPACT (FNSI) PROGRAMMATIC ENVIRONMENTAL ASESSMENT FOR THE IMPLEMENTATION OF THE 2013-2017 FORT CARSON AND PIÑON CANYON MANEUVER SITE INTEGRATED NATURAL RESOURCE MANAGEMENT PLAN

Fort Carson has prepared an Environmental Assessment (EA) (March 2013) that evaluates the potential environmental impacts associated with implementing the 2013-2017 Integrated Natural Resource Management Plan (INRMP) for Fort Carson and Piñon Canyon Maneuver Site.

Description of the Proposed Action
The Proposed Action is implementation of the 2013-2017 Integrated Natural Resource Management Plan. There are 151 reoccurring activities under the Proposed Action which, for the purpose of this Environmental Assessment, have been organized into eight categories: adaptive management, administration, coordination, monitoring, outreach, planning, studies, and training. The Proposed Action is also the Preferred Alternative.

Alternatives Considered
For the purpose of this project Fort Carson considered two alternatives, the Proposed Action and the No Action Alternative. The No Action Alternative served as a baseline against which impacts associated with the Proposed Action could be evaluated.

No Action Alternative
Under the No Action Alternative the 2007-2011 INRMP will remain in effect and guide policy and management of natural resources on Fort Carson and Piñon Canyon Maneuver Site without the additional benefits associated with updates and revisions to the Plan.

Environmental Consequences
No significant environmental consequences were identified in the Environmental Assessment. Implementation of the Proposed Action would result in positive benefits to biological, water, and soil resources with neither positive or negative benefits associated with air quality. The ecosystem-based management approach espoused in the INRMP strives to maintain sustainable training lands, maintain biodiversity, conserve terrestrial and aquatic habitat, and support recreational activities when and where appropriate.

Conclusion
The EA on which this draft FNSI was prepared is pursuant to 32 Code of Federal Regulations (CFR) 651 and U.S. Council on Environmental Quality (CEQ) regulations (Title 40, U.S. Code, Parts 1500-1508) for implementing the procedural requirements of the National Environmental Policy Act (NEPA). Based on the analysis contained in the EA and the Army's intent to follow prescribed regulations and comply with applicable permits, the Army has determined that the Proposed Action would have no significant direct, indirect, or cumulative impact on the human or natural environment.

Integrated Natural Resource Management Plan, Fort Carson and the Pinon Canyon Maneuver Site

Therefore, based on review of the EA, I hereby incorporate the entire EA by reference and conclude that the Proposed Action is not a major federal action that would significantly affect the quality of the environment within the meaning of Section 102(2)(c) of the National Environmental Policy Act of 1969, as amended. Accordingly, no Environmental Impact Statement (EIS) is required. With this finding, I approve selection of the proposed action.

Roderick Chisholm

DAVID L.GROSSO
COL, SF
Garrison Commander
Fort Carson, CO 80913

10 Sept 2013
Date

Integrated Natural Resource Management Plan, Fort Carson and the Pinon Canyon Maneuver Site

PROGRAMMATIC ENVIRONMENTAL ASSESSMENT FOR THE IMPLEMENTATION OF THE 2013-2017 FORT CARSON AND PIÑON CANYON MANEUVER SITE INTEGRATED NATURAL RESOURCE MANAGEMENT PLAN

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Date

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PROGRAMMATIC ENVIRONMENTAL ASSESSMENT FOR THE IMPLEMENTATION OF THE 2013-2017 FORT CARSON AND PIÑON CANYON MANEUVER SITE INTEGRATED NATURAL RESOURCE MANAGEMENT PLAN

1.0 PURPOSE, NEED , AND SCOPE

1.1 INTRODUCTION

This environmental assessment (EA) analyzes the potential impacts related to implementation of an updated Integrated Natural Resource Management Plan (referred to throughout this environmental assessment as INRMP or the Plan) for Fort Carson and Piñon Canyon Maneuver Site (PCMS). The programmatic nature of this analysis encompasses actions, activities, programs, research, and studies throughout the lifespan and application of the INRMP and serves as the necessary environmental review for these actions. This section identifies the purpose and need of the Integrated Natural Resource Management Plan, defines the scope of the environmental analysis, identifies public participation efforts, and provides the relevant and necessary legal framework for the environmental review of the Proposed Action and Alternatives.

1.2 HISTORY

The Sikes Act of 1960, as amended, serves as the legislative driver for the development and implementation of Integrated Natural Resource Management Plans on military installations. At the broadest scope, Integrated Natural Resource Management Plans support the Army's goals and objectives by maintaining sustainable training lands while reducing conflicts between natural resource management and training missions. The ecosystem-based management approach espoused in the INRMP strives to maintain sustainable training lands, maintain biodiversity, conserve terrestrial and aquatic habitat, and support recreational activities when and where appropriate.

1.3 PURPOSE AND NEED FOR PROPOSED ACTION

The Proposed Action, as detailed below in Section 2.0, is the implementation of the 2013-2017 Integrated Natural Resource Management Plan. The INRMP will guide natural resource policy and management on Fort Carson and Piñon Canyon Maneuver Site from 2013-2017, the Plan will be reviewed annually to determine if a revision is needed and warranted. The Plan addresses conservation and management of land, water, and biodiversity while ensuring compliance with environmental laws and regulations. The INRMP ensures the maintenance of quality training lands on Fort Carson and PCMS in support of Fort Carson's critical military missions while ensuring that natural resource conservation, sustainable multipurpose use, and Army training mission activities are integrated and consistent with federal stewardship requirements.

Implementation of the updated INRMP partially satisfies the ongoing natural resource management requirements of the Sikes Act. Implementation of the new plan will improve coordination of natural resource management and the Army's training mission on Fort Carson and PCMS. Without implementation of the updated INRMP Fort Carson and PCMS will continue to operate under the current INRMP. Over time, this may impede the long-term effectiveness of natural resource management on Fort Carson and PCMS and may hinder ongoing sustainability efforts, especially sustainability efforts associated with the newly established Fort Carson Net Zero goals (Fort Carson, 2012). Continuing to manage natural resources under the current INRMP would fail to account for the impacts of climate change on the natural resource base.

1.4 SCOPE OF ANALYSIS

United States Army policy, as put forth in 32 CFR Part 651 (Environmental Analysis of Army Actions; Final Rule) requires that an environmental assessment be completed for the development and implementation of an Integrated Natural Resource Management Plan. The programmatic nature of this environmental assessment serves as the basis for tiering subsequent environmental documentation related to conservation, management, research, and program activities associated with the INRMP.

1.5 AGENCY AND PUBLIC PARTICIPATION

Agency and public participation in development of an Integrated Natural Resource Management Plan begin early. The U.S. Fish and Wildlife Service (USFWS) and the Colorado Division of Parks and Wildlife (CPW) are signatories of the Plan and as such, provide comments to the Plan throughout its development. Additional agencies and the general public will have the opportunity to review and comment on the INRMP and this environmental assessment. A forty-five day public comment period will be provided to facilitate public input that will allow the Army to address any issues and concerns that agencies and the general public may have with regards to the INRMP and this environmental assessment. All comments related to this EA will be included in an annex to this EA along with responses to those comments.

1.6 LEGAL FRAMEWORK

Development and implementation of the Integrated Natural Resource Management Plan is guided by the Sikes Act. Environmental review for the Proposed Action is mandated by the National Environmental Policy Act of 1969 and supported by Army regulation 200-1 (Environmental Protection and Enhancement) and Army Regulation 200-2 as identified in 32 CFR Part 651 (Environmental Analysis of Army Actions; Final Rule).

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

The Proposed Action is implementation of the 2013-2017 Integrated Natural Resource Management Plan. The 2013-2017 INRMP is composed of 151 reoccurring activities which, for the purpose of this Environmental Analysis, have been broken down into eight categories. The eight broad categories that encompass the reoccurring activities from the 2013-2017 INRMP are- adaptive management, administration, coordination, monitoring, outreach, planning, studies, and training. A brief description of each of the categories and examples of reoccurring actions are provided below. The Proposed Action is also the Preferred Alternative.

Adaptive Management- Adaptive management is the implementation of actions, monitoring of those actions, assessment of outcomes, and reevaluation and reimplementation based on empirical results. Adaptive management actions for the Preferred Alternative span all resource types found within Fort Carson and PCMS to include air, water, soils, fish & wildlife, and vegetative communities. Examples of adaptive management activities include the development of water resources, erosion control measures, prescribed burning, and creating cover for sensitive species.

Administration- Administrative activities include those reoccurring actions that are primarily associated with budget and personnel related activities that are largely confined to an office environment. Examples of administrative activities include funding for professional development and budgeting for fire related expenses.

Coordination- Coordination activities are actions which require the Fort Carson Environmental Division to actively work with organizations within Fort Carson and PCMS as well as outside organizations that include state and federal regulatory organizations, universities, natural resource professional organizations, and stakeholder working groups. Example coordination activities include formal and informal consultation with regulatory agencies and working group attendance.

Monitoring- Monitoring is an integral component of successful natural resource management and directly supports an adaptive management paradigm. Examples of monitoring activities contained within the Preferred Action on both Fort Carson and PCMS include monitoring of water and soil conditions, monitoring of sensitive species, and monitoring of vegetative community health.

Outreach- Outreach activities contained within the 2013-2017 INRMP are efforts by the Fort Carson to actively work with the surrounding communities and the larger public to address natural resource related issues. Examples of outreach actions include maintaining public access to recreational areas on Fort Carson.

Planning- Planning activities seek to address natural resource related goals and objectives through formal processes which engage interdisciplinary expertise. Examples of planning activities include updating and implementing various natural resource management plans and addressing the review of proposed activity impacts on natural resources through the NEPA process.

Studies- Studies provide natural resource managers with critical data on the state and trends of natural resources. Example studies included in the Preferred Action include the effects of power poles on avifauna and the effects of off road vehicles on ground nesting birds on Fort Carson.

Training- Training and professional development are a critical element of natural resource management. Examples of training needs identified within the 2013-2017 INRMP include pest management certification and landscaping technical advice for contractors and government personnel.

2.2 NO ACTION ALTERNATIVE

Consideration of the No Action Alternative is a requirement of the NEPA process. It provides a basis of comparison for the Proposed Action and also serves as a baseline against which to judge the environmental impacts associated with the Proposed Action. Under this alternative, the 2007-2011 INRMP will remain in effect and guide policy and management of natural resources on Fort Carson and Piñon Canyon Maneuver Site without the additional benefits associated with updates and revisions to the Plan that account for issues such as climate change and Fort Carson's Net Zero sustainability goals.

3.0 ENVIRONMENTAL CONSEQUENCES

3.1 INTRODUCTION

This portion of the EA presents the direct and indirect impacts of the Proposed Action and Alternatives based on an analysis of the current information and data related to natural resources and their conservation and management presented in the 2013-2017 INRMP. The section immediately following will list and briefly discuss those issues not addressed.

3.2 ISSUES NOT ADDRESSED

The following natural resource, social, and socioeconomic factors have been screened from further review in this environmental assessment as they were found to be negligible when reviewed by an interdisciplinary team of environmental scientists, biologists, economists, planners, and archaeologists. A brief synopsis will be provided below for each factor screened and dismissed.

3.2.1 Land Use

Any changes to land use as a result of either the No Action or Preferred Alternative will be associated with the Limited Use Program associated with the Army Integrated Training Area Management (ITAM) program. Any land that is designated under the Limited Use Program for rehabilitation will be temporary in nature in order to maintain training land sustainability. No other changes to land use are anticipated.

3.2.2 Noise

It is not anticipated that any activities associated with natural resource management under either the No Action or Preferred Alternative will result in anything beyond limited, short duration noise impacts related to conventional daily activities at Fort Carson or Piñon Canyon Maneuver Site.

3.2.3 Socioeconomics

No activities or programs associated with natural resource management under either the No Action or Preferred Alternative are anticipated to produce long-term positive or negative impacts to the regional socioeconomic climate. Small, limited duration contracts may be awarded to accomplish projects associated with natural resource management at Fort Carson or Piñon Canyon Maneuver Site, but it is anticipated that such contracts will be well below any threshold that would impact the regional economic climate.

3.2.4 Environmental Justice

It is not anticipated that any activities, research, studies, or programs associated with natural resource management under either the No Action or Preferred Alternative will have an adverse impact on minority and/or low-income populations in or around Fort Carson or Piñon Canyon Maneuver Site.

3.2.5 Cultural Resources

Under both the No Action and Preferred Alternative cultural resources, with regard to natural resource management, are addressed under program, activity, study, and research specific NEPA reviews. These reviews will continue to ensure that protection and mitigation of cultural resources are undertaken.

3.2.6 Hazardous Substances

Under the No Action and Preferred Alternative herbicides and pesticides will continue to be utilized in accordance with their prescribed usage by trained and licensed personnel. Such substances will be utilized in a manner that reflects the benefit of their application in the context of the broader ecological community and accounts for human health concerns. Additionally, herbicide use will be reduced as biological controls become available and are employed.

3.3 AFFECTED ENVIRONMENT

3.3.1 AIR QUALITY

No Action Alternative
Under the No Action Alternative both wildfire and prescribed burning on Fort Carson and Piñon Canyon Maneuver Site would continue to be managed in accordance with the 2007-2011 INRMP. Air quality under this alternative would be maintained in a satisfactory state as any planned burning under this alternative would continue to be overseen by the state of Colorado through issuance of an Air Quality Burning Permit. Under this alternative newly established goals with regard to prescribed fire for the benefit of wildlife and habitat would not be undertaken. Additionally, the use of prescribed burning would only be pursued to the extent that such activities are consistent with the 2007-2011 INRMP.

Preferred Alternative
Under the Preferred Alternative air quality on Fort Carson and Piñon Canyon would continue to be maintained in a satisfactory state. Updated natural resource management goals that are addressed in full or in part as a result of prescribed burning will continue to be executed in compliance with all federal, state, and local permit requirements. Air quality will be maintained and overseen through the issuance of an Air Quality Burning Permit through the Colorado Department of Public Health and Environment.

3.3.2 SOILS

No Action Alternatives
Under the No Action Alternative soils will continue to see slight benefits at both Fort Carson and PCMS as conservation and protection measures offered under the existing INRMP and the annual Integrated Training Area Management plan continue to be utilized. On Fort Carson the implementation of an aggressive Stormwater Management Plan (DPW, 2010) also continues to benefit and protect soils on the post from degradation as a result of stormwater related erosion. Minor improvements to the soils at Fort Carson and Piñon Canyon Maneuver Site are anticipated under this alternative as a result of ongoing management activities.

Preferred Alternative
Under the Preferred Alternative it is anticipated that soils will benefit from an increase in protection as a result of updated and validated projects and an adaptive management strategy presented in the 2013-2017 INRMP. Coupled with ongoing management activities encompassed in the ITAM and Stormwater Management plans the benefits to soils will be greater than those of the No Action Alternative. Examples of increased soil protection offered in the 2013-2017 INRMP include reoccurring projects at Fort Carson and PCMS that include construction of erosion control dams and the implementation of stormwater best management practices (BMPs). Finally, prescribed burns that result in low intensity fires maintain the established seedbank in the soil thereby allowing rapid vegetative regrowth which ameliorates the effects of water and wind erosion.

3.3.3 WATER RESOURCES

No Action Alternative
Under the No Action Alternative water resources on Fort Carson and Piñon Canyon Maneuver Site will continue to be maintained through erosion mitigation efforts in conjunction with the ITAM program and the implementation of stormwater runoff Best Management Practices (BMPs). Floodplain protection will continue to be enforced as per Executive Order 11988, Floodplain Management. Positive benefits from these activities will continue to accrue if the status quo is maintained.

Preferred Alternative
Under the Preferred Alternative the positive benefits obtained through erosion control projects will continue. Small benefits may be gained from improved suppression of riparian invasive species such as tamarisk (*Tamarix ramosissima*) and updated prescribed burn plans and riparian rehabilitation. Floodplains and their associated benefits such as flood control, wetlands maintenance, and riparian habitat, will continue to be protected.

3.3.4 BIOLOGICAL RESOURCES

No Action Alternative

Flora
Under the No Action Alternative vegetative communities will continue to be managed as per the 2007-2011 INRMP. While ecological integrity and within that, training land sustainability, are sought after goals, advances in ecosystem-based and watershed management proposed in the 2013-2017 INRMP will not be incorporated. Thus forests, rangelands, shrubland, riparian, landscaped areas, and other vegetative communities will see only short-term benefits as a result of the No Action Alternative.

Flora species of conservation concern on Fort Carson and PCMS encompass federal threatened, endangered, and candidate species for listing; Colorado species of special concern; and Army Species at Risk. Under the No Action Alternative flora species of conservation concern will continue to be managed through the 2007-2011 INRMP. Survey and monitoring of species distribution and abundance will continue under this alternative as will flexible management of these species and their population numbers within the currently existing adaptive management paradigm. Limitations associated with this alternative stem from reduced multi-species, holistic, ecosystem-based management approach to managing species of conservation management concern. Thus, it is anticipated that there will be neither long-term positive benefits nor negative impacts associated with the No Action Alternative regarding flora species of special concern on Fort Carson or PCMS.

Wetlands
Under the No Action Alternative wetlands will continue to be managed in accordance with the 2007-2011 INRMP. No net loss of wetlands guides the Fort Carson and PCMS management paradigm as per the Clean Water Act, Section 404 and Executive Order 11990 (Protection of Wetlands). Wetland mitigation and rehabilitation will be guided by the four activities of avoidance, minimization, compensation, and mitigation. Under this alternative wetland impacts and losses are to be avoided whenever possible and when not possible minimized to the greatest extent feasible. When wetland impacts or loss take place a 1-for-1 replacement of acreage and function of lost wetlands for new or expanded wetlands elsewhere will be undertaken. Finally, mitigation and/or restoration of wetland impacts or loss can be undertaken. In comparison with the Preferred Alternative there will be neither positive benefit nor negative impacts for wetlands associated with the No Action Alternative.

Fauna
Under the No Action Alternative vertebrate wildlife, to include terrestrial, aquatic, and avifauna species, will continue to be managed within the auspices of the 2007-2011 INRMP. It is anticipated that when compared to the Preferred Alternative, neither long-term positive benefits nor negative impacts will result. The adaptive management paradigm currently encompassed in the 2007-2011 INRMP allows for a flexible approach to management of fauna on Fort Carson and PCMS. However, an ecosystem-based management paradigm encompassed in the 2013-2017 INRMP allows for greater interagency coordination, a focus on multispecies solutions, and a focus on ecosystem structure and function.

Faunal species of conservation concern will continue to be managed under the 2007-2011 INRMP. A single species approach with an adaptive management emphasis guides efforts on Fort Carson

and PCMS. Currently no critical habitat has been designated at either location. Coordination with the appropriate agencies and stakeholders will continue to be undertaken per statutory and policy requirements. It is anticipated that there will be no long-term positive benefits or negative impacts associated with the No Action Alternative beyond those that have accrued under the 2007-2011 INRMP.

Preferred Alternative

Flora
Under the Preferred Alternative vegetative communities will be managed as part of an ecosystem-based management approach. This natural resource management approach recognizes ecosystems as complex systems and accounts for potential cascading consequences and non-linear processes associated with changes to ecological communities. Ecosystem-based management, in addition to seeking multispecies solutions, engages stakeholders as broadly as possible whenever relevant and feasible. Additionally, the adaptive management approach espoused in the 2013-2017 INRMP provides managers the tools necessary to monitor, collect, and analyze ecological data. Examples of the application of such an approach include thinning of timber resources when appropriate and would result in positive ecological outcomes and biological control of tamarisk with *Diohabda carinulata*, the Northern Tamarisk Beetle, which preys on the invasive plant species. In turn, management assumptions and approaches can be validated, and if necessary, refined quickly and more effectively than under more rigid and compartmentalized approaches.

Species of special conservation concern on Fort Carson and PCMS will be managed within an ecosystem-based management paradigm under the Preferred Alternative. An emphasis on a multispecies community approach to managing species of concern provides a management framework that views conservation efforts through a broad ecological community scope with an eye toward cascading consequences. Understanding and addressing issues associated with species of concern at larger spatial scales and ecological context, coupled with stakeholder engagement, will increase the likelihood of success in maintaining species populations resulting in positive long-term benefits.

Wetlands
Under the Preferred Alternative wetlands on Fort Carson and PCMS will be managed by a three-tiered mitigation procedure that encompasses avoidance, minimization, and compensation, thus streamlining the four-tiered process from prior INRMPs. The Clean Water Act and EO 11990 (Wetlands Protection), underpin wetlands management and protection on both installations. There are no anticipated impacts or benefits to wetlands associated with the Preferred Alternative.

Fauna
Under the Preferred Alternative vertebrate wildlife, to include terrestrial, aquatic, and avifauna, will be managed under an ecosystem-based management paradigm. Ecosystem-based management emphasizes structure, function, and resilience of an ecosystem and its component species and processes. This natural resource management approach recognizes ecosystems as complex systems and accounts for potential cascading consequences and non-linear processes associated with ecological communities. Reoccurring actions such as planning level surveys of game and non-game species, the determination of species abundance and distribution, and analysis of protection measures such as those under the "monitoring" category in Appendix A of this EA, provide relevant examples of data gathered to support this approach.

It is anticipated that long-term positive benefits will result from the Preferred Alternative through an ecosystem-based management paradigm encompassed in the 2013-2017 INRMP that allows for greater coordination, a focus on multispecies solutions, and a focus on ecosystem structure and function.

3.4 CUMULATIVE IMPACTS

NEPA requires the analysis of cumulative impacts on the human and natural environment. Guidance on cumulative impacts from the Council on Environmental Quality (CEQ) is provided in the following quote:

> Cumulative impact is the impact on the human and natural environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Cumulative impacts associated with natural resource management span the entirety of both Fort Carson and PCMS. As such, potential past, present, and future impacts (positive as well as negative) with implications for natural resource management include game species management, the control of invasive species, and wildfire management. Given the geographic scope of the INRMP, consideration must be given to potential impacts outside the boundaries of both Fort Carson and PCMS.

The Colorado Department of Parks and Wildlife will continue to assess the population of game species within defined management units. The department's assessment of game species populations and its health will determine the level of hunting pressure that is acceptable at both Fort Carson and PCMS. Game species and habitat management by the Army will impact game populations both on and off Fort Carson and PMCS.

The introduction and spread of floral invasive species continues to produce challenges on public lands, whether state or federal, and on private property. Controlling the spread of invasive species within Fort Carson and PCMS will continue under the 2013-2017 INRMP. An ongoing challenge is to identify routes and vectors for new introductions of invasive species from adjacent public and private land. Long-term invasive species control requires a coordinated effort with regional stakeholders at both Fort Carson and PCMS.

The escape of wildfire from within installation boundaries to adjacent land or the movement of a wildfire from adjacent land onto the installation is an ongoing concern. Wildfires are random and unpredictable events that can produce impacts beyond Fort Carson and PCMS even if the wildfire itself is confined to the installation. Wildfire, as an ecological disturbance, is beneficial to the shortgrass prairie and ponderosa pine ecosystems. Nevertheless, wildfire can in some instances result in economic loss, social disruption, and produce human health impacts. The cumulative impacts of wildfire will need to be addressed in a post-event fashion both on and off the installations.

4.0 CONCLUSIONS

The purpose of the Integrated Natural Resource Management Plan is to further sustainable natural resource management on military training lands while supporting the Army's critical training missions. Impacts associated with implementing the updated INRMP range from neutral to beneficial, while maintaining the status quo through the continuation of the current INRMP also continues to provide limited benefits to natural resources, albeit to a lesser extent than the Preferred Alternative. Cumulative impacts are unclear, although it is understood that active management of game species, invasive species, and to the extent possible wildfire, will reduce negative impacts. Table 1 provides a succinct summary of the effects associated with both the Preferred Action and the No Action Alternative from this EA.

Table 1: Environmental Consequences Summary Table

Resource Area	Preferred Alternative	No Action Alternative
Air Quality	o	o
Biological Resources	+	o
Soils	+	+
Water Resources	+	+

1. Neither positive benefit or negative impacts are denoted by 'o'
2. Positive benefits are denoted by '+'

Based on this Environmental Assessment, implementation of the Preferred Alternative (implementing the 2013-2017 INRMP) would result in no significant impacts. Because no significant impacts are associated with implementing the Preferred Alternative, preparation of a Finding of No Significant Impact (FNSI) is appropriate.

5.0 PERSONS CONTACTED

Beall, Dawn – Forester, DPW
Bunn, Richard – Wildlife Office Program Manager, DPW
Burton, Kacey – Archaeologist / GIS Analyst, Stell Environmental Enterprises, contractor, DPW
Frank, Jessica – Stormwater Program Manager, DPW
Goss, Brian – Natural Resources Specialist, DPW
Gray, Dan – Forester, DPW
Hennessy, Bill – Attorney, HQ, 4th Infantry Division (M) & Fort Carson Office of the Staff Judge Advocate
Johnson, Bradley - NEPA Coordinator, DPW
Kulbeth, James – Noxious Weeds Program Manager and CWA Section 404 Coordinator, DPW
Linn, Jeffrey – Natural Resources and Forestry Section Chief, Conservation Branch, DPW
Lubchenco, Sara - Air Quality Engineer, HDR Inc, contractor, DPW
McDermott, Jim - Conservation Branch Chief, DPW
Naeyaert, Jacob - RCRA Program Manager, DPW
Owings, Deb - NEPA Program Manager, DPW
Peyton, Roger – Wildlife Biologist, DPW
Thomas, Wayne – NEPA and Cultural Management Branch Chief, DPW
Wheeler, Matt - GIS Analyst, DPW

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Department of the Army. 1995. *Integrated Training Area Management (ITAM) Program Strategy*. Headquarters, Washington, DC. 66 pp. + appendices.

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Annex A: INRMP Reoccurring Activities

	Reoccurring Activity	Activity Type	Location[1]	INRMP
1	Aggressively manage against forest insect and disease pests to prevent widespread tree mortality.	Adaptive Management	FC, PM	4.e
2	Complete legal requirements in the stormwater management plan.	Adaptive Management	FC	4.r
3	Continue developing and maintaining water resources for mitigating movements of big game species related to effects of military training.	Adaptive Management	FC, PM	4.d
4	Continue dusting to prevent plague in prairie dog colonies important to nesting and wintering eagles and the Ferruginous Hawk, and nesting Burrowing Owls.	Adaptive Management	FC	4.a
5	Continue management of recreational fishing on Fort Carson, to include stocking fish, improving fish habitat, and managing irrigation water to maximize angling opportunities on Fort Carson.	Adaptive Management	FC	4.m
6	Continue to manage wildlife at BAAF to reduce the probability of a strike.	Adaptive Management	FC	4.n
7	Control those plant and animal species that affect human health, quality of life, natural resources management (e.g. reduce ecosystem functionality, displace native species) or the military mission, exclusive of noxious weeds.	Adaptive Management	FC, PM	4.i
8	Create cover for sensitive species of reptiles, amphibians, and small mammals by leaving non-diseased, felled tree trunks in place during forestry operations.	Adaptive Management	PM	4.a/4.d
9	Create cover for sensitive species of reptiles, amphibians, and small mammals by leaving non-diseased, felled tree trunks in place during forestry operations. Logs are an important component of Mexican Spotted Owl habitat and should be left in place following forestry operations in owl habitat.	Adaptive Management	FC	4.a/4.d
10	Create slash brush piles at sites where this would not increase intensity or spread of wildfire.	Adaptive Management	FC, PM	4.a/4.d
11	Deploy wildlife escape ladders in open water tanks developed for wildlife.	Adaptive Management	FC, PM	4.g
12	Develop warm-water sport fishing on Fort Carson.	Adaptive Management	FC	4.m
13	Identify and implement measures in the prevention of new infestations;	Adaptive Management	FC, PM	4.h
14	Identify and remove hazard trees annually using the U.S. Forest Service Hazard Tree Rating system.	Adaptive Management	FC, PM	4.e

[1] FC= Fort Carson, PM= Piñon Canyon

15	Improve shelterbelts to replace loss of owl nesting and wintering habitat due to extensive fires at the PCMS.	Adaptive Management	PM	4.g
16	Initiate reforestation efforts after human and natural disturbances, preferably using local seed sources.	Adaptive Management	FC, PM	4.e
17	Integrate installation management practices, e.g., prescribed fire, revegetation, pest management, storm water management, and invasive species management to enhance and protect biological diversity.	Adaptive Management	FC, PM	4.d
18	Maintain and improve approximately 72 miles of firebreaks which encompass Fort Carson.	Adaptive Management	FC	4.o
19	Maintain bat gates to prevent disturbance and the spread of white-nose syndrome from anthropogenic sources.	Adaptive Management	FC	4.a
20	Maintain some of the windmills at PCMS.	Adaptive Management	PM	4.u
21	Manage the forests and woodlands at FCMR and PCMS to improve forest health through thinning, individual tree selection and sanitation salvage thinning.	Adaptive Management	FC, PM	4.e
22	Mitigate loss of raptor and Chihuahuan Raven nesting sites using artificial structures.	Adaptive Management	PM	4.g
23	Mitigate loss of raptor and owl nest sites using artificial structures.	Adaptive Management	FC	4.g
24	On active firing ranges create a minimum of a 100-foot strip of burn along all perimeters where feasible, which will be sufficient to contain any unintentional starts and assist in maintaining planned training schedules.	Adaptive Management	FC, PM	4.o
25	Plant shelterbelts to replace loss of owl nesting and wintering habitat in and near the Bird Farm area at Fort Carson.	Adaptive Management	FC	4.g
26	Reduce the number of trees per acre and remove understory fuel loads to minimize the risk of catastrophic wildfire and create zones of defensible space.	Adaptive Management	FC, PM	4.e
27	Rehabilitate areas treated for invasive species control, where necessary.	Adaptive Management	FC, PM	4.h
28	Reseeding and erosion control downrange;	Adaptive Management	FC, PM	4.w
29	Restore native grassland habitats by reducing piñon-juniper (P-J) encroachment into prairie habitats	Adaptive Management	FC, PM	4.e
30	Restore ponderosa pine forests by thinning, removing ladder fuels, reducing crown connectivity, and then reintroducing low-intensity fires.	Adaptive Management	FC, PM	4.e

31	Suppress wildfires in MSO habitat. Prescribe burn a buffer zone between Booth Mountain and training ranges to keep military mission-related fires from entering MSO habitat.	Adaptive Management	FC	4.o
32	Sustain sensitive small mammal and bird populations in woodland areas by preferentially leaving large trees with natural and bird created cavities and crevices.	Adaptive Management	FC, PM	4.a/4.d
33	Treat selected invasive species using an integrated approach (biological, chemical, cultural and mechanical);	Adaptive Management	FC, PM	4.h
34	Use chemical control as a last resort to control pests; cultural, mechanical, and biological control methods are first priority. When chemical control is required, use the least environmentally toxic pesticide. Utilize new technology, educational opportunities, and the judicious and professional use of chemicals to reduce chemical pesticide use.	Adaptive Management	FC, PM	4.i
35	Use prescribed burning to support Forestry and Noxious Weed Management programs.	Adaptive Management	FC, PM	4.o
36	Continue managing artificial cavity nesting project in the Bird Farm as mitigation for tree loss due to fire, forestry practices, and training.	Adaptive Management	FC	4.g
37	Continue managing artificial cavity nesting project outside of training areas as mitigation for tree loss due to fire, forestry practices, and training.	Adaptive Management	PM	4.g
38	Continue to work with Texas A&M University, Colorado State Insectary and U.S. Department of Agriculture – APHIS to release, redistribute and monitor biological control agents for noxious weed control.	Adaptive Management	FC, PM	4.h
39	Support fire department personnel in suppressing wildfires resulting from training or other sources.	Adaptive Management	FC, PM	4.o
40	Continue conducting post-hunting deer population composition surveys. Fort Carson will provide CPW copies of survey data, which will be integrated into the CPW population models for the DAUs that include Fort Carson.	Administration	FC, PM	4.d
41	Continue to review project proposals for potential conflicts with the BGEPA and identify permits, documents, collaboration, and recommend mitigation to avoid violations. Consultation with USFWS law enforcement and permit office may be required to ensure actions are adequately mitigated.	Administration	FC, PM	4.x

42	Ensure military and civilian personnel and activities are in compliance with natural, cultural and environmental laws and regulations on Fort Carson and the PCMS.	Administration	FC, PM	4.c
43	Fully implement and maintain an automated, web based recreational control system.	Administration	FC, PM	4.m
44	Funding requested for PPE, hazardous duty pay and overtime, fire related training and maintenance of 2 brush trucks, 2 tenders, 1 utility vehicle, and 1 ATV. Prescribed burning identified for FY 13 and not accomplished will be incorporated into the FY 14 burn plan.	Administration	FC, PM	4.o
45	Implement a safety program that provides for the safety and well being of all pest management personnel.	Administration	FC, PM	4.i
46	Maintain up-to-date software and data.	Administration	FC, PM	4.l
47	Maintain/update database of waters of the US delineations with the USACE.	Administration	FC, PM	4.b
48	Prepare maps and provide decision support;	Administration	FC, PM	4.w
49	Procure, maintain and properly store adequate supplies of pesticides and pesticide dispersal equipment.	Administration	FC, PM	4.i
50	Provide funding for personnel to attend annual workshops or professional conferences.	Administration	FC, PM	4.p
51	Provide maps and spatial analyses to support natural resources management as well as other missions.	Administration	FC, PM	4.l
52	Actively participate with state, county, local and other federal agencies in the management of invasive species;	Coordination	FC, PM	4.h
53	Annually assist Fort Carson Fire and Emergency Services in preparing the Prescribed Fire Burn Plan covering both Fort Carson and PCMS.	Coordination	FC, PM	4.o
54	Certain lands included within Fort Carson and the PCMS must be withdrawn from public availability for mining every few years. In 2007, as part of the Transformation EIS, the Army requested that Congress withdraw those lands for another 15 years. That process is now complete. The Federal Register of Friday, 23 September 2011, pages 59157 and 59158, noted the extension of the withdrawals for 15 years. Therefore, the Army will have to once again request that Congress renew the withdrawal of those lands, beginning the process prior to the year 2026.	Coordination	FC, PM	4.s
55	Consult with the CPW regarding big game issues related to airfield operations.	Coordination	FC	4.n
56	Consult with the USFWS regarding migratory birds and eagles as related to airfield operations.	Coordination	FC	4.n

57	Continue consulting with the state and installation activities to resolve hunter access restrictions during big game seasons.	Coordination	FC, PM	4.m
58	Continue cooperative management of big game populations with the CPW.	Coordination	FC, PM	4.d
59	Continue DOD Partners In Flight membership and support.	Coordination	FC	4.g
60	Continue participation in the National Military Fish and Wildlife Association WASH working group.	Coordination	FC	4.n
61	Continue to assist the USFWS and CPW with relocating Arkansas darter and redbelly dace to new and existing sites in Colorado.	Coordination	FC	4.a
62	Continue to submit proposals to the U.S. Forest Service and US Army Environmental Center for insect and disease management projects.	Coordination	FC, PM	4.e
63	Coordinate enforcement activities with other stakeholder agencies and organizations.	Coordination	FC, PM	4.c
64	Coordinate with cultural resource personnel during wildfires and prior to conducting prescribed burns.	Coordination	FC, PM	4.o
65	Coordinate with the Wildlife Office for the protection of wildlife (particularly listed or sensitive species) during pesticide operations.	Coordination	FC, PM	4.i
66	Ensure Prescribed Fire Burn Plan and Burn Permits are in compliance with CDPHE requirements.	Coordination	FC, PM	4.o
67	Participate in the BAAF WASH Working Group.	Coordination	FC	4.n
68	Send monthly well reports to CWPDA (by DPW ED Water Program manager);	Coordination	FC, PM	4.u
69	Send quarterly reports to State (by USGS);	Coordination	FC, PM	4.u
70	Work cooperatively with all GIS users to share GIS data and products.	Coordination	FC, PM	4.l
71	Work cooperatively with other Directorates, agencies, and the Colorado State University on forest management issues.	Coordination	FC, PM	4.e
72	Work with DPW, DOC, and USACE to include improved urban forestry requirements in solicitations for new contracts.	Coordination	FC	4.t
73	Work with other installations in the region to include the Fort Carson pest management program within the Front Range Ecoregional Management Team.	Coordination	FC, PM	4.i
74	Complete 100 acres of forest inventory annually and update in Geographical Information System layer.	Monitoring	FC, PM	4.e
75	Complete 400 acres of insect and disease survey annually and update inventory in Geographical Information System layer.	Monitoring	FC, PM	4.e
76	Conduct amphibian planning level surveys.	Monitoring	FC, PM	4.d

77	Conduct bat planning level surveys, particularly in pinyon-juniper and riparian habitats.	Monitoring	FC	4.d
78	Conduct planning level surveys of small mammals in wetland and ponderosa pine vegetation communities, and sites within MSO winter habitat.	Monitoring	FC	4.d
79	Conduct pretreatment surveys for Burrowing Owl prior to lethal control of prairie dogs	Monitoring	FC	4.n
80	Conduct preventive maintenance and surveillance inspections for pests.	Monitoring	FC, PM	4.i
81	Conduct reptile planning level surveys.	Monitoring	FC, PM	4.d
82	Conduct small mammal trapping to determine if population densities are likely to increase the number of raptors hunting at or near the airfield. Increase seasonal raptor activity would be filed as a NOTAM for pilot briefings.	Monitoring	FC	4.n
83	Continue annual grassland bird monitoring.	Monitoring	FC	4.g
84	Continue Arkansas darter and southern redbelly dace population monitoring and inventory.	Monitoring	FC	4.a
85	Continue Burrowing Owl monitoring.	Monitoring	FC, PM	4.g
86	Continue CWD surveillance and require mandatory testing of harvested deer on Fort Carson.	Monitoring	FC	4.d
87	Continue evaluation of MSO roost tree buffer zones for compliance with restrictions specified by the USFWS	Monitoring	FC	4.a
88	Continue inventory of northern leopard frog populations on Fort Carson.	Monitoring	FC	4.a
89	Continue mapping distribution of sensitive species.	Monitoring	FC	4.a
90	Continue monitoring distribution and plague status of the Black-tailed Prairie Dogs and for the presence of nesting Burrowing Owls and Mountain Plovers	Monitoring	FC	4.a
91	Continue monitoring native fish populations on Fort Carson.	Monitoring	FC	4.d
92	Continue Mountain Plover monitoring.	Monitoring	FC, PM	4.g
93	Continue operation of hunter check stations during big game seasons for collecting harvest data	Monitoring	FC, PM	4.m
94	Continue protection and monitoring of Townsend's big-eared bat maternal colonies, hibernacula, and fringed myotis roost sites.	Monitoring	FC, PM	4.a

95	Continue to conduct annual eagle eyrie surveys. Identify and map active eyries and provide locations to Range Control and Butts Army Airfield for protecting occupied sites. Active eyries will be protected January through the fledging season, generally in July. Protection is achieved by restricting ground and air activities within a buffer zone around an active eyrie.	Monitoring	FC	4.x
96	Continue to conduct compliance monitoring surveys at project sites and coordinate required mitigation with action proponents and/or law enforcement.	Monitoring	FC, PM	4.g/4.x
97	Continue to inventory Army SAR populations and evaluate persistence and relationship to training	Monitoring	FC, PM	4.a
98	Continue to monitor the original population of African rue at PCMS annually through calendar year 2014;	Monitoring	PM	4.h
99	Continue to monitor the original population of myrtle spurge at Fort Carson annually through calendar year 2016;	Monitoring	FC	4.h
100	Continue to perform quarterly inspection of boundary fence for evidence of mammal encroachment and identify sites for repair.	Monitoring	FC	4.n
101	Develop monitoring program for northern leopard frogs on Fort Carson.	Monitoring	FC	4.d
102	Identify, burn, and monitor areas to improve forage for big game species. Due to the importance to pronghorn in winter, cholla grasslands will be excluded or burned in a mosaic pattern to preserve integrity of the resource.	Monitoring	FC, PM	4.d
103	Implement a systematic inventory program to identify new invasive species populations and to document the size and abundance of existing populations. Report occurrences of new species to county and state officials;	Monitoring	FC, PM	4.h
104	Implement a systematic monitoring program on treated populations to document the results and to assess for further action;	Monitoring	FC, PM	4.h
105	Monitor flows (by USGS);	Monitoring	FC, PM	4.u
106	Monitor for the presence of nesting Burrowing Owls and Mountain Plovers.	Monitoring	PM	4.a
107	Operate a hunter check station for the purpose of aging and scoring harvested deer, and tracking recreational use of training lands.	Monitoring	PM	4.d
108	Operate a hunter check station to facilitate CWD specimen collection, aging harvested deer, collecting location data for deer testing positive for CWD, and tracking recreational use of Fort Carson training lands.	Monitoring	FC	4.d

109	Survey for Golden Eagle eyries and monitor nest success annually.	Monitoring	PM	4.x
110	Vegetation monitoring;	Monitoring	FC, PM	4.w
111	Assist in providing education and awareness classes to various groups that use Fort Carson and the PCMS.	Outreach	FC, PM	4.c
112	Continue migratory bird outreach and education through personal contacts, Environmental Protection Officer Training, and through media available on Fort Carson.	Outreach	FC	4.g
113	Continue to be involved in education and outreach efforts;	Outreach	FC, PM	4.h
114	Describe fire use benefits in education and outreach programs such as Environmental Protection Officer training and Earth and Arbor Days for local schools.	Outreach	FC, PM	4.o
115	Maintain public access areas (Bird Farm, Wildlife Demonstration Area, and fishing reservoirs).	Outreach	FC	4.m
116	Organize and operate a Fort Carson hunting and fishing working group to facilitate communication among sportsmen for improving hunting and fishing opportunities for Soldiers.	Outreach	FC	4.d
117	Participate in academic partnerships and regional and national working groups to increase technical knowledge and expertise needed to develop alternative management options facilitating both military training and conservation.	Outreach	FC	4.d
118	Annually plan, organize, and participate in Arbor Day celebrations and meet standards established by the National Arbor Day Foundation to achieve recognition as a 'Tree City USA", depending upon available funding.	Outreach	FC	4.t
119	Continue to implement the Invasive Plants Management Plan and update the plan on a 5 year cycle;	Planning	FC, PM	4.h
120	Continue to review projects and installation activities to identify and mitigate conflicts with the MBTA and/or BGEPA	Planning	FC, PM	4.g
121	Continue to review projects and installation activities to identify and mitigate effects on biological communities.	Planning	FC, PM	4.d
122	Develop programs which generate income from the sale of forest products such as firewood, woodchips, and fence posts which support standard forest management practices.	Planning	FC, PM	4.e
123	Emphasize integrated pest management techniques to minimize the use of pesticides.	Planning	FC, PM	4.i

124	Encourage implementation of practices listed in the 1994 White House Memorandum on federal landscaped grounds.	Planning	FC, PM	4.t
125	Ensure no-net-loss of wetland acreage on Fort Carson and the PCMS.	Planning	FC, PM	4.b
126	Ensure wildlife and endangered species habitat enhancement and protection are considered during fire management activities.	Planning	FC, PM	4.o
127	Investigate potential forest product markets, including firewood, fence posts, woodchips, biomass for biofuel, and innovative use of forest and woodland tree species.	Planning	FC, PM	4.e
128	Know and understand the changing training requirements of military units;	Planning	FC, PM	4.w
129	Leave standing snags at a rate of 1-4 snags per acre, during forest management or post fire management, for bats, small mammals, and cavity nesting birds.	Planning	FC, PM	4.g
130	Maintain and implement the IPMP on a five-year cycle, including an update in 2013.	Planning	FC, PM	4.i
131	Pinon pine will be retained over juniper, and old growth juniper will be retained over younger trees during woodland thinning operations.	Planning	FC, PM	4.g
132	Pistillate-flowered Oneseed and Rocky Mountain junipers will be retained during woodland thinning operations to sustain birds wintering in pinon-juniper woodlands.	Planning	FC, PM	4.g
133	Prevent damage or loss of valuable resources from insects, disease, wind, construction damage, and/or neglect.	Planning	FC	4.t
134	Provide support in the implementation of the Xeriscape Master Plan.	Planning	FC, PM	4.t
135	Review the INRMP in the first quarter of each FY with the USFWS and the CPW. Review accomplishments and anticipated projects for the current FY and FY + 1.	Planning	FC, PM	1.g
136	Submit quarterly RGP reports, and review/update the RGP on a 5 year basis.	Planning	FC, PM	4.b
137	Use the NEPA environmental review process to evaluate impacts on wetlands, which could result from new construction or other activities, and assist with coordination between proponent and USACE.	Planning	FC, PM	4.b
138	Assess the extent of hawk, eagle, and owl electrocutions on Fort Carson, to include identification of killer poles, identification of pole configurations and landscape features influencing pole selection, and estimating level of pole use by raptors. Post-assessment recommendations will be provided to DPW Operations.	Studies	FC	4.g

139	Assess the potential for hawk, eagle, and owl electrocutions on the PCMS, to include identification of killer poles and landscape features influencing pole selection, and estimating level of pole use by raptors.	Studies	PM	4.g
140	Continue assessment risk of electrocution of hawks, eagles, and owls on Fort Carson, to include identification and mitigation of high-risk poles.	Studies	FC, PM	4.x
141	Continue investigating effects of off-road vehicle use on ground nesting birds.	Studies	FC	4.g
142	Evaluate WASH hazards at downrange PCMS aircraft landing sites.	Studies	PM	4.n
143	Map grasslands important to nesting birds with declining populations for input into development of annual prescribed fire plans.	Studies	FC	4.g
144	Provide guidance on how to plant and maintain trees and shrubs on Fort Carson main post and the PCMS cantonment area to enhance aesthetics and provide benefits, such as visual barriers, windbreaks, decreased heating costs, reduced soil erosion, and safety enhancements; ensure a two-year survival rate of 80%.	Training	FC, PM	4.t
145	Provide guidance on proper pruning of shrubs and trees and remove dead plants as an essential objective for the long-term health of trees and shrubs on the installation and to ensure the safety of people and structures.	Training	FC, PM	4.t
146	Educate military and civilian personnel;	Training	FC, PM	4.w
147	Encourage personnel to join and be active in professional societies and cooperative groups.	Training	FC, PM	4.p
148	Ensure pest management personnel receive adequate formal, as well as on-the-job, training to achieve required pest management certification and to operate at the most efficient level.	Training	FC, PM	4.i
149	For government employees, include in Individual Development Plans refresher training needed to fulfill job requirements (e.g., enforcement, GIS, NEPA, endangered species documentation/ consultation, firefighter, pesticide application) and ensure that they get the training.	Training	FC, PM	4.p
150	Provide technical advice to the grounds maintenance contractor to ensure all turfgrass and landscaped areas are properly maintained.	Training	FC, PM	4.t
151	Ensure pesticide applicators are fully certified or under the necessary direction of a certified applicator.	Training	FC, PM	4.i

Annex B: Comments Received from Public, and Responses to Comments

May 15, 2013

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U.S. Army Environmental Command
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2450 Connell Road (Building 2264) Fort
Sam Houston, Texas 78234-7664
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Re: Comments on the Programmatic Environmental Assessment and Draft Finding of No Significant Impact for the Integrated Natural Resource Management Plan 2013 – 2017 Fort Carson and Piñon Canyon Maneuver Site

To Whom It May Concern:

These comments are submitted on behalf of Not 1 More Acre! ("N1MA"), PO Box 773, Trinidad, Colorado 81082 and Jean Aguerre, to the Department of the Army, Fort Carson, Colorado in response to the March 27, 2013 publication of the Programmatic Environmental Assessment and Draft Finding of No Significant Impact for the Integrated Natural Resource Management Plan 2013 – 2017 Fort Carson and Piñon Canyon Maneuver Site ("INRMP PEA").

Once more, our comments are submitted under protest based on the Army's continued failure to fulfill requisite procedures for the publication of the Notice of Availability ("NOA") for the INRMP PEA in the Federal Register. Because the scope and scale of military use ongoing and contemplated, the INRMP PEA is linked to current and foreseeable major federal actions at the Piñon Canyon Manuever Site ("PCMS"), the Proposed Action is therefore "unprecedented" as that term is used in 32 C.F.R § 651.25. The use and development of the 236,000-acre PCMS – located at what Fritz L. Knopf, an expert on the historical ecology of the Great Plains, describes as the "headwinds" of the devastating Dust Bowl of the 1930s -- is self-evidently "of national concern" within the meaning of 32 C.F.R. § 651.25. That's because the Army's has consequences – both undefined and unaddressed in the INRMP document – on the environment, economies and communities of Colorado, Kansas, New Mexico, Nebraska, Texas and Oklahoma.

Commenters' legal counsel had to contact Fort Carson to confirm the close of comment date which was cited as 30 days from issuance of the INRMP PEA in the document (INRMP PEA, 1.5 Agency and Public Participation; 119/10-11), but was cited as 45 days from issuance of the NEPA document in the Notice to the Public posted in the Colorado Springs Gazette for five days beginning March 27, 20 (Exhibit #1).

In addition, commenters believe that the combination of Fort Carson and the Piñon Canyon Manuever Site in the same document is confusing and, given their separation and habitat differences, inappropriate. To comply with the spirit and potentially the letter of NEPA, there should be separate INRMPS for the two sites. Because the PCMS is a separate military

installation and more than 100,000 acres larger than Fort Carson and involves many important landforms and habitat types, the PCMS INRMPS should have been designed to specifically, responsibly, and thoroughly address the environmental impacts and concerns particular to the PCMS. It is arbitrary, capricious, and contrary to the spirit and purpose of NEPA to attempt to manage the environmental resources of two separate military facilities, distinct in both ecology and mission, in a single management plan. The Army has failed to meet its obligations under NEPA by preparing a combined INRMP. Again, commenters respond to the combined INRMP under protest.

Part A: Introduction

Not 1 More Acre! is a non-profit organization formed to promote the ecological, cultural and economic health of southern Colorado and northern New Mexico. Jean Aguerre is a native of La Junta, Colorado, who grew up on a ranch near the Timpas Unit of the Comanche National Grassland. Since 2006, Not 1 More Acre! and Ms. Aguerre have actively participated in all NEPA processes related to activities at the Department of Defense's Piñon Canyon Maneuver Site (PCMS), Colorado.

The Piñon Canyon Maneuver Site ("PCMS") is a separate military installation of DOD consisting of approximately 236,000 acres of land located roughly 150 miles southeast of Colorado Springs. In the early 1980s, the Department of the Army engaged in a long and bitter acquisition of dozens of ranches on the last intact shortgrass prairie in all the American Great Plains that would become DOD's Piñon Canyon Maneuver Site. In 2006, a map of DOD's massive 6.9 million-acre land expansion of the Piñon Canyon Maneuver Site, which had been secretly planned for years, was leaked to ranchers.[1] That disclosure caused a political uproar and, among other results, caused Congress in 2007 to pass a comprehensive funding ban prohibiting the Department of Defense from spending money on any aspect of expansion at PCMS.

[1] The map was later found in "Piñon Vision Operations Order 05-09," dated December 22, 2004. Piñon Vision documents describe a plan for implementing "the long-term expansion of [PCMS] in order to obtain adequate training areas and ranges to support current and future Army and Joint force mobilization, mission rehearsal and training requirements." AR 276 at 0019157. The map is also part of the revised version of the Piñon Vision 05-09, published in January 2006, entitled "Piñon Vision OPLAN 05-18." A.R. 275. Both versions of Piñon Vision were obtained by commenters when the Federal District Court ruled the documents be included in the Supplemental Administrative Record during litigation that vacated the PCMS Transformation EIS.

The ban has been renewed annually since the original prohibition in 2007.[2] Yet the Army has repeatedly and blatantly disregarded the funding ban, as well as ignoring the Order of the Federal District Court vacating the PCMS Transformation Record of Decision[3] and concurrently flouting the public disclosure requirements of NEPA by continuing to train, intensify and expand military activity at PCMS. The Army has also repeatedly failed to appropriately consider the best available science during their NEPA process. This failure or refusal to rely on the best available science is arbitrary, capricious, and contrary to law.

It bears emphasizing that the PCMS is not an extension of Fort Carson, as evidenced by the Federal Court Order in *Not 1 More Acre! v. U.S. Dept. of the Army*, 08- cv-00828-RPM (USDC Colorado, 2009), and by the congressional funding ban prohibiting spending on any aspect of expansion at DOD's Piñon Canyon Maneuver Site. Fort Carson is simply the installation manager, scheduler and one of the users of the PCMS, which is itself an independent installation of the DOD. PCMS is also used by other elements of the military and others for a range of purposes, which the INRMP PEA should have acknowledged and analyzed as required by NEPA. Failure to acknowledge and analyze the full range of current and intended uses contemplated at the PCMS is a clear violation of the statutory and regulatory duties imposed by NEPA.

As reported in Not 1 More Acre's February 1, 2012 comment letter (included by reference) on the new $3.5 billion Heavy Combat Aviation Brigade to be trained at PCMS, Fort Carson schedules many other than its own units into PCMS including but not limited to Army Reserve, Navy Reserve, Colorado Army National Guard, The Marine Forces Reserve, Navy SEALS and SEABEES, Air Force Special Operations Command, the U.S. Air Force Academy, the Colorado Air National Guard and numerous Army and Joint Force units from around the country as well foreign troops and various federal, state and local law enforcement agencies. None of the past, present or foreseeable impacts from military or other users have ever been taken into consideration and put through rigorous analysis as required by NEPA. The 2013-2017 INRMP PEA continues these violations of NEPA, the Sikes Act and the funding ban betraying public disclosure and the public trust.

That Fort Carson continues to produce documents that suggest Piñon Canyon Maneuver Site is an extension of itself is a misuse of power meant to obfuscate facts, avoid analysis and mislead decision makers and the public about the catastrophic impacts past, current and proposed military use of the PCMS, a separate DOD installation, are perpetrating on the environment, economy and culture of the Southern Great Plains at the expense of every American taxpayer in violation of the Sikes Act, DOD's own rules and instructions, the National Environmental Policy Act (NEPA), other acts of Congress and orders of the Federal District Court. NEPA's statutory and regulatory obligations are

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[2] Congress has renewed the funding ban each year since 2007. See, Pub. L. 110-329 § 127 (Sept. 30, 2008); 122 Stat.3701; 123 Stat. 3296, Pub. L. 111-117 at § 127 (Dec. 16, 2009); H. R. 2055at § 128; Cong. Rec. at H3964, H3972 (June 2, 2011); Pub.L 112-74 §128 (December 2011).

[3] *Not 1 More Acre! v. U.S. Dept. of the Army*, 08-cv-00828-RPM (USDC Colorado, 2009). *Exhibit F*.

intended to promote environmental consideration, analysis of impacts and disclosure in federal decision-making.

The Sikes Act creates an affirmative obligation to sustain the long-term ecological integrity of the ecosystem for each installation. It is arbitrary and capricious to claim to have appropriately considered the environmental impacts on two distinct ecologies and economies separated by 150 miles and significant ecological differences while simultaneously treating those disparate ecologies as part of the same military installation. Further it is contrary to the purpose of both NEPA and the Sikes Act. In order to adequately meet it's obligations under NEPA and the Sikes Act, the Army must prepare a separate INRMP for the PCMS, independent of the Fort Carson INRMP, and containing a full and complete analysis of the affected ecosystems, along with the current, cumulative, and future uses, resources, and program activities.

Appropriately, our comments address the Piñon Canyon Maneuver Site, a separate installation of DOD.

Part B: General Comments on the INRMP PEA

On March 27, 2013, the Army at Fort Carson using Army Installation Management Command (IMCOM) document format issued a "Programmatic Environmental Assessment" purporting to analyze and disclose foreseeable environmental impacts of its 2013 – 2017 Integrated Natural Resource Management Plan as directed by the National Environmental Policy Act and the Department of Defense Natural Resources Conservation Program known as the Sikes Act.

> Sikes Act Section 670a(a)(1)(B):
> To facilitate the program, the Secretary of each military department shall prepare and **implement** [emphasis added] an integrated natural resources management plan for each military installation in the United States under the jurisdiction of the Secretary, unless the Secretary determines that the absence of significant natural resources on a particular installation makes preparation of such a plan inappropriate.

According to DOD Instruction 4715.03 (Mar 18, 2011: USD(AT&L): (Exhibit 2).

> The principal purpose of DoD [*sic* DOD] lands, waters, airspace, and coastal resources is to support mission-related activities. All DoD natural resources conservation program activities shall work to guarantee DoD continued access to its land, air, and water resources for realistic military training and testing and to sustain the long-term ecological integrity of the resource base and the ecosystem services it provides, in accordance with section 670a-670o of title 16, United States Code (U.S.C.) (also known as and hereafter referred to as the "Sikes Act.[4]

[4] Sikes Act: Sections 470–470x-61, 590a–590q32, 668-668d3, 670a–670o4, 703–7125, 1361–

(DoDI 4715.03 Mar 18, 2011 4.a)

Under the Natural Resource Management on Military Lands Act of 1960, commonly known as the Sikes Act, as amended according to the Sikes Act Improvement Act of 1997, the Secretary of Defense must carry out a program to provide for the conservation and rehabilitation of natural resources on military installations. 16 U.S.C. § 670 a (a)(B) *et seq*. To facilitate the program, each military department must prepare and implement an Integrated Natural Resources Management Plans (INRMP) for each military installation in the United States. The purpose of the INRMP is to guide natural resources management programs, while ensuring the sustainability of desired military training area conditions and maintaining ecosystem viability. In addition, INRMPs were intended to ensure that natural resources conservation measures and Army activities are consistent with federal stewardship requirements.

The Army has an affirmative duty under the Sikes Act to manage the natural resources on its installations, and its impacts upon them, in a comprehensive and coordinated manner. When describing its environmental programs and policies, the Army states that "[i]n the spirit of the Sikes Act, these initiatives would also be intended to make the Army a 'good neighbor' and a 'joint steward' with local communities, land users, and land managers." (Transformation PEIS, 1999).

More than once the INRMP PEA states that the Integrated Natural Resources Management Plan at PCMS will, "Foster a sense of environmental stewardship among soldiers, employees, and neighbors who use or have in interest in natural resources on Fort Carson and PCMS, and Improve communication, coordination, and participation among interested parties and partners in the region." (INRMP PEA; p3, 9)

In truth and fact, the Army has not been a good neighbor to or a joint steward of the PCMS with local communities or interested parties. Fort Carson as manager, scheduler and user of PCMS betrays its mission to meet training requirements through its refusal to acknowledge scientific findings that establish impacts from military training on the shortgrass prairie are irreparable.

The Army continues to ignore data that conclude that it is not possible to successfully recover a native shortgrass landscape. Army and its contractors fail the public disclosure requirements of NEPA through demonstrated inability to collect meaningful inventories that support reliable monitoring or to conduct credible analyses using "best available science" (INRMP PEA; 3/27-28). The Army refuses to acknowledge that since the Dust Bowl of the 1930s raged across the region from its headwinds in southeastern Colorado, native shortgrass prairie still has not recovered despite almost 60 years of focused conservation efforts with that vision (Ecology of the Shortgrass Steppe, Lauenroth and Burke, Oxford University Press 2008).

1423h6,1431–1445c-17, 1451–14668, 1531–15449, 3501–351010, 4701–475111 of title 16, United States
CODE

USDA's Conservation Reserve Program authorized within the Farm Bill has not documented the successful re-establishment of shortgrass landscapes (specifically species blue grama and buffalograss) in any of its contracts.

The Army fails to consider or disclose facts that demonstrate it is not possible for the Secretary of Defense to comply with the requirements of public disclosure, environmental and cultural laws including NEPA and the Sikes Act that specifically mandate the Secretary "must carry out a program to provide for the conservation and rehabilitation of natural resources on military installations." Nor is it possible for the military to fulfill its training mission on the shortgrass, where decimated soils blow even when temporary exotic seed is used which further permanently degrades the integrity of native prairie. The Army admits "fugitive dust" is a problem, but curiously ignores dust impacts to immediate and distant "neighbors" and fails to provide data demonstrating the inevitability of severe dust events being perpetrated by military impacts over time and currently in record drought.

The INRMP PEA is yet another unsubstantiated volume in a long series of bogus analyses and inadequate disclosures of impacts to the human environment by past, current and foreseeable military use of the Piñon Canyon Maneuver Site. Through its failure to meet even the basic requirements of the National Environmental Policy Act, the Sikes Act and other relevant Acts of Congress, the Army continues to break the spirit and letter of our nation's laws at enormous cost to the human environment, the economies and communities of the Southern Great Plains and public disclosure.

Part C: Specific Comments on Ecological Impacts

Because the ecological consequences of the Army's failure to meet the standards of NEPA and the Sikes Act are so great, commenters devote this section to specific comments made in the INRMP PEA:

Page 24, lines 45-47

> Assuming that this process is implemented, and assuming that training is not curtailed by budgetary pressures, this may mean a gradual increase in training at both installations, which could cause greater impact on vegetation, soils, etc. Such impacts would be especially noticeable, since **the vegetation on both Fort Carson and the PCMS has recovered quite well over the past nine years.** [Emphasis added.]

In this and other passages, the Army demonstrates that it is not using the best science available. As Not 1 More Acre! has previously pointed out, since the Dust Bowl of the 1930s, re-establishing shortgrass species has not yet been successfully demonstrated in the Central Shortgrass Prairie. The Army frequently refers to the Central Shortgrass Prairie Plan, much of which was funded by DOD, but ignores Long Term Ecological Research (LTER) that substantiates impacts to the shortgrass, like those inflicted by military training, are quantifiable and irreparable. So the seed that Army is

using that has "recovered quite well over the past nine years" (24/47-48; Future Military Impacts) must be non-native seed, which will not hold soils in place in the long run.

Despite the Army's acknowledgement that plant cover is essential to prevent soil erosion, all non-native seedings are temporary. Non-native seed must have rain and even if enough rain falls to support sprouting, establishing a deep-rooted grass cover to protect the soil after the shortgrass has been destroyed has not been successfully demonstrated.

Perhaps spreading non-native grasses is the reason the Army neglects to consider invasive species in their failed "monitoring" of landcover (31/9; 2b Landcover). Range management and invasive species – two of the biggest issues in natural resource management at PCMS – are the two obvious shortfalls in natural resource staffing. These vacant positions clearly document the Army's lip-service-only approach to natural resource management. As a testament to the Army's lack of conviction to understand
and fulfill its obligations, Salt Cedar (31/17) has been placed in the wrong ecological setting: it is a riparian invasive species.

Describing management for state-listed species the Army states: "The Burrowing Owl is widely distributed across Fort Carson and the PCMS but occupies only a small percentage of available habitat. The owl is present on both installations March-October and is primarily restricted to prairie dog colonies during the nesting season. The owl is not protected by the ESA but is protected by the MBTA and state regulation. The Burrowing Owl is the only state-listed species known to occur at the PCMS. Breeding surveys are conducted annually, in conjunction with Mountain Plover and black-tailed prairie dog surveys." (45/2-15; State Listed Species) However, no data is given to evaluate and analyze species population responses over time. Inventories gathered through monitoring are not referred to or included in the INRMP PEA. NEPA requires analysis of impacts of proposed actions. (40 Fed. Reg. §1500.2(b). Analysis requires data. The Army presents none.

When discussing native fish management (56/12-13; Native Fish) Army says, "At PCMS, the primary native fish management tool is enforcing the regulation prohibiting fishing. DPW will continue to provide native fish to CPW to assist with breeding programs and establishing populations at locations in eastern Colorado." How is it possible to manage fish that are not monitored and inventoried? Army and other military units have been impacting the environment at PCMS for thirty-three years but Army has not collected data with which to analyze the Natural Resource Management Plan for its effectiveness in dealing with past, current and future impacts of its actions and ability for the environment to support its training requirements. Instead, Army's native fish management is enforcement of no-fishing regulations at PCMS, an austere remote site on the largest expanse of native shortgrass prairie remaining in the American Great Plains. Enforcing no-fishing rules on a site that the public cannot access for fishing in any event is probably harmless, but no substitute for analyzing the impact of training and other activities on fish habitat and population.
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The Army recognizes the Leopard Frog (44/12-18; Federal petitioned species) is petitioned for listing but it does not prioritize or even propose a monitoring program for Leopard Frog. Bullfrog range expansion is a serious problem throughout the Southern Great Plains region. The Army failed to include a bullfrog control program in its management program. Such a program would be critical to the population viability of the Leopard Frog.

The Army's rhetoric describing its Prescribed Fire Plan (96/6-47) demonstrates a fundamental lack of ecological understanding of the shortgrass prairie. (Exhibit 3) Prescribed fire has no documented history or ecological value in shortgrass. Because 90% of shortgrass biomass is below ground, the nitrogen flush fire provides to grasses where biomass is above ground does not follow burning of shortgrass species. In fact, burning shortgrass only destroys cover and can exacerbate soil erosion. On impacted soils, burning exacerbates loss of healthy soil communities and loss of habitat. Historically, Native Americans set fires in the mixed-grass ecotone – the 'feathered edge' between the shortgrass and tall grass prairies of the Great Plains – to attract bison (*Where the Buffalo Roamed;* Richard Hart, U of Nebraska-Lincoln, 2001: Exhibit 4). Burnt, taller grasses don't 'cure' well, meaning burnt grasses lose their protein content and digestibility. Burning reinvigorates tall grasses into earlier growth stages and bison readily moved onto burns in the mixed-grass prairie. The dynamic does not hold true for shortgrass. On shortgrass it is prairie dogs that reinvigorate grasses into earlier growth stages.

However, commenters see on page 108 that the Army is considering poisoning prairie dogs, which they survey as critical to Conservation Species: owl and plover. Prairie dogs are a keystone species. Poisoning them will poison other species that rely on them for food, including the Burrowing Owl, Ferruginous Hawk, the Mountain Plover, the Golden Eagle, the black-footed ferret, snakes, and dozens of other species. Further, prairie dogs can help restore delicate prairie ecosystems damaged by human use by encouraging water infiltration to greater depths, they control invasive plant species, and reverse soil compaction.[5]

The Sikes Act was amended to allow land trusts to take conservation easements surrounding military landspaid for with tax dollars funneled through DOD's Readiness and Environmental Protection Initiative (REPI). (Sikes Act, 10 USC 670c-1(a)(2)). These easements are taken by land trusts and other actors for the purpose of "increasing the installations' effective training spaces" and "relieving testing and training restrictions" by removing species to surrounding lands and/or poisoning habitat – even that habitat shared by multiple "conservation species."(DODI 4715.03; May 18, 2011: 41/15-17)

It is curious that the Army does not discuss REPI or other "Compatible Use Buffer" programs at PCMS. However, commenters are aware that a contract between The Nature Conservancy and Fort Carson to encumber lands around PCMS exists. Commenters are also aware that information about REPI and other tax-supported real

[5] "Praire Dogs are a Keystone Species of the Great Plains" Nicole Rosmarino, Southern Plains Land Trust. http://www.prairiedogcoalition.org/pd-associated-species.php

estate programs are not transparent due in large part because private military contractors including land trusts are shielded from Freedom of Information Act requests. The Army's own PCMS land expansion plan, Piñon Vision, recites that The Nature Conservancy was a partner in years of secret land expansion plans at PCMS. Fiscal partnerships with the Army make its land trust partners tax-supported perpetrators of irreparable environmental destruction that is perpetuating catastrophic consequences to the Central Shortgrass and Southern Great Plains regions.

The Army Compatible Use Buffer Program (ACUB), the establishment of the Army Sustainable Range program, and the Readiness and Environmental Protection Initiative (REPI) are intended to support the military's testing and training mission and conservation goals by improving environmental quality, preventing encroachment, relieving testing and training restrictions, and establishing buffers around installations, thereby protecting and increasing the installations' effective training space.

Science has clearly established how critical the shortgrass region in and surrounding PCMS is to long-term conservation. Yet, while 'fugitive dust' is proclaimed by the Army to be important, it is not addressed. Regional dust exacerbated to dangerous levels by military destruction of the native shortgrass prairie affects the environment, culture and economy of southeastern Colorado, northeastern New Mexico, southwestern Kansas and the panhandles of Oklahoma and Texas.

The Army's INRMP PEA continues its long history of ignoring shortgrass prairie protection on site exacerbating the most significant ecological issue caused by military impacts: dust. 'Fugitive Dust' is the real issue and the Army knows it. 'Fugitive Dust' is the most critical on-site issue as well as the most important off-site issue because PCMS sits at the headwinds of the Dust Bowl and dust generated from this site can smother grasses on surrounding lands, metastasizing the Dust Bowl. The superficial management targets described by the Army in its previous plans and proposed the INRMP PEA make a mockery of its stated commitment to sustain the environment to support training. The Army's rhetoric that disturbed shortgrass prairie is being 'reclaimed' is scientifically naïve and ignores the relevant technical literature of which they are aware.

09 The Army should be asked specifically why they have ignored scientific articles in peer-reviewed journals such as studies conducted on the PCMS by D. G. Milchunas and others (Milchunas, D.G., et al. "Plant community responses to disturbance by mechanized military maneuvers." J. Environ. Qual. 28:1533-1547, 1999; and, "Plant community structure in relation to long-term disturbance by mechanized military maneuvers in a semiarid region." Environ. Manage. 25:525-539, 2000) that also concluded that the distinctive/documentable impacts of tracking by military vehicles represent a soil disturbance that leads to an ecological shift from a deep-rooted, wind-resistant, soil-protecting vegetative cover to a shallow-rooted flora prone to severe wind erosion in periods of drought. Selectively citing information from only some of the Army's own in-house contract reports is not the rigorous state-of- science analysis demanded by NEPA.

The Army's betrayal of its stated commitment to "Foster a sense of environmental stewardship among soldiers, employees, and neighbors who use or have in interest in natural resources on Fort Carson and PCMS" (3/29-32) would be laughable if it were not so tragic. The Dust Bowl of the 1930s happened due to fragmentation and plowing of rangeland. Impacts from tanks and all other military exercises at PCMS guarantee dire consequences for the entire region and national tresury and global health

.. Massive land expansion authorizations at PCMS remain in place while REPI and other tax-supported military environmental 'protection' programs encumber land to be primarily managed for 'military need'. The larger plan disguises the fact that impacts to the shortgrass prairie at PCMS have laid the foundation for and are perpetrating the next Dust Bowl emanating from the 'headwinds' of the Southern Great Plains.

Part D: Natural and Cultural Resources of the Purgatoire River Valley

Grasslands are well documented as the most imperiled ecosystems in the world; in the last 125 to 150 years, most of America's native grasslands have been destroyed.

The climate of the Purgatoire River region is semi-arid, with generally low relative humidity, abundant sunshine, little rainfall and a wide daily temperature range. The region receives roughly 15 inches of rain per year and about half of the yearly precipitation is received during the months of May through August, largely from thunderstorm activity. These storms result in considerable soil erosion if the native grasses are disturbed or missing. Summer average maximum temperatures in July and August are near or above 90 ºF. Winters are cold and very dry. This climate makes bare soil extremely vulnerable to the effects of drought and wind erosion, twin conditions that set the stage for the American "Dust Bowl" of the 1930s, when topsoil exposed following large-scale agricultural plowing resulted in severe dust storms that caused catastrophic ecological damage throughout the region. Climatic conditions today are similar to those experienced during the Dust Bowl. The epicenter of the Dust Bowl was Boise City, Oklahoma, and the dust blowing into Boise City originated in Colorado.

The human cultural history of southeastern Colorado dates to more than 10,000 years ago. From that point until the 1600s, the area remained the domain of various groups of Native Americans, including northern Pueblo and Plains Apache groups at the time of European arrival/influence. Historical documentation indicates the arrival and presence of French, Basque, Spanish, English and American exploration from the 1600s through the 1800s.

The PCMS and surrounding lands contain some of the richest concentrations of prehistoric, archaeological and historic sites in the American West. Thousands of sites document the lives of dinosaurs, Native Americans, trappers, traders, early Hispanic settlers, cowboys, cattle and sheep ranchers, farmers and homesteaders.

In February 2007, Colorado Preservation, Inc. added the Santa Fe Trail and Southeast Heritage Region to Colorado's Most Endangered Places List, due to the threat of intensified and expanded military operations. On June 14, 2007, one day before the US House of Representatives overwhelmingly (383-34) passed a comprehensive prohibition on spending for any aspect of expansion at PCMS, the National Trust for Historic Preservation added the PCMS region to its list of the nation's most endangered places.

Originally included within the boundaries of the PCMS, Picket Wire Canyonlands was transferred in 1990 by Congress to the Forest Service to be specially managed as part of the adjacent Comanche National Grasslands. Picket Wire is the only portion of the entire National Forest System with a specific mandate for the management and protection of fossil resources. The site contains petroglyphs and more than 1,300 individual
dinosaur tracks in addition to bones and skeletons representing as many as 100 different animals that lived 150 million years ago. Exploratory ground penetrating radar work has confirmed that the exposed tracks constitute only a small part of a much larger track site buried in the surrounding area, making this the largest assemblage of dinosaur track trails in North America. This is also the only archeological site providing evidence that at least some dinosaurs moved in social units.

Failure to quantify baseline conditions at PCMS

The 236,000-acre Piñon Canyon Maneuver Site lies in the Arkansas Tablelands section of the Great Plains-Palouse Dry Steppe physiographic province. Elevation ranges from 4,400 feet to 5,800 feet. The site consists primarily of tablelands cut by tributary drainages of the Purgatoire River. A total of ten intermittently flowing arroyos and canyons cross Piñon Canyon Maneuver Site, predominantly from northwest to southeast, all flowing down to the river. Playas, seeps and springs in these canyons and adjacent to the river flow year-round, creating unique plant communities, including small wetlands, shrub communities, and aspen groves rare in southeastern Colorado.

The Army admitted in the vacated PCMS Transformation EIS/ROD that there is a lack of baseline data for PCMS and, apparently, no baseline data has been collected since that admission. Not 1 More Acre! is aware that from 1985 through 2002, the Army prepared After Action Reports summarizing training exercises conducted at the PCMS. The reports confirm that even those limited training exercises have had severe and long- lasting environmental consequences. These AARs demonstrate the failure of the Army's management plan to give consideration to past, present and foreseeable adverse environmental impacts of military activities and the inadequacy of the plans for
mitigation on and surrounding the Piñon Canyon Manuever Site.

Soils

Training at PCMS results in irreversible disturbance of soils. In violation of NEPA, Army continues to fail to analyze and disclose loss of topsoil, erosion, sedimentation, drought and climate conditions and other soil issues with regards to

PCMS despite clearly stated issues with "fugitive dust". Soils of the shortgrass prairie are highly erodible. Historically, southeastern Colorado lies in what might be termed the 'headwinds' of the Dust Bowl of the 1930s. As noted, The epicenter of Dust Bowl impact is generally considered to be the Boise City, Oklahoma area, just ESE (downwind) of PCMS and the dust smothering Boise City primarily originated in Colorado.

Current activities at the PCMS that include cutting of the soil surface to the point of destroying the crowns and roots of the shortgrasses are at least as destructive as the historic plowing of a site. Studies by Shaw and Diersing (Shaw, R.B. and V.E. Diersing. "Tracked vehicle impacts on vegetation at the Pinion Canyon Maneuver Site, Colorado." J. Environ. Qual. 19:234-243, 1990) concluded that tracking by military vehicles decreased plant basal and litter cover, and increased the proportion of bare ground on the PCMS, most specifically reducing cover by the perennials blue grama and buffalo grass while increasing cover by ecologically and economically undesirable annual grasses and both native and exotic invasive herbaceous plants.[6]

The Army ignored studies conducted on the PCMS by Milchunas and others (Milchunas, D.G., et al. "Plant community responses to disturbance by mechanized military maneuvers." J. Environ. Qual. 28:1533-1547, 1999; and, "Plant community structure in relation to long-term disturbance by mechanized military maneuvers in a semiarid region." Environ. Manage. 25:525-539, 2000) that also concluded that the distinctive/documentable impacts of tracking by military vehicles represent a soil disturbance that leads to an ecological shift from a deep-rooted, wind-resistant, soil- protecting vegetative cover to a shallow-rooted flora prone to severe wind erosion in periods of drought.[7]

The PCMS studies further identified the issue of invasive, undesirable species subsequently dominating areas impacted during training exercises as a critical ecological issue. The US Forest Service (Reeves, M.C. and J.E. Mitchell. 2012. A synoptic review of U.S. rangelands: a technical document supporting the Forest Service 2010 RPA Assessment. USDA Forest Service Gen. Tech. Rep. RMRS-GTR-288. Fort Collins, CO) recently concluded that invasive plant species pose the greatest threat to the future health of U.S. rangelands and will cause a serious financial burden to society. The synthesis concluded that invasive species threaten many ecosystems as they interrupt ecological processes like nutrient cycling and pollination, as well as increase soil erosion, degrade wildlife habitat, reduce the carrying capacity of livestock, interfere with predator and prey relationships, and reduce overall ecosystem biodiversity.

Most of the biological diversity of the shortgrass prairie lies below ground. These plants have extensive root systems that hold the highly erodible soils during severe climatic (water and wind) events. The Army simply and falsely assumes that surface

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[6] Previously submitted to the agency as Exhibit 2 to N1MA!'s 2020 PEA comment letter submitted March 19th, 2013.

[7] Previously submitted to the agency as Exhibits 5 and 6 to N1MA!'s 2020 PEA comment letter submitted March 19th, 2013.

damage to ecologically stable native grasses can be mitigated/recovered and flagrantly ignores the collective research programs at the Agricultural Research Service's Long- Term Ecological Research site in Eastern Colorado (Lauenroth, W.K. and I.C. Burke. 2008. Ecology of the shortgrass steppe. Oxford Univ. Press.) that conclude that restoration of shortgrass prairie from severe damage is so slow that it has not yet been definitively documented anywhere in eastern Colorado – 75 years after the Dust Bowl. Despite the Army's casual statements that severely damaged sites will be re-vegetated, current science does not support mitigation or control of erosion and exotic plant invasions as being possible in any ecologically or economically sustainable manner. Restated, the state of the science at this point in time is that historical and future damage to shortgrass prairie must be considered ecologically irreversible and irreparable. Any restorative efforts must match the native grassland previously existing on the PCMS to preclude the ultimate fate of severe wind erosion in the future (Knopf, F.L. and F.B. Samson, eds. Ecology and conservation of Great Plains vertebrates." Ecological Studies 125:1-320; and Samson, F. B., et al. "Prairie Ecosystems: Past, Present, and Future." Wildlife Soc. Bull. 32:6-15, 2004.)[8]

Water quality and quantity

The Nationwide Rivers Inventory has identified 117 miles of the Purgatoire River, part of which runs through the PCMS, as having outstanding scenic, geological, fish, wildlife and cultural values and as eligible for special protection. The INRMP PEA failed to catalog these special features of the Purgatoire River and develop mitigation measures to prevent any adverse impacts that would prevent designation as a wild and scenic river.

The Purgatoire River and its side canyons are a unique aquatic resource within Colorado. No other Front Range or eastern plains major basin has been subject to so little introduction of exotic fishes. The only known eastern Colorado populations of invertebrates such as Megaloptera (hellgrammites) and the Trichopterans (caddisflies) Ithytrichia and Myatrichia occur throughout the region as well as within and adjacent to PCMS.

Pursuant to section 303(d) of the Clean Water Act, the State of Colorado has placed the section of the Purgatoire River from I-25 to its confluence with the Arkansas River on the State's list of impaired waters for selenium and sediment. One of the designated uses for this section of the Purgatoire River is for Aquatic Life, Warm Water – Class 2. The 2010 Impairment Reporting found the river impaired for this use. This section of the river runs directly through and drains the PCMS. (*U.S. E.P.A. Watershed Assessment, Tracking and Environmental Results, 2010 Waterbody Report for Purgatoire River, I-25 to Arkansas River.*[9]*)*

[8] Previously submitted to the agency as Exhibits 3 and 4 to N1MA!'s 2020 PEA comment letter submitted March 19th, 2013.

[9] Previously submitted to the agency as Exhibit 8 to N1MA!'s 2020 PEA comment letter submitted March 19th, 2013.

Activities that disturb the soil on the PCMS introduce significant sediments (and INRMP PEA potentially selenium) into the Purgatoire River. The Army has not addressed how it will prevent accelerated sediment and selenium erosion with this or unanticipated events that require a plan for on-site storm water management.

The Army further fails to identify both how and where water resources will be acquired and how wastewater containing toxic chemicals, hazardous substances, and pathogens will be managed to avert impacts to resident vegetation, wildlife and water resources. Impacts from hazardous and toxic materials used at the PCMS facility is unsubstantiated by any monitoring data or plan. Thus, the proposed mitigation as described in Section 4.9.4 to "continue to implement all applicable hazardous waste management plans and training" cannot logically constitute an adequate response given its efficacy cannot be evaluated. We anecdotally note that the recent BCT Warhorse Maneuver used an estimated 30,000 gallons/day of fuel. The INRMP PEA neither discusses the current and anticipated quantities of fuel to be stored nor addresses fuel and accidental spill management and containment.

The Purgatoire River is a significant tributary to the Arkansas River. Not only did the Army plainly fail to conduct sufficient research to consider the environmental impacts of the proposed action on the already impaired water quality in the PCMS watershed but it also fails did address how impacted water quality in these streams will compromise water quality for fish, wildlife, and human use downstream in the Arkansas River. Failure to consider this information and determine whether the proposed actions may exacerbate these impairments or otherwise adversely impact water quality is a violation of NEPA.

Wetlands

Based on review of the National Wetlands Inventory, areas in and adjacent to PCMS contain wetlands. Discharge of dredged or fill material into waters of the United States, including wetlands, are regulated under Section 505 of the Clean Water Act (CWA). The permit program is jointly administered by the U.S. Army Corps of Engineers (Corps) and EPA. The applicability of CWA 404 permit requirements to the proposed action is not reported in the INRMP PEA. Additionally, Executive Order (EO) 11990 directs Federal Agencies to "take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities." The INRMP PEA fails to describe how the proposed action or the alternatives would address the wetland protection goals in EO 11990. EPA suggests a mitigation commitment that indirect draining of, or direct disturbance of, wetland areas will be avoided if at all possible." The INRMP PEA provides no indication that this analysis was performed for PCMS. The agency failed to analyze and disclose a full and complete wetlands baseline delineation that must be considered for INRMP PEA to anticipate any impacts to the wetlands from the proposed action and its alternatives.

Wildlife and fish, threatened and endangered species

The biological diversity of the PCMS and surrounding lands is remarkable for a region without abundant water resources. In 2007, the Colorado Natural Heritage Program conducted a biological survey on a 2,052,474-acre tract of land surrounding the PCMS. The CNHP identified thirty-eight animals in the study area that are rare, imperiled or vulnerable globally or within the state of Colorado. The PCMS is known to be home to many imperiled wildlife species, including the Bald and Golden eagles, American Peregrine Falcon, Burrowing Owl, Mountain Plover, Ferruginous Hawk and swift fox, most of which are designated as "Species of Concern" by the Colorado Division of Wildlife. These species are dependent on the black-tailed prairie dog, a keystone species of the shortgrass prairie ecosystem and another Colorado-designated Species of Concern. Other Species of Concern known to occur on the PCMS include the flathead chub, plains leopard frog, triploid checkered whiptail, Texas blind snake, Texas horned lizard, Yellow-billed Cuckoo, Long-billed Curlew, massasauga, Greater Sandhill Crane, Townsend's big-eared bat, and Botta's pocket gopher. The Mexican Sspotted Owl, a federally listed Threatened Species, has the potential to occur at the PCMS, and the endangered black-footed ferret was undoubtedly present in the area historically.

The PCMS is also used by numerous large mammal species for migrating, breeding and foraging, including bobcat, coyote, mule deer, and pronghorn. Some of these are game species that also represent an economic asset within the drainage.

Migratory birds are protected by the Migratory Bird Treaty act but a credible inventory of those species using PCMS is apparently not available. The Army failed to inventory all wildlife species and prepare mitigation measures to protect wildlife and the habitat they depend upon as required by NEPA.

Bald and Golden Eagle Protection Act

Bald and golden eagle nests and habitat exist at the Piñon Canyon Maneuver Site and the Army has violated legal statutes 16 U.S.C. 668-668c.

Air Quality

The Army failed to evaluate air pollution impacts resulting from the proposed action. These include air pollution resulting from development, increased traffic, the addition of a Heavy Combat Aviation Brigade that includes 113 -120 more helicopters, the addition of 700 more wheeled vehicles, the cumulative impacts of integrated weapon systems and payloads – including UAV and Laser systems – and dust emissions from training at PCMS. In addition, the cumulative impacts of DOD's proposed LATN must also be analyzed.

The Dust Bowl of the 1930s had devastating effects on the air quality in the Great Plains states, contributing powerfully to the deadly disease of silicosis and a lethal condition known as dust pneumonia, in which dust settles all the way into the alveoli of the lungs, stopping the cilia from moving and preventing the lungs from ever clearing themselves.[10]

More than 300,000 tons of topsoil was airborne on "Black Sunday," April 14, 1935 (Egan, Timothy. 2006. The Worst Hard Time: the untold story of those who survived the great American dust bowl. First Mariner Books. New York, New York.). "Prairie dust has a high silica content. As it builds up in the lungs it tears at the honeycombed web of air sacs and weakens the body's resistance. After prolonged exposure, it has the same effect on people as coal dust has on a miner. Silicosis has long been a plague of people who work underground and is the oldest occupational respiratory disease. But it takes years to build up. In the High Plains, doctors were seeing a condition similar to silicosis after just three years of storms. Sinusitis, laryngitis, bronchitis – a trio of painful breath and throat ailments – were common. By the mid-1930s, a fourth condition, dust pneumonia, was rampant. It was one of the biggest killers. Doctors were not even sure if it was a disease unique from any of the common types of pneumonia, which is an infection of the lungs. They saw a pattern of symptoms: children, infants, or the elderly with coughing jags and body aches, particularly chest pains, and shortness of breath. Many had nausea and could not hold food down. Within days of diagnosis, some would die.... In March [1935] one of every five people admitted to all hospitals in southwest Kansas said they were choking on dust. The next month, more than 50 percent of admissions were for dust-related respiratory ailments." (Egan, Timothy. 2006. The Worst Hard Time: the untold story of those who survived the great American dust bowl. First Mariner Books. New York, New York.)

The Army's failure to consider the effects of the proposed action on air quality is highly concerning and dangerous to the human environment in the downwind Great Plains states.

Vegetation

The Army continues to fail to provide monitoring data concerning rare plant species including several rare plant species found at the PCMS, including Arkansas Valley evening primrose (Oenothera harringtonii) (for which PCMS contains 17% of known occupied acreage and 49% of high quality plant occurrences acreage), Rayless goldenweed (Haplopappus fremontii) (a Category 2 Candidate plant for federal listing, for which PCMS contains 80 % of known occupied acreage and 86% of high quality plant occurrences acreage), Roundleaf four-o'clock (Oxybaphus (Mirabilis) rotundifolius) (C2 species for which PCMS contains 12% of known occupied acreage and

[10] Whereas there are no official death rates published for the Great Plains in the 1930s, the Kansas State Board of Health reported that in April 1935, 17 people had already died from dust pneumonia. The Red Cross declared a medical crisis in 1935. (Egan, Timothy. 2006. The Worst Hard Time: the untold story of those who survived the great American dust bowl. First Mariner Books. New York, New York.)

13% of high quality plant occurrences acreage), and the largest known populations of Dwarf milkweed (Asclepias uncialis) (C2 species for which PCMS contains 24% of known occupied acreage and 34% of high quality plant occurrences acreage).

The biological diversity of the shortgrass prairies and juniper-rimmed canyons of Southeast Colorado represent a vast and largely intact ecosystem that is not fully understood or documented. This area harbors the largest intact landscape remaining not only on Colorado's eastern plains, but also in the entire Central Shortgrass Prairie ecoregion. One of the factors that make this area so phenomenal, and so unique in Colorado, is the fact that the landscape still supports a mosaic of ecological systems, with large, very high quality patches of rare communities. The Shortgrass Prairie Partnership identified priority areas within the Central Shortgrass Prairie network to guide conservation efforts and concluded that 69,000 acres of Department of Defense lands (including PCMS) support irreplaceable plant species and communities.

Helicopters and other weapon systems also have impacts on shortgrass prairie. PCMS abuts the Comanche National Grasslands, which is a recovery unit from the Dust Bowl era. Also, surrounding ranchlands, communities and the regional economy face catastrophic impacts exacerbated dust by disturbance of soils on the PCMS.

Social-cultural and economy

The Army's current and proposed actions have consequences – both undefined and unaddressed in the INRMP document – on the economies and communities of Colorado, Kansas, New Mexico, Nebraska, Texas and Oklahoma, where multiple generations of families have farmed and ranched in the region. The ranchers of the shortgrass country, in particular, serve as modern keepers of an ecological system that has endured for thousands of years. Before the 19th century, the grasslands were grazed by creatures such as the buffalo, whose manure helped enrich and stabilize the soil. It is said that during the region's periodic droughts, the grass would go dormant, forcing the buffalo to seek fodder elsewhere and/or reducing their number by starvation. When the rains returned, the grasses grew anew, the buffalo returned and increased in number, and the natural cycle of grazing and fertilization renewed itself. The rapid removal of the buffalo caused the first dramatic manmade impacts to the short grass prairie ecosystem.

This natural cycle was interrupted by widespread deep plowing of the virgin topsoil of the Great Plains in the 1920s that displaced the natural deep-rooted grasses that normally kept the soil in place and trapped moisture even during periods of drought and high winds. Rapid mechanization of farm implements, especially small gasoline tractors and combine harvesters, led many farmers to convert arid grassland (much of which received no more than 10 inches of precipitation per year) to cultivated cropland.[11]

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11 ^ *Drought in the Dust Bowl Years*. USA: National Drought Mitigation Center. 2006. Retrieved December 6, 2007.

When drought and high winds returned in the 1930s, the former grasslands had lost their traditional shields and the resulting Dust Bowl devastated 100,000,000 acres (400,000 km^2), encompassing all of the panhandles and Oklahoma, and adjacent sections of New Mexico, Colorado, and Kansas, and spreading into other Great Plains states as well.[12] The result was the largest migration in American history within a short period of time. By 1940, 2.5 million people had moved out of the Plains, abandoning farms in Colorado, New Mexico, Oklahoma, Arkansas, Missouri, Iowa, Nebraska, Kansas and Texas. Eventually, government policies led to the repurchase of some dust bowl lands and placing them in the Comanche National Grasslands.

It is thus not just the historic Dust Bowl region that is threatened by the Army's current activities and future plans. The Army is also threatening the way of life of the ranch families and rural communities throughout of southern Colorado and northern New Mexico. Continued training operations on these fragile soils of course threaten to harm adjacent ranch land by wind-blown dust and other damage. But likewise, renewed expansion of the PCMS site itself threatens to remove thousands of additional acres from generational ranching activities, either by voluntary sale or condemnation. While Congressional funding bans, annually renewed, have stopped such additional acquisitions since 2007, the Army and its politicans have not foresworn its eventual goal of engorging its holdings at the expense of traditional ranching activities that have been central to life and livelihoods of southeast Colorado and northeast New Mexico.

Today, approximately 44,000 people live and work in Las Animas, Huerfano and Otero counties, the region of influence surrounding the PCMS. The rural communities and economies surrounding the PCMS depend heavily on a healthy environment, family ranching, farming and related small businesses. Many residents live and work on ranches and for ranching-related businesses, many of which have been in their families for generations.

The Purgatoire River region is home to hundreds of multi-generational ranches and farms. According to the 2007 Census of Agriculture, in Las Animas County alone there were 585 working farms and ranches encompassing more than 2 million acres of lands. Some families have lived in the Purgatoire River area since the 19th century. Many of the family ranches are owned and operated by descendants of pioneers who came to the Purgatoire Region of the Colorado Territory in the 1870s. Because of the wise stewardship of these generational owners, many of the prairie lands that hosted family ranches survived the Dust Bowl.

In 2006, a map of DOD's massive 6.9 million-acre land expansion, which had been secretly planned for years, was leaked to ranchers. The regional real estate economy was immediately paralyzed as news of the military's plans spread throughout the area. Over the course of time, as details of the takeover are discovered and DOD continues to exert unrelenting pressure on the people of the region through intensified

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[12] Hakim, Joy (1995). *A History of Us: War, Peace and all that Jazz*. New York: Oxford University
Press. ISBN 0-19-509514-6

and expanded military operations, the markets continue to be frozen. Capital investments and improvements throughout the region are delayed as ranchers, communities and businesses live under the threatened impacts of intensified military presence in the region. Memories of the condemnations and the bitter legacy the military left in its wake of establishing the PCMS in the 1980s exacerbate social-cultural tensions and economic insecurity throughout the region.

Despite a comprehensive annually renewed congressional funding ban prohibiting DOD from spending money on any aspect of expansion at PCMS and the Order of the Federal Court vacating the 2007 PCMS Transformation ROD, the military, its contractors and politicians continue to intensify and expand military activity at PCMS and throughout the southern Great Plains. These inexorable pressures on the civilian lives and economy of the people dangerously erode confidence in the institutions of democracy.

Archeological Resources

The documented human cultural history of southeastern Colorado dates to more than 10,000 years ago. From that point until the 1600s, the area remained the domain of various groups of Native Americans, including northern Pueblo and Plains Apache groups.

The PCMS and surrounding lands contain some of the richest concentrations of prehistoric, archaeological and historic sites in the American West. Thousands of sites document the lives of dinosaurs, Native Americans, trappers, traders, early Hispanic settlers, cowboys, cattle and sheep ranchers, farmers and homesteaders.

According to the Army, approximately 89% of the PCMS has been inventoried for cultural resources. Of the 4,163 archaeological sites identified by the military, 948 have been determined to be eligible for inclusion in the National Register of Historic Places. In addition, five sacred-site locations have been identified at the PCMS, along with three Traditional Cultural Properties and two Areas of Concern. **13**

Finally, PCMS contains a large number of fossils and fossil localities, ranging from dinosaur and plant beds to shell beds that were derived in an ancient lake. The lower sequence of exposed sedimentary rocks in canyons along the Purgatoire River was deposited in wind, river, lake, and shoreline environments. The upper sequence was deposited in a shallow seaway, the Western Interior Sea. Fossils of these marine rocks include clams, snails, and ammonoids. The PCMS is one of few places in the Western Interior Seaway that these species of geographically widespread animals lived. Fossils of lower canyons included fossil logs that accumulated as log jams at the base of deep

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13 (Page 4.8. 1.2,lines 13 – 21; Fort Carson Combat Aviation Brigade Stationing Implementation Draft Environmental Assessment January 2012Prepared by: U.S. Army Environmental Command and U.S. Army Garrison Fort Carson, CO

valleys. Nowhere else in western United States are logs of this age known. The most important for dinosaurs is the Morrison formation; it contains dinosaur bones and stomach stones. Plant fossils also occur in the Morrison, but plant fossils are more abundant in uppermost rocks that support rims of canyons. These plants include some of the earliest fossils of flowering plants known from the region.

Part E – Conclusion

In summary, the Army has completely and consistently failed to meet the minimum obligations under NPEA and the Sikes Act for more than eight years now. During that time, the Army has issued a series of more than 20 NEPA reports (all incorporated by reference) that purport to study the relationship between military training and environmental impacts at the PCMS:

Oct 2006	**Draft PCMS Transformation EIS**
June 2007	**Final PCMS Transformation EIS**
Aug 2007	**PCMS Transformation EIS Record of Decision (ROD)**
Aug 2007	**Draft Programmatic EIS (PEIS) For Army Growth and Force Structure Realignment**
Oct 2007	**Final Programmatic EIS (PEIS) For Army Growth and Force Structure Realignment**
Dec 2007	**Final Programmatic EIS (PEIS) For Army Growth and Force Structure Realignment Record of Decision (ROD)**
Apr 2008	**Filed NEPA lawsuit against PCMS Transformation ROD Aug**
2008	**Draft Fort Carson Grow the Army EIS**
Feb 2009	**Final Fort Carson Grow the Army EIS**
Mar 2009	**Fort Carson Grow the Army EIS Record of Decision (ROD) Sept**
2009	**PCMS Transformation ROD Vacated**
May 2010	**PEIS Grow the Army ROD Update ICBT Proposal Withdrawn**
July 16 - August 13 2010	**Warhorse Rampage BCT Maneuver PCMS**

Nov 2010	**Draft Programmatic Combat Aviation Brigade (PEIS) (CAB) (aka: Fort Carson CAB Stationing Implementation with training at Pinon Canyon Maneuver Site)**
Jan 2011	**Draft PCMS Transformation EA FONSI**
Jan 28, 2011	**Notice of noncompliance with federal court order and the National Environmental Policy Act. (Warhorse Rampage, illegal construction and other offensive acts)**
Feb 2011	**Final Combat Aviation Brigade PEIS (aka: Fort Carson Draft CAB Stationing Implementation with training at Pinon Canyon Maneuver Site)**
Mar 2011	**CAB PEIS Record of Decision (ROD)**
Jan 2012	**Draft Fort Carson CAB Stationing Implementation EA**
May 8, 2012	**Not 1 More Acre! – Final UAV Test Sites Comment Letter to FAA**
May 2012	**Final Fort Carson CAB Stationing Implementation Final EA and Draft FONSI**
Jan 2013	**Programmatic Environmental Assessment (PEA) for Army 2020 Force Structure Realignment**
Mar 2013	**PCMS Construction EA**
Mar 2013	**Fort Carson and PCMS Integrated Natural Resource Management Plan and Environmental Assessment and Finding of No Significant Impact (Close of Comment: May 15, 2013)**
Apr 2013	**Environmental Assessment and Draft Finding of No Significant Impact for Construction of an Equipment Holding Yard and Improved Field Maintenance Area, Piñon Canyon Maneuver Site, Colorado [April 12, 2013 Final Finding of No Significant Impact for 2020 PEA for Force Structure.]**

Over the last nearly eight years the Army has issued a staggering 10,000 pages of alleged NEPA documentation. Each of the studies identified above – all of which

conveniently find that the Army's actions have no significant impact to the quality of the human environment – is expressly based upon, tiered to and/or incorporates by reference the PCMS Transformation EIS, which was vacated after the District Court found its environmental analysis to be arbitrary and capricious.

Fort Carson and IMCOM's environmental management program has become a directionless bureaucracy – producing thousands of pages of meaningless analysis at huge cost to taxpayers while perpetuating a catastrophic national environmental disaster and threatening the military training the Army's management program purports to protect.

In one segmented document after the next, the Army's analysis methodology ignores science and even the sound principles of science. Even as military training expands – less than 5% of the PCMS is off limits to training – and intensifies, the Army and its tax-supported real estate partners encumbering land in the region to be managed for military needs employ environmental tactics that appear to trick 'neighbors' and the public into believing that impacts will be insignificant.

The Army's use of Programmatic Environmental Assessements in place of traditional NEPA requirements – coupled with the Army's habit of segmenting large scale cumulative projects into discrete subparts that do not trigger the Army's environmental obligations – has resulted in a pervasive lack of compliance with NEPA and the Sikes Act. As a further example of this segmentation, commenters ask where the Integrated Cultural Resource Management Plan is and why it wasn't issued as part of the Integrated Natural Resource Management Plan together with all cumulative and foreseeable impact analysis determining its integrated management plans? In effect, this segmentation/PEA process is a kind of "make-believe NEPA" that fails to comply either the spirit or letter of NEPA.

As demonstrated in the N1MA! February 1, 2012 Combat Aviation Brigade Comment Letter, between FY 2003 and FY 2008 the DOD provided an average of nearly $1.5 million annually to the USFWS for conservation work at Fort Carson and PCMS, representing about 40% of all funds appropriated by DOD under the Sikes Act during that time. See, Exhibits 75-80. However, after Fort Carson terminated its cooperative agreement with USFWS, the funding implementation of the 2007 INRMP fell to zero, as shown in the following table:

Year	Total DOD Sikes Act Expenditures	Total Fort Carson/PCMS Expenditures	% of Total
FY2001	$4,193,100	$2,889,037[1]	69%
FY2002	$2,232,777	$1,437,803	64%
FY2003	$3,849,314	$1,156,661	30%
FY2004	$3,648,465	$1,351,565	37%

FY2005	$3,068,191	$1,181,155	38%
FY2006	$3,564,619	$1,671,712	47%
FY2007	$5,172,835	$1,784,347	35%
FY2008	$3,413,583	$1,713,420	50%
FY2009	$3,084,452	$2,045,649[2]	66%
FY2010	$ 848,091	$0	0%

The Army's termination of its cooperative agreement with the USFWS violates the Sikes Act and renders its environmental analysis, which expressly relies on implementation of the INRMP, arbitrary and capricious.

The Army's termination of its former partnership with the USFWS is another example of a policy that has continually ignored both the spirit and the letter of NEPA and the Order of the Federal District Court vacating the PCMS Transformation Record of Decision[14] and concurrently flouting the public disclosure requirements of NEPA by continuing to intensify and expand military activity at PCMS.

For the reasons discussed above, the Programmatic Environmental Assessment and Draft Finding of No Significant Impact for the Integrated Natural Resource Management Plan 2013 – 2017 Fort Carson and Piñon Canyon Maneuver Site 2020 is inadequate and precludes meaningful disclosure and analysis of impacts. Chief among the deficiencies is the INRMP PEA failure to acknowledge or consider definitive science that would enable the military and its contractors to take a "hard look" at environmental, archaeological, cultural and socioeconomic impacts of their proposed actions. The INRMP PEA fails to emphasize real environmental issues and impacts and present them concisely, clearly, and supported by evidence showing the Army has made the necessary environmental analyses. 40 Fed. Reg. §1500.2(b). Instead inevitable catastrophic impacts are repeatedly ignored or minimized without attempt at quantification or discussion in a manner intended to mislead the public into believing the proposed action and alternatives at PCMS are insignificant and even "beneficial." In fact, analysis and disclosure of the significance of the action's impacts on resources are simply absent.

Most disconcerting is the failure of the draft to recognize that the most significant impact of proposed actions will be region wide. The ecosystem-level consequence of 'fugitive dust' is acknowledged but never addressed as an impact, likely because damages fostering blowing dust (and stormwater erosion) can neither be repaired nor mitigated given the current state of the science. 'Fugitive dust' and erosion in general are irreversible consequences of surface disturbance by military vehicles in this ecological landscape. Inevitably, such damage will have severe consequences to the stability of the southern Great Plains ecosystem and it's ability to support existing communities and economies.

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[14] *Not 1 More Acre! v. U.S. Dept. of the Army*, 08-cv-00828-RPM (USDC Colorado, 2009). *Exhibit F*.

For the reasons stated in this letter, N1MA! opposes any continued use or expansion of the PCMS. The INRMP PEA and its predecessors upon which it is directly based are flawed and violate the intent and plain language of NEPA in a myriad of respects. Therefore, the Army must withdraw the INRMP PEA and Finding of No Significant Impact and immediately cease any training and/or any other activities at the PCMS.

The INRMP PEA should be withdrawn. At the most basic level, it has the same flaw as all of its predecessors in that it fails to fulfill its basic purpose under NEPA – which is to provide objective information and analysis to assist decision makers and to inform the public about the potential environmental consequences of this proposed action. Instead, it provides a bureaucratic veneer that glosses over well-established environmental facts while segmenting its proposed actions into a a pattern of "death by a thousand cuts" inflicted on this nation's most Southern Great Plains, the last intact shortgrass prairie. Further, the INRMP PEA, at least as far as it applies to PCMS, should be withdrawn because it fails to meet the basic requirements of the National Environmental Policy Act. It also fails to heed the mandates of Congress as expressed in the 2007 funding ban, which has been renewed annually since that date. It fails to make sense from a policy standpoint and it would both sanction and inflict massive and irreversible damage on America's last major intact grassland, a fragile ecosystem that elsewhere has not yet recovered from the devastation wrought by ill- considered federal government policies that led to plowing of these fragile grasslands in the 1920s in the bone-headed public campaign that "rain follows the plow." In fact, what followed the plow when the inevitable drought cycle reasserted itself was this nation's most catastrophic environmental collapse, the Dust Bowl of the 1930s.

In addition, as noted in the introduction, believe that the combination of Fort Carson and the Piñon Canyon Manuever Site in the same document is confusing and, given their separation and habitat differences, inappropriate. To comply with the spirit and potentially the letter of NEPA, there should be separate INRMPS for the two sites, becausethe two locations are separate DOD installations. PCMS is more than 100,000 acres larger than Fort Carson and involves many important landforms and habitat types, the INRMP analyzing the PCMS should have been designed to specifically, responsibly, and thoroughly address the environmental impacts and concerns particular to the PCMS.

Now, the Army, in defiance of both scientific studies and common sense, is effectively asking the public to believe that "rain will follow the tank!" and magically reseed and renew these tortured lands. Alas, the best science on this subject shows that the notion that invasive species can somehow revive devastated grasslands that required thousands of years of natural processes to reach their original productive state is a discredited policy as misguided and mischievous as the original "rain follows the plow" folly.

For the reasons stated in this letter, N1MA! opposes any continued use or expansion of the PCMS. The INRMP PEA is flawed and violate the intent and plain language of NEPA in a myriad of respects. Therefore, the Army must withdraw the INRMP PEA and immediately cease any training and/or any other activities at the PCMS. Commenters demand that all construction, military and related activity at PCMS immediately cease and the PCMS be shuttered from further destructive use.

Thank you for the opportunity to submit these comments, and please don't hesitate to contact me directly if you have any questions about my clients' positions.



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Responses for N1MA

1. Commenter refers in several places to military training operations, and to expansion of the PCMS.

The purpose of the INRMP is to address management of the natural resources on Fort Carson and the PCMS. In the course of managing natural resources, staff members do consider military training, and coordinate with the training community and with training managers. Since training is the goal of the landowner, that goal affects, in many ways, how the natural resources are managed. For example, although we like buffalograss under certain conditions, western wheatgrass is much more resilient under military training loads. Much of our education and outreach effort is directed toward the training community. Also, our staff members consider military training operations and procedures in order to more effectively support the training mission. But the purpose of the INRMP is to focus primarily on the management aspects of natural resources on Fort Carson and the PCMS. Consideration of expansion does not fall within the scope of the INRMP and therefore was neither considered nor discussed.

2. Training Impacts- Global comment

Fort Carson takes very seriously its responsibility to maintain and sustain training lands at Fort Carson and Piñon Canyon Maneuver Site (PCMS). Natural resource management at Fort Carson and PCMS takes place within the context of supporting Fort Carson's training mission, which includes working hand-in-hand with the training community to identify and mitigate issues of potential concern as well as

addressing the impacts of maneuver training through the Integrated Training Area Management (ITAM) Program. Fort Carson has in place protocols and procedures for the coordination of natural resource protection and mitigation to address training impacts. Fort Carson coordinates its Best Management Practices (BMPs) implemented by the ITAM Program and mitigation practices with State Water Resource offices responsible for both Fort Carson and Pinon Canyon Maneuver Site. Their recommendations and guidelines have been a valuable tool in managing our training lands in compliance with state laws and regulations.

3. Commenter suggests that a Notice of Availability for the EA should have been published in the federal register, because the action is "unprecedented", as that term is used in 32 C.F.R. Part 651.25 and because the use and development of the 236,000-acre PCMS is self evidently "of national concern" within the meaning of 32 C.F.R. Part 651.25.

The proposed action does not require, include, or involve any expansion of land holdings at the PCMS. It does not include any expanded use of the PCMS. Therefore, the scope and scale of military activity at PCMS is not at issue. This action is not unprecedented or of national concern, and federal register publication was not necessary and was not required by 32 C.F.R. Part 651.

The introduction to commenter's letter raises a series of topics that are expanded and more comprehensively developed in other sections of commenter's document.

The Army's response to those components is presented in other parts of this present section.

The conclusion to commenter's letter indicates that the commenter opposes "any continued use or expansion of PCMS" and calls for the Army to withdraw the current proposal and "immediately cease any training and/or other activities at the PCMS", and that "all construction, military and related activity at PCMS immediately cease and the PCMS be shuttered from further destructive use."

Again, the proposed action does not require, include or involve any expansion of land or expanded use of PCMS. Therefore, the scope and scale of military activity at PCMS is not at issue in this proposal.

4. Comment period

Commenter is correct in identifying the discrepancy that exists between the 45-day public comment period that was advertised in the four local newspapers and the 30-day comment period that was stated in the Programmatic Environmental Assessment (PEA). As per the advertised announcement, the public comment period was forty-five days. The PEA has been edited to reflect that a 45-day comment period was undertaken rather than a 30-day comment period.

5. PCMS as a separate installation

PCMS is administered by the Fort Carson garrison and command staff. The Army manages both locations with a unified environmental staff, and has chosen to address both locations in a single INRMP, as has been our practice in coordination with the USFWS and CPW for many years. We and our partners find this arrangement the most effective for coordinating our plans and our efforts to manage the natural resources. Ecologically, PCMS closely reflects the shortgrass prairie ecosystem that extends north into southern Fort Carson. We explicitly consider, assess, and account for the distinctions and unique qualities of the natural resources at the PCMS. Given the administrative realities and ecological similarity it is a cost effective use of taxpayer dollars to complete a single Integrated Natural Resource Management Plan (INRMP) that encompasses Fort Carson and PCMS rather than complete two separate INRMPs. Also, the PCMS is integral to training the units stationed at Fort Carson. Given the number and types of

units, the current doctrinal as well as real world mission training requirements, along with the fact that much of Fort Carson's maneuver land is taken up by live fire ranges, it is essential to have the PCMS available in order to help keep units trained to standard.

6. Commenter asserts multiple times that Army has "repeatedly failed to consider the best available science" in regard to management of natural resources on the PCMS.

The Army does use the best available science in both the development and implementation of the INRMP. Best science may be recent or old. Best, for us, is science that has been tried and proven on either Fort Carson or the PCMS. Our restoration efforts are adequate for our goal and purpose, which is to train military units. Military training was the purpose specified by Congress when they appropriated the funds to purchase the PCMS. Commenter refers to publications by Milchunas et al. Army helped to fund that work, and reviewed the findings. In 25-plus years of rehabilitation experience, we have found that, given sufficient funding to reseed disturbed areas, and sufficient precipitation at favorable times, vegetative cover adequate for the purpose of military training can be achieved.

7 and 8. Commenter asserts that the Army has violated the Sikes Act by not preparing a separate INRMP for the PCMS, because the commenter asserts that Fort Carson and the PCMS are "two distinct ecologies".

The Sikes Act recognizes the ecological importance and value of military lands. It directs the DoD to ensure that the ecological integrity of these lands is protected and enhanced while allowing the military to continue to meet the needs of its mission and to adequately train the defenders of our freedom.

We disagree with the statement that including Fort Carson and the PCMS in one INRMP is "contrary to the purpose of both NEPA and the Sikes Act". The INRMP does address the fact that Fort Carson and the Piñon Canyon Maneuver Site do indeed fall within the same ecoregion (INRMP: 2.b.(3) Ecoregion). The Shortgrass Prairie Partnership, comprised of a diverse group of organizations and landowners, including Fort Carson, shows the central shortgrass prairie ecoregion encompassing portions of 7 states. Fort Carson and the PCMS are both included as part of this ecoregion.

Ecologically, PCMS closely reflects the shortgrass prairie ecosystem that extends north into southern Fort Carson. Given the administrative realities and ecological similarity it is a cost effective use of taxpayer dollars to complete a single Integrated Natural Resource Management Plan (INRMP) that encompasses Fort Carson and PCMS rather than complete two separate INRMPs.

9. Commenter asserts multiple times that it is not possible to successfully recover a native shortgrass landscape, specifically in the form of a blue grama/buffalograss prairie.

The Army disagrees. First, blue grama and buffalograss are not the only native species that can be found in a shortgrass prairie. Several other species are native, such as western wheatgrass, black grama, sideoats grama, galleta, alkali sacaton, sand dropseed, little bluestem, ring muhly, etc. Second, there is no known legal or ecological requirement for the Army to use blue grama and buffalo grass exclusively. Third, blue grama is somewhat resilient under military training, but not as resilient as some other species, such as western wheatgrass, which can reproduce both from seeds and from rhizomes. Buffalograss is not very successful under military training, and is very difficult to establish. The seed mix used by the Army at the PCMS is all native species except alfalfa, which makes up approximately 10% by weight of the mix. The other 90% of the mix is made up of western wheatgrass, sideoats grama, alkali sacaton, sand dropseed, and blue grama. Alfalfa was recommended by the Soil Conservation Service (now Natural Resource Conservation Service) many years ago when the Army began reseeding at PCMS. Alfalfa is

deep-rooted, fixes nitrogen, is not aggressive, and is relished by wildlife. Again, given adequate funding, time, and precipitation, the Army has been successful in revegetating disturbed areas to a condition suitable for the Army's purpose of military training.

A minor revision was made to the text of Section 2.b.(9), page 31, to include a reference to Shaw's 1989 work describing the vegetative communities of the PCMS.

10. Fugitive dust/ soils

The issue of fugitive dust at PCMS is addressed in multiple areas within the comments. To the extent that fugitive dust is a natural resource related issue, it is through mitigation that takes place following training exercises at PCMS. Fort Carson has a robust training impacts mitigation strategy that is employed following the conclusion of maneuver training at PCMS. Through the ITAM program, areas where maneuver damage has occurred are identified, graded, reseeded, and monitored to ensure that vegetative cover is reestablished, thereby reducing the risk that soils will succumb to wind erosion. Additionally, Fort Carson has in place a Fugitive Dust Plan (2012) in order to proactively address the issue.

11. Commenter expressed a concern that monitoring data for species such as the Burrowing Owl are not presented, along with analyses, in the INRMP.

Populations of Burrowing Owls fluctuate from year to year, for various reasons. At present, the population of Burrowing Owls at the PCMS seems to be holding steady. The Army monitors a number of species. To include the raw data and subsequent analyses in the INRMP would add substantially to the size of the INRMP. Such information is more properly presented in scientific publications. The main purpose of the INRMP is to describe how we manage the resources.

Commenter expressed a concern that the fish populations at the PCMS are not monitored.

The PCMS has no water bodies large enough or reliable enough to support sustained public fishing. Training has a negligible effect, at most, on the native fish at the PCMS. For those reasons, it is not a good use of tax dollars to continuously monitor those fish populations. A minor change has been made to the text of Section 4.d, page 56.

12. Commenter expressed a concern that prescribed fire in shortgrass prairie has no ecological value.

Section 4.o Wildland Fire Management clearly states that the primary purpose of conducting prescribed burns at Fort Carson and the PCMS is to reduce fuel loads in key areas to assist in minimizing the potential of military training starting large, damaging wildland fires. It is also explained that these training wildfires increase the frequency of fire beyond historic regimes on the prairie and are often damaging to shortgrass. Using prescribed burns to reduce fuel continuity adjacent to these training areas minimizes these damaging fires.

A small percentage of prescribed burns are designed to improve conditions in some vegetative communities that are a part of the shortgrass prairie. These ecological burns include site specific improvements of some vegetative communities when burned under specific conditions, and burning buffers around key natural resource sites and/or man-made facilities to minimize the risk of a wildland fire damaging it.

The fire program is also building and improving on a prescribed fire monitoring program that will assist with ensuring that prescribed fire is used wisely and effectively.

13. Commenter asserts that poisoning prairie dogs will, in turn, kill other species that rely on prairie dogs for food.

The outcome is a possible, but not necessary or likely, consequence of poisoning prairie dogs. See Section 5.f of the INRMP, where it is stated that Fort Carson will initiate informal consultation with the USFWS to resolve the issue.

14. Army Compatible Use Buffer (ACUB) at PCMS

There are currently no agreements in place that would allow Fort Carson to work with third-parties to develop and establish a buffer around PCMS under the ACUB program.

15. Commenter asserts that previous damage from training "had severe and long-lasting environmental consequences".

The most severe training impacts the Army is aware of at the PCMS were the long, deep trenches dug to prepare soldiers for deployment to the First Gulf War in about 1991. There were at least two such trenches, each of which measured approximately 5 or 6 feet deep, 8 to 10 feet wide, and roughly a mile long. After the training was over, the trenches were backfilled, with no attention paid to previous soil horizons or layers. The areas were then drill seeded with the standard PCMS rangeland grass seed mix. Within 2 or 3 years, native grasses were established on the sites. Now it is difficult to see the difference between those areas and surrounding prairie which was less disturbed. All other training impacts from rotations that took place between 1985 and 2002 have been repaired. The repair was accomplished with funding and other resources (personnel, equipment) that were available at the time.

16. Commenter asserts that training at the PCMS "results in irreversible disturbance of soils".

Extensive damage such as trenching and backfilling does mix soil horizons or layers. However, that does not mean that those areas cannot be revegetated. Various species of native grasses and forbs are adapted to the "pioneer" role of initial revegetation. Once those species establish, they can modify the microclimate sufficiently, in many cases, to allow other perennial native species to establish. It also is well to keep in mind that such major disturbance occurs on only a very small number of acres out of the entire 236,000 acre Maneuver Site. In the vast majority of cases of maneuver damage, the soils are not significantly disturbed, and will readily support native perennials given a seed source and adequate precipitation.

17. Commenter states that "The PCMS studies further identified the issue of invasive, undesirable species subsequently dominating areas impacted during training exercises as a critical ecological issue."

Fort Carson has an invasive species management program that addresses species included in the State of Colorado noxious weed list. (See the INRMP, of which this INRMP PEA is a part, Section 4.h. Invasive Species Management, and Appendix 2.) Disturbed areas requiring the application of seed are treated using certified noxious-weed-free seed.

18. Commenter states that "Pursuant to Section 303(d) of the Clean Water Act, the State of Colorado has placed the section of the Purgatoire River from I-25 to its confluence with the Arkansas River on the State's list of impaired waters for selenium and sediment."

Although the Purgatory River does not flow through the PCMS, the Army is interested because much of the PCMS drains into said river. As of 28 May 2013, the website of the Environmental Protection Agency (EPA) states that the section of the Purgatory River in question is indeed impaired for selenium,

which occurs naturally in southeastern Colorado, but no TMDL (Total Maximum Daily Load) has been established for selenium. The website does not say the river is impaired for sediment. However, the Army has invested considerable sums to build erosion control structures to catch sediment that might contain selenium, so it will not reach the river. The Army has also invested considerable sums in reseeding the PCMS, to re-establish vegetation where needed, which helps to minimize transport of sediment that might contain selenium. Also, the Army has engaged the U.S. Geological Survey, Pueblo, Colorado, to monitor streamflows, suspended sediment, and other parameters since 1983. In 2008 they compiled Scientific Investigations Report 2008-5111, entitled *Temporal and Spatial Variations in Precipitation, Streamflow, Suspended-sediment Loads and Yields, and Land Condition Trend Analysis at the U.S. Army Pinon Canyon Maneuver Site, Las Animas County, Colorado, 1983 through 2007.* We quote from the abstract: "The tributary watersheds at PCMS are 13.9 percent of the drainage area of the Purgatoire Rock Crossing station [near the mouth of Minnie Canyon]. The stormflow suspended-sediment load contribution of the tributaries to stormflow loads at the Purgatoire Rock Crossing station was about 3.5 percent during the 2000 through 2006 period, indicating that the suspended-sediment load contribution from the PCMS generally was small."

19. Commenter states "Discharge of dredged or fill material into waters of the United States, including wetlands, are regulated under Section 505 of the Clean Water Act(CWA)."

Section 505 CWA refers to "Citizen Suits". Obviously they are referring to Section 404 based on the context of this and the next sentence.

Commenter asserts "The INRMP PEA fails to describe how the proposed action or the alternatives would address the wetland protection goals in the EO 11990."

See Section 4.b. of the INRMP, of which the INRMP PEA is a part, regarding Wetlands Management. Projects that may impact wetlands are to be reviewed using the NEPA process to avoid/minimize impacts to wetlands. This includes the review by the Fort Carson Section 404 specialist who coordinates potential impacts with the USACE for their determination. The USACE, not Fort Carson, determines if a permit is required and, if so, identifies if it falls under an individual permit or Nationwide permit.

Page 124 of the draft PEA under the "wetland" heading addresses EO 11990 as it applies to the No Action Alternative. Under the same heading on page 125 of the draft PEA, wetlands and the role of EO 11990 are addressed with regard to the Preferred Alternative.

20. Commenter expresses concern that Botta's pocket gopher, a Species of Concern, and the Mexican Spotted Owl, a federal Threatened Species, have the potential to occur on the PCMS.

The subspecies *rubidus* of Botta's pocket gopher is the Species of Concern, but it is not the subspecies that occurs on the PCMS. A three year monitoring program for the Mexican Spotted Owl was conducted in accordance with criteria set forth by the USFWS, and no birds or suitable habitat were found on the PCMS.

Commenter asserts that the Leopard frog is a federal petitioned species.

The Northern Leopard frog was formerly a petitioned species. However, the USFWS has determined that listing the Northern Leopard frog is not warranted at this time. See the Federal Register, Volume 76, No. 193, Wednesday, October 5, 2011. The Leopard frog that occurs on the PCMS is the Plains Leopard frog; it is not a petitioned species. A minor change was made to the text in Section 4.a, page 44, in regard to the Northern Leopard frog. A minor change was made to the text in Section 4.d, page 56, to describe Fort Carson's policy on bullfrogs.

21. Commenter states "Migratory birds are protected by the Migratory Bird Treaty Act but a credible inventory of those species using PCMS is apparently not available."

Please see Appendix 4 of the INRMP, which contains lists of species.

22. Commenter asserts that Bald and Golden Eagle nests and habitat exist at the PCMS.

Golden Eagles do indeed nest at times on the PCMS. When a nest is occupied, FC Regulation 200-6 requires that a ½ mile buffer be maintained until the birds are off the nest. There are no Bald Eagle nests on the PCMS.

23. Commenter asserts that the Army fails to provide monitoring data on rare plant species.

Please see Section 4.a of the INRMP, which in part discusses rare plants on Fort Carson and the PCMS. The Army has not conducted surveys or monitoring of rare plants in recent years due to lack of manpower and funding for same. To include the raw data and subsequent analyses in the INRMP would add substantially to the size of the INRMP. Such information is more properly presented in scientific publications. The main purpose of the INRMP is to describe how we manage the resources.

24. Commenter asserts that the proposed action is "segmented" from larger scale projects.

However, this current NEPA analysis is independently triggered and required by law. The Sikes Act requires that the Integrated Natural Resources Management Plan "must be reviewed as to operation and effect by the parties thereto on a regular basis, but not less often than every 5 years". See Title 5 of the U.S. Code, Section 670a.

25. Sikes Act

The Sikes Act does not require or mandate that the Army use USFWS personnel to augment its staff. The Army's coordination with the USFWS (as well as CPW) is now primarily implemented through the cooperative management efforts detailed in the plan under review here.

26. Cultural resources global comment

Cultural resources are a separate and distinct set of resources from natural resources; therefore, it is outside of the scope of the INRMP to establish procedures for managing cultural resources and as such was screened from further evaluation within the PEA. Nevertheless, as indicated in the PEA, individual natural resource management projects will undergo additional NEPA review, which will allow Cultural Program personnel the opportunity to comment on a project and identify any issues or concerns that need to be addressed prior to undertaking a project.

SOUTHERN COLORADO ENVIRONMENTAL COUNCIL
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"Protecting our land, water, wildlife and people"

May 15,2013

COMMENT TO THE PROGRAMMATIC ENVIRONMENTAL ASSESSMENT FOR THE IMPLEMENTATION OF THE 2013-2017 FORT CARSON AND PINON CANYON MANEUVER SITE INTREGATED NATURAL RESOURCE MANAGEMENT PLAN SPECIFICALLY TO THE NATURAL RESOURCE PLAN FOR PINON CANYON MANEUVER SITE





The most fundamental comment to the environmental assessment of the INRMP is for the plan to be fully implemented and embraced by the totality of Fort Carson/PCMS personnel, both military and civilian. To date, what the Southern Colorado Environmental Council is becoming more and more concerned that INRMP, ICRMP, EA's, EIS, Fort Carson Regulations and Army Regulations, Sikes Act, National Environmental Act Process, all are good in theory regarding training and adhering to environmental issues and compliances. But in practice, these great tools do not always get utilized or adhered too. If they were, there would not be adverse negative impacts or the risk of adverse negative impacts to the soil,

water, wildlife, vegetation, or cultural resources on Pinon Canyon Maneuver Site.



Upon reviewing the draft INRMP, we also looked at other documents and regulations that are interwoven with this plan such as Fort Carson 350 regulations, sections Army Regulations 200, which currently have been updated; Sikes Act; NEPA process and the expired INRMP; EIS on stationing of the Combat Aviation Unit; our findings are that most of the time regulations and proactive measures are completely ignored thus creating an atmosphere of always having to do corrective assessments and corrective mitigation as opposed to good sound preventive and proactive assessments that would insure minimal to no damage to the natural and cultural resources of Pinon Canyon Maneuver Site. **If there is one obvious insight to all this, that even after 30 years of stewardship efforts at Pinon Canyon Maneuver, it is still a hit and miss stewardship effort. As shown by the photos in this report.**



Even with all the Federal, State and Local stakeholders input, it all seems to fall on deaf ears. Every time the Leadership at Fort Carson changes and structural changes of oversight by different departments, the process and flow of environmental compliance and sustainability of eco-system changes courses as to the balance between training and environmental arm of Fort Carson; example changing structure from DECAM to DPW. The disappointing part of this the losers in these events are the land, water, wildlife and the American citizen. All military land is public land and belongs to the citizens of this country and all personnel, military regardless of ranking, and civilian are called to good stewardship. Obviously this is not happening. It is apparent that the training arm does not get the importance of INRMP, Sikes Act and Fort Carson Regulations 350. Yes, our military needs to train to meet the needs of their profession, but they need to remember they are training in the homeland and all these regulations and legislation are tools that allow them to train exceptionally well and at the same time protect the environment so that the training land will be there for a very long time and in useable condition.

The intent of the INRMP is to give the tool to Fort Carson to attain sustainable stewardship of the maneuver site without adverse negative impact. Co-existence with the native wildlife and vegetation is workable on the maneuver site. This is also a learning tool for the training element. In foreign countries our troops don't tear up growing fields and rice patties unnecessarily, as they are important to the local population of that region. No different here. Maintaining a healthy grassland and wildlife habitat on PCMS should always be a top priority in the training manual. If not, then we would say a lot of tax payer money is being wasted on NEPA, compliance of Sikes Act, Clean Air and Water regulations ,DPW,ITAM, both the Department of the Army's and Department of Defense's Installation and Environment Offices; and makes the zero sustainability programs a joke.

JUST AS IN VERBAL AND WRITTEN RESPONSES TO EISs AND EAs THAT THE SOUTHERN COLORADO ENVIRONMENTAL COUNCIL HAS DONE PREVIOUSLY, WE NEED TO ONCE AGAIN REMIND FORT CARSON THAT THERE ALWAYS HAS TO BE A COMPLETE BALANCE OF TRAINING ARM AND THE ENVIRONMENTAL ARM IF THERE IS EVER GOING TO BE A CHANCE TO SUSTAIN THE ECO-SYSTEM OF PINON CANYON MANEUVER SITE SO THAT THE MANEUVER SITE WILL REMAIN HEALTHY FOR DECADES TO COME OTHERWISE ALL THE INRMPs, REGULATIONS, ENVIRONMENTAL IMPACT STUDIES AND ENVIRONMENTAL ASSESSMENTS ARE ALL IN VAIN AND THERE WILL BE MAJOR ADVERSE SIGNIFICANT IMPACTS TO THE SOIL,WATER, VEGETATION, WILDLIFE, AIR AT THE MANEUVER SITE.

Specific section issues and concerns that the SCEC do have in regards to the draft INRMP are as follows:

3.0 ENVIRONMENTAL CONSEQUENCES



3.2.1 Land Use- In relationship to the land use and training restrictions on page 100, lines 25-31 of the Draft INRMP it clearing states "Off road travel leaves signs for the enemy to track units or determine unit strength. Removed vegetation and other dug areas are indications of unit strength to enemy intelligence. This type of damage can also be defined as "tactical signature". Reducing tactical signature can equate to reducing maneuver damage in the training areas, a concept taught at Fort Carson during Sustainable range Awareness Briefs. Thus, it is important to fit environmental restrictions into tactically-realistic training scenarios." Obviously, during the maneuvers over the years and even the most recent one held at PCMS in February-March 2013 this tactical signature concept was not followed or there was no briefing on reducing tactical signature nor Fort Carson Regulations 350 which offers protection of the off road land at the maneuver site by staying on main roads when weather conditions are not compatible with heavy mechanized unit training. It would be far better for the budget and the environment to be proactive rather than in a corrective posture which then eliminates not having sufficient manpower or monies regarding mitigation and good reclamation after training at PCMS.

We would also ask under this section that there would be listed limited use in areas of the maneuver site when the herds of our large mammals are gathering for the rutting season and then again during their calving season if it coincides with training maneuvers. During the nesting season of raptors that nest in the grasses there should be limited use as to protect the nests and the hatching of their offspring, most especially restricted from combat aviation training below l, 000 feet. Our wildlife are just as important to us as other areas in our state that Fort Carson has agreed to not fly lower altitudes as to not disturb their area's activities. Also that the areas of our resident eagles nest and their territory is off limits to all training activity.

3.2.5 Cultural Resources- We disagree with this consequence as the preservation of vegetation on historical ranches and removal of invasive species of vegetation do fall under the natural resource management program.







We do have great concern about the preservation of the historical ranches that are eligible for the National Historical Registration on the maneuver site. On our tour we noticed that there is no upkeep of these ranches other than Brown Sheep Camp. It is a disappointment to see the deterioration that is going on with these ranches. There needs to be consideration of avenues to preserve these ranches. At our last working group meeting we did ask Fort Carson to consider rendering the historical ranches and the immediate area around the ranch houses that include the barns and outbuildings that are eligible for the National Historical Register to another Federal agency like United States Forest Service to be added to the Comanche Grassland just like the Department of the Army did sign over the dinosaur tracks and the Picket wire Canyon were. Consideration of our local Historical Society or the State Historical Society could also be a suggestion.

We also would like to see trees replanted that were taken out by the last wildfire at Cowboys Springs to offer natural protection for the carvings on the rocks



If you can't plant trees, we ask for mitigation from the wildfires that some type of artificial protection be build that would prolong the life of these etchings carved into the rocks that are part of Las Animas County Ranching community that are of both culturally and historically important to our region. Both the Historical Ranches and Cowboy Springs are areas that are already restricted from the training area and marked with the Siber stakes so we do not see our request interfering with the training activities.





3.2.6 Hazardous Substances- On this one there should be mention of dealing with spills of hazardous substances on the soil or in the water. Also methods of immediate removal of hazardous spilled substances to prevent exposure that would be fatal to wildlife.

3.3.1 Air Quality- We do have some great concerns about the air quality with the current exceptional level of drought that we are presently in and projection of the continuance of the exceptional level of drought in combination of the adverse negative impact to the land from the recent maneuver training there is going to be a higher level of fugitive dust on the maneuver site and will affect the air quality in the area, not to forget the fugitive dust that will occur with the combat aviation training brigade.

3.3.2 Soils- There needs to be a very proactive plan to deal with less maneuver training damage to the soils during inclement weather conditions. There really needs to be land conservation 101 classes for all training arm leadership so that they fully understand the consequences of unnecessary damage to the soil.

3.3.3 Water Resources-In this section there needs to be mentioned the necessity of maintaining the water wells in all areas of the maneuver site for the wildlife. If they are not maintained it will be interpreted at a quiet "taking" of the wildlife that do reside on PCMS. Without good water resources, we will lose a lot of our wildlife that have cohabitated in the region first with the Native Americans, then the ranching community and now the military. We are aware that all species are not on the Federal Endangered Species list. State endangered or of concern or your SAR list. The Department of the Army since back in the 1980's always agreed to coexist with our wildlife and maintain their habitat. The wildlife is necessary to sustain a healthy eco-system on the maneuver site.



3.3.4 Biological Resources- The native like-n-kind grasses are always used and that the protection of the native diversity of the vegetation be always a top priority and that the invasive species be kept under control. An ongoing invasive species program needs to be always a priority to keep the native vegetation from being overtaken by cheat grass and non-native species. Greater protection of the amazing variety of native plants that do grow on the maneuver site needs to be a priority at PCMS.

In regards to the wildlife we are in agreement with the artificial nesting platforms for the raptor and avian population that are being created at PCMS. This enables the avian population including the song birds to continue to coexist on the maneuver site. The prohorn, deer, elk, big horn sheep populations have decreased on the maneuver site in recent years due to lack of water supply. We are optimistic that with the continued funding and increase in the number of working water wells, watering stations that the populations will increase. Also their rutting seasons and calving seasons are honored always and the necessary restrictions of no training in these areas if a maneuver is taking place.

Regarding conservation methods that relate to the wildlife on the maneuver site we would like to have the inclusion that all interior areas that are fenced off are done with smooth wire to prevent unnecessary injury to the wildlife and consideration of using on the exterior fences one barb wire on top and smooth on the other.

3.4Cumulative Impacts and 4.0 Conclusion-To reinforce our main findings that unless there is a complete even balance between the training arm and the environmental arm in the management of the maneuver site there will be negative impacts to the four resource areas-air quality, biological resources, soils, and water.

Concern-there is not a lot mentioned about the combat aviation training at PCMS and its affects and necessary protections set worth regarding same. There needs to be specific impacts addressed and what necessary restriction of certain areas by the use of combat aviation.

In conclusion, Southern Colorado Environmental Council reinforces the need that there has to be complete balance between the training arm and the environmental arm of Fort Carson to ensure sustainability of Pinon Canyon Maneuver Site. Without the balance, there will not be longevity of the eco-system and it will become a barren land that will be useless and nonproductive for hundreds of years before nature could restore herself.

Without the balance of the two arms, there will be significant negative impact to the natural resources- land, water, wildlife, vegetation, and cultural resources on Pinon Canyon Maneuver Site.



OUR GOAL IS TO PROTECT OUR LAND, WATER, WILDLIFE AND PEOPLE BUT WHEN FORT CARSON FAILS AT EVERY TURN TO FOLLOW YOUR OWN RULES, REGULATIONS, MANAGEMENT PLANS, SIKES ACT AND THE NEPA PROCESS; THEN WHAT OPTION DO YOU LEAVE US?

On behalf of the membership of the Southern Colorado Environmental Council

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Responses for SCEC

1. Commenter expresses concern about whether or how fully the INRMP will be implemented.

We agree. Implementation of the INRMP depends mainly on levels of funding and staffing, both of which are very constrained at present. Fort Carson will continue to manage natural resources to support the training mission on Fort Carson and the PCMS, to the greatest extent possible under current constraints.

2. Commenter asserts that if sufficient preventive and proactive measures were taken, there would be minimal or no damage to the natural resources of the PCMS.

Preventive and proactive measures are taken, in the form of educational briefings and training classes given to troops prior to the beginning of maneuver training exercises at the PCMS. The measures do help to

minimize damage. However, it is simply not possible to train an entire mechanized infantry brigade combat team, let alone a division, to standard, without incurring some level of maneuver damage. At times, there is some damage, but the vast majority of the damage is what we consider to be fair wear and tear. The Army will continue to request funding sufficient to repair maneuver damage, in order to sustain the PCMS in usable condition for the military training mission.

3. Commenter asserts that there were no briefings on reducing tactical signature.

Unit Maneuver Damage Control Officers are required to attend a one-hour class once per year. Those classes include the concept of tactical signature minimization. Tactical signatures have indeed been reduced over the years, but there are limits to how much reduction can be done given the size and weight of the vehicles.

4. Pg 7 Commenter feels that the preservation of vegetation and the removal of invasive species on historical ranches should "fall under the natural resource management program"

The Natural Resources Management program is involved in the vegetation and invasive species management on historical ranches. Any activities to manipulate vegetation on historical ranches, to include invasive species, must go through the NEPA process and cultural resources management for approval. See the INRMP, of which this INRMP PEA is a part, Section 4.h. Invasive Species Management and Appendix 2.

5. Hazardous substances

Any spills resulting in the release of a potentially hazardous substance will be addressed and treated in accordance with Fort Carson's Spill Prevention, Control, and Countermeasure Plan.

6. Fugitive dust/ soils

The issue of fugitive dust at PCMS is addressed in multiple areas within the comments. To the extent that fugitive dust is a natural resource related issue, it is through mitigation that takes place following training exercises at PCMS. Fort Carson has a robust training impacts mitigation strategy that is employed following the conclusion of maneuver training at PCMS. Through the ITAM program, areas where maneuver damage has occurred are identified, graded, reseeded, and monitored to ensure that vegetative cover is reestablished, thereby reducing the risk that soils will succumb to wind erosion. Additionally, Fort Carson has in place a Fugitive Dust Plan (2012) in order to proactively address the issue.

7. Commenter expresses concern that offroad vehicular maneuver during wet weather is detrimental to soils.

The training for Maneuver Damage Control Officers include recommendations about maneuvering on wet soils. The decision whether to train or not train off roads when soils are wet is made by the senior commander on the ground, based on his assessment of the need to train versus conditions. Wars do not stop when it starts to rain or when snow starts to melt. Soldiers and leaders need to have some experience in order to estimate when it is worthwhile to press on and when it is best to stop or modify mechanized off road maneuver. By continuing to train off road under certain conditions when soils are wet, the result may look bad at first, but those areas can be and will be rehabilitated, subject to availability of resources. And we may have contributed to saving American lives on the battlefields of the future.

8. Commenter asserts that if the Army does not maintain the water wells, it will be interpreted as a "taking" of wildlife.

Maintenance of wells requires considerable sums of tax dollars. The Army does maintain as many wells as we can with the funds available and approved for that purpose. We think it would be unlikely that any unlawful 'taking' would occur. Any determinations of taking would be made as follows: if the animal is a game species, the determination would be made by the CPW; if the animal is a threatened or endangered species or a migratory bird, the determination would be made by the USFWS.

Commenter requests that large areas be set aside for limited training use when elk, deer, and pronghorn are rutting and 'calving'.

Doing so would in effect preclude military training for most of the year on most of the PCMS. Our mission as natural resource managers of an Army post is to keep the maximum number of acres available for military training as is possible at any given time. The species mentioned are mobile, and have been observed to move out of the way of training exercises, then move right back in after the exercises are over.

Commenter suggests that eagle nests should be off limits to all training activity.

Golden eagle nests, when actually occupied, are protected by a ½ mile buffer until the birds are off the nest, in accordance with FC Regulation 200-6. There are no Bald eagle nests on the PCMS.

9. Pg 15 " An ongoing invasive species program needs to be always a priority to keep the native vegetation from being overtaken by cheat grass and non-native species."

See the INRMP, of which this INRMP PEA is a part, Section 4.h. Invasive Species Management and Appendix 2.

Control of invasive species is important to the Army. We have an active program to control invasive species, and activities such as seeding disturbed areas and using certified noxious-weed-free seed mix, to help prevent the establishment or accidental introduction of invasive species. We've been successful in eradicating African rue on PCMS and continue to monitor the site each year.

10. Pg 15 "…we would like to have the inclusion that all interior areas that are fenced off are done with smooth wire…"

Replacing barbed wire with smooth will be addressed when it becomes necessary to replace fence. It would be fiscally irresponsible for us to replace all interior fence wire when it is not required.

11. Training Impacts- Global comment

Fort Carson takes very seriously its responsibility to maintain and sustain training lands at Fort Carson and Piñon Canyon Maneuver Site (PCMS). Natural resource management at Fort Carson and PCMS take place within the context of supporting Fort Carson's training mission, which includes working hand-in-hand with the training community to identify and mitigate issues of potential concern as well as addressing the impacts of maneuver training through the Integrated Training Area Management (ITAM) Program. Fort Carson has in place protocols and procedures for the coordination of natural resource protection and mitigation to address training impacts. Fort Carson coordinates its Best Management Practices (BMPs) implemented by the ITAM Program and mitigation practices with State Water Resource offices responsible for both Fort Carson and Pinon Canyon Maneuver Site. Their recommendations and guidelines have been a valuable tool in managing our training lands in compliance with state laws and regulations.

APPENDIX 4

Surveys

Fort CarsonVertebrates

[1]Federal

BCC (Birds of Conservation Concern) - Species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973.

FP (Federal Petitioned) - A formal request, with the support of adequate biological data, suggesting that a species, with the support of adequate biological data, be listed.

FC (Federal Candidate) - Plants and animals that have been studied and the Service has concluded that they should be proposed for addition to the Federal endangered and threatened species list.

FT (Federal Threatened) - The classification provided to an animal or plant likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

[2]State

[2]ST (State Threatened) - An animal or plant likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

SE (State Endangered) - Any species which is in danger of extinction throughout all or a significant portion of its range.

SC (Species of Special Concern - Declining or potentially declining species of greatest conservation need.

[3]Colorado Natural Heritage Program (CNHP)

WL (Watchlisted) - These species are common if you find the right habitat, but are still species of concern due to either habitat imperilment or a general decline in the species population.

PT (Partial Tracking) - These species are common if you find the right habitat, but healthy populations or high quality occurrences are of conservation concern.

FT (Fully Tracked) – These species are vulnerable and imperiled at any location.

[4] NON NATIVE SPECIES

Common Name	Scientific Name	**Federal[1]**	**State[2]**	**Other[3]**
Stoneroller	*Campostoma anomalum*			
Grass carp[4]	*Ctenopharyngodon idella*			
Brook stickleback	*Culaea inconstans*			
Carp[4]	*Cyprinus carpio*			

Common Name	Scientific Name	**Federal**[1]	**State**[2]	**Other**[3]
Creek chub	*Semotilus atromaculatus*			
Arkansas darter	*Etheostoma cragini*	FC	ST	T
Plains killifish	*Fundulus zebrinus*			
Mosquitofish[4]	*Gambusia affinis*			
Black bullhead	*Ameiurus (Ictalurus) melas*			
Channel catfish	*Ictalurus punctatus*			
Green sunfish	*Lepomis cyanellus*			
Bluegill[5]	*Lepomis macrochirus*			
Largemouth bass[4]	*Micropterus salmoides*			
Golden shiner	*Notemigonus crysoleucas*			
Southern redbelly dace	*Phoxinus erythrogaster*		SE	T
Fathead minnow	*Pimephales promelas*			
Black crappie[4]	*Pomoxis nigromaculatus*			
Longnose dace	*Rhinichthys cataractae*			
Snake River Cutthroat trout	*Salmo clarki*			
Rainbow trout[4]	*Salmo gairdneri*			
Brook trout[4]	*Salvelinus fontinalis*			
Tiger salamander	*Ambystoma tigrinum*			
Woodhouse's toad	*Bufo woodhousii*			
Striped chorus frog	*Pseudacris triseriate*			
Bullfrog[4]	*Rana catesbeiana*			
Northern leopard frog	*Rana pipiens*	FP	SC	T
Plains spadefoot	*Scaphiopus bombifrons*			
New Mexico spadefoot	*Scaphiopus multiplicatus*			
Snapping turtle	*Chelydra serpentina*			
Western box turtle	*Terrapene ornata ornata*			
Painted turtle	*Chrysemys picta*			PT
Six-lined racerunner	*Aspidoscelis sexlineatus*			
Triploid checkered whiptail	*Aspidoscelis neotesselatus*		SC	T
Many-lined skink	*Eumeces multivirgatus*			T
Lesser earless lizard	*Holbrookia maculata*			
Short-horned lizard	*Phrynosoma douglassi*			WL
Eastern fence lizard	*Sceloporus undulatus*			
Eastern yellowbelly racer	*Coluber constrictor*			
Western rattlesnake	*Crotalus viridis viridis*			
Western hognose snake	*Heterodon nasicus nasicus*			
Coachwhip	*Masticophis flagellum*			
Bullsnake	*Pituophis melanoleucus*			
W. terrestrial garter snake	*Thamnophis elegans vagrans*			
Plains garter snake	*Thamnophis radix*			
Common Loon	*Gavia immer*			
Pied-billed Grebe	*Podilymbus podiceps*			
Horned Grebe	*Podiceps auritus*			
Eared Grebe	*Podiceps nigricollis*			
Western Grebe	*Aechmophorus occidentalis*			
Clark's Grebe	*Aechmophorus clarkii*			

Common Name	Scientific Name	**Federal**[1]	**State**[2]	**Other**[3]
American White Pelican	*Pelecanus erythrorhynchos*			T
Double-crested Cormorant	*Phalacrocorax auritus*			
American Bittern	*Botaurus lentiginosus*	BCC		
Great Blue Heron	*Ardea herodias*			
Great Egret	*Casmerodius albus*			
Snowy Egret	*Egretta thula*			T
Green Heron	*Butorides virescens*			
Black-crowned Night-Heron	*Nycticorax nycticorax*			
White-faced Ibis	*Plegadis chihi*			T
Tundra Swan	*Cygnus columbianus*			
Greater White-fronted Goose	*Anser albifrons*			
Snow Goose	*Chen caerulescens*			
Canada Goose	*Branta canadensis*			
Cackling Goose	*Branta hutchinsii*			
Wood Duck	*Aix sponsa*			
Green-winged Teal	*Anas crecca*			
Mallard	*Anas platyrhynchos*			
Northern Pintail	*Anas acuta*			
Blue-winged Teal	*Anas discors*			
Cinnamon Teal	*Anas cyanoptera*			
Northern Shoveler	*Anas clypeata*			
Gadwall	*Anas strepera*			
American Wigeon	*Anas americana*			
Canvasback	*Aythya valisineria*			
Redhead	*Aythya americana*			
Ring-necked Duck	*Aythya collaris*			
Lesser Scaup	*Aythya affinis*			
Common Goldeneye	*Bucephala clangula*			
Bufflehead	*Bucephala albeola*			
Hooded Merganser	*Lophodytes cucullatus*			
Common Merganser	*Mergus merganser*			
Red-breasted Merganser	*Mergus serrator*			
Ruddy Duck	*Oxyura jamaicensis*			
Turkey Vulture	*Cathartes aura*			
Osprey	*Pandion haliaetus*			
Mississippi Kite	*Ictinia mississippiensis*			
Bald Eagle	*Haliaeetus leucocephalus*	BCC	SC	T
Northern Harrier	*Circus cyaneus*			
Sharp-shinned Hawk	*Accipiter striatus*			
Cooper's Hawk	*Accipiter cooperii*			
Northern Goshawk	*Accipiter gentilis*			WL
Broad-winged Hawk	*Buteo platypterus*			
Swainson's Hawk	*Buteo swainsoni*			
Western Red-tailed Hawk	*Buteo jamaicensis calurus*			
Harlan’s Red-tailed Hawk	*Buteo jamaicensis harlani*			
Ferruginous Hawk	*Buteo regalis*	BCC	SC	T
Rough-legged Hawk	*Buteo lagopus*			
Golden Eagle	*Aquila chrysaetos*	BCC	SC	
American Kestrel	*Falco sparverius*			

Common Name	Scientific Name	**Federal**[1]	**State**[2]	**Other**[3]
Merlin	*Falco columbarius*			
Peregrine Falcon	*Falco peregrinus*	BCC	SC	T
Prairie Falcon	*Falco mexicanus*	BCC		WL
Ring-necked Pheasant[4]	*Phasianus colchicus*			
Wild Turkey	*Meleagris gallopavo*			
Northern Bobwhite	*Colinus virginianus*			
Scaled Quail	*Callipepla squamata*			
Virginia Rail	*Rallus limicola*			
Sora	*Porzana carolina*			
American Coot	*Fulica americana*			
Sandhill Crane	*Grus canadensis*			
Black-bellied Plover	*Pluvialis squatarola*			
Semipalmated Plover	*Charadrius semipalmatus*			
Killdeer	*Charadrius vociferus*			
Mountain Plover	*Charadrius montanus*	BCC	SC	T
Black-necked Stilt	*Himantopus mexicanus*			T
American Avocet	*Recurvirostra americana*			
Greater Yellowlegs	*Tringa melanoleuca*			
Lesser Yellowlegs	*Tringa flavipes*			
Solitary Sandpiper	*Tringa solitaria*			
Willet	*Catoptrophorus semipalmatus*			T
Spotted Sandpiper	*Actitis macularia*			
Whimbrel	*Numenius phaeopus*			
Long-billed Curlew	*Numenius americanus*	BCC	SC	T
Sanderling	*Calidris alba*			
Semipalmated Sandpiper	*Calidris pusilla*			
Western Sandpiper	*Calidris mauri*			
Least Sandpiper	*Calidris minutilla*			
Baird's Sandpiper	*Calidris bairdii*			
Pectoral Sandpiper	*Calidris melanotos*			
Stilt Sandpiper	*Calidris himantopus*			
Long-billed Dowitcher	*Limnodromus scolopaceus*			
Common Snipe	*Gallinago gallinago*			
Wilson's Phalarope	*Phalaropus tricolor*			T
Red-necked Phalarope	*Phalaropus lobatus*			
Franklin's Gull	*Larus pipixcan*			
Bonaparte's Gull	*Larus philadelphia*			
Ring-billed Gull	*Larus delawarensis*			
California Gull	*Larus californicus*			
Herring Gull	*Larus argentatus*			
Forster's Tern	*Sterna forsteri*			T
Black Tern	*Chlidonias niger*			
Rock Pigeon	*Columba livia*			
Band-tailed Pigeon[4]	*Columba fasciata*			
Mourning Dove	*Zenaida macroura*			
Eurasian Collared-Dove[4]	*Streptopelia decaocto*			
White-winged Dove	*Zenaida asiatica*			
Yellow-billed Cuckoo	*Coccyzus americanus*			
Greater Roadrunner	*Geococcyx californianus*			

Common Name	Scientific Name	**Federal**[1]	**State**[2]	**Other**[3]
Barn Owl	*Tyto alba*			
Western Screech-Owl	*Otus kennicottii*			
Great Horned Owl	*Bubo virginianus*			
Northern Pygmy-Owl	*Glaucidium gnoma*			WL
Burrowing Owl	*Speotyto cunicularia*	BCC	ST	WL
Mexican Spotted Owl	*Strix occidentalis*	FT	ST	
Long-eared Owl	*Asio otus*			
Short-eared Owl	*Asio flammeus*			WL
Northern Saw-whet Owl	*Aegolius acadicus*			
Common Nighthawk	*Chordeiles minor*			
Common Poorwill	*Phalaenoptilus nuttallii*			
Black Swift	*Cypseloides niger*	BCC		T
Chimney Swift	*Chaetura pelagica*			
White-throated Swift	*Aeronautes saxatalis*			
Calliope Hummingbird	*Stellula calliope*			
Black-chinned Hummingbird	*Archilochus alexandri*			
Broad-tailed Hummingbird	*Selasphorus platycercus*			
Rufous Hummingbird	*Selasphorus rufus*			
Belted Kingfisher	*Ceryle alcyon*			
Red-headed Woodpecker	*Melanerpes erythrocephalus*			
Acorn Woodpecker	*Melanerpes formicivorus*			
Lewis' Woodpecker	*Melanerpes lewis*	BCC		T
Yellow-bellied Sapsucker	*Sphyrapicus varius*			
Red-naped Sapsucker	*Sphyrapicus nuchalis*			
Williamson's Sapsucker	*Sphyrapicus thyroideus*			
Ladder-backed Woodpecker	*Picoides scalaris*			
Downy Woodpecker	*Picoides pubescens*			
Hairy Woodpecker	*Picoides villosus*			
Northern Flicker	*Colaptes auratus*			
Yellow-shafted Flicker	*Colaptes auratus auratus*			
Red-shafted Flicker	*Colaptes auratus x cafer*			
Olive-sided Flycatcher	*Contopus borealis*			
Western Wood-Pewee	*Contopus sordidulus*			
Willow Flycatcher	*Empidonax traillii*	BCC		WL
Least Flycatcher	*Empidonax minimus*			
Hammond's Flycatcher	*Empidonax hammondii*			
Dusky Flycatcher	*Empidonax oberholseri*			
Gray Flycatcher	*Empidonax wrightii*			
Cordilleran Flycatcher	*Empidonax occidentalis*			
Eastern Phoebe	*Sayornis phoebe*			
Say's Phoebe	*Sayornis saya*			
Ash-throated Flycatcher	*Myiarchus cinerascens*			
Cassin's Kingbird	*Tyrannus vociferans*			
Western Kingbird	*Tyrannus verticalis*			
Eastern Kingbird	*Tyrannus tyrannus*			
Horned Lark	*Eremophila alpestris*			
Tree Swallow	*Tachycineta bicolor*			
Violet-green Swallow	*Tachycineta thalassina*			
N. Rough-winged Swallow	*Stelgidopteryx serripennis*			

Common Name	Scientific Name	**Federal**[1]	**State**[2]	**Other**[3]
Bank Swallow	*Riparia riparia*			
Cliff Swallow	*Hirundo pyrrhonota*			
Barn Swallow	*Hirundo rustica*			
Steller's Jay	*Cyanocitta stelleri*			
Blue Jay	*Cyanocitta cristata*			
Western Scrub Jay	*Aphelocoma coerulescens*			
Pinyon Jay	*Gymnorhinus cyanocephalus*	BCC		
Clark's Nutcracker	*Nucifraga columbiana*			
Black-billed Magpie	*Pica pica*			
American Crow	*Corvus brachyrhynchos*			
Chihuahuan Raven	*Corvus cryptoleucus*			
Common Raven	*Corvus corax*			
Black-capped Chickadee	*Parus atricapillus*			
Mountain Chickadee	*Parus gambeli*			
Juniper Titmouse	*Parus inornatus*	BCC		
Bushtit	*Psaltriparus minimus*			
Red-breasted Nuthatch	*Sitta canadensis*			
White-breasted Nuthatch	*Sitta carolinensis*			
Pygmy Nuthatch	*Sitta pygmaea*			
Brown Creeper	*Certhia americana*			
Rock Wren	*Salpinctes obsoletus*			
Canyon Wren	*Catherpes mexicanus*			
Bewick's Wren	*Thryomanes bewickii*			
House Wren	*Troglodytes aedon*			
Marsh Wren	*Cistothorus palustris*			
American Dipper	*Cinclus mexicanus*			
Golden-crowned Kinglet	*Regulus satrapa*			
Ruby-crowned Kinglet	*Regulus calendula*			
Blue-gray Gnatcatcher	*Polioptila caerulea*			
Eastern Bluebird	*Sialia sialis*			
Western Bluebird	*Sialia mexicana*			
Mountain Bluebird	*Sialia currucoides*			
Townsend's Solitaire	*Myadestes townsendi*			
Veery	*Catharus fuscescens*	BCC		WL
Swainson's Thrush	*Catharus ustulatus*			
Hermit Thrush	*Catharus guttatus*			
American Robin	*Turdus migratorius*			
Gray Catbird	*Dumetella carolinensis*			
Northern Mockingbird	*Mimus polyglottos*			
Sage Thrasher	*Oreoscoptes montanus*			
Brown Thrasher	*Toxostoma rufum*			
Curve-billed Thrasher	*Toxostoma curvirostre*			WL
American Pipit	*Anthus rubescens*			
Bohemian Waxwing	*Bombycilla garrulus*			
Cedar Waxwing	*Bombycilla cedrorum*			
Northern Shrike	*Lanius excubitor*			
Loggerhead Shrike	*Lanius ludovicianus*			
European Starling[4]	*Sturnus vulgaris*			
White-eyed Vireo	*Vireo griseus*			

Common Name	Scientific Name	**Federal**[1]	**State**[2]	**Other**[3]
Blue-headed Vireo	*Vireo solitarius*			
Cassin's Vireo	*Vireo cassinii*			
Plumbeous Vireo	*Vireo plumbeus*			
Warbling Vireo	*Vireo gilvus*			
Red-eyed Vireo	*Vireo olivaceus*			
Golden-winged Warbler	*Vermivora chrysoptera*			
Orange-crowned Warbler	*Vermivora celata*			
Nashville Warbler	*Vermivora ruficapilla*			
Virginia's Warbler	*Vermivora virginiae*			
Northern Parula	*Parula americana*			
Yellow Warbler	*Dendroica petechia*			
Chestnut-sided Warbler	*Dendroica pensylvanica*			
Yellow-rumped Warbler	*Dendroica coronata*			
Black-throated Gray Warbler	*Dendroica nigrescens*			
Townsend's Warbler	*Dendroica townsendi*			
Black-throated Green Warbler	*Dendroica virens*			
Western Palm Warbler	*Dendroica palmarum*			
Blackpoll Warbler	*Dendroica striata*			
Black-and-white Warbler	*Mniotilta varia*			
American Redstart	*Setophaga ruticilla*			
Worm-eating Warbler	*Helmitheros vermivorus*			
Ovenbird	*Seiurus aurocapillus*			T
Northern Waterthrush	*Seiurus noveboracensis*			
MacGillivray's Warbler	*Oporornis tolmiei*			
Common Yellowthroat	*Geothlypis trichas*			
Hooded Warbler	*Wilsonia citrina*			
Wilson's Warbler	*Wilsonia pusilla*			
Yellow-breasted Chat	*Icteria virens*			
Hepatic Tanager	*Piranga flava*			
Western Tanager	*Piranga ludoviciana*			
Rose-breasted Grosbeak	*Pheucticus ludovicianus*			
Black-headed Grosbeak	*Pheucticus melanocephalus*			
Blue Grosbeak	*Guiraca caerulea*			
Lazuli Bunting	*Passerina amoena*			
Indigo Bunting	*Passerina cyanea*			
Dickcissel	*Spiza americana*			
Green-tailed Towhee	*Pipilo chlorurus*			
Spotted Towhee	*Pipilo*			
Canyon Towhee	*Pipilo*			
Cassin's Sparrow	*Aimophila cassinii*			WL
Rufous-crowned Sparrow	*Aimophila ruficeps*			T
American Tree Sparrow	*Spizella arborea*			
Chipping Sparrow	*Spizella passerina*			
Clay-colored Sparrow	*Spizella pallida*			
Brewer's Sparrow	*Spizella breweri*	BCC		
Vesper Sparrow	*Pooecetes gramineus*			
Lark Sparrow	*Chondestes grammacus*			
Black-throated Sparrow	*Amphispiza bilineata*			

Common Name	Scientific Name	**Federal**[1]	**State**[2]	**Other**[3]
Lark Bunting	*Calamospiza melanocorys*	BCC		
Savannah Sparrow	*Passerculus sandwichensis*			
Grasshopper Sparrow	*Ammodramus savannarum*	BCC		
Slate-colored Fox Sparrow	*Passerella schistacea*			
Song Sparrow	*Melospiza melodia*			
Lincoln's Sparrow	*Melospiza lincolnii*			
Swamp Sparrow	*Melospiza georgiana*			
White-throated Sparrow	*Zonotrichia albicollis*			
White-crowned Sparrow	*Zonotrichia leucophrys*			
Harris' Sparrow	*Zonotrichia querula*			
Dark-eyed Junco	*Junco hyemalis*			
Lapland Longspur	*Calcarius lapponicus*			
Chestnut-collared Longspur	*Calcarius ornatus*	BCC	SC	T
McCown's Longspur	*Calcarius mccownii*	BCC		T
Bobolink	*Dolichonyx oryzivorus*			WL
Red-winged Blackbird	*Agelaius phoeniceus*			
Western Meadowlark	*Sturnella neglecta*			
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*			
Brewer's Blackbird	*Euphagus cyanocephalus*			
Great-tailed Grackle	*Quiscalus mexicanus*			
Common Grackle	*Quiscalus quiscula*			
Brown-headed Cowbird	*Molothrus ater*			
Orchard Oriole	*Icterus spurius*			
Bullock's Oriole	*Icterus bullockii*			
Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*			
Brown-capped Rosy-Finch	*Leucosticte australis*	BCC		
Cassin's Finch	*Carpodacus cassinii*	BCC		PT
House Finch	*Carpodacus mexicanus*			
Red Crossbill	*Loxia curvirostra*			
Common Redpoll	*Carduelis flammea*			
Pine Siskin	*Carduelis pinus*			
Lesser Goldfinch	*Carduelis psaltria*			
American Goldfinch	*Carduelis tristis*			
Evening Grosbeak	*Coccothraustes vespertinus*			
House Sparrow[4]	*Passer domesticus*			
Virginia opossum	*Didelphis virginiana*			
Colorado chipmunk	*Neotamias quadrivittatus*			PT
Rock squirrel	*Otospermophilus variegatus*			
Thirteen-lined ground squirrel	*Ictidomys tridecemlineatus*			
Spotted ground squirrel	*Xerospermophilus spilosoma*			
Black-tailed prairie dog	*Cynomys ludovicianus*		SC	PT
Abert's squirrel	*Sciurus aberti*			
Fox squirrel	*Sciurus niger*			
Beaver	*Castor canadensis*			
Olive-backed pocket mouse	*Perognathus fasciatus*			
Plains pocket mouse	*Perognathus flavescens*			
Silky pocket mouse	*Perognathus flavus*			

Common Name	Scientific Name	**Federal**[1]	**State**[2]	**Other**[3]
Hispid pocket mouse	*Chaetodipus hispidus*			
Ord's kangaroo rat	*Dipodomys ordii*			
Botta's pocket gopher	*Thomomys bottae*			
Northern pocket gopher	*Thomomys talpoides*			
Plains pocket gopher	*Geomys bursarius*			
Long-tailed vole	*Microtus longicaudus*			
Prairie vole	*Microtus ochrogaster*			
Meadow vole	*Microtus pennsylvanicus*			
Muskrat	*Ondatra zibethicus*			
Western harvest mouse	*Reithrodontomys megalotis*			
Plains harvest mouse	*Reithrodontomys montanus*			
Brush mouse	*Peromyscus boylii*			
Northern rock mouse	*Peromyscus nasutus*			
White-footed mouse	*Peromyscus leucopus*			
Deer mouse	*Peromyscus maniculatus*			
Pinyon mouse	*Peromyscus truei*			
N. grasshopper mouse	*Onychomys leucogaster*			
Bushy-tailed woodrat	*Neotoma cinerea*			
Eastern woodrat	*Neotoma floridana*			
Mexican woodrat	*Neotoma mexicana*			
Hispid cotton rat	*Sigmodon hispidus*			
Norway rat[4]	*Rattus norvegicus*			
House mouse[4]	*Mus musculus*			
Porcupine	*Erethizon dorsatum*			
Desert cottontail	*Sylvilagus audubonii*			
Nuttall's cottontail	*Sylvilagus nuttallii*			
Black-tailed jack rabbit	*Lepus californicus*			
Montane shrew	*Sorex monticolus*			
Big free-tailed bat	*Nyctinomos macrotis*			T
Western small-footed myotis	*Myotis ciliolabrum*			
Little brown myotis	*Myotis lucifugus*			
Fringed myotis	*Myotis thysanodes*			T
Hoary bat	*Lasiurus cinereus*			
Yuma myotis	*Myotis yumanensis*			
Silver-haired bat	*Lasionycteris noctivagans*			
Eastern pipistrelle	*Perimyotis subflavus*			
Big brown bat	*Eptesicus fuscus*			
Townsend's big-eared bat	*Corynorhinus townsendii*		SC	T
Pallid bat	*Antrozous pallidus*			
Mountain lion	*Puma concolor*			
Bobcat	*Lynx rufus*			
Coyote	*Canis latrans*			
Swift fox	*Vulpes velox*		SC	T
Red fox	*Vulpes vulpes*			
Gray fox	*Urocyon cinereoargenteus*			
Black bear	*Ursus americanus*			
Ermine	*Mustela erminea*			
Long-tailed weasel	*Mustela frenata*			
Badger	*Taxidea taxus*			

Common Name	Scientific Name	**Federal[1]**	**State[2]**	**Other[3]**
Western spotted skunk	*Mephitis gracilis*			
Striped skunk	*Mephitis mephitis*			
Ringtail	*Bassariscus astutus*			
Raccoon	*Procyon lotor*			
Elk	*Cervus elaphus*			
Mule deer	*Odocoileus hemionus*			
White-tailed deer	*Odocoileus virginianus*			
Pronghorn	*Antilocapra americana*			
Bighorn sheep	*Ovis canadensis*			

Vertebrates Known on Pinon Canyon Maneuver Site

Common Name	**Scientific Name**	**Federal[1]**	**State[2]**	**Other[3]**
Central stoneroller	*Campostoma*			
White sucker	*Catostomus commersoni*			
Red shiner	*Cyprinella lutrensis*			
Common carp[4]	*Cyprinus carpio*			
Plains killifish	*Fundulus zebrinus*			
Flathead chub	*Hybopsis gracilis*		SC	T
Black bullhead	*Ictalurus melas*			
Channel catfish	*Ictalurus punctatus*			
Green sunfish	*Lepomis cyanellus*			
Sand shiner	*Notropis stamineus*			
Fathead minnow	*Pimephales promelas*			
Longnose dace	*Rhinichtthys cataractae*			
Tiger salamander	*Ambystoma tigrinum*			
Red-spotted toad	*Bufo punctatus*			
Woodhouse's toad	*Bufo woodhousii woodhousei*			
Plains leopard frog	*Rana blairi*		SC	T
Bullfrog[4]	*Rana catesbeiana*			
Plains spadefoot	*Scaphiopus bombifrons*			
New Mexico spadefoot	*Scaphiopus multiplicatus*			
Snapping turtle	*Chelydra serpentina*			
Western box turtle	*Terrapene ornata ornata*			
Six-lined racerunner	*Cnemidophorus sexlineatus*			
Triploid checkered whiptail	*Cnemidophorus neotesselatus*		SC	T
Collared lizard	*Crotaphytus collaris collaris*			
Great Plains skink	*Eumeces obsoletus*			
Lesser earless lizard	*Holbrookia maculata maculata*			
Texas horned lizard	*Phrynosoma cornutum*		SC	T
Short-horned lizard	*Phrynosoma douglassi*			WL
Eastern fence lizard	*Sceloporus undulatus*			
Glossy snake	*Arizona elegans elegans*			

Common Name	Scientific Name	Federal[1]	State[2]	Other[3]
Eastern yellowbelly racer	*Coluber constrictor flaviventris*			
Western rattlesnake	*Crotalus viridis viridis*			
Ring-necked snake	*Diadophis punctatus arnyi*			
Corn snake	*Elaphe guttata emoryi*			
Western hognose snake	*Heterodon nasicus nasicus*			
Night snake	*Hypsiglena torquata jani*			
Milk snake	*Lampropeltis triangulum*			
Texas blind snake	*Leptotyphlops dulcis*		SC	
Coachwhip	*Masticophis flagellum*			
Bullsnake	*Pituophis melanoleucus sayi*			
Ground snake	*Sonora semiannulata*			WL
Blackneck garter snake	*Thamnophis cyrtopsis*			
W. terrestrial garter snake	*Thamnophis elegans vagrans*			
Plains garter snake	*Thamnophis radix haydeni*			
Pied-billed Grebe	*Podilymbus podiceps*			
Eared Grebe	*Podiceps nigricollis*			
American White Pelican	*Pelecanus erythrorhynchos*			
Double-crested Cormorant	*Phalacrocorax auritus*			
American Bittern	*Botaurus lentiginosus*	BCC		
Least Bittern	*Ixobrychus exilis*			
Great Blue Heron	*Ardea herodias*			
Snowy Egret	*Egretta thula*			T
Green Heron	*Butorides virescens*			
Black-crowned Night-Heron	*Nycticorax nycticorax*			
White-faced Ibis	*Plegadis chihi*			T
Snow Goose	*Chen caerulescens*			
Ross' Goose	*Chen rossii*			
Canada Goose	*Branta Canadensis*			
Crackling Goose	*Branta hutchinsii*			
Wood Duck	*Aix sponsa*			
Green-winged Teal	*Anas crecca*			
Mallard	*Anas platyrhynchos*			
Northern Pintail	*Anas acuta*			
Blue-winged Teal	*Anas discors*			
Cinnamon Teal	*Anas cyanoptera*			
Northern Shoveler	*Anas clypeata*			
Gadwall	*Anas strepera*			
American Wigeon	*Anas americana*			
Canvasback	*Aythya valisineria*			
Redhead	*Aythya americana*			
Ring-necked Duck	*Aythya collaris*			
Lesser Scaup	*Aythya affinis*			
White-winged Scoter	*Melanitta fusca*			
Common Goldeneye	*Bucephala clangula*			
Bufflehead	*Bucephala albeola*			
Ruddy Duck	*Oxyura jamaicensis*			
Turkey Vulture	*Cathartes aura*			
Osprey	*Pandion haliaetus*			

Common Name	Scientific Name	Federal[1]	State[2]	Other[3]
Mississippi Kite	*Ictinia mississippiensis*			
Bald Eagle	*Haliaeetus leucocephalus*	BCC	ST	T
Northern Harrier	*Circus cyaneus*			
Sharp-shinned Hawk	*Accipiter striatus*			
Cooper's Hawk	*Accipiter cooperii*			
Northern Goshawk	*Accipiter gentilis*			WL
Broad-winged Hawk	*Buteo platypterus*			
Swainson's Hawk	*Buteo swainsoni*			
Red-tailed Hawk	*Buteo jamaicensis*			
Western Red-tailed Hawk	*Buteo jamaicensis calurus*			
Ferruginous Hawk	*Buteo regalis*	BCC	SC	T
Rough-legged Hawk	*Buteo lagopus*			
Golden Eagle	*Aquila chrysaetos*	BCC		
American Kestrel	*Falco sparverius*			
Merlin	*Falco columbarius*			
Peregrine Falcon	*Falco peregrinus*	BCC	SC	T
Prairie Falcon	*Falco mexicanus*	BCC		WL
Wild Turkey	*Meleagris gallopavo*			
Northern Bobwhite	*Colinus virginianus*			
Scaled Quail	*Callipepla squamata*			
Virginia Rail	*Rallus limicola*			
Sora	*Porzana carolina*			
American Coot	*Fulica americana*			
Sandhill Crane	*Grus canadensis*			
Semipalmated Plover	*Charadrius semipalmatus*			
Killdeer	*Charadrius vociferus*			
Mountain Plover	*Charadrius montanus*	BCC	SC	T
Black-necked Stilt	*Himantopus mexicanus*			T
American Avocet	*Recurvirostra americana*			
Greater Yellowlegs	*Tringa melanoleuca*			
Lesser Yellowlegs	*Tringa flavipes*			
Solitary Sandpiper	*Tringa solitaria*			
Willet	*Catoptrophorus semipalmatus*			T
Spotted Sandpiper	*Actitis macularia*			
Upland Sandpiper	*Bartramia longicauda*	BCC		
Long-billed Curlew	*Numenius americanus*	BCC	SC	T
Sanderling	*Calidris alba*			
Semipalmated Sandpiper	*Calidris pusilla*			
Western Sandpiper	*Calidris mauri*			
Least Sandpiper	*Calidris minutilla*			
Baird's Sandpiper	*Calidris bairdii*			
Pectoral Sandpiper	*Calidris melanotos*			
Long-billed Dowitcher	*Limnodromus scolopaceus*			
Common Snipe	*Gallinago gallinago*			
Wilson's Phalarope	*Phalaropus tricolor*			T
Franklin's Gull	*Larus pipixcan*			
Ring-billed Gull	*Larus delawarensis*			
Rock Pigeon[4]	*Columba livia*			
Band-tailed Pigeon	*Columba fasciata*			

Common Name	Scientific Name	Federal[1]	State[2]	Other[3]
White-winged Dove	*Zenaida asiatica*			
Mourning Dove	*Zenaida macroura*			
Black-billed Cuckoo	*Coccyzus erythropthalmus*			
Yellow-billed Cuckoo	*Coccyzus americanus*			
Greater Roadrunner	*Geococcyx californianus*			
Barn Owl	*Tyto alba*			
Western Screech-Owl	*Otus kennicottii*			
Great Horned Owl	*Bubo virginianus*			
Burrowing Owl	*Athene cunicularia*	BCC	ST	WL
Long-eared Owl	*Asio otus*			
Short-eared Owl	*Asio flammeus*			T
Common Nighthawk	*Chordeiles minor*			
Common Poorwill	*Phalaenoptilus nuttallii*			
White-throated Swift	*Aeronautes saxatalis*			
Black-chinned Hummingbird	*Archilochus alexandri*			
Calliope Hummingbird	*Stellula calliope*			
Broad-tailed Hummingbird	*Selasphorus platycercus*			
Rufous Hummingbird	*Selasphorus rufus*			
Belted Kingfisher	*Ceryle alcyon*			
Lewis' Woodpecker	*Melanerpes lewis*	BCC		T
Red-headed Woodpecker	*Melanerpes erythrocephalus*			
Red-naped Sapsucker	*Sphyrapicus nuchalis*			
Ladder-backed Woodpecker	*Picoides scalaris*			
Downy Woodpecker	*Picoides pubescens*			
Hairy Woodpecker	*Picoides villosus*			
Northern Flicker	*Colaptes auratus*			
Yellow-shafted Flicker	*Colaptes auratus auratus*			
Red-shafted Flicker	*Colaptes auratus x cafer*			
Olive-sided Flycatcher	*Contopus borealis*			
Western Wood-Pewee	*Contopus sordidulus*			
Dusky Flycatcher	*Empidonax oberholseri*			
Gray Flycatcher	*Empidonax wrightii*			
Cordilleran Flycatcher	*Empidonax occidentalis*			
Eastern Phoebe	*Sayornis phoebe*			
Say's Phoebe	*Sayornis saya*			
Ash-throated Flycatcher	*Myiarchus cinerascens*			
Cassin's Kingbird	*Tyrannus vociferans*			
Western Kingbird	*Tyrannus verticalis*			
Eastern Kingbird	*Tyrannus tyrannus*			
Scissor-tailed Flycatcher	*Tyrannus forficatus*			
Horned Lark	*Eremophila alpestris*			
Tree Swallow	*Tachycineta bicolor*			
Violet-green Swallow	*Tachycineta thalassina*			
N. Rough-winged Swallow	*Stelgidopteryx serripennis*			
Bank Swallow	*Riparia riparia*			
Cliff Swallow	*Hirundo pyrrhonota*			
Barn Swallow	*Hirundo rustica*			
Steller's Jay	*Cyanocitta stelleri*			
Blue Jay	*Cyanocitta cristata*			

Common Name	Scientific Name	Federal[1]	State[2]	Other[3]
Western Scrub Jay	*Aphelocoma coerulescens*			
Pinyon Jay	*Gymnorhinus cyanocephalus*	BCC		
Clark's Nutcracker	*Nucifraga columbiana*			
Black-billed Magpie	*Pica pica*			
American Crow	*Corvus brachyrhynchos*			
Chihuahuan Raven	*Corvus cryptoleucus*			
Common Raven	*Corvus corax*			
Mountain Chickadee	*Parus gambeli*			
Juniper Titmouse	*Parus inornatus*	BCC		
Bushtit	*Psaltriparus minimus*			
Red-breasted Nuthatch	*Sitta canadensis*			
White-breasted Nuthatch	*Sitta carolinensis*			
Pygmy Nuthatch	*Sitta pygmaea*			
Brown Creeper	*Certhia americana*			
Rock Wren	*Salpinctes obsoletus*			
Canyon Wren	*Catherpes mexicanus*			
Bewick's Wren	*Thryomanes bewickii*			
House Wren	*Troglodytes aedon*			
Marsh Wren	*Cistothorus palustris*			
Golden-crowned Kinglet	*Regulus satrapa*			
Ruby-crowned Kinglet	*Regulus calendula*			
Blue-gray Gnatcatcher	*Polioptila caerulea*			
Mountain Bluebird	*Sialia currucoides*			
Townsend's Solitaire	*Myadestes townsendi*			
Swainson's Thrush	*Catharus ustulatus*			
Hermit Thrush	*Catharus guttatus*			
American Robin	*Turdus migratorius*			
Gray Catbird	*Dumetella carolinensis*			
Northern Mockingbird	*Mimus polyglottos*			
Sage Thrasher	*Oreoscoptes montanus*			
Brown Thrasher	*Toxostoma rufum*			
Curve-billed Thrasher	*Toxostoma curvirostre*			WL
American Pipit	*Anthus rubescens*			
Bohemian Waxwing	*Bombycilla garrulus*			
Cedar Waxwing	*Bombycilla cedrorum*			
Northern Shrike	*Lanius excubitor*			
Loggerhead Shrike	*Lanius ludovicianus*			
European Starling[4]	*Sturnus vulgaris*			
Gray Vireo	*Vireo vicinior*	BCC		T
Cassin’s Vireo	*Vireo cassinii*			
Plumbeous Vireo	*Vireo plumbeus*			
Warbling Vireo	*Vireo gilvus*			
Red-eyed Vireo	*Vireo olivaceus*			
Orange-crowned Warbler	*Vermivora celata*			
Nashville Warbler	*Vermivora ruficapilla*			
Virginia's Warbler	*Vermivora virginiae*			
Northern Parula	*Parula americana*			
Yellow Warbler	*Dendroica petechia*			

Common Name	Scientific Name	Federal[1]	State[2]	Other[3]
Chestnut-sided Warbler	*Dendroica pensylvanica*			
Yellow-rumped Warbler	*Dendroica coronata*			
Black-throated Gray Warbler	*Dendroica nigrescens*			
Townsend's Warbler	*Dendroica townsendi*			
American Redstart	*Setophaga ruticilla*			
Ovenbird	*Seiurus aurocapillus*			T
Northern Waterthrush	*Seiurus noveboracensis*			
MacGillivray's Warbler	*Oporornis tolmiei*			
Common Yellowthroat	*Geothlypis trichas*			
Wilson's Warbler	*Wilsonia pusilla*			
Yellow-breasted Chat	*Icteria virens*			
Hepatic Tanager	*Piranga flava*			
Summer Tanager	*Piranga rubra*			
Western Tanager	*Piranga ludoviciana*			
Rose-breasted Grosbeak	*Pheucticus ludovicianus*			
Black-headed Grosbeak	*Pheucticus melanocephalus*			
Blue Grosbeak	*Guiraca caerulea*			
Lazuli Bunting	*Passerina amoena*			
Indigo Bunting	*Passerina cyanea*			
Dickcissel	*Spiza americana*			
Green-tailed Towhee	*Pipilo chlorurus*			
Spotted Towhee	*Pipilo*			
Canyon Towhee	*Pipilo*			
Cassin's Sparrow	*Aimophila cassinii*			WL
Rufous-crowned Sparrow	*Aimophila ruficeps*			T
American Tree Sparrow	*Spizella arborea*			
Chipping Sparrow	*Spizella passerina*			
Clay-colored Sparrow	*Spizella pallida*			
Brewer's Sparrow	*Spizella breweri*	BCC		
Vesper Sparrow	*Pooecetes gramineus*			
Lark Sparrow	*Chondestes grammacus*			
Black-throated Sparrow	*Amphispiza bilineata*			
Lark Bunting	*Calamospiza melanocorys*	BCC		
Savannah Sparrow	*Passerculus sandwichensis*			
Grasshopper Sparrow	*Ammodramus savannarum*	BCC		
Song Sparrow	*Melospiza melodia*			
Lincoln's Sparrow	*Melospiza lincolnii*			
White-throated Sparrow	*Zonotrichia albicollis*			
White-crowned Sparrow	*Zonotrichia leucophrys*			
Harris' Sparrow	*Zonotrichia querula*			
Dark-eyed Junco	*Junco hyemalis*			
McCown's Longspur	*Calcarius mccownii*	BCC		T
Lapland Longspur	*Calcarius lapponicus*			
Chestnut-collared Longspur	*Calcarius ornatus*	BCC		T
Bobolink	*Dolichonyx oryzivorus*			WL
Red-winged Blackbird	*Agelaius phoeniceus*			
Western Meadowlark	*Sturnella neglecta*			
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*			
Brewer's Blackbird	*Euphagus cyanocephalus*			

Common Name	Scientific Name	Federal[1]	State[2]	Other[3]
Great-tailed Grackle	*Quiscalus mexicanus*			
Common Grackle	*Quiscalus quiscula*			
Brown-headed Cowbird	*Molothrus ater*			
Orchard Oriole	*Icterus spurius*			
Baltimore Oriole	*Icterus galbula*			
Bullock's Oriole	*Icterus bullockii*			
Scott's Oriole	*Icterus parisorum*			
Cassin's Finch	*Carpodacus cassinii*	BCC		
House Finch	*Carpodacus mexicanus*			
Red Crossbill	*Loxia curvirostra*			
Pine Siskin	*Carduelis pinus*			
Lesser Goldfinch	*Carduelis psaltria*			
American Goldfinch	*Carduelis tristis*			
Evening Grosbeak	*Coccothraustes vespertinus*			
House Sparrow[4]	*Passer domesticus*			
Colorado chipmunk	*Neotamias quadrivittatus*			PT
Rock squirrel	*Otospermophilus variegatus*			
Thirteen-lined ground squirrel	*Ictidomys tridecemlineatus*			
Spotted ground squirrel	*Xerospermophilus spilosoma*			
Black-tailed prairie dog	*Cynomys ludovicianus*		SC	PT
Beaver	*Castor canadensis*			
Plains pocket mouse	*Perognathus flavescens*			
Silky pocket mouse	*Perognathus flavus*			
Hispid pocket mouse	*Chaetodipus hispidus*			
Ord's kangaroo rat	*Dipodomys ordii*			
Yellow-faced pocket gopher	*Cratogeomys castanops*			
Botta's pocket gopher	*Thomomys bottae*			
Muskrat	*Ondatra zibethicus*			
Western harvest mouse	*Reithrodontomys megalotis*			
Plains harvest mouse	*Reithrodontomys montanus*			
Brush mouse	*Peromyscus boylii*			
Northern rock mouse	*Peromyscus nasutus*			
White-footed mouse	*Peromyscus leucopus*			
Deer mouse	*Peromyscus maniculatus*			
Pinyon mouse	*Peromyscus truei*			
Northern grasshopper mouse	*Onychomys leucogaster*			
Eastern woodrat	*Neotoma floridana*			
E. White-throated woodrat	*Neotoma leucodon*			
Mexican woodrat	*Neotoma mexicana*			
Southern plains woodrat	*Neotoma micropus*			T
Mogollon vole	*Microtus mogollonensis*			
Meadow vole	*Microtus pennsylvanicus*			
Hispid cotton rat	*Sigmodon hispidus*			
House mouse[4]	*Mus musculus*			
Porcupine	*Erethizon dorsatum*			
Desert cottontail	*Sylvilagus audubonii*			
Black-tailed jack rabbit	*Lepus californicus*			
Desert shrew	*Notiosorex crawfordi*			

Common Name	Scientific Name	Federal[1]	State[2]	Other[3]
Brazilian free-tailed bat	*Tadarida brasiliensis*			
Big free-tailed bat	*Nyctinomops macrotis*			T
Yuma myotis	*Myotis yumanensis*			
Hoary bat	*Lasiurus cinereus*			
Big brown bat	*Eptesicus fuscus*			
Townsend's big-eared bat	*Corynorhinus townsendii*			T
Pallid bat	*Antrozous pallidus*			
Mountain lion	*Puma concolor*			
Bobcat	*Lynx rufus*			
Coyote	*Canis latrans*			
Swift fox	*Vulpes velox*			
Gray fox	*Urocyon cinereoargenteus*			
Black bear	*Ursus americanus*			
Badger	*Taxidea taxus*			
Western spotted skunk	*Spilogale gracilis*			
Striped skunk	*Mephitis mephitis*			
Ringtail	*Bassariscus astutus*			
Raccoon	*Procyon lotor*			
Elk	*Cervus elaphus*			
Mule deer	*Odocoileus hemionus*			
White-tailed deer	*Odocoileus virginianus*			
Pronghorn	*Antilocapra americana*			
Bighorn sheep	*Ovis canadensis*			

[1]Federal

BCC (Birds of Conservation Concern) - Species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973.

FP (Federal Petitioned) - A formal request, with the support of adequate biological data, suggesting that a species, with the support of adequate biological data, be listed.

FC (Federal Candidate) - Plants and animals that have been studied and the Service has concluded that they should be proposed for addition to the Federal endangered and threatened species list.

FT (Federal Threatened) - The classification provided to an animal or plant likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

[2]State

[2]ST (State Threatened) - An animal or plant likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

SE (State Endangered) - Any species which is in danger of extinction throughout all or a significant portion of its range.

SC (Species of Special Concern - Declining or potentially declining species of greatest conservation need.

[3]Colorado Natural Heritage Program (CNHP)

WL (Watchlisted) - These species are common if you find the right habitat, but are still species of concern due to either habitat imperilment or a general decline in the species population.

PT (Partial Tracking) - These species are common if you find the right habitat, but healthy populations or high quality occurrences are of conservation concern.

FT (Fully Tracked) – These species are vulnerable and imperiled at any location.

[4] NON NATIVE SPECIES

Plant Species Known on Fort Carson

Life Form: A = Annual, B = Biennial, P = Perennial

Origin: N = Native, I = Introduced

Form: F = Forb, G = Grass, V = Vine, S = Shrub, T = Tree

Season: W = Warm Season, C = Cool Season

* Species of Special Concern

	Life	Origin	Form
FERNS & FERN ALLIES			
EQUISETACEAE Horsetail Family			
Equisetum arvense L. Horsetail	P	N	F
Hippochaete laevigata (A. Braun) Farw., Scouring-rush	P	N	F
SELAGINELLACEAE Little Club-Moss Family			
Selaginella densa Rydb., Little club-moss	P	N	F
Selaginella mutica (D. C. Eaton), Little club-moss	P	N	F
SINOPTERIDACEAE Lipfern Family			
**Argyrochosma fendleri* (Kunze) Windham, Lipfern	P	N	F
**Cheilanthes eatonii* Baker, Lipfern	P	N	F
Cheilanthes fendleri Hook., Lipfern	P	N	F
WOODSIACEAE Woodsia Family			
Woodsia oregana ssp. *cathcartiana* (Robins.) Windham, Woodsia	P	N	F
GYMNOSPERMS			
CUPRESSACEAE Cypress Family			
Sabina monosperma (Engelm.) Rydb., Oneseed juniper	P	N	T
Sabina scopulorum (Sargent) Rydb., Rocky Mountain juniper	P	N	T

PINACEAE **Pine Family**

Abies concolor (Gordon) Lindl., White fir	P	N	T
Picea pungens Engelm., Blue spruce	P	N	T
Pinus edulis Engelm., Pinyon pine	P	N	T
Pinus ponderosa Dougl. ssp. *scopulorum* (Watson) Weber, Ponderosa pine	P	N	T
Pseudotsuga menziesii (Mirbel) Franco, Douglas-fir	P	N	T

ANGIOSPERMS, FLOWERING PLANTS

ACERACEAE **Maple Family**

Acer glabrum Torrey, Mountain maple	P	N	S/T
Negundo aceroides (L.) Moench	P	I	T

AGAVACEAE **Agave Family**

Yucca glauca Nuttall, Small soapweed	P	N	S

ALLIACEAE **Onion Family**

Allium cernuum Roth, Wild onion	P	N	F
Allium textile Nels. & Macbr., Textile onion	P	N	F

ALSINACEAE **Chickweed Family**

Cerastium fontanum Baumgartner, Common mouse-ear	P	N	F
Eremogone fendleri (Gray) Ikkon., Fendler's sandwort	P	N	F
Eremogone hookeri (Nuttall) Weber, Hooker's sandwort	P	N	F
Paronychia jamesii Torrey & Gray, Jame's nailwort	P	N	F
Paronychia sessiliflora Nuttall, Nailwort	P	N	F

AMARANTHACEAE **Amaranth Family**

Amaranthus blitoides S. Watson, Amaranth	A	N	F
Amaranthus retroflexus L., Redroot amaranth	A	N	F

ANACARDIACEAE Sumac Family

Rhus aromatica Aiton Skunkbush	P	N	S
Rhus glabra L., Smooth sumac	P	N	S
Toxicodendron rydbergii (Small) Greene, Poison ivy	P	N	S/V

APIACEAE Carrot Family

Berula erecta (Huds.) Cov., Water parsnip	P	N	F
Conium maculatum L., Poison hemlock	B	I	F
Cymopterus montanus Nuttall, Mountain spring parsley	P	N	F
Daucus carota L. Wild carrot	A	I	F
Heracleum sphondylium L. ssp. *montanum* (Schleich.) Briq., Cow parsnip	P	N	F
Ligusticum porteri Coulter & Rose, Osha	P	N	F
Lomatium orientale Coulter & Rose, Northern Idaho biscuitroot	P	N	F

APOCYNACEAE Dogbane Family

Apocynum cannabinum L., Indian hemp	P	N	F

ASCLEPIADACEAE Milkweed Family

Asclepias asperula (Dcne.) Woods, Spider milkweed	P	N	F
Asclepias engelmanniana Woods, Englemann's milkweed	P	N	F
Asclepias incarnata L., Swamp milkweed	P	N	F
Asclepias latifolia (Torrey) Rafinesque milkweed	P	N	F
Asclepias pumilla (Gray) Vail, Plains milkweed	P	N	F
Asclepias speciosa Torrey, Showy milkweed	P	N	F
Asclepias subverticillata (Gray) Vail, Whorled milkweed	P	N	F
Asclepias tuberosa L. ssp. *terminalis* Woods, Butterflyweed	P	N	F
**Asclepias uncialis* Greene, Dwarf milkweed	P	N	F
Asclepias viridiflora Raf., Green milkweed	P	N	F
**Sarcostemma crispum* Bentham, Twinvine	P	N	F

ASPARAGACEAE Asparagus Family

Asparagus officinalis L., Garden asparagus	P	I	F

ASTERACEAE Sunflower Family

Achillea lanulosa Nuttall, Yarrow	P	N	F

Acosta diffusa (Lam.) Sojak, Diffuse knapweed	B	I	F
Acosta maculosa (L.) Holub., Spotted knapweed	P	I	F
Acroptilon repens (L.) DC., Russian knapweed	P	I	F
Ageratina herbacea (A. Gray) King & Robinson	P	N	F
Ambrosia psilostachya DC. var. *coronopifolia* (Torrey & Gray) Farw., Western ragweed	P	N	F
Ambrosia tomentosa Nuttall, Skeletonleaf	P	N	F
Ambrosia trifida L., Giant ragweed	A	I	F
Antennaria parvifolia Nuttall, Littleleaf pussytoes	P	N	F
Antennaria rosea Greene, Pink pussytoes	P	N	F
Arctium minus (Hill) Bernh., Common burdock	P	I	F
Artemisia biennis Willdenow, Wormwood	B	I	F
Artemisia bigelovii Gray, Bigelow's sagebrush	P	N	S
Artemisia frigida Willd., Silver sagebrush	P	N	S
Artemisia ludoviciana Nuttall, Louisiana sagebrush	P	N	F
Aster porteri Gray, Porter's aster	P	N	F
Bahia dissecta (Gray) Britt., Ragleaf bahia	P	N	F
**Bolophyta tetraneuris* (Barneby) Weber, Arkansas feverfew	P	N	F
Breea arvensis (L.) Less., Canada thistle	P	I	F
Brickellia californica (Torrey & Gray) Gray, California brickellbush	P	N	S
Brickellia eupatorioides (L.) Shinners, False prairie boneset	P	N	F
Brickellia grandiflora (Hook.) Nuttall, Tasselflower brickellbush	P	N	F
Brickellia rosmarinifolia (Vent.) Weber ssp. *chlorolepis* (Woot. & Stand.) Weber, Boneset	P	N	F
Carduus nutans L. ssp. *macrolepis* (Peterm.) Kazmi, Musk thistle	P	I	F
Chaetopappa ericoides (A. Gray) Nesom Pincushion	P	N	S
Chrysothamnus nauseosus (Pallas) Britt. ssp. *graveolens* (Nuttall) Piper, Rabbitbrush	P	N	F
Chrysothamnus parryi (Gray) Greene ssp. *howardii* (Parry) Hall & Clem., Rabbitbrush	P	N	S
Cirsium undulatum (Nuttall) Spreng., Wavyleaf thistle	P	N	F
Cirsium vulgare (Savi) Ten., Bull thistle	P	I	F
Conyza canadensis (L.) Cronq., Canadian horseweed	A	N	F
Conyza coultereri A. Gray, Horseweed	A	N	F
Coreopsis lanceolata L., Lanceleaf tickseed	P	I	F
Coreopsis tinctoria Nuttall, Plains coreopsis	A	N	F
Cyclachaena xanthifolia (Nuttall) Fresen., Marsh-elder	A	N	F
Dyssodia aurea (Gray) Nels., Dogweed	A	N	F
Dyssodia papposa (Vent.) Hitchc., Fetid marigold	A	N	F

Erigeron colo-mexicanus Nelson, Fleabane	P	N	F
Erigeron divergens Torrey & Gray, Spreading fleabane	P	N	F
Erigeron engelmannii Nels., Engelmann's fleabane	P	N	F
Erigeron flagellaris Gray, Trailing fleabane	P	N	F
Erigeron pumilus Nuttall, Low fleabane	P	N	F
Erigeron subtrinervis Rydb., Threenerved fleabane	P	N	F
Gaillardia pinnatifida Torrey, Blanket flower	P	N	F
Grindelia inornata Greene, Gumweed	P	N	F
Grindelia revoluta Steyerm., Rolled gumweed	B	N	F
Grindelia squarrosa (Pursh) Dunal, Curlycup gumweed	B	N	F
Gutierrezia sarothrae (Pursh) Britt. & Rusby, Broom snakeweed	P	N	F
Helianthus annuus L., Annual sunflower	A	N	F
Helianthus petiolaris Nuttall, Prairie sunflower	A	N	F
Heliomeris multiflora Nuttall, Showy goldeneye	P	N	F
Heterotheca canescens (DeCandolle) Shinners, Golden aster	P	N	F
Heterotheca villosa (Pursh) Shinners, Hairy goldaster	P	N	F
Hymenopappus filifolius Hook., Fineleaf hymenopappus	P	N	F
Lactuca ludoviciana (Nuttall) Ridd., Western wild lettuce	P	N	F
Lactuca serriola L., Prickly lettuce	P	I	F
Lactuca tatarica (L.) Meyer ssp. *pulchella* (Pursh) Steb., Chicory lettuce	P	N	F
Leucanthemum vulgare Lam., Ox-eye daisy	P	I	F
Leucelene ericoides (Torrey) Greene, Sand aster	P	N	F
Liatris punctata Hook, Dotted gayfeather	P	N	F
Lygodesmia juncea (Pursh) D. Don., Rush skeletonweed	P	N	F
Microseris nutans (Geyer) Schultz-Bipontinus	P	N	F
Machaeranthera bigelovii (A. Gray) Greene, Tansy aster	P	N	F
Machaeranthera canescens (Pursh) A. Gray, Tansy aster	P	N	F
Machaeranthera pinnatifida (Hook.) Shinners, Lacy tansyaster	P	N	F
Machaeranthera tanacetifolia (H.B.K.) Nees, Tansyleaf aster	A	N	F
Melampodium leucanthum Torrey & Gray, Plains blackfoot daisy	P	N	F
Nothocalis cuspidata (Pursh) Greene	P	N	F
Oligosporus caudatus (Michx.) Poljakov, Sagewort wormwood	P	N	F
Oligosporus dracunculus (L.) ssp. *glaucus* (Pallus) Love & Love, Wild tarragon	P	N	F
Oligosporus filifolius (Torrey) Poljakov, Sand sagebrush	P	N	S
Oligosporus pacificus (Nuttalll) Poljakov, Sagewort	P	N	F
Onopordum acanthium L., Scotch thistle	B	I	F

Oonopsis foliosa (Gray) Greene, Fremont goldenweed	P	N	F
**Oonopsis puebloensis* n. sp. ined. (G.Brown)	P	N	F
Packera fendleri (Gray) Weber & Love, Fendler groundsel	P	N	F
Packera neomexicana (Greene) W. & Love ssp. *mutabilis* (Gray) Weber & Love, Groundsel	P	N	F
Packera tridenticulata (Rydb.) Weber & Love, Groundsel	P	N	F
Pectis angustifolia Torrey, Narrow-leaf pectis	P	N	F
Picradeniopsis oppositifolia (Nuttall) Rydb.	P	N	F
Podospermum laciniatum (L.) de Candolle, False salsify	P	I	F
Ratibida columnifera (Nuttall) Woot. & Standl., Prairie coneflower	P	N	F
Rudbeckia ampla Nelson, Goldenglow	P	N	F
Senecio flaccidus Less. ssp. *douglasii* (DC.) Turner & Barclay, Douglas groundsel	P	N	F
Senecio integerrimus Nuttall, Lambstongue groundsel	P	N	F
Senecio spartioides Torrey & Gray, Broom groundsel	P	N	F
Solidago canadensis L., Canada goldenrod	P	N	F
Solidago missouriensis Nuttall, Prairie goldenrod	P	N	F
Solidago gigantea Aiton, Goldenrod	P	N	F
Solidago mollis Bartl., Velvety goldenrod	P	N	F
Solidago nana Nuttall, Low goldenrod	P	N	F
Solidago velutina DC., Three-nerved goldenrod	P	N	F
Sonchus asper (L.) Hill, Prickly sow thistle	A	I	F
Stephanomeria pauciflora (Torrey) Nels. Desert wirelettuce	P	N	F
Taraxacum officinale G. H. Weber, Common dandelion	P	I	F
Tetraneuris acaulis (Pursh) Greene, Stemless hymenoxys	P	N	F
Thelesperma filifolium (Hook.) A. Gray, Stiff greenthread	A	N	F
Thelesperma megapotamicum (Spreng.) O. Ktze., Hopi-tea greenthread	P	N	F
Thelesperma subnudum Gray, Navajo-tea greenthread	P	N	F
Thymophylla aurea (A. Gray) Greene, Dogweed	A	N	F
Townsendia exscapa (Richard.) Porter, Stemless townsendia	P	N	F
**Townsendia fendleri* A. Gray, Easter daisy	P	N	F
Townsendia grandiflora Nuttall, Easter daisy	P	N	F
Tragopogon dubius Scop. ssp. *major* (Jacq.) Vollmann, Western salsify	P	I	F
Virgulus ericoides (L.) Reveal & Keener, White aster	P	N	F
Virgulus falcatus (Lindl.) Reveal & Keener, Aster	P	N	F
Virgulus fendleri (Gray) Reveal & Keener, Fendler's aster	P	N	F
Ximenesia encelioides Cav., Golden crownbeard	A	N	F
Zinnia grandiflora Nuttall, Rocky Mountain zinnia	P	N	F

BETULACEAE			
Alnus incana (L.) Moench ssp. *tenuifolia* (Nuttall) Breitung, Speckled alder	P	N	T
BORAGINACEAE Borage Family			
Cryptantha crassisepala (Torrey & Gray) Greene, Cryptantha	A	N	F
Cryptantha minima Rydb., Little catseye	A	N	F
Cynoglossum officinale L., Hound's tongue	B	I	F
Hackelia floribunda (Lehm.) Johnston, Large-flowered stickseed	P	N	F
Lappula marginata (Bieberstein) Guerke, Stickseed	A	N	F
Lappula redowskii (Hornem.) Greene, Blueburr stickseed	A	N	F
Lithospernum incisum Lehm., Narrowleaf gromwell	P	N	F
Mertensia lanceolata (Pursh) DC., Lanceleaf bluebells	P	N	F
Onosmodium molle Michx. var. *occidentale* (Mack.) Cochrane, Western marbleseed	P	N	F
Oreocarya suffruticosa (Torrey) Greene, James cryptantha	P	N	F
Oreocarya thyrsiflora Greene, Cluster cryptantha	P	N	F
BRASSICACEAE Mustard Family			
Barbarea orthoceras Ledebour, Wintercress	P	N	F
Barbarea vulgaris R. Brown, Wintercress	P	I	F
Camelina microcarpa Andrz., Littlepod falseflax	A	I	F
Capsella bursa-pastoris (L.) Medikus, Shepherd's purse	A	I	F
Cardaria chalepensis (L.) Handel-Mazzetti, Whitetop	P	N	F
Cardaria draba (L.) Desv., Whitetop	P	N	F
Cardaria latifolia (L.) Spach, Whitetop	P	I	F
Chorispora tenella (Pallas) De Candolle, Purple mustard	A	I	F
Descurania incisa (Engelm.) Britton, Tansy mustard	A	N	F
Descurainia pinnata (Walter) Britton, Western tansy mustard	P	N	F
Descurainia sophia (L.) Webber, Flimweed tansey mustard	A	I	F
Erysimum asperum (Nuttall) DC., Western wallflower	P	N	F
Erysimum capitatum (Dougl.) Greene, Western wallflower	P	N	F
Hesperis matronalis L., Rocket	P	I	F
Lepidium alyssoides Gray, Mesa pepperwort	P	N	F
Lepidium densiflorum Schrad., Common pepperweed	A	N	F
**Lesquerella calcicola* Rollin, Bladderpod	P	N	F
Lesquerella fendleri (Gray) Watson, Fendler's bladderpod	P	N	F

Lesquerella ludoviciana (Nuttall) Watson, Foothill bladderpod	P	N	F
Lesquirella montana (Gray) Watson, Mountain bladderpod	P	N	F
Lesquerella ovalifolia Rydberg, Bladderpod	P	N	F
Nasturtium officinale R. Brown, Watercress	P	N	F
Schoenocrambe linearifolia (Gray) Rollins, Slimleaf plains mustard	P	N	F
Schoenocrambe linifolia (Nuttall) Greene, Skeleton mustard	P	N	F
Sinapsis arvensis L., Charlock	A	I	F
Sisymbrium altissimum L., Jim Hill mustard	A	I	F
Stanleya pinnata (Pursh) Britt., Prince's plume	P	N	F
Thlaspi arvense L., Pennycress	A	I	F

CACTACEAE Cactus Family

Coryphantha vivipara (Nuttall) Britt. & Rose, Nipple cactus	P	N	S
Cylindropuntia imbricata (Haw.) Knuth, Candelabra cactus	P	N	S
Echinocereus triglochidiatus Engelm., Claret cup	P	N	S
Echinocereus viridiflorus Engelm., Hens-and-chickens	P	N	S
Opuntia macrorhiza Engelm., Twisted spine prickly pear	P	N	S
Opuntia phaeacantha Engelm., New Mexican prickly-pear	P	N	S
Opuntia polyacantha (Cockll.) Haw., Plains prickly-pear	P	N	S
Pediocactus simpsonii (Engel.) Britt. & Rose var. *minor* (Engelm.) Cockll., Ball cactus	P	N	S

CALOCHORTACEAE Mariposa Family

Calochortus gunnisonii Watson, Mariposa lily	P	N	F

CANNABACEAE Hops Family

Humulus lupulus L. ssp. *americanus* (Nuttall) Love & Love, Wild hops	P	N	V

CAPPARIDACEAE Caper Family

Cleome serrulata Pursh, Rocky Mountain beeplant	A	N	F
Polanisia dodecandra (L.) DC., Roughseed clammyweed	P	N	F

CAPRIFOLIACEAE Honeysuckle Family

Lonicera morrowii Gray, Honey-suckle	P	I	S
Symphoricarpos albus (L.) Blake, White coralberry	P	N	S
Symphoricarpos occidentalis Hook, Western snowberry	P	N	S
Symphoricarpos rotundifolius Gray, Mountain snowberry	P	N	S

CARYOPHYLLACEAE **Pink Family**			
Melandrium dioicum (L.) Coss. & Germ., White campion	P	I	F
CHENOPODIACEAE **Goosefoot Family**			
Atriplex argenta Nuttall, Tumbling saltbush	A	N	F
Atriplex canescens (Pursh) Nuttall, Fourwing saltbush	P	N	S
Atriplex confertifolia (Torrey & Fremont) Watson, Shadscale saltbush	P	N	S
Atriplex patula L., Spear saltbush	P	N	F
Bassia sieversiana (Palla) Weber, Ironweed	A	I	F
Chenopodium album L., Lambsquarters	A	I	F
Cycloloma atriplicifolium (Sprengel) Coulterer, Winged pigweed	N	A	F
Chenopodium desiccatum Nels., Desert goosefoot	A	N	F
Chenopodium fremontii Watson, Fremont goosefoot	A	N	F
Chenopodium incanum (Watson) Heller, Mealy goosefoot	A	N	F
Chenopodium leptophyllum (Nuttall) Watson, Slimleaf goosefoot	A	N	F
Chenopodium simplex (Torrey) Rafinesque, Goosefoot	A	N	F
Krascheninnikovia lanata (Pursh) Meeuse & Smit, Common winterfat	P	N	S
Salsola australis R. Brown, Russian-thistle	A	I	F
Salsola collina Pallas, Russian-thistle	A	I	F
Sarcobatus vermiculatus (Hook.) Torrey, Black greasewood	P	N	S
Suaeda calceoliformis (Hook.) Moq., Sea-blite	P	N	F
COMMELINACEAE **Spiderwort Family**			
Commelina dianthifolia Delile, Birdbill dayflower	P	N	F
Commelina erecta L. var. *angustifolia* (Michx.) Fern., Whitemouth dayflower	P	N	F
Tradescantia occidentalis (Britt.) Smyth, Spiderwort	P	N	F
CONVALLARIACEAE **Mayflower Family**			
Maianthemum stellatum (L.) Link, False Solomon's seal	P	N	F
CONVOLVULACEAE **Morningglory Family**			
Convolvulus arvensis L., Creeping jenny	P	I	F
Convolvulus equitans Benth., Texas bindweed	P	N	F
Evolvulus Nuttallianus Roem. & Schult., Arizona evolvulus	P	N	F
Ipomoea leptophylla Torrey, Bush morningglory	P	N	F

CORNACEAE **Dogwood Family**			
Swida sericea L., Red osier dogwood	P	N	S
CUCURBITACEAE **Gourd Family**			
Cucurbita foetidissima H.B.K., Buffalo gourd	P	N	F
CYPERACEAE **Sedge Family**			
Carex emoryi Dewey, Emory's sedge	P	N	G
Carex hystericina Muhl., Bottlebrush sedge	P	N	G
Carex occidentalis Bailey, Western sedge	P	N	G
Carex pensylvanica Lam. ssp. *heliophila* (Mack) Weber, Sun sedge	P	N	G
Carex stenophylla Wahl. ssp. *eleocharis* (Bailey) Hulten, Needleleaf sedge	P	N	G
Eleocharis palustris (L.) Roem. & Schult., Common spikerush	P	N	G
Mariscus fendlerianus (Boeck.) Koyama, Fendlers flatsedge	P	N	G
Schoenoplectus lacustris (L.) Palla ssp. *acutis* (Muhl.) Love & Love, Tule bulrush	P	N	G
Schoenoplectus lacustris ssp. *creber* (Fern.) Love & Love, hardstem bulrush	P	N	G
Schoenoplectus pungens (Vahl) Palla, Bulrush	P	N	G
Scirpus pallidus (Britt.) Fern., Cloaked bulrush			
DIPSACACEAE **Teasel Family**			
Dipsacus fullonum L., Teasel	B	I	F
Dipsacus laciniatus L., Teasel	B	I	F
ELAEAGNACEAE **Oleaster Family**			
Elaeagnus angustifolia L., Russian olive	P	I	T
ERICACEAE **Heath Family**			
Arctostaphylus uva-ursi (L.) Spreng., Bearberry	P	N	S
EUPHORBIACEAE **Spurge Family**			
Agaloma marginata (Pursh) Love & Love, Snow-on-the-mountain	A	N	F
Chamaesyce fendleri (Torrey & Gray), Sandmat	P	N	F
Chamaesyce glyptosperma (Engelm.) Small, Ribseed sandmat	A	N	F
Chamaesyce missurica (Raf.) Shinners, Prairie sandmat	A	N	F
Chamaesyce serpyllifolia (Pers.) Small, Thymeleaf sandmat	A	N	F
Chamaesyce stictospora (Engelm.) Small, Slimseed sandmat	A	N	F

Croton texensis (Klotsch) Muller-Argoviensis, Croton	A	N	F
Poinsettia dentata (Michx.) Kl. & Garcke, Toothed spurge	A	N	F
Tragia ramosa Torrey, Noseburn	P	N	F

FABACEAE Pea Family

Amorpha fruticosa L. var. *angustifolia* Pursh, False indigo	P	N	S
Astragalus adsurgens Pallas var. *robustior* Hook, Prairie milk-vetch	P	N	F
Astragalus bisulcatus (Hook.) Gray, Two-grooved vetch	P	N	F
Astragalus drummondii Dougl., Drummond's milk-vetch	P	N	F
Astragalus missouriensis Nuttall, Missouri milk-vetch	P	N	F
Astragalus racemosus Pursh, Alkali milk-vetch	P	N	F
Astragalus tenellus Pursh, Looseflower milk-vetch	P	N	F
Caragana arborescens Lam., Siberian pea-shrub	P	I	S
Dalea aurea Nuttall, Silktop dalea	P	N	F
Dalea candida Michx. var. *oligophylla* (Torrey) Shinners, White prairie clover	P	N	F
Dalea jamesii (Torrey) Torrey & Gray, Jame's dalea	P	N	F
Dalea purpurea Vent., Purple prairie clover	P	N	F
Gleditsis triacanthos L. Honey locust	P	I	T
Glycyrrhiza lepidota Pursh, American licorice	P	N	F
Hedysarum boreale Nuttalll, Sweet vetch	P	N	F
Hoffmanseggia drepanocarpa Gray, Sicklepod rushpea	P	N	F
Lathyrus eucosmus Butt. & St. John, Bush peavine	P	N	F
Lathrus latifolius L., Perenial sweetpea	P	I	F
Medicago lupulina L., Black medic	P	I	F
Medicago sativa L., Alfalfa	P	I	F
Melilotus albus Medic., White sweet clover	P	I	F
Melilotus officinalis (L.) Pallas, Yellow sweet clover	P	I	F
Oxytropis lambertii Pursh, Lambert crazyweed	P	N	F
Psoralidium argophyllum (Pursh) Rydberg, Scurfpea	P	N	F
Psoralidium tenuiflorum (Pursh) Rydb., Slimflower scurfpea	P	N	F
Robina neomexicana Gray, New Mexico locust	P	I	S/T
Robinia pseudo-acacia L., Black locust	P	I	S/T
Thermopsis divaricarpa Nels., Golden banner	P	N	F
Trifolium pratense L., Red clover	P	I	F
Vexibia Nuttallliana (Turner) Weber, White loco	P	N	F
Vicia americana ssp. *americana* Muhl., American vetch	P	N	F

FAGACEAE Oak Family			
Quercus gambelii Nuttall, Gambel's oak	P	N	S/T
Quercus turbinella Greene, Shrub live oak	P	N	S
Quercus undulata Torrrey, Wavyleaf oak	P	N	S
FRANKENIACEAE Frankenia Family			
Frankenia jamesii Torrey, Jame's frankenia	P	N	S
GENTIANACEAE Gentian Family			
Eustoma grandiflorum (Rafinesque) Shinners, Tulip gentian			
Frasera speciosa Douglas ex Grisebach	P	N	F
Pneumonanthe bigelovii (A. Gray) Greene	P	N	F
GERANIACEAE Geranium Family			
Erodium cicutarium (L.) L'Heritier, Filaree	A	I	F
Geranium caespitosum ssp. *caespitosum* James, Parry geranium	P	N	F
Geranium richardsonii Fischer & Trautv., Richardson's cranebill	P	N	F
GROSSULARIACEAE Currant or Gooseberry Family			
Ribes aurem Pursh, Golden currant	P	N	S
Ribes cereum Dougl., Wax currant	P	N	S
Ribes inerme Rydberg, Gooseberry	P	N	S
Ribes leptanthum Gray, Trumpet gooseberry	P	N	S
HALORAGACEAE Water Milfoil Family			
Myriophyllum sibiricum Komarov, Water milfoil	P	N	F
HELLEBORACEAE Hellebore Family			
Delphinium carolinianum Walter ssp. *virescens* (Nuttall) Johnson, Prairie larkspur	P	N	F
Delphinium Nuttalllianum Greene, Larkspur	P	N	F
Delphinium Nuttalllianum Pritz., Nuttalls's larkspur	P	N	F
HYDROPHYLLACEAE Waterleaf Family			
**Phacelia denticulata* Osterhout, Rocky Mountain phacelia	P	N	F
HYPERICACEAE St. Johnswort Family			

Hypericum perforatum L., St. Johnswort	P	I	F
IRIDACEAE Iris Family			
Iris missouriensis Nuttall, Rocky Mountain iris	P	N	G
Sisyrinchium montanum Greene, Blue-eyed grass	P	N	G
JUNCACEAE Rush Family			
Juncus arcticus Willd. ssp. *ater* (Rydb.) Hulten, Arctic rush	P	N	G
Juncus dudleyi Weig., Path rush	P	N	G
Juncus gerardii Lois., Inland rush	P	N	G
Juncus interior Weig., Inland rush	P	N	G
Juncus nodosus L., Jointed rush	P	N	G
Juncus torreyi Cov., Torrey's rush	P	N	G
JUNCAGINACEAE Arrowgrass Family			
Triglochin maritima L., Seaside arrowgrass	P	I	G
LAMIACEAE Mint Family			
Hedeoma drummondii Benth., Drummond's false pennyroyal	P	N	F
Lycopus americanus Muhl., American bugleweed	P	N	F
Marrubium vulgare L., Horehound	P	I	F
Mentha arvensis L., Field mint	P	N	F
Monarda fistulosa L. *var. menthifolia* (R. Graham) Fernald	F	N	F
Nepeta cataria L., Catnip	P	I	F
Prunella vulgaris L., Common self-heal	P	N	F
Salvia reflexa Hornem., Lanceleaf sage	A	N	F
Teucrium laciniatum Torrey, Cutleaf germander	P	N	F
LEMNACEAE Duckweed Family			
Lemna minor L., Duckweed	A	N	F
LILIACEAE Lily Family			
Leucocrinum montanum Nuttalll, Sand Lily	P	N	F
LINACEAE Flax Family			
Adenolinum lewisii (Pursh) Love & Love, Wild blue flax	P	N	F
Mesynium puberulum (Engelm.) Heller, Plains flax	A	N	F

LOASACEAE Loasa Family

Acrolasia albicaulis (Douglas ex Hooker) Rydberg, White-stemmed mentzelia	A	N	F
**Nuttalllia chrysantha* Greene, Golden blazing star	P	N	F
Nuttalllia decapetala (Pursh ex Sims) Greene, Blazingstar	P	N	F
Nuttalllia multiflora (Nuttall) Greene, Manyflowered mentzelia	P	N	F
Nuttalllia nuda (Pursh) Greene, Blazingstar			

MALVACEAE Mallow Family

Alcea rosea L., Hollyhock	B	I	F
Callirhoe involucrata (Torrey & Gray) A. Gray, Poppymallow	P	N	F
Malva neglecta (L.) L., Cheeseweed	A	I	F
Sphaeralcea angustifolia (Cav.) D.Don var. *cuspidata* Gray, Narrowleaf globemallow	P	N	F
Sphaeralcea coccinea (Nuttall) Rydb., Scarlet globemallow	P	N	F

MORACEAE Mulberry Family

Morus alba L., White mulberry	P	I	T

NYCTAGINACEAE Four-O'Clock Family

Abronia fragrans Nuttalll, Sand-verbena	P	N	F
Mirabilis multiflora (Torrey) Gray, Colorado four-o'clock	P	N	F
Mirabilis oxybaphoides (Gray), Spreading four-o'clock	P	N	F
Oxybaphus linearis (Pursh) Robins., Narrowleaf umbrellawort	P	N	F
Oxybaphus nyctagineus (Michx.) Porter & Coulter, Wild four-o'clock	P	N	F
**Oxybaphus rotundifolius* (Greene) Standl., Roundleaf four-o'clock	P	N	F

OLEACEAE Olive Family

Fraxinus pensylvanica H. Marsh. var. *lanceolata* (Borkh.) Sargent, Green ash	P	I	T
Menodora scabra (Engelm.) Gray, Rough menodora	P	N	F

ONAGRACEAE Evening-Primrose Family

Calylophus lavandulifolius (Torrey & Gray) Raven, Lavenderleaf evening primrose	P	N	F
Calylophus serrulatus (Nuttall) Raven, Plains yellow primrose	P	N	F
Epilobium ciliatum Raf., Hairy willowherb	P	N	F
Gaura coccinea Nuttall, Scarlet gaura	P	N	F
Gaura mollis James, Smallflower gaura	P	N	F

Oenothera albicaulis Pursh, Prairie evening primrose	A	N	F
Oenothera coronopifolia Torrey & Gray, Crownleaf evening primrose	P	N	F
* *Oenothera harringtonii* Wagner, Arkansas valley primrose	P	N	F
Oenothera villosa Thunb., Common evening primrose	P	N	F
Oenothera latifolia (Rydberg) Munz, Evening-primrose	P	N	F
ORCHIDACEAE Orchid Family			
Corallorhiza wisteriana Conrad, Coral-root	P	N	F
OROBANCHACEAE Broom-Rape Family			
Aphyllon fasciculatum (Nuttall) Torrey & Gray, Broomrape	P	N	T
PAPAVERACEAE Poppy Family			
Argemone hispida Gray, Prickly poppy	P	N	F
Argemone polyanthemos (Fedde) G.B. Ownbey, Prickly poppy	P	N	F
PLANTAGINACEAE Plantain Family			
Plantago lanceolata L., Narrowleaf plantain	P	N	F
Plantago major L., Common plantain	P	N	F
Plantago patagonica Jacq., Woolly plantain	A	N	F
POACEAE Grass Family			
Achnatherum hymenoides (Roem. & Schult.) Barkworth, Indian ricegrass	P	N	G
Achnatherum robustum (Vasey) Barkworth, Sleepygrass	P	N	G
Achnatherum scribneri (Vasey) Barkworth, Scribner's needlegrass	P	N	G
Agropyron cristatum (L.) Gaertn. ssp. *Cristatum*, Crested wheatgrass	P	I	G
Agropyron cristatum (L.) Gaertn. ssp. *desertorum* (Fischer) Love, Crested wheatgrass	P	N	G
Agrostis stolonifera (L.), Redtop bentgrass	P	I	G
Alopecurus aequalis Sobol., Short-awn foxtail	P	N	G
Andropogon gerardii Vitman, Big bluestem	P	N	G
Anisantha tectorum (L.) Nevski, Cheatgrass	A	I	G
Aristida divaricata Humbolt & Bonpland, Poverty threeawn	P	N	G
Aristida purpurea Nuttall, Purple threeawn	P	N	G
Avena fatua L., Wild oat	A	I	G
Beckmannia syzigache (Steud.) Fern. ssp. *baicalensis* (Kuzne) Koyama & Kuwano, Sloughgrass	P	I	G
Bothriochloa bladhii (Retz.) S.T. Blake, Australian bluestem	P	I	G

Bothriochloa laguroides (de Cand.) Herter ssp. *torriana* (Steud.) Allred & Gould, Silver bluestem	P	N	G
Bouteloua curtipendula (Michx.) Torrey, Sideoats grama	P	N	G
Bromopsis inermis (Leyss.) Holub, Smooth brome	P	I	G
Bromus japonicus Thunb., Japanese brome	A	I	G
Buchloe dactyloides Engelm., Buffalograss	P	N	G
Calamovilfa longifolia (Hook.) Scribn., Prairie sandreed	P	N	G
Cenchrus longispinus (Hackel) Fernald, Sandbur	P	I	G
Chloris verticillata Nuttall, Windmill grass	P	N	G
Chondrosum gracile Humbolt, Bonpland & Kunth, Blue grama	P	N	G
Chondrosum hirsutum (Lag.) Sweet, Hairy grama	P	N	G
Chondrosum prostratum (Lag.) Sweet, Mat grama	A	N	G
Critesion jubatum (L.) Nevski, Foxtail barley	P	N	G
Critesion pusillum (Nuttall) Love, Little barley	A	N	G
Dactylis glomerata L., Orchardgrass	P	I	G
Diplachne fascicularis (Lam.) Gray, Sprangletop	P	N	G
Distichlis stricta (Torrey) Rydb., Inland saltgrass	P	N	G
Echinochloa crus-galli (L.) Beauv., Barnyardgrass	A	I	G
Elymus canadensis L., Canada wildrye	P	N	G
Elymus elymoides (Raf.) Swezey, Bottlebrush squirreltail	P	N	G
Elymus lanceolatus (Scribn. & Smith) Gould, Streambank wheatgrass	P	N	G
Elymus longifolius (J. G. Smith) Gould, Squirreltail	P	N	G
Elymus trachycaulus (Link) Gould, Slender wheatgrass	P	N	G
Eragrostis cilianensis (All.) Hubb., Stinkgrass	A	N	G
Eragrostis pilosa (L.) Beauv., Carolina lovegrass	A	N	G
Erioneuron pilosum (Buckl.) Nash, Hairy false tridens	P	N	G
Festuca arundinacea Schreb., Tall fescue	P	I	G
Festuca pratensis Huds., Meadow fescue	P	I	G
Hesperostipa comata (Trin. & Rupr.) Barkworth, Needle and thread	P	N	G
Hesperostipa neomexicana (Thurber) Barkworth, New Mexico feathergrass	P	N	G
Hilaria jamesii (Torrey) Benth., Galleta	P	N	G
Koeleria macrantha (Ledeb.) Schult., Junegrass	P	N	G
Leymus ambiguus (Vasey & Scribn.) Dewey, Colorado wild rye	P	N	G
Leymus cinereus Scribn. & Merrill, Basin wild rye	P	N	G
Lycurus setosus (Nuttall) C. Reeder, Common wolftail	P	N	G
Monroa squarrosa (Nuttall) Torrey, False buffalograss	A	N	G
Muhlenbergia arenacea (Buckl.) A. S. Hitchc., Ear muhly	P	N	G

Muhlenbergia arenicola Buckl., Sand muhly	P	N	G
Muhlenbergia asperifolia (Nees & Meyen) Parodi, Alkali muhly	P	N	G
Muhlenbergia cuspidata (Torrey) Rydb., Plains muhly	P	N	G
Muhlenbergia montana (Nuttall) Hitchc., Mountain muhly	P	N	G
Muhlenbergia racemosa (Michx.) Britt. *et al.*, Green muhly	P	N	G
Muhlenbergia torreyi (Kunth) A.S. Hitchc., Ring muhly	P	N	G
Muhlenbergia wrightii Vasey, Wright's muhly	P	N	G
Nassella viridula (Trin.) Barkworth, Green needlegrass	P	N	G
Oryzopsis pungens (Torrey) Hitchc., Mountain ricegrass	P	N	G
Panicum capillare L., Common witchgrass	A	N	G
Panicum obtusum H.B.K., Vine mesquite	P	N	G
Panicum virgatum L., Switchgrass	P	N	G
Pascopyrum smithii (Rydberg) Loeve *var. molle*, Western wheatgrass	P	N	G
Pascopyrum smithii (Rydberg) Loeve *var. smithii* (Rydberg) Love, Western wheatgrass	P	N	G
Phalaroides arundinacea (L.) Rauschert, Canarygrass	P	I	G
Phleum pratense L., Timothy	P	I	G
Phragmites australis (Cav.) Trin., Common reed	P	N	G
Piptatherum micranthum (Trin. & Rupr.) Barkworth, Littleseed ricegrass	P	N	G
Poa compressa L., Canada bluegrass	P	N	G
Poa fendleriana (Steud.) Vasey, Muttongrass	P	N	G
Poa juncifolia Scribn., Alkali bluegrass	P	N	G
Poa palustris L., Fowl bluegrass	P	I	G
Poa pratensis L., Kentucky bluegrass	P	I	G
Polypogon monspeliensis (L.) Desf., Rabbitfoot grass	A	I	G
Psathyrostachys juncea (Fischer) Nevski, Russian wild rye	A	I	G
Schedonnardus paniculatus (Nuttall) Trel., Tumblegrass	P	N	G
Schizachyrium scoparium (Michx.) Nash, Little bluestem	P	N	G
Scleropogon brevifolius Phil., Burro grass	P	N	G
Setaria viridis (L.) *P. Beauvois,*, Green foxtail	A	I	G
Setaria glauca (L.) P. Beauvois Yellow foxtail	A	I	G
Sorgastrum avenaceum (Michx.) Nash, Indiangrass	P	N	G
Spartina gracilis Trin., Alkali cordgrass	P	N	G
Spartina pectinata Link, Prairie cordgrass	P	N	G
Sphenopholus obtusata (Michx.) Scribn., Wedgegrass	P	N	G
Sporobolus airoides (Torrey) Torrey, Alkali sacaton	P	N	G
Sporobolus asper (Michx.) Kunth, Rough dropseed	P	N	G

Sporobolus cryptandrus (Torrey) Gray, Sand dropseed	P	N	G
Thinopyrum intermedium (Host) Barkworth & Dewey, Intermediate wheatgrass	P	N	G
Thinopyrum ponticum (Podpera) Barkworth & Dewey	P	N	G
Tridens muticus (Torrey) Nash var. *elongatus* (Buckl.) Shinners, Green tridens	P	N	G
Triticum aestivum L., Wheat	A	I	G
Vulpia octoflora (Walter) Rydb., Sixweeks fescue	A	N	G

POLEMONIACEAE Phlox Family

Ipomopsis laxiflora (Coulter) V. Grant, Iron skyrocket	P	N	F
Ipomopsis longiflora (Torrey) V. Grant, Flaxflowered gilia	A	N	F
Ipomopsis spicata (Nuttall) V. Grant, Spike gilia	P	N	F
Leptodactylon pungens (Torrey) Nuttall, Granite prickly gilia	P	N	F
Phlox hoodii Richardsonii *subsp. canescens* (Torrey & Gray) Wherry, Phlox	P	N	F

POLYGONACEAE Knotweed Family

Acetosella vulgaris (Koch) Fourr., Sheep sorel	P	I	F
Eriogonum effusum Nuttall, Spreading buckwheat	P	N	F
Eriogonium fendlerianum (Benth.) Small, buckwheat	P	N	F
Eriogonum jamesii Benth. James' buckwheat	P	N	F
Eriogonum lachnogynum Torrey ex Bentham in A. De Candolle, Buckwheat	P	N	F
Eriogonum tenellum Torrey Matted wild buckwheat	P	N	F
Eriogonum umbellatum Torrey Sulfur eriogonum	P	N	F
Fallopia convolvulus (L.) A. Love, Black bindweed	A	I	F
Fallopia x bohemica, Giant knotweed	P	I	F
Persicaria maculata (Raf.) Gray, Lady's Thumb	A	I	F
Persicaria pennsylvanica (L.) Gomez, Pinkweed	A	N	F
Polygonum arenastrum Boreau, Knotweed	A	I	F
Polygonum ramosissimum Michx., Bushy knotweed	A	N	F
Pterogonum alatum (Torrey) Gross, Winged buckwheat	P	N	F
Rumex altissimus Wood, Pale dock	P	N	F
Rumex crispus L., Curly dock	P	I	F
Rumex maritimus L. *subsp. fueginus* (Philippi) Hulten, Dock	B	N	F
Rumex venosus Pursh, Wild-begonia	P	N	F

PORTULACACEAE Purslane Family

Portulaca oleracea L., Common purslane	A	I	F

POTAMOGETONACEAE **Pondweed Family**			
Potamogeton foliosus Raf., Leafy pondweed	P	N	F
Potamogeton nodosus Poiret, Longleaf pondweed	P	N	F
Potomogeton pectinatus L., Sago pondweed	P	N	F
RANUNCULACEAE **Buttercup Family**			
Batrachium longirostre (Godron) Shultz, Water crowfoot	P	N	F
Clematis ligusticifolia Nuttall, Western virgin's bower	P	N	F
Coriflora hirsutissima (Pursh) Weber, Sugarbowls	P	N	F
Halerpestes cymbalaria (Pursh) Greene ssp. *saximontana* (Fern.) Moldenke, Alkali crowfoot	P	N	F
RESEDACEAE **Mignonette Family**			
Reseda lutea L., Wild mignonette	P	I	F
RHAMNACEAE **Buckthorn Family**			
Ceanothus herbaceus Raf., New Jersey tea	P	N	S
ROSACEAE **Rose Family**			
Agrimonia striata Michx., Agrinony	P	N	F
Cerasus pumila (L.) Michx. ssp. *besseyi* (Bailey) Weber, Sand cherry	P	N	S
Cercocarpus montanus Raf., Mountain-mahogany	P	N	S
Crataegus succulenta Schrader ex Link, Hawthorn	P	I	S
Crataegus erythropoda Ashe, Hawthorn	P	N	S
Geum aleppicum Jacq., Yellow avens	P	I	F
Oreobatus deliciosus James, Boulder raspberry	P	N	S
Malus domestica Borkhausen, Apple	P	I	T
Padus virginiana (L.) Miller ssp. *melanocarpa* (Nels.) Weber, Chokecherry	P	N	S/T
Physocarpus monogynus (Torrey) Coulter, Mountain ninebark	P	N	S
Potentilla norvegica L., Norway cinquefoil	P	I	F
Potentilla pensylvanica L., Pennsylvanica cinquefoil	P	N	F
Potentilla supina L. ssp. *paradoxa* (Nuttall) Sojak, Bushy cinquefoil	P	N	F
Prunus americana Marsh., American plum	P	N	S/T
Prunus persica var. persica (L.) Batsch., Peach	P	I	T
Rosa arkansana Porter, Arkansas rose	P	N	S
Rosa woodsii Lindl., Wood's rose	P	N	S

Rubus idaeus L. var. *melanolasius* (Dieck) Focke, Red raspberry	P	N	S
Sanguisorba minor Scop., Small burnet	P	I	F
RUBIACEAE Madder Family			
Galium spp. L., Bedstraw	P	N	F
RUTACEAE Citrus Family			
Ptelea trifoliata L. Hoptree	P	N	T
SALICACEAE Willow Family			
Populus angustifolia James, Narrowleaf cottonwood	P	N	T
Populus deltoides Marshall, Plains cottonwood	P	N	T
Populus x acuminata Rydb., Lanceleaf cottonwood	P	N	T
Salix amygdaloides Anderss., Peachleaf willow	P	N	T
Salix exigua Nuttall, Sandbar willow	P	N	S
Salix fragilis L., Crack willow	P	I	T
Salix irrorata Anderss., Bluestem willow	P	N	S
SANTALACEAE Sandlewood Family			
Comandra umbellata (L.) Nuttall, Bastard toadflax	P	N	F
SCROPHULARIACEAE Figwort Family			
Castilleja integra Gray, Indian Paintbrush	P	N	F
Linaria dalmatica (L.) Mill., Toadflax	P	I	F
Linaria vulgaris Miller, Toadflax	P	I	F
Penstemon angustifolius Nuttall, Broadbeard beard-tongue	P	N	F
Penstemon auriberbis Penn., Colorado beard-tongue	P	N	F
Penstemon barbatus Torrey *subsp. trichander* (A. Gray) Keck, Penstemon	P	N	F
Penstemon brandegei (T. C. Porter) T. C. Porter ex Rydberg, Penstemon	P	N	F
Penstemon secundiflorus Benth., Sidebells penstemon	P	N	F
Penstemon versicolor Penn., Penstemon	P	N	F
Penstemon virens Penn., Front Range beard-tongue	P	N	F
Penstemon virgatus ssp. *asa-grayi* Crosswhite, Beard-tongue	P	N	F
Pocilla biloba (L.) Weber, Pocilla	A	I	F
Scrophularia lanceolata Pursh, Figwort	P	N	F
Verbascum thapsus L., Great mullein	P	I	F
Veronica americana (Raf.) Schwein. American brooklime	P	N	F

Veronica anagallis-aquatica L., Water speedwell	P	I	F
Veronica catenata Penn., Speedwell	P	I	F

SMILACACEAE Simlax Family

**Smilax lasioneuron* Hook., Carrionflower	P	N	V

SOLANACEAE Nightshade Family

Chamaesaracha coniodes (Moricandl) Britton, False nightshade	P	N	F
Chamaesaracha coronopus (Dunal) Gray, False nightshade	P	N	F
Physalis hederifolia Gray var. *cordifolia* (Gray) Waterfall, Clammy groundcherry	P	N	F
Physalis virginiana Miller, Virginia groundcherry	P	N	F
Quincula lobata (Torrey) Raf., Chinese lantern	P	N	F
Solanum heterodoxum Dunal, Buffalobur	A	N	F
Solanum rostratum Dunal, Buffalobur	A	N	F
Solanum triflorum Nuttalll, Nightshade	A	I	F

TAMARICACEAE Tamarisk Family

Tamarix ramosissima Ledeb., Tamarisk	P	I	S

THALICTRACEAE Meadow Rue Family

Thalictrum fendleri Engelm., Fendler's meadowrue	P	N	F

TYPHACEAE Cattail Family

Typha angustifolia L., Narrow-leaved cattail	P	N	G
Typha latifolia L., Broad-leaved cattail	P	N	G

ULMACEAE Elm Family

Celtis reticulata Torrey Netleaf hackberry	P	N	T
Ulmus pumila L. Siberian elm	P	I	T

VERBENACEAE Vervain Family

Glandularia bipinnatifida (Nuttall) Nuttall, Showy vervain	P	N	F
Verbena bracteata Lag. & Rodriguez, Prostrate vervain	P	N	F
Verbena hastata L., Blue vervain	P	N	F

VIOLACEAE Violet Family

Viola Nuttalllii Pursh, Nuttalll's violet	P	N	F
VISCACEAE Mistletoe Family			
Arceuthobium vaginatum (Wildennow) Presl *subsp. cryptopodium* (Engelmann) Hawksworth & Weins, Dwarf mistletoe	P	N	F
VITACEAE Grape Family			
Parthenocissus quinquefolia (L.) Planchon, Creeper	P	N	V
Parthenocissus vitaceae (Knerr) Hitchcock, Virgin's creeper	P	I	V
Vitis ripara Michx., Grape	P	N	V
ZYGOPHYLLACEAE Caltrop Family			
Kallstroemia parviflora Norton, Caltrop	A	N	F
Tribulus terrestris L., Puncturevine	A	I	F

Plant Species Known on Pinon Canyon

Life Form: A = Annual, B = Biennial, P = Perennial

Origin: N = Native, I = Introduced

Form: F = Forb, G = Grass, V = Vine, S = Shrub, T = Tree

Season: W = Warm Season, C = Cool Season

* Species of Special Concern

	Lif	Orig	Form
FERNS & FERN ALLIES			
Athyriaceae Ladyfern Family			
Cystopteris fragilis (L.) Bernhardi, brittle fern	P	N	F
Aspidaceae Shieldfern Family			
Dryopteris felix-mas (L.) Schott, male fern	P	N	F
EQUISETACEAE Horsetail Family			
Hippochaete laevigata (A. Braun) Farwell, smooth horsetail	P	N	G
Hippochaete variegata (Schleicher) Bruhin	P	N	G
SELAGINELLACEAE Little Club-Moss Family			
Selaginella densa Rydb.	P	N	F
Selaginella mutica (D. C. Eaton)	P	N	F
SINOPTERIDACEAE Lipfern Family			
Cheilanthes feei Moore	P	N	F
Cheilanthes fendleri Hook.	P	N	F
WOODSIACEAE Woodsia Family			
Woodsia oregana ssp. *cathcartiana* (Robins.) Windham	P	N	F
GYMNOSPERMS			
CUPRESSACEAE Cypress Family			
Sabina monosperma (Engelm.) Rydb.	P	N	T
Sabina scopulorum (Sargent) Rydb.	P	N	T
PINACEAE Pine Family			
Pinus edulis Engelmann	P	N	T
Pinus ponderosa Douglas ssp. *scopulorum* (Watson) Weber	P	N	T
ANGIOSPERMS, FLOWERING PLANTS			
ACERACEAE Maple Family			

Acer glabrum Torr.	P	N	T
AGAVACEAE Agave Family			
Yucca glauca Nutt.	P	N	F
ALISMATACEAE Water-Plantain Family			
Alisma trivale Pursh	N	P	F
Sagittaria spp. L.	N	P	F
ALLIACEAE Onion Family			
Allium cernuum Roth	P	N	F
Allium textile Nelson & Macbride	P	N	F
ALSINACEAE Chickweed Family			
Eremogone hookeri (Nuttall) Weber	P	N	F
Paronychia sessiliflora Nuttall	P	N	F
AMARANTHACEAE Amaranth Family			
Amaranthus blitoides Watson	A	I	F
ANACARDIACEAE Sumac Family			
Rhus aromatica Aiton	P	N	S
Toxicodendron rydbergii (Small) Greene	P	N	S
APIACEAE Carrot Family			
Conium maculatum L.	B	I	F
Cymopterus acaulis (Pursh) Rafinesque	P	N	F
Cymopterus montanus Nuttall	P	N	F
Heracleum sphondylium L. ssp. *montanum* (Schleicher) Briquet	P	N	F
Lomatium orientale Coulter & Rose	P	N	F
Musineon divaricatum (Pursh) Rafinesque	P	N	F
APOCYNACEAE Dogbane Family			
Apocynum cannabinum L.	P	N	F
ASCLEPIADACEAE Milkweed Family			
Asclepias arenaria Torrey	P	N	F
Asclepias asperula (Decaisne) Woodson	P	N	F
Asclepias engelmanniana Woodson	P	N	F
Asclepias incarnata L.	P	N	F
Asclepias macrotis Torrey	P	N	F
Asclepias speciosa Torrey	P	N	F

Asclepias subverticillata (Gray) Vail	P	N	F
* *Asclepias uncialis* Greene	P	N	F
Asclepias verticillata (Gray) Vail	P	N	F
Asclepias viridiflora Rafinesque	P	N	F
* *Sarcostemma crispum* Bentham	P	N	F

ASTERACEAE **Daisy Family**

Acroptilon repens (L.) De Candolle	P	I	F
Ambrosia psilostachya de Candolle var. *coronopifolia* (Torrey & Gray) Farwell	P	N	F
Ambrosia trifida L.	A	I	F
Antennaria howellii Greene	P	N	F
Antennaria parvifolia Nuttall	P	N	F
Arctium minus (Hill) Bernhardi	P	I	F
Artemisia bigelovii Gray	P	N	S
Artemisia frigida Willdenow	P	N	F
Artemisia ludoviciana Nuttall	P	N	F
Baccharis wrightii Gray	P	N	F
Brickellia brachyphylla Gray	P	N	F
Brickellia californica (Torrey & Gray) Gray	P	N	S
Chrysothamnus nauseosus (Pallas) Britton	P	N	S
Cirsium undulatum (Nuttall) Sprengel	P	N	F
Conyza canadensis (L.) Cronquist	A	N	F
Coreopsis tinctoria Nuttall	A	N	F
Cyclachaena xanthifolia (Nuttall) Fresenius	A	N	F
Dyssodia aurea (Gray) Nelson	A	N	F
Erigeron divergens Torrey & Gray	P	N	F
Erigeron pumilus Nuttall	P	N	F
Erigeron subtrinervis Rydberg	P	N	F
Evax prolifera Nuttall	A	N	F
Gaillardia pinnatifida Torrey	P	N	F
Grindelia squarrosa (Pursh) Dunal	P	N	F
Gutierrezia sarothrae (Pursh) Britton & Rusby	P	N	F
Helianthus annuus L.	A	N	F
Helianthus petiolaris Nuttall	A	N	F
Heterotheca villosa (Pursh) Shinners	P	N	F
Hymenopappus filifolius Hooker	P	N	F
Hymenopappus tenuifolius Hooker	P	N	F
Iva axillaris Pursh	P	N	F
Lactuca serriola L.	P	I	F
Lactuca tatarica (L.) Meyer ssp. *pulchella* (Pursh) Stebbins	P	N	F
Leucelene ericoides (Torrey) Greene	P	N	F

Liatris punctata Hooker	P	N	F
Lygodesmia juncea (Pursh) D. Don.	P	N	F
Machaeranthera pinnatifida (Hooker) Shinners	P	N	F
Machaeranthera tanacetifolia (Humbolt, Bonpland & Kunth) Nees	A	N	F
Melampodium leucanthum Torrey & Gray	P	N	F
Nothocalis cuspidata (Pursh) Greene	P	N	F
Oligosporus caudatus (Michaux) Poljakov	P	N	F
Oligosporus dracunculus (L.) ssp. *glaucus* (Pallus) Love & Love	P	N	F
Oligosporus filifolius (Torrey) Poljakov	P	N	S
Oonopsis foliosa (Gray) Greene	P	N	F
Packera neomexicana (Greene) W. & Love ssp. *mutabilis* (Gray) Weber & Love	P	N	F
Packera pseudaurea (Rydberg) Weber & Love	P	N	F
Packera tridenticulata (Rydberg) Weber & Love	P	N	F
Palafoxia rosea (Bush) Cory *var*. *macrolepsis* (Rydberg) Turner	P	N	F
Pectis angustifolia Torrey	P	N	F
Picradeniopsis oppositifolia (Nuttall) Rydberg	P	N	F
Ratibida columnifera (Nuttall) Wooton & Standley	P	N	F
Ratibida tagetes (James) Barnhart	P	N	F
Senecio riddellii Torrey & Gray	P	N	F
Solidago mollis Bartling	P	N	F
Solidago multiradiata Aiton	P	N	F
Solidago petiolaris Aiton	P	N	F
Solidago velutina de Candolle	P	N	F
Stephanomeria pauciflora (Torrey) Nelson	P	N	F
Taraxacum officinale G.H. Weber	P	I	F
Tetraneuris acaulis (Pursh) Greene	P	N	F
Thelesperma megapotamicum (Sprengel) O. Kuntze	P	N	F
Thelesperma subnudum Gray	P	N	F
Townsendia exscapa (Richardson) Porter	P	N	F
Townsendia hookeri Beaman	P	N	F
Tragopogon dubius Scopoli ssp. *major* (Jacquin) Vollmann	P	N	F
Virgulus ericoides (L.) Reveal & Keener	P	I	F
Virgulus falcatus (Lindley) Reveal & Keener	P	N	F
Virgulus fendleri (Gray) Reveal & Keener	P	N	F
Zinnia grandiflora Nuttall	P	N	F
BORAGINACEAE Borage Family			
Cryptantha minima Rydberg	A	N	F
Lappula marginata (Bieberstein) Guerke	A	I	F
Lappula redowskii (Hornemamm) Greene	A	N	F
Lithospernum incisum Lehmann	P	N	F

Onosmodium molle Michaux var. *occidentale* (Mackenzie) Cochrane	P	N	F
Oreocarya bakeri (Greene) Payson	P	N	F
Oreocarya suffruticosa (Piper) Greene	P	N	F
Oreocarya thyrsiflora Greene	P	N	F
BRASSICACEAE Mustard Family			
Arabis hirsuta L.	A	I	F
Camelina microcarpa Andrzejowski	A	I	F
Descurainia incana (L.) Webb	P	N	F
Descurania incisa (Engelmann) Britton	P	N	F
Descurainia pinnata (Walter) Britton	A	I	F
Descurainia sophia (L.) Webb.	A	I	F
Draba reptans (Lamarck) Fernald	A	N	F
Erysimum asperum (Nuttall) de Candolle	P	N	F
Erysimum inconspicuum (Watson) MacMillan	P	N	F
Lesquerella fendleri (Gray) Watson	P	N	F
Lesquerella ovalifolia Rydberg	P	N	F
Stanleya pinnata (Pursh) Britton	P	N	F
Thelypodium wrightii Gray ssp. *oklahomensis* Al-Shehbaz	P	N	F
CACTACEAE Cactus Family			
Coryphantha vivipara (Nuttall) Britton & Rose	P	N	S
Cylindropuntia imbricata (Haworth) Knuth	P	N	S
Echinocereus reichenbackii (Terscheck) Haage var. *perbellus* (Britt. & Rose) Benson	P	N	S
Echinocereus viridiflorus Engelmann	P	N	S
Opuntia macrorhiza Engelmann	P	N	S
Opuntia phaeacantha Engelmann	P	N	S
Opuntia polyacantha Haworth	P	N	S
CALOCHORTACEAE Mariposa Family			
Calochortus gunnisonii Watson	P	N	F
CAMPANULACEAE BellFlower Family			
Lobelia cardinalis L. ssp. *graminea* (Lamarck) McVaugh	P	N	F
CAPPARIDACEAE Caper family			
Cleome serrulata Pursh	A	N	F
Polanisia dodecandra (L.) de Candolle	P	N	F
CAPRIFOLIACEAE Honeysuckle Family			
Sambucus canadensis (L.) Blake	P	N	S

Symphoricarpos albus (L.) Blake	P	N	S
Symphoricarpos occidentalis Hooker	P	N	S
Symphoricarpos oreophilus Gray	P	N	S
CHENOPODIACEAE Goosefoot Family			
Atriplex argenta Nuttall	A	N	F
Atriplex canescens (Pursh) Nuttall	P	N	S
Bassia sieversiana (Palla) Weber	A	I	F
Chenopodium album L.	A	I	F
Chenopodium desiccatum Nelson	A	N	F
Chenopodium incanum (Watson) Heller	A	N	F
Chenopodium leptophyllum (Nuttall) Watson	A	N	F
Kraschenninnikovia lanata (Pursh) Meeuse & Smit	P	N	H
Salsola australis R. Brown	A	I	F
Sarcobatus vermiculatus (Hooker) Torrey	P	N	S
COMMELINACEAE Spiderwort Family			
Tradescantia occidentalis (Britton) Smyth	P	N	F
CONVOLVULACEAE Morningglory Family			
Convolvulus arvensis L.	P	I	F
Evolvulus nuttallianus Roemer & Schultes	P	N	F
Ipomoea leptophylla Torrey	P	N	F
CROSSOSOMATACEAE			
Forsellesia planitierum Ensign	P	N	S
CUCURBITACEAE Gourd Family			
Cucurbita foetidissima Humbolt Bonpland & Kunth	P	N	V
CYPERACEAE Sedge Family			
Carex gravida Bailey var. *lunelliana* (Mackenzie) Hermann	P	N	G
Carex lanuginosa Fernald	P	N	G
Carex stenophylla Wahlenberg ssp. *eleocharis* (Bailey) Hulten	P	N	G
Eleocharis palustris (L.) Roemer & Schultes	P	N	G
Mariscus filiculmis (M. Vahl) Koyama	P	N	G
Mariscus schweinitzii (Torrey) Koyama	P	N	G
Schoenoplectus lacustris (L.) Palla ssp. *acutis* (Muhlenberg) Love & Love	P	N	G
Schoenoplectus pungens (Vahl) Palla	P	N	G
ELAEAGNACEAE Oleaster Family			
Elaeagnus angustifolia L.	P	I	T

EUPHORBIACEAE **Spurge Family**			
Alagloma marginata (Pursh) Love & Love	A	N	F
Chamaesyce fendleri (Torrey & Gray)	P	N	F
Chamaesyce glyptosperma (Engelmann) Small	A	N	F
Chamaesyce lata (Engelmann) Small	P	N	F
Chamaesyce missurica (Rafinesque) Shinners	A	N	F
Chamaesyce stictospora (Engelmann) Small	A	N	F
Croton texensis (Klotzsch) Muller-Argoviensis	A	N	F
Poinsettia dentata (Michaux) Klotsch & Garcke	A	N	F
Tithymalus spathulatus (Lamark) Weber	A	N	F
Tragia ramosa Torrey	P	N	F
FABACEAE **Pea Family**			
Amorpha fruticosa L. var. *angustifolia* Pursh	P	N	S
* *Amorpha nana* Pursh	P	N	S
Astragalus crassiocarpus Nuttall	P	N	F
Astragalus gracilis Nuttall	P	N	F
Astragalus missouriensis (Nuttall) Rydberg	P	N	F
Astragalus nuttallianus de Candolle var. *micranthiformis* Barneby	P	N	F
Astragalus paryii Nuttall	P	N	F
Astragalus puniceus Osterhout	P	N	F
Astragalus racemosus Pursh	P	N	F
Alkali poisonvetch			
Astragalus shortianus Nuttall	P	N	F
Caesalpinia jamesii (Torrey & Gray) Fischer	P	N	F
Dalea aurea Nuttall	P	N	F
Dalea candida Michaux var. *oligophylla* (Torrey) Shinners	P	N	F
Dalea enneandra Nuttall	P	N	F
Dalea jamesii (Torrey) Torrey & Gray	P	N	F
Dalea purpurea Ventenat	P	N	F
Glycyrrhiza lepidota Pursh	P	N	F
Hedysarum boreale Nuttall	P	N	F
Hoffmanseggia drepanocarpa Gray	P	N	F
Lathyrus eucosmus Butters & St. John	P	N	F
Lupinus pusillus Pursh	A/B	N	F
Medicago sativa L.	P	I	F
Melilotus albus Medikus	P	I	F
Melilotus officinalis (L.) Pallas	P	I	F
Oxytropis deflexa (Pallas) deCandolle var. *sericea* Torrey & Gray	P	N	F
Oxytropis lambertii Pursh	P	N	F

Pediomelum hypogaeum (Nuttall) Rydberg	P	N	F
Psoralidium tenuiflorum (Pursh) Rydberg	P	N	F
Vexibia nuttalliana (Turner) Weber	P	N	F
Vicia americana Muhlenberg ssp. *americana* Muhlenberg	P	N	F
Vicia americana Muhlenberg ssp. *minor* (Hooker) Love & Love	P	N	F
FRANKENIACEAE Frankenia Family			
Frankenia jamesii Torrey	P	N	S
FUMARIACEAE Fumitory Family			
Corydalis aurea Willdenow	A	N	F
Corydalis curvisiliqua Engelmann ssp. *occidentalis* (Engelmann) W.A. Weber	A	N	F
GERANIACEAE Geranium Family			
Erodium cicutarium (L.) L'Heritier	A	I	F
GROSSULARIACEAE Currant or Gooseberry Family			
Ribes aureum Pursh	P	N	S
Ribes cereum Douglas	P	N	S
Ribes leptanthum Gray	P	N	S
HELLEBORACEAE Hellebore Family			
Delphinium carolinianum Walter ssp. *virescens* (Nuttall) Johnson	P	N	F
Delphinium wootonii Rydberg	P	N	F
HYDRANGEACEAE Hydrangea Family			
Philadelphus microphyllus Gray	P	N	S
IRIDACEAE Iris Family			
Sisyrinchium montanum Greene	P	N	G
JUNCACEAE Rush Family			
Juncus arcticus Willdenow ssp. *ater* (Rydberg) Hulten	P	N	G
Juncus dudleyi Wiegand	P	N	G
Juncus interior Wiegand	P	N	G
Juncus torreyi Coville	P	N	G
JUNCAGINACEAE Arrowgrass Family			
Triglochin maritima L.	P	I	G
LAMIACEAE Mint Family			
Hedeoma drummondii Bentham	P	N	F

Marribium vulgare L.	P	I	F
Monarda pectinata Nuttall	P	N	F
Salvia reflexa Hornemann	A	N	F
Teucrium laciniatum Torrey	P	N	F
LILIACEAE Lily Family			
Leucrocrinum montanum Nuttall	P	N	F
LINACEAE Flax Family			
Adenolinum lewisii (Pursh) Love & Love	P	N	F
Mesynium puberulum (Engelmann) Heller	A	N	F
Mesynium rigidum (Pursh) Love & Love	A	N	F
LOASACEAE Loasa Family			
Acrolasia albicaulis (Douglas) Rydberg	A	N	F
Mentzelia oligosperma Nuttall	P	N	F
Nuttallia nuda (Pursh) Greene	P	N	F
Nuttallia rusbyi (Wooton) Rydberg	P	N	F
MALVACEAE Mallow Family			
Sphaeralcea angustifolia (Cavanilles) D.Don var. *cuspidata* Gray	P	N	F
Sphaeralcea coccinea (Nuttall) Rydberg	P	N	F
MARTYNIACEAE Unicorn Plant Family			
Proboscidea louisianica (Miller) Thellung	P	A	F
NYCTAGINACEAE Four-O'Clock Family			
Ambronia fragrans Nutttall	P	N	F
Mirabilis multiflora (Torrey) Gray	P	N	F
Oxybaphus hirsutus (Pursh) Sweet	P	N	F
Oxybaphus linearis (Pursh) B.L. Robinson	P	N	F
* *Oxybaphus rotundifolius* (Greene) Standley	P	N	F
Tripterocalyx micranthus (Torrey) Hooker	A	N	F
ONAGRACEAE Evening-Primrose Family			
Calylophus lavandulifolius (Torrey & Gray) Raven	P	N	F
Gaura coccinea Nuttall	P	N	F
Gaura mollis James	P	N	F
Oenothera albicaulis Pursh	A	N	F
Oenothera caespitosa Nuttall	P	N	F
* *Oenothera harringtonii* Wagner	P	N	F

OROBANCHACEAE Broom-Rape Family			
Orobanche multiflora Nuttall	P	N	F
PAPAVERACEAE Poppy Family			
Argemone hispida Gray	P	N	F
PLANTAGINACEAE Plantain Family			
Plantago patagonica Jacquin	A	N	F
POACEAE Grass Family			
Achnatherum hymenoides (Roemer & Schultes) Barkworth	P	N	G
Achnatherum robustum (Vasey) Barkworth	P	N	G
Achnatherum scribneri (Vasey) Barkworth	P	N	G
Agropyron cristatum (L.) Gaertner ssp. *cristatum*	P	I	G
Agropyron cristatum (L.) Gaertner ssp. *desertorum* (Fischer) Love	P	N	G
Agrostis stolinifera (L.)	P	I	G
Alopecurus aequalis Sobolewski	P	N	G
Aristida purpurea Nuttall	P	N	G
Andropogon gerardii Vitman	P	N	G
Avena fatua L.	A	I	G
Bothriochloa laguroides (de Cand.) Herter ssp. *torreyana* (Steud.) Allred & Gould	P	N	G
Bouteloua curtipendula (Michaux) Torrey	P	N	G
Bromopsis inermis (Leyss.) Holub	P	I	G
Bromus japonicus Thunberg	A	I	G
Buchloe dactyloides Engelmann	P	N	G
Calamagrostis stricta (Timm) Koeler	P	N	G
Chondrosum eriopodum Torrey	P	N	G
Chondrosum gracile Humbolt, Bonpland & Kunth	P	N	G
Chondrosum hirsutum (Lagasca) Sweet	P	N	G
Chondrosum prostratum (Lagasca) Sweet	A	N	G
Critesion jubatum (L.) Nevski	P	N	G
Critesion pusillum (Nuttall) Love	A	N	G
Dactylis glomerata L.	P	I	G
Echinochloa crus-galli (L.) Beauvois	A	I	G
Elymus canadensis L.	P	N	G
Elymus elymoides (Rafinesque) Swezey	P	N	G
Elymus lanceolatus (Scribner & Smith) Gould	P	N	G
Erioneuron pilosum (Buckley) Nash	P	N	G
Hesperostipa comata (Trinius & Ruprecht) Barkworth	P	N	G
Hesperostipa neomexicana (Thurber) Barkworth	P	N	G
Hilaria jamesii (Torrey) Bentham	P	N	G

Koeleria macrantha (Ledebour) Schultes	P	N	G
Lycurus setosus (Nuttall) C. Reeder	P	N	G
Monroa squarrosa (Nuttall) Torrey	A	N	G
Muhlenbergia arenacea (Buckley) A. S. Hitchcock	P	N	G
Muhlenbergia arenicola Buckley	P	N	G
Muhlenbergia asperifolia (Nees & Meyen) Parodi	P	N	G
Muhlenbergia torreyi (Kunth) A.S. Hitchcock	P	N	G
Nassella viridula (Trinius) Barkworth	P	N	G
Panicum capillare L.	P	N	G
Panicum obtusum Humbolt, Bonpland & Kunth	A	N	G
Pascopyrum smithii (Rydberg) Love	P	N	G
Phragmites australis (Cavanilles) Trinius	P	N	G
Piptatherum micranthum (Trinius & Ruprecht) Barkworth	P	N	G
Poa bigelovi Vasey & Scribner	A	N	G
Poa pratensis L.	P	I	G
Poa secunda J. Presl.	P	N	G
Polypogon monspeliensis (L.) Desfontaines	A	I	G
Schedonnardus paniculatus (Nuttall) Trelease	P	N	G
Schizachyrium scoparium (Michaux) Nash	P	N	G
Scleropogon brevifolius Philippi	P	N	G
Sporobolus airoides (Torrey) Torrey	P	N	G
Sporobolus cryptandrus (Torrey) Gray	P	N	G
Sphenopholus obtusata (Michaux) Scribner	P	N	G
Tridens muticus (Torrey) Nash var. *elongatus* (Buckley) Shinners	P	N	G
Vulpia octoflora (Walter) Rydberg	A	N	G

POLEMONIACEAE **Phlox Family**

Gilia opthalmoides Brand	A	N	F
Giliastrum rigidulum ssp. *acerosum* (Bentham) Rydberg	P	N	F
Ipomopsis laxiflora (Coulter) V. Grant	P	N	F
Ipomopsis pumila (Nuttall) V. Grant	A	N	F
Ipomopsis spicata (Nuttall) V. Grant	P	N	F
Phlox longifolia Nuttall	P	N	F

POLYGONACEAE **Knotweed Family**

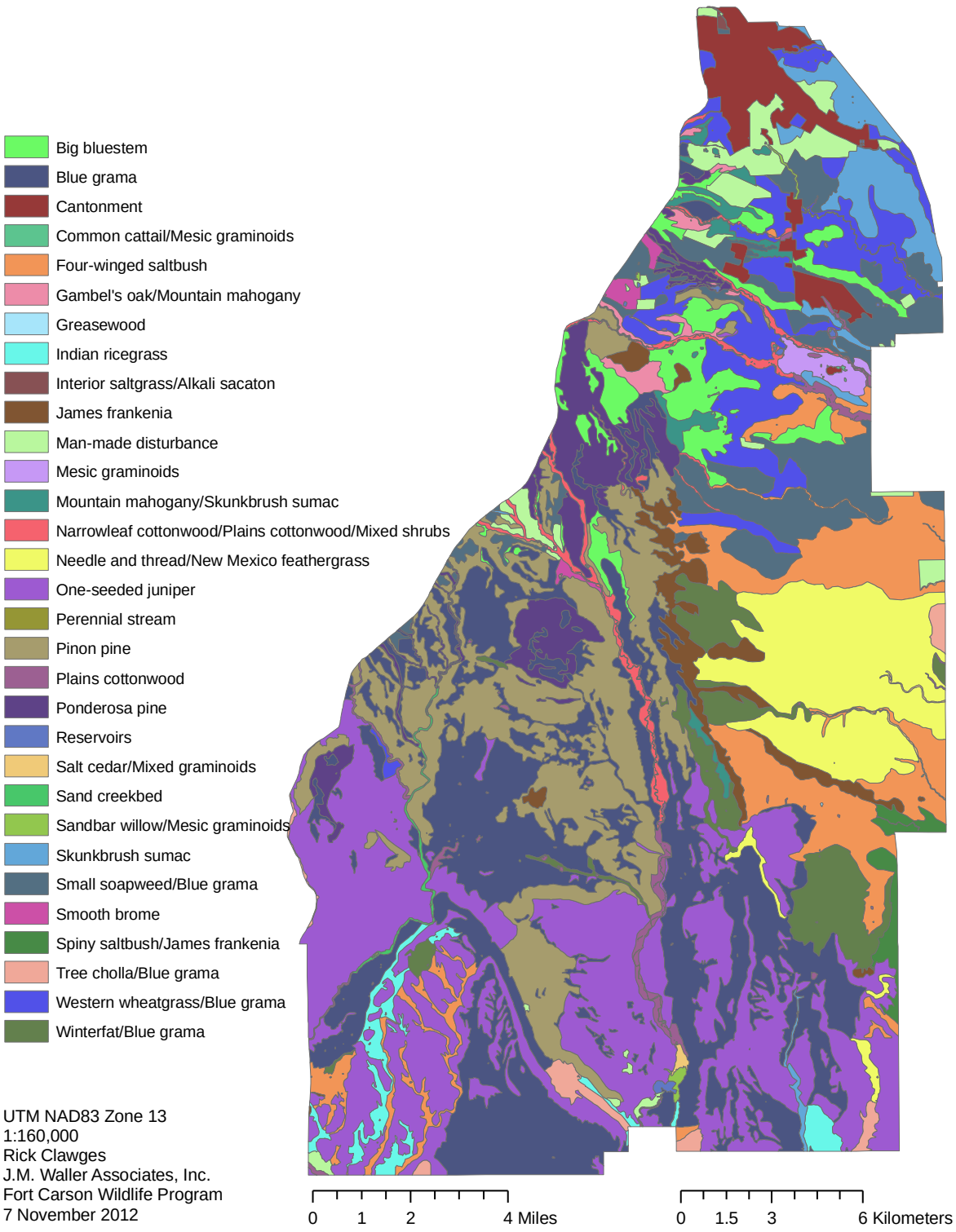
Eriogonum annuum Nuttall	A	N	F
Eriogonum effusum Nuttall	P	N	F
Eriogonium fendlerianum (Benth.) Small	P	N	F
Eriogonium gordonii Bentham	A	N	F
Eriogonum jamesii Bentham	P	N	F
Eriogonum lachnogynum Torrey	P	N	F
Eriogonum tenellum Torrey	P	N	F

Rumex crispus L.	P	I	F
Rumex stenophyllus Ledebour	P	I	F
PORTULACACEAE Purslane Family			
Portulaca oleracea L.	A	N	F
Portulaca halimoides L.	A	I	F
RANUNCULACEAE Buttercup Family			
Clematis ligusticifolia Nuttall	P	N	F
ROSACEAE Rose Family			
Cerasus pensylvanica L.	P	N	T
Cercocarpus montanus Rafinesque	P	N	S
Drymocallis arguta (Pursh) Rydberg	P	N	F
Oreobatus deliciosus James	P	N	S
Padus virginiana (L.) Miller ssp. *melanocarpa* (Nelson) Weber	P	N	T
Physocarpus monogynus (Torrey) Coulter	P	N	S
Prunus americana Marshall	P	N	T
Rosa woodsii Lindley	P	N	S
RUTACEAE Citrus Family			
Ptelea trifoliata L.	P	N	T
SALICACEAE Willow Family			
Populus x acuminata Rydberg	P	N	T
Populus angustifolia James	P	N	T
Populus deltoides Marshall spp. *monolifera* (Aiton) Eckenwalder	P	N	T
Populus tremuloides Michaux	P	N	T
Salix alba L. var. *vitellina* (L.) Koch X *S. fragilis* L.	P	N	S
Salix amygdaloides Andersson	P	N	S
Salix interior Rowlee	P	N	S
SANTALACEAE Sandlewood Family			
Comandra umbellata (L.) Nuttall	P	N	F
SAPINDACEAE Soapberry Family			
* *Sapindus saponaria* L. var. *drummondii* (Hooker & Arnott) Benson	P	N	S
SAXIFRAGACEAE			
Heuchera parvifolia Nuttall Little leaf alumroot	P	N	F

SCROPHULARIACEAE Figwort Family			
Castilleja integra Gray	P	N	F
Castilleja sessiliflora Gray	P	N	F
Penstemon angustifolius ssp *caudatus* Nuttall	P	N	F
Penstemon auriberbis Pennell	P	N	F
Penstemon barbatus (Cavanilles) Roth var. *torreyi* (Bentham) Keck	P	N	F
Verbascum thapsus L.	P	I	F
SOLANACEAE Nightshade Family			
Chamaesaracha conoides (Moricand) Britton	P	N	F
Chamaesaracha coronopus (Dunal) Gray	P	N	F
Lycium pallidum Miers	P	N	S
Physalis hederifolia Gray var. *cordifolia* (Gray) Waterfall	P	N	F
Physalis virginiana Miller	P	N	F
Quincula lobata (Torrey) Rafinesque	P	N	F
Solanum americanum Miller	A	N	F
Solanum elaeagnifolium Cavanilles	P	N	F
Solanum rostratum Dunal	A	N	F
Solanum triflorum Nuttall	A	N	F
TAMARICACEAE Tamarisk Family			
Tamarix ramosissima Ledebour	P	I	T
TYPHACEAE Cattail Family			
Typha angustifolia L.			
Typha latifolia L.			
ULMACEAE Elm Family			
Celtis reticulata Torr.	P	N	T
URTICACEAE Nettle Family	A	N	F
Parietaria pensylvanica Muhlenberg			
VERBENACEAE Vervain Family			
Glandularia bipinnatifida (Nuttall) Nuttall	P	N	F
Phyla cuneifolia (Torrey) Greene	P	N	F
Verbena bracteata Lagasca & Rodriguez	P	N	F
VIOLACEAE Violet Family			
Hybanthus verticillatus (Ortega) Baillon	P	N	F
Viola nuttallii Pursh	P	N	F

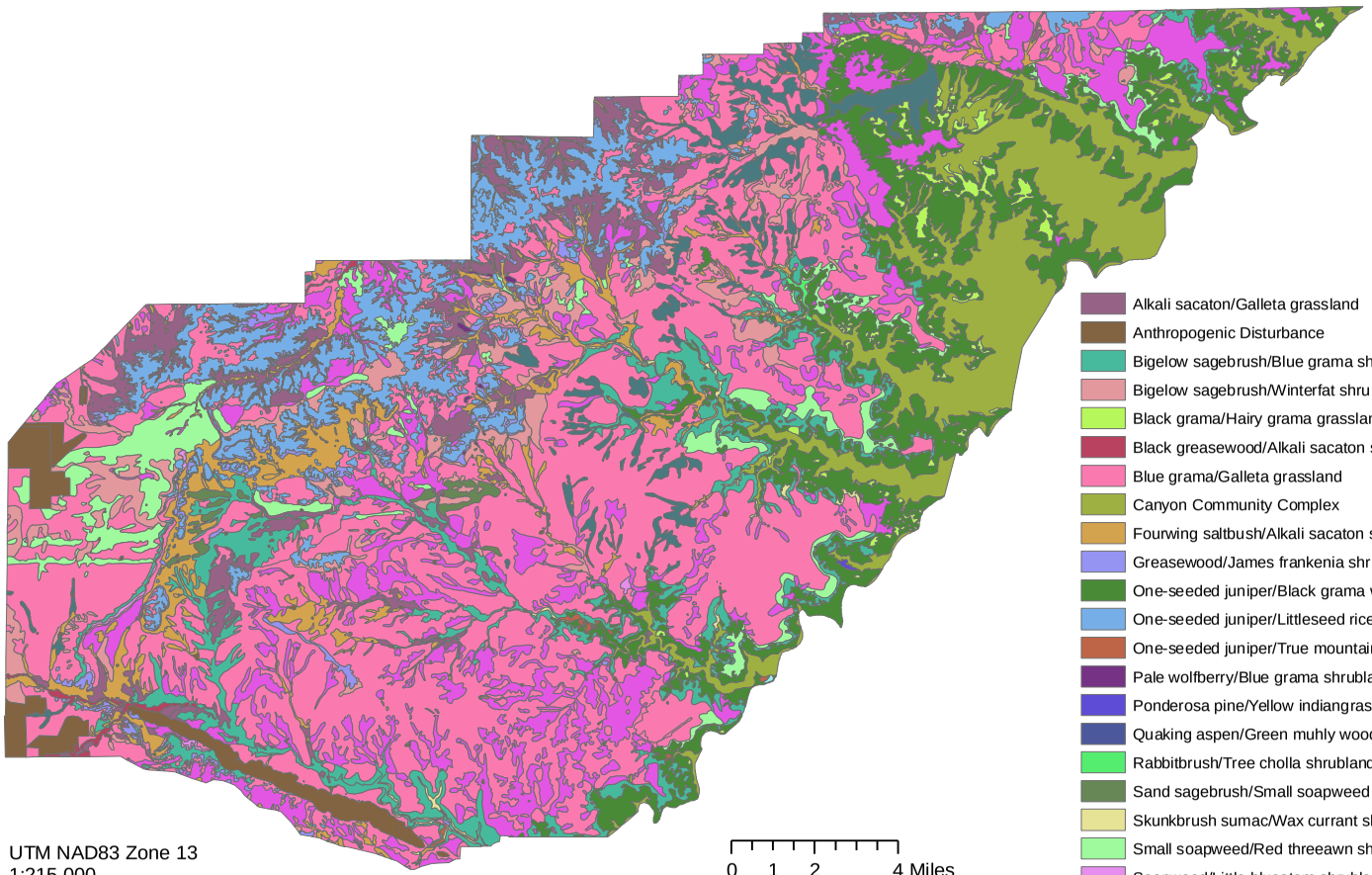
VITACEAE Grape Familt			
Parthenocissus vitaceae (Knerr) Hitchcock	P	N	F
Vitis acerifolia Rafinesque	P	N	F
VISCACEAE Mistletoe Family			
Arceuthobium spp.	P	N	F
ZYGOPHYLLACEAE Caltrop Family			
Peganum harmala	P	A	S

Plant Communities on Fort Carson



UTM NAD83 Zone 13
1:160,000
Rick Clawges
J.M. Waller Associates, Inc.
Fort Carson Wildlife Program
7 November 2012

Plant Communities on Pinon Canyon Maneuver Site



UTM NAD83 Zone 13
1:215,000
Rick Clawges
J.M. Waller Associates, Inc.
Fort Carson Wildlife Program
7 November 2012

APPENDIX 5

Research projects

Insert a list of research projects that would be nice to do (but not required) by program area

Forestry

- *P-J Growth and Yield* — Estimation of average annual increment of piñon -juniper woodlands at Fort Carson and PCMS. There has been some discussion about generating electricity from biomass, to include some form of wood product. If technology improves sufficiently, and/or if the haul distance constraint can be overcome, there could be interest in using piñon-juniper wood products to provide electricity for Fort Carson and PCMS. In that event, it would be useful, if not essential, to have a good estimate of how much wood is added yearly, on average, at the two installations. Then a sustainable harvest level could be determined.

- *Classify the age of pinon and juniper habitat* – obtain tree age on a stem cross section, count number of rings at ground level to provide the total age of the tree.

- *Effects of tree dynamics after the exclusion of grazing* – does the exclusion of grazing promote tree expansion or vice versa?

APPENDIX 6

Migratory bird management

Conservation actions for migratory bird management are identified in section 4.g. Migratory Bird Management.

A Memorandum of Understanding between the U. S. Department of Defense and the Fish and Wildlife Service was signed initially in 2006. That document is readily available, to anyone interested, at either organization's website.

The basic agreement was recently extended until July 2013. See document below.

MEMORANDUM OF UNDERSTANDING
BETWEEN THE
U.S. DEPARTMENT OF DEFENSE
AND THE
U.S. FISH AND WILDLIFE SERVICE
TO PROMOTE THE CONSERVATION OF MIGRATORY BIRDS

The Memorandum of Understanding (MOU) between the U.S. Fish and Wildlife Service and the Department of Defense (hereinafter referred to "the Parties"), signed in 2006, expired on July 31, 2011. Both Parties have agreed to extend the MOU as currently written for two more years while the Parties work together to evaluate the MOU to ensure that the MOU is meeting its stated purpose and scope and responsibilities identified in Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds* (66 FR 3853, 2001). If deemed necessary, the Parties will revise any portions of the MOU based on this evaluation and upon signature of a revised MOU, the current MOU will no longer be valid.

The principal contacts for this instrument are as follows:

Chief
Division of Migratory Bird Management
US Fish and Wildlife Service
4401 North Fairfax Drive
MS4107
Arlington, VA 22203

Conservation Team Leader
Office of the Secretary of Defense
1225 South Clark Street
Suite 1500
Arlington, VA 22202-4336

The Parties hereto have extended this agreement as of the date shown below to remain effective through July 31, 2013.

Director
US Fish and Wildlife Service

Signature _____ Date 17 OCT 2011

Assistant Deputy Under Secretary of
Defense (Installations and Environment)
US Department of Defense

Signature _____ Date 9/1/2011

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
US ARMY ENVIRONMENTAL COMMAND
5179 HOADLEY ROAD
ABERDEEN PROVING GROUND, MD 21010-5401

REPLY TO
ATTENTION OF

IMAE-CO

28 JUL 2008

MEMORANDUM FOR

IMCOM NORTHEAST REGION (IMNE-PWD/MR. RICHARD YATES), 5A NORTH GATE RD, FORT MONROE, VA 23651-1048
IMCOM PACIFIC REGION (IMPA-PWD/MR. AL CARROLL), H PLACE, BLDG 104, FORT SHAFTER, HI 96858-5520
IMCOM SOUTHEAST REGION (IMSE-PWD/MR. MICHAEL FRNKA), 1593 HARDEE AVE, SW, FORT MCPHERSON, GA 30330-1053
IMCOM WEST REGION (IMWE-PWD/MR. STEVE BONNEAU), 2405 STANLEY RD., BLDG 1000, FORT SAM HOUSTON, TX 78234-6106

SUBJECT: Interim Guidance – Unintentional Take of Migratory Birds for Actions Other than Military Readiness Activities

1. References:

a. National Defense Authorization Act for Fiscal Year 2003, P.L. 107-772, Section 315, "Incidental Take of Migratory Birds During Military Readiness Activities."

b. Migratory Bird Permits; Take of Migratory Birds by the Armed Forces Rule, Final Rule, 28 February 2007 (Federal Register volume 70, pages 8931-8950).

c. Memorandum of Understanding Between the US Department of Defense and the US Fish and Wildlife Service to Promote the Conservation of Migratory Birds, 29 July 2006 (Federal Register, volume 71, pages 51580 – 51585; 30 Aug 06).

2. The Migratory Bird Treaty Act (MBTA; 16 USC 703-712) prohibits the take of migratory birds without a permit or other authorization promulgated by the Department of Interior. In no circumstances will any Army Soldier, civilian employee, or contractor intentionally take a migratory bird, its active nest or egg(s) without obtaining a permit from the US Fish and Wildlife Service (USFWS).

3. In Center for Biological Diversity vs. Pirie, (191 F.Supp. 2d), the Federal District Court for the District of Columbia found that the MBTA prohibition of unpermitted take applies to both "intentional" and "unintentional" take of migratory birds even when such take occurs as a result of conducting military training and operations.

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4. In reference 1a, Congress provided authorization for incidental take of migratory birds without a permit for any military readiness activity (MRA) conducted by a member of the Armed Forces. This general exemption for military readiness activities would last until the Department of Interior promulgated regulations implementing the authorization.

5. The Department of Interior promulgated implementing regulations authorizing and explaining the conditions under which members of the Armed Forces, civilian employees, and contractors performing a MRA, can unintentionally take migratory birds (reference 1b). Any MRA conducted by a Department of the Army Soldier, civilian employee, or contractor shall be carried out in accordance with the terms and conditions of reference 1b.

6. The remainder of this guidance pertains to the process for conducting non-MRAs, which is not covered by the authorization in reference 1b, with specific focus on those activities that provide direct and essential support to MRAs. No authorization or permitting process currently exists for the unintentional take of migratory birds during lawful activities that are not considered MRAs. These include routine installation operations, maintenance and construction. The USFWS will exercise prosecutorial discretion in determining whether to pursue civil or criminal penalties for Migrating Bird Treaty Act (MBTA) violations related to unpermitted, unintentional take of a migratory bird for non-MRAs. Reference 1c helps guide military installations on the conservation and management of migratory birds and their habitat.

7. An installation's Integrated Natural Resources Management Plan (INRMP) is required to address migratory bird management and conservation. In the case of military non-MRAs, an INRMP should include management practices to avoid or minimize adverse impacts on migratory birds to the greatest extent practical. Where circumstances do not permit, the INRMP needs to focus on and sufficiently address those activities that cannot be delayed until after the nesting season or modified to minimize impacts on migratory birds because of the activity's direct and essential support of MRAs or other vital military activities (i.e., range construction and maintenance which includes prescribed burning, forest manipulation, maintaining fields for target ranges, installation security and safety such as maintaining a clear perimeter or removal of hazardous trees). Installations must document and explain these activities in the INRMP by providing the information identified in 8a(1)-(7) below. Example verbiage to address non-MRA and unintentional take in the INRMP is provided in the enclosure.

8. Until the installation INRMP is updated/revised to address non-MRAs, or for non-MRAs that are outside the parameters established in the INRMP, installations will need to address and document those actions necessary to support MRAs or other mission critical activities that cannot be modified to avoid or minimize impacts on migratory birds. Provided below is guidance on addressing and implementing such non-MRAs that are likely to take migratory birds and/or their active nests (with egg(s) and/or chick(s)):

a. If the activity cannot be delayed until the end of the migratory bird nesting season, document the following information in the applicable National Environmental Policy Act (NEPA) documentation, (Environmental Assessment (EA), or Environmental Impact Statement (EIS), or a Record of Environmental Consideration with supporting documentation in the project's supporting Administrative Record if an EA or EIS will not be prepared:

(1) Activity being conducted.

(2) Purpose for the activity.

(3) Why the activity has to be conducted during the nesting season.

(4) Possible migratory birds that could be impacted by the action (with emphasis on species of concern (SOC) - go to http://dodpif.org/BCRMap.htm to identify SOCs that may occur on the installation).

(5) Project-specific conservation/management/minimization/mitigation measures, if any, being employed in and around the action area that benefit migratory birds.

(6) Conservation measures the installation implements to manage and conserve migratory bird populations, as identified in the installation's INRMP, with emphasis on the birds that will be affected by the action.

(7) The overall effect of the action on migratory bird populations affected by the action.

b. Contact the USFWS, inform them of the action, coordinate the document in 8a above, and seek comments on the proposed measures identified in 8a(5), if any. If possible, obtain the written concurrence of the USFWS on the proposed measures.

c. If active nest(s) is/are situated in a manner that could cause damage to military equipment or could be damaged by the use of such equipment (targetry equipment, communication network), explore the possibility of acquiring an intentional take permit under 50 CFR 21.41 (Depredation Permit) or 50 CFR 21.27 (Special Use Permit).

9. On an annual basis, record the installation's management efforts that benefit migratory birds. Ensure the installation is aware of the important habitats for migratory birds on the installation and the areas used by migratory bird SOCs. Provide this information to the Installation Management Command and to the State and USFWS during the installation's annual INRMP review.

10. The USFWS has enforced the MBTA with discretion, focusing on individuals or organizations that take birds with disregard for the law, particularly where no valid conservation measures have been employed. Therefore, the conservation and management efforts being implemented by the installation to benefit migratory birds, as identified in the INRMP and project-specific documentation, should be evident to the USFWS and general public.

11. The best way to protect oneself from an MBTA violation and possible litigation by a third party is by implementing conservation measures, as feasible, to ensure management of military lands are done in a manner that benefits migratory birds and by planning non-readiness activities so impacts to migratory birds are avoided, minimized, or mitigated appropriately.

12. The POC for this Command is Mr. Jay Rubinoff, (410) 436-6458, or email Jay.M.Rubinoff@us.army.mil.

Encl

MICHAEL P. O'KEEFE
Colonel, CM
Commanding

Management Practices for Unintentional Take of Migratory Birds for Actions Other than Military Readiness Activities

In accordance with Executive Order 13186 and the associated Memorandum of Understanding between the DoD and the US Fish and Wildlife Service (USFWS) to Promote the Conservation of Migratory Birds, (installation name) will, to the extent feasible and practical, conduct military non-readiness activities in a manner that will minimize or avoid their impacts on migratory birds, with special emphasis on migratory bird species of concern (SOC).

There are a number of non-readiness activities that provide direct and essential support for military readiness activities (MRAs) or other essential mission activities. Because of the absolute criticality of these activities in establishing the environmental conditions necessary to provide the realistic training needed to prepare or sustain the competencies of Soldiers for conflict, or maintaining the safety and security of the installation, efforts to minimize or avoid impacts on migratory birds may not be feasible.

At (installation name), Soldiers are provided training in the use of individual and heavy weaponry, tracked and wheeled vehicles, crew-served weapon's systems, involving target practice/maneuver areas/mock battlefield, to develop and/or sustain their skills to ensure battle readiness. To meet the required "battle ready" standards, Soldiers are scheduled to train on all installation land and range facilities multiple times a year. Given the number of Soldiers that will be training at (installation name) to meet these standards, the target range/maneuver areas must remain open and in ready condition throughout the year. To maintain such sites, prescribed burning/mowing of fields/select timber harvesting must occur even during periods when migratory birds are most active in the area. As such, migratory birds may be unintentionally taken as a result of these preparatory activities.

In addition, maintaining a secure border of the installation or munitions storage area requires the installation to control vegetation within ___ feet of the existing fence. The installation must also remove trees and/or other vegetation that cause a direct safety hazard, such as dead tree(s) in and around residential or administrative areas or vegetation that poses an unacceptable fire danger within these areas (identify other land management activities required to maintain or sustain other critical mission activities). Migratory birds may be unintentionally taken during implementation of these activities.

The (MRA (i.e., target range) or other mission critical activity (i.e., perimeter fence)) area provides foraging and breeding habitat for a number of migratory bird species. We've determined that the proposed maintenance activities within the area will have immediate but minimal impact on these species including the SOC known to nest in the area (see appendix, tab, or enclosure___). According to the Partners in Flight Landbird Population Estimates database, the populations of the migratory bird SOC are plentiful within the Bird Conservation Region where the installation occurs, plus other breeding

End

habitat exists on and off the installation that can be used by the species. The potential loss or unintentional "take" of active nests would be minimal and would not significantly affect these SOC. The indirect impacts of habitat loss are also not to the level that would result in a significant impact to any migratory bird species. In this ecosystem, many vegetative communities have developed in a pyrophytic environment that requires growing (nesting) season prescribed fire. These communities will not develop when the burning is conducted during the dormant season. However, because these maintenance activities will have a beneficial effect on the entire installation, the overall habitat quality will be improved, thus providing even more opportunities for successful nesting.

Although effects of the maintenance or other proposed land management activities are considered to be minimal on migratory birds, the installation still employs management/conservation efforts, to the greatest extent feasible, that will lessen the impacts on and, in many circumstances, benefit the effected species. To reduce the probability of take, the installation will, to the greatest extent possible, conduct maintenance activities (mowing, tree and/or vegetation clearing) early enough in the spring so an area is less suitable for the habitat-associated birds. Other minimization efforts, if and when possible, would be to avoid nests or remove inactive nests to discourage nesting in an area that will be impacted by readiness and non-readiness activities. For migratory bird SOC, some mitigation measures that could be considered, if feasible and practicable, are removing active nests before conducting the activity and giving the eggs and/or chicks to a licensed migratory bird rehabilitator.

The installation implements a number of management and conservation projects/efforts that benefit migratory birds, including those species that may be impacted by the military non-readiness activities discussed above. For further information and details on the installation's migratory bird program, go to section ___ of the INRMP.

In addition, the installation has established a Army Compatible Use Buffer (ACUB) to limit the effects of encroachment and maximize land inside the installation that can be used to support the installation's mission. The ACUB area is a ___ acre (woodland/grassland/mixed/etc.) parcel being managed as a natural area in perpetuity. The management and conservation practices being implemented in the area benefit migratory bird species including species of concern such as ___. For more information on this ACUB parcel and management of the site, go to ___.

APPENDIX 7

Benefits to endangered species management

Consistent with amended section 4(a) (3) of the 2004 National Defense Authorization Act (Pub. L. 108-136, November 2003), Section 318, Military Readiness and Conservation of Protected Species, Fort Carson was excluded from the 2004 critical habitat designation because specific guidelines for protection and management of the Mexican Spotted Owl were indentified in the final 2003 INRMP (FR 2004).

The 2004 critical habitat designation was limited to lands within protected or restricted areas and includes mixed conifer, pine-oak, and riparian habitat types as identified in the 1995 Mexican Spotted Owl Recovery Plan (USDI USFWS 1995). At the time of designation, the constituent elements essential to the conservation of the species did not occur on Fort Carson.

The 2011 recovery plan, as in the 1995 plan, identifies levels of protection and management of forested and canyon habitats required for recovery and these are classified as Protected Activity Centers (PACs), recovery habitats, and other forest types. Forested habitats included in PACs and recovery habitats are not known or suspected to occur on Fort Carson. Fort Carson forests and woodlands are grouped within the other forest types identified in the plan.

The 2011 recovery plan included Rocky-Canyon Habitat as environments providing habitat for nesting, roosting, and foraging. As defined in the 2011 plan, canyon habitat could occur on Fort Carson, and it is unlikely the landscape physical characteristics necessary to provide cool and shaded microclimates are present on Fort Carson. Field and/or GIS measurements will be required to determine if the canyons on Fort Carson meet the criteria specified in the 2011 recovery plan.

Appendix 2 contains information on how to review the current Mexican Spotted Owl Management Plan (2002). The plan is currently undergoing revision, but the 2002 Plan remains in effect until the revised plan is signed. Fort Carson will determine if canyons on the installation meet the criteria defined in the 2011 MSO recovery Plan for Rocky-Canyon Habitat.

References

Gene Stout and Associates. 2002. Biological Assessment and Management Plan for the Mexican Spotted Owl on Fort Carson. Prepared for the Directorate of Environmental Compliance and Management, Fort Carson, CO. Loveland, CO. 26 pp.

FR 2004. Endangered and Threatened Wildlife Plants; Final Designation of Critical Habitat for the Mexican Spotted Owl; Final Rule. Federal Register 69 (168): 53182-53230, August 31, 2004.

U.S. Department of the Interior, Fish and Wildlife Service [USDI UFWS]. 1995. Recovery plan for the Mexican spotted owl: vol. I. USDI Fish and Wildlife Service, Albuquerque, New Mexico, USA.

APPENDIX 8

Critical habitat issues

There is no critical habitat designated on Fort Carson or on the PCMS for any species.

See also Section 4.a. of this INRMP, especially the paragraph headed ‘Army species at risk (SAR)’.

APPENDIX 9

List of projects

The various program areas within the DPW , DPTMS and DES carry out a number of activities, many on an annual basis, that help in managing the various resources. Such activities usually do not require 'project funding', because they are done with in-house personnel, equipment, etc. The recurring actions are listed at the end of each section in Chapter 4 of this INRMP. For convenience, they are also listed below.

(Please note: all proposed recurring actions will be implemented subject to availability of funding and manpower.)

Recurring actions for INRMP Review and revision (1.g.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Review the INRMP in the first quarter of each FY with the USFWS and the CPW. Review accomplishments and anticipated projects for the current FY and FY + 1.	REQ						

Recurring actions for managing species of conservation concern on Fort Carson (4.a.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Continue monitoring distribution and plague status of the Black-tailed Prairie Dogs and for the presence of nesting Burrowing Owls and Mountain Plovers.	BMP						
2. Continue evaluation of MSO roost tree buffer zones for compliance with restrictions specified by the USFWS	REQ						
3. Continue dusting to prevent plague in prairie dog colonies important to nesting and wintering eagles and the Ferruginous Hawk, and nesting Burrowing Owls.	BMP						
4. Continue Arkansas darter and southern redbelly dace population monitoring and inventory.	BMP						
5. Continue inventory of northern leopard frog populations on Fort Carson.	BMP						
6. Continue to inventory Army SAR populations and evaluate persistence and relationship to training	REQ						

7. Continue to assist the USFWS and CPW with relocating Arkansas darter and redbelly dace to new and existing sites in Colorado.	BMP						
8. Continue mapping distribution of sensitive species.	BMP						
9. Continue protection and monitoring of Townsend's big-eared bat maternal colonies, hibernacula, and fringed myotis roost sites.	BMP						
10. Maintain bat gates to prevent disturbance and the spread of white-nose syndrome from anthropogenic sources.	BMP						
11. Create cover for sensitive species of reptiles, amphibians, and small mammals by leaving non-diseased, felled tree trunks in place during forestry operations. Logs are an important component of Mexican Spotted Owl habitat and should be left in place following forestry operations in owl habitat.	BMP						
12. Create slash brush piles at sites where not increasing spread of wildland fire.	BMP						
13. Sustain sensitive small mammal and bird populations in woodland areas by preferentially leaving large trees with natural and bird created cavities and crevices.	BMP						

Recurring actions for managing species of conservation concern on the PCMS (4.a.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Continue to inventory Army SAR populations and evaluate persistence and relationship to training.	REQ						
2. Continue protection and monitoring of Townsend's big-eared bat maternal colonies, hibernacula,	BMP						

and fringed myotis roosts.							
3. Create cover for sensitive species of reptiles, amphibians, and small mammals by leaving non-diseased, felled tree trunks in place during forestry operations.	BMP						
4. Sustain sensitive small mammal and bird populations in woodland areas by preferentially leaving large trees with natural and bird created cavities and crevices.	BMP						
5. Create slash brush piles at sites where not increasing spread of wildland fire.	BMP						
6.Monitor for the presence of nesting Burrowing Owls and Mountain Plovers.							

Recurring actions for wetlands management (4.b.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Ensure no-net-loss of wetland acreage on Fort Carson and the PCMS.	REQ						
2. Use the NEPA environmental review process to evaluate impacts on wetlands, which could result from new construction or other activities, and assist with coordination between proponent and USACE.	REQ						
3. Submit quarterly RGP reports, and review/update the RGP on a 5 year basis.	REQ						
4. Maintain/update database of waters of the US delineations with the USACE.	REQ						

Recurring Actions for Conservation Law Enforcement (4.c.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Ensure military and civilian personnel and activities are in compliance with natural, cultural and environmental laws and regulations on Fort Carson and the PCMS.	Req						
2. Coordinate enforcement activities with other stakeholder agencies and	BMP						

organizations.							
3. Assist in providing education and awareness classes to various groups that use Fort Carson and the PCMS.	BMP						

Recurring actions for wildlife management at Fort Carson (4.d.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Continue conducting post-hunting deer population composition surveys. Fort Carson will provide CPW copies of survey data., which will be integrated into the CPW population models for the DAUs that include Fort Carson.	BMP						
2. Continue CWD surveillance and require mandatory testing of harvested deer on Fort Carson.	BMP						
3. Operate a hunter check station to facilitate CWD specimen collection, aging harvested deer, collecting location data for deer testing positive for CWD, and tracking recreational use of Fort Carson training lands.	BMP						
4. Continue cooperative management of big game populations with the CPW.	BMP						
5. Conduct bat planning level surveys, particularly in pinyon-juniper and riparian habitats.	REQ						
6. Participate in academic partnerships and regional and national working groups to increase technical knowledge and expertise needed to develop alternative management options facilitating both military training and conservation.	BMP						
7. Continue developing and maintaining water resources for mitigating movements of big game species related to effects of military training.	BMP						
8. Identify, burn, and monitor areas to improve forage for big game species. Due to the importance to pronghorn in	BMP						

winter, cholla grasslands will be excluded or burned in a mosaic pattern to preserve integrity of the resource.							
9. Organize and operate a Fort Carson hunting and fishing working group to facilitate communication among sportsmen for improving hunting and fishing opportunities for Soldiers.	BMP						
10. Integrate installation management practices, e.g., prescribed fire, revegetation, pest management, storm water management, and invasive species management to enhance and protect biological diversity.	BMP						
11. Continue monitoring native fish populations on Fort Carson.	BMP						
12. Conduct amphibian planning level surveys.	REQ						
13. Develop monitoring program for northern leopard frogs on Fort Carson.	BMP						
14. Conduct reptile planning level surveys.	REQ						
15. Conduct planning level surveys of small mammals in wetland and ponderosa pine vegetation communities, and sites within MSO winter habitat.	BMP						
16. Create cover for sensitive species of reptiles, amphibians, and small mammals by leaving non-diseased, felled tree trunks in place during forestry operations. Logs are an important component of Mexican Spotted Owl habitat and should be left in place following forestry operations in owl habitat.	BMP						
17. Continue to review projects and installation activities to identify and mitigate effects on biological communities.	BMP						
18. Sustain sensitive small mammal and bird populations in woodland areas by preferentially leaving large trees with natural and bird created cavities and crevices.	BMP						
19. Create slash brush piles at sites where this would not increase intensity of spread of wildfire.	BMP						

Recurring actions for wildlife management at the PCMS (4.d.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Continue developing and maintaining water resources for mitigating movements of big game species related to effects of military training.	BMP						
2. Continue conducting post-hunting deer population composition surveys. Fort Carson will provide CPW copies of survey data, which will be integrated into the CPW population models for the DAUs that include Fort Carson.	BMP						
3. Identify, burn, and monitor areas to improve forage for big game species. Due to the importance to pronghorn in winter, cholla grasslands will be excluded or burned in a mosaic pattern to preserve integrity of the resource.	BMP						
4. Continue cooperative management of big game populations with the CPW.	BMP						
5. Operate a hunter check station for the purpose of aging and scoring harvested deer, and tracking recreational use of training lands.	BMP						
6. Integrate installation management practices, e.g., prescribed fire, revegetation, pest management, storm water management, and invasive species management to enhance and protect biological diversity.	BMP						
7. Conduct amphibian planning level surveys.	REQ						
8. Conduct reptile planning level surveys.	REQ						
9. Continue to review projects and installation activities to identify and mitigate effects on biological communities.	BMP						
10. Create cover for sensitive species of reptiles, amphibians, and small mammals by leaving non-diseased, felled tree trunks in place during	BMP						

forestry operations.							
11. Create slash brush piles at sites where this would not increase intensity or spread of wildfire.	BMP						
12. Sustain sensitive small mammal and bird populations in woodland areas by preferentially leaving large trees with natural and bird created cavities and crevices.	BMP						

Recurring actions for forest management (4.e.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Manage the forests and woodlands at FCMR and PCMS to improve forest health through thinning, individual tree selection and sanitation salvage thinning.	REQ						
2. Restore ponderosa pine forests by thinning, removing ladder fuels, reducing crown connectivity, and then reintroducing low-intensity fires.	REQ						
3. Aggressively manage against forest insect and disease pests to prevent widespread tree mortality.	REQ						
4. Reduce the number of trees per acre and remove understory fuel loads to minimize the risk of catastrophic wildfire and create zones of defensible space.	REQ						
5. Complete 400 acres of insect and disease survey annually and update inventory in Geographical Information System layer.	BMP						
6. Complete 100 acres of forest inventory annually and update in Geographical Information System layer.	BMP						
7. Restore native grassland habitats by reducing piñon-juniper (P-J) encroachment into prairie habitats	REQ						

8. Initiate reforestation efforts after human and natural disturbances, preferably using local seed sources.	BMP						
9. Identify and remove hazard trees annually using the U.S. Forest Service Hazard Tree Rating system.	BMP						
10. Continue to submit proposals to the U.S. Forest Service and US Army Environmental Center for insect and disease management projects.	BMP						
11. Work cooperatively with other Directorates, agencies, and the Colorado State University on forest management issues.	BMP						
12. Develop programs which generate income from the sale of forest products such as firewood, woodchips, and fence posts which support standard forest management practices.	REQ						
13. Investigate potential forest product markets, including firewood, fence posts, woodchips, biomass for biofuel, and innovative use of forest and woodland tree species.	REQ						

Recurring actions for managing migratory birds at Fort Carson (4.g.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Continue Burrowing Owl monitoring.	BMP						
2. Continue annual grassland bird monitoring.	BMP						
3. Continue Mountain Plover monitoring.	BMP						
4. Continue to review projects and installation activities to identify and mitigate conflicts with the MBTA and/or BGEPA	BMP						

5. Continue to conduct compliance monitoring surveys at project sites and coordinate required mitigation with action proponents and/or law enforcement.	BMP						
6. Continue DOD Partners In Flight membership and support.	BMP						
7. Assess the extent of hawk, eagle, and owl electrocutions on Fort Carson, to include identification of killer poles, identification of pole configurations and landscape features influencing pole selection, and estimating level of pole use by raptors. Post-assessment recommendations will be provided to DPW Operations.	REQ						
8. Map grasslands important to nesting birds with declining populations for input into development of annual prescribed fire plans.	BMP						
9. Continue migratory bird outreach and education through personal contacts, Environmental Protection Officer Training, and through media available on Fort Carson.	BMP						
10. Plant shelterbelts to replace loss of owl nesting and wintering habitat in and near the Bird Farm area at Fort Carson.	BMP						
11. Pistillate-flowered Oneseed and Rocky Mountain junipers will be retained during woodland thinning operations to sustain birds wintering in pinon-juniper woodlands.	BMP						
12. Pinon pine will be retained over juniper, and old growth juniper will be retained over younger trees during woodland thinning operations.	BMP						
13. Continue managing artificial cavity nesting project in the Bird Farm as mitigation for tree loss due to	BMP						

fire, forestry practices, and training.							
14. Mitigate loss of raptor and owl nest sites using artificial structures.	BMP						
15. Leave standing snags at a rate of 1-4 snags per acre, during forest management or post fire management, for bats, small mammals, and cavity nesting birds.	BMP						
16. Deploy wildlife escape ladders in open water tanks developed for wildlife.	BMP						
17. Continue investigating effects of off-road vehicle use on ground nesting birds.	BMP						

Recurring actions for managing migratory birds at the PCMS (4.g.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Continue Burrowing Owl monitoring.	BMP						
2. Continue Mountain Plover monitoring.	BMP						
3. Continue to review projects and installation activities to identify and mitigate conflicts with the MBTA and/or BGEPA.	BMP						
4. Continue to conduct compliance monitoring surveys at project sites and coordinate required mitigation with action proponents and/or law enforcement.	BMP						
5. Assess the potential for hawk, eagle, and owl electrocutions on the PCMS, to include identification of killer poles and landscape features influencing pole selection, and estimating level of pole use by raptors.	REQ						
6. Improve shelterbelts to replace loss of owl nesting and wintering habitat due to extensive fires at the PCMS.	BMP						
7. Mitigate loss of raptor and Chihuahuan Raven nesting sites using	BMP						

artificial structures.							
8. Pistillate-flowered oneseed and Rocky Mountain junipers will be retained during woodland thinning operations to sustain birds wintering in pinon-juniper woodlands.	BMP						
9. Pinon pine will be retained over juniper, and old growth juniper will be retained over younger trees during woodland thinning operations.	BMP						
10. Leave standing snags at a rate of 1-4 snags per acre, during forest management or post fire management, for bats, small mammals, and cavity nesting birds.	BMP						
11. Continue managing artificial cavity nesting project outside of training areas as mitigation for tree loss due to fire, forestry practices, and training.	BMP						
12. Deploy wildlife escape ladders in open water tanks developed for wildlife.	BMP						

Recurring actions for invasive species program, for both installations (4.h.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Continue to implement the Invasive Plants Management Plan and update the plan on a 5 year cycle;	REQ						
2. Treat selected invasive species using an integrated approach (biological, chemical, cultural and mechanical);	BMP						
3. Continue to monitor the original population of myrtle spurge at Fort Carson annually through calendar year 2016;	REQ						
4. Actively participate with state, county, local and other federal agencies in the management of invasive species;	REQ						
5. Continue to monitor the original population of African rue at PCMS annually through calendar year 2014;	REQ						
6. Implement a systematic inventory program to identify new invasive	REQ						

species populations and to document the size and abundance of existing populations. Report occurrences of new species to county and state officials;							
7. Implement a systematic monitoring program on treated populations to document the results and to assess for further action;	REQ						
8. Rehabilitate areas treated for invasive species control, where necessary.	BMP						
9. Identify and implement measures in the prevention of new infestations;	BMP						
10. Continue to work with Texas A&M University, Colorado State Insectary and U.S. Department of Agriculture – APHIS to release, redistribute and monitor biological control agents for noxious weed control.	BMP						
11. Continue to be involved in education and outreach efforts;	BMP						

Recurring actions for IPM (4.i.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Control those plant and animal species that affect human health, quality of life, natural resources management (e.g. reduce ecosystem functionality, displace native species) or the military mission, exclusive of noxious weeds.	REQ						
2. Maintain and implement the IPMP on a five-year cycle, including an update in 2013.	REQ						
3. Emphasize integrated pest management techniques to minimize the use of pesticides.	REQ						
4. Use chemical control as a last resort to control pests; cultural, mechanical, and biological control methods are first priority. When chemical control is required, use the least	REQ						

environmentally toxic pesticide. Utilize new technology, educational opportunities, and the judicious and professional use of chemicals to reduce chemical pesticide use.							
5. Ensure pesticide applicators are fully certified or under the necessary direction of a certified applicator.	REQ						
6. Conduct preventive maintenance and surveillance inspections for pests.	REQ						
7. Ensure pest management personnel receive adequate formal, as well as on-the-job, training to achieve required pest management certification and to operate at the most efficient level.	REQ						
8. Procure, maintain and properly store adequate supplies of pesticides and pesticide dispersal equipment.	REQ						
9. Implement a safety program that provides for the safety and well being of all pest management personnel.	REQ						
10. Coordinate with the Wildlife Office for the protection of wildlife (particularly listed or sensitive species) during pesticide operations.	BMP						
11. Work with other installations in the region to include the Fort Carson pest management program within the Front Range Ecoregional Management Team.	BMP						

Recurring actions for GIS management (4.l.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Provide maps and spatial analyses to support natural resources management as well as other missions.	BMP						
2. Work cooperatively with all GIS users to share GIS data and products.	BMP						
3. Maintain up-to-date software and	BMP						

data.							

Recurring actions for wildlife recreation at Fort Carson (4.m.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Continue management of recreational fishing on Fort Carson, to include stocking fish, improving fish habitat, and managing irrigation water to maximize angling opportunities on Fort Carson.	BMP						
2. Maintain public access areas (Bird Farm, Wildlife Demonstration Area, and fishing reservoirs).	REQ						
3. Continue consulting with the state and installation activities to resolve hunter access restrictions during big game seasons.	BMP						
4. Continue operation of hunter check stations during big game seasons for collecting harvest data	BMP						
5. Fully implement and maintain an automated, web based recreational control system.	BMP						
6. Develop warm-water sport fishing on Fort Carson.	BMP						

Recurring actions for wildlife recreation at the PCMS (4.m.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Continue consulting with the state and installation activities to resolve hunter access restrictions during big game seasons.	BMP						
2. Continue operation of hunter check stations during big game seasons for collecting harvest data.	BMP						
3. Fully implement and maintain an automated, web based recreational control system.	BMP						

Recurring actions for WASH at Fort Carson (4.n.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Conduct pretreatment surveys for Burrowing Owl prior to lethal control of prairie dogs	REQ						
2. Consult with the USFWS regarding migratory birds and eagles as related to airfield operations.	REQ						
3. Participate in the BAAF WASH Working Group.	REQ						
4. Continue participation in the National Military Fish and Wildlife Association WASH working group.	REQ						
5. Continue to manage wildlife at BAAF to reduce the probability of a strike.	REQ						
6. Conduct small mammal trapping to determine if population densities are likely to increase the number of raptors hunting at or near the airfield. Increase seasonal raptor activity would be filed as a NOTAM for pilot briefings.	BMP						
7. Continue to perform quarterly inspection of boundary fence for evidence of mammal encroachment and identify sites for repair.	REQ						
8. Consult with the CPW regarding big game issues related to airfield operations.	REQ						

Recurring actions for WASH at the PCMS (4.n.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Evaluate WASH hazards at downrange PCMS aircraft landing sites.	REQ						

Recurring actions for the wildland fire program (4.o.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Funding requested for PPE, hazardous duty pay and overtime, fire related training and maintenance of 2 brush trucks, 2 tenders, 1 utility vehicle, and 1 ATV. Prescribed burning identified for FY 13 and not accomplished will be incorporated into the FY 14 burn plan.	Req						
2. Support fire department personnel in suppressing wildfires resulting from training or other sources.	Req						
3. Annually assist Fort Carson Fire and Emergency Services in preparing the Prescribed Fire Burn Plan covering both Fort Carson and PCMS.	Req						
4. Ensure Prescribed Fire Burn Plan and Burn Permits are in compliance with CDPHE requirements.	Req						
5. Suppress wildfires in MSO habitat. Prescribe burn a buffer zone between Booth Mountain and training ranges to keep military mission-related fires from entering MSO habitat.	Req						
6. Ensure wildlife and endangered species habitat enhancement and protection are considered during fire management activities.	Req						
7. Use prescribed burning to support Forestry and Noxious Weed Management programs.	Req						
8. Coordinate with cultural resource personnel during wildfires and prior to conducting prescribed burns.	Req						
9. Describe fire use benefits in education and outreach programs such as Environmental Protection Officer training and Earth and Arbor Days for local schools.	Req						
10. Maintain and improve approximately 72 miles of firebreaks which encompass Fort Carson.	Req						

11. On active firing ranges create a minimum of a 100-foot strip of burn along all perimeters where feasible, which will be sufficient to contain any unintentional starts and assist in maintaining planned training schedules.	Req						

Recurring actions for training of personnel (4.p.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. For government employees, include in Individual Development Plans refresher training needed to fulfill job requirements (e.g., enforcement, GIS, NEPA, endangered species documentation/ consultation, firefighter, pesticide application) and ensure that they get the training.	REQ						
2. Provide funding for personnel to attend annual workshops or professional conferences.	BMP						
3. Encourage personnel to join and be active in professional societies and cooperative groups.	BMP						

Recurring actions for floodplains management (4.r.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Complete legal requirements in the stormwater management plan.	Req						

Recurring actions for minerals management (4.s.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Certain lands included within Fort Carson and the PCMS must be withdrawn from public availability for mining every few years. In 2007, as part of the Transformation EIS, the	REQ						

Army requested that Congress withdraw those lands for another 15 years. That process is now complete. The Federal Register of Friday, 23 September 2011, pages 59157 and 59158, noted the extension of the withdrawals for 15 years. Therefore, the Army will have to once again request that Congress renew the withdrawal of those lands, beginning the process prior to the year 2026.							

Recurring actions for urban forestry (4.t.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Prevent damage or loss of valuable resources from insects, disease, wind, construction damage, and/or neglect.	BMP						
2. Provide technical advice to the grounds maintenance contractor to ensure all turfgrass and landscaped areas are properly maintained.	BMP						
3. Provide guidance on how to plant and maintain trees and shrubs on Fort Carson main post and the PCMS cantonment area to enhance aesthetics and provide benefits, such as visual barriers, windbreaks, decreased heating costs, reduced soil erosion, and safety enhancements; ensure a two-year survival rate of 80%.	BMP						
4. Provide guidance on proper pruning of shrubs and trees and remove dead plants as an essential objective for the long-term health of trees and shrubs on the installation and to ensure the safety of people and structures.	BMP						
5. Annually plan, organize, and participate in Arbor Day celebrations and meet standards established by the National Arbor Day Foundation to achieve recognition as a 'Tree City USA", depending upon available funding.	BMP						
6. Work with DPW, DOC, and	BMP						

USACE to include improved urban forestry requirements in solicitations for new contracts.							
7. Provide support in the implementation of the Xeriscape Master Plan.	REQ						
8. Encourage implementation of practices listed in the 1994 White House Memorandum on federal landscaped grounds.	REQ						

Recurring actions for water rights management (4.u.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Monitor flows (by USGS);	REQ						
2. Send quarterly reports to State (by USGS);	REQ						
3. Send monthly well reports to CWPDA (by DPW ED Water Program manager);	REQ						
4. Maintain some of the windmills at PCMS.	REQ						

Recurring actions for ITAM program (4.w.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Reseeding and erosion control downrange;							
2. Know and understand the changing training requirements of military units;							
3. Vegetation monitoring;							
4. Prepare maps and provide decision support;							
5. Educate military and civilian personnel;							

Recurring actions for managing eagles at Fort Carson (4.x.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Continue to review project proposals for potential conflicts with	REQ						

the BGEPA and identify permits, documents, collaboration, and recommend mitigation to avoid violations. Consultation with USFWS law enforcement and permit office may be required to ensure actions are adequately mitigated.							
2. Continue to conduct compliance-monitoring surveys at project sites and coordinate required mitigation with action proponents and/or law enforcement.	REQ						
3. Continue to conduct annual eagle eyrie surveys. Identify and map active eyries and provide locations to Range Control and Butts Army Airfield for protecting occupied sites. Active eyries will be protected January through the fledging season, generally in July. Protection is achieved by restricting ground and air activities within a buffer zone around an active eyrie.	REQ						
4. Continue assessment risk of electrocution of hawks, eagles, and owls on Fort Carson, to include identification and mitigation of high-risk poles.	REQ						

Recurring actions for managing eagles at the PCMS (4.x.)
(Please note: all proposed recurring actions will be implemented subject to availability of funding and manpower.)

Action	Req or BMP	FY13	FY14	FY15	FY16	FY17	
1. Continue assessment risk of electrocution of hawks, eagles, and owls on the PCMS, to include identification and mitigation of high-risk poles.	REQ						
2. Survey for Golden Eagle eyries and monitor nest success annually.	REQ						

ITAM proposes to accomplish the following LRAM projects at Fort Carson and the PCMS in FY 13 and FY14. For additional detail regarding design and specifications of LRAM standard projects, please see "ITAM/LRAM Best Management Practices January 2012". Information on how to review these Practices can be found in Appendix 2 of this INRMP.

(Please note: all proposed recurring actions will be implemented subject to availability of funding and manpower.)

Task 13-101 **Priority - Medium**

Fort Carson TA 18 Sloped Trail Rehab

Project Description

The stretch of this trail in question has begun to channel water and is now sloped quite dramatically causing a rollover hazard. This trail will be remediated by diverting most of the channelized water with a water berm, filling the trail with material hauled from a nearby disturbed site, and in-sloping the new trail into a swale controlled by check dams.

WGS84 UTM LOCATION

	Easting	Northing
Center of Mass	514399	4272008

Task 13-102 **Priority – High**

Fort Carson TA 43 DAM 388 BANK SLOPE

Project Description

A gully in TA 43 is in need of bank sloping. The gully now drains into dam 388. There are five separate fingers to the gully. A large sloped area will be configured to allow for safer maneuver in the area. Trails exist completely around the area and the project will eliminate the safety hazard.

WGS84 UTM Grid Location

Description	Easting	Northing
NE CORNER	507772	4259659

Task 13-103 **Priority - Medium**

Fort Carson TA 24 DAM ENHANCEMENTS

Project Description
Two erosion control dams in TA 24 are in need of enhancements. Both dams have very steep slopes with narrow tops. Each dam will be enhanced to have a 25 foot top and be sloped to a 4:1 ratio to enhance military training and remove safety hazards.

WGS84 UTM Grid Location

Description	Easting	Northing
Dam 1	508607	4272187
Dam 2	508393	4272419

Task 13-104 **Priority - High**
Fort Carson TA 43 Bank Slope

Project Description
A deep gully in the eastern portion of TA 43 is posing a serious safety hazard. Vehicle traffic is required to travel westerly to go around the hazard. The gully is very difficult to see due to the heavy vegetation in the area. The gully will be bank-sloped down to an intersecting gully which will also be bank sloped for 70 meters. Bank-sloping will have a 4:1 ratio to improve maneuver. A low water crossing will be placed in the intersection of the gullies and check dams will also be placed in the bottom of the bank-sloped areas to slow water and prevent erosion. The entire disturbed area will be seeded with the Fort Carson seed mix.

WGS84 UTM Location

Top Head Cut	508913	4259599
Reach 1 End	508986	4259508
Reach 2 End	509035	4259459
Reach 3 End	509073	4259449
Reach 4 End	509132	4259401
Reach 5 (N-S)	509142	4259384

Task 13- 501 **Priority - Medium**

PCMS TA 7 Low Water Crossing

Project Description
A trail in TA 7 at Pinon Canyon Maneuver Site needs to have a low water crossing installed. This site is in the Taylor Arroyo and will enhance maneuver in the area complimenting the rehabilitated and new dams in the area.

WGS84 UTM Grid Location

Description	Easting	Northing
Center of Mass	583178	4147155

Task 13-502 **Priority – Medium**

PCMS TA 7 Low Water Crossing and Trail Rehabilitation

Project Description
A trail leading south from the Burson Camp in TA 7 crosses a large gully that will have a low water crossing installed. The trail heading west from the gully will have in-sloping and check dams installed on the south side. A large rectangular area west of the in-sloped area where this trail and another trail merge will be armored to mitigate further erosion. A water bar will be constructed at the west end of the armored area running from NW to SE crossing both trails.

WGS84 UTM Location

Description	Easting	Northing
Center of Low Water Crossing	587393	4149106

Task 13-503 **Priority - Medium**

PCMS TA 7 Low Water Crossing

Project Description
A gully is forming in the trail heading south from the Burson Camp at PCMS in TA 7. This location will have a low water crossing installed to straighten the trail and to remove the obstacle. This location is north of project 502 on the same trail.

WGS84 UTM Grid Location

Description	Easting	Northing
Center of Mass	587472	4149436

Task 13-504 **Priority – Medium**

PCMS TA 7 Low Water Crossing

Project Description
A trail in TA 7, located just southeast of the gas line, is to be enhanced with a low water crossing. The area to be rehabilitated is within a long and narrow gully which frequently runs water. The low water crossing will be excavated to a depth of one meter, lined with geo-textile fabric, covered with 5-12" rip rap and topped with 2-4" rip rap.

WGS84 UTM Grid Location

Description	Easting	Northing
Center of Mass	587338	4143666

Task 13-505 **Priority –Medium**

PCMS DAM 231 ENHANCEMENT

Project Description
Pinon Canyon Maneuver Site Dam 231 will be enhanced to a width of 25 feet and a culvert will be placed in the dam at a maximum height of four feet. This will increase maneuverability in the area and will also eliminate the safety hazard of steep dam sides. The entire dam and basin area will be sloped to a 4:1 ratio.

WGS84 UTM Grid Location

Description	Easting	Northing
Center of Mass	583138	4148630

Task 13-506 **Priority – Medium**
PCMS TA 7 Trail Rehabilitation

Project Description
A trail at PCMS in TA 7 needs repair and rehabilitation. This trail will connect areas that are now maneuverable due to new erosion control dams and features allowing vehicular traffic. The trail will be crowned, a low water crossing installed, and in-sloping with check dams will complete the project.

WGS84 UTM Grid Location

Description	Easting	Northing
Center of Mass	582589	4147531

Task 13-507 **Priority - High**
PCMS New Taylor Dam 1

Project Description
A new erosion control dam will be constructed in TA 7 at PCMS. This dam will have a culvert outlet constructed at grade level. This dam will tie in the upper fingers of the Taylor Arroyo.

WGS84 UTM Grid Location

Description	Easting	Northing
Spillway Pt	584347.37	4146920.50
Toe Pt	584342.84	4147004.11

Task 13-508 **Priority – Medium**
PCMS TA 7 New Taylor Dam 2

Project Description
A new erosion control dam will be constructed in the Taylor Arroyo within TA 7 at PCMS. This dam will allow trails to connect to other areas, opening up a wide maneuver corridor and reducing safety hazards by providing a wide travel path. The dam will have a culvert outlet installed, allowing evacuation of any standing water.

WGS84 UTM Grid Location

Description	Easting	Northing
Spillway Pt	583720.10	4146964.55
Toe Pt	508732.32	4146893.40

Task 13-509 **Priority - High**

PCMS TA 7 Burke New EC Dam 1

Project Description

A large gully is forming at the head of the Burke Arroyo in TA 7 at PCMS. A new erosion control dam will be constructed at this location. The gullies above the new EC dam will be bank sloped and check dams installed to retard erosion and improve maneuver safety in the area. This is the first in a series of new EC dams in this area which will increase training options in this area significantly.

WGS84 UTM Grid Location

Description	Easting	Northing
Spillway Pt	582449.17	4144101.05
Toe Pt	583732.32	4146893.40

Task 13-510 **Priority - Medium**

PCMS Baldwin Dams East

Project Description

Two new erosion control dams will be built in TA 10 south of the Baldwin Ranch. The dams will prevent more erosion from occurring in the gullies below. These gullies are in good condition and no work will be needed if erosion from above is stopped. This will prevent any loss of maneuver area and will keep the gullies stable.

WGS84 UTM Grid Location

Description	Easting	Northing
Spillway Pt 1	605320.08	4160756.25
Toe Pt 1	605232	4160701
Spillway Pt 2	605702	4160967
Toe Pt 1	605602.31	4160906.63

Task 13-511 **Priority – Medium**

PCMS TA 13 Baldwin Trail Rehab and LWC

Project Description

A trail in TA 13 at PCMS near the Baldwin Ranch is in need of repair and reconfiguration to eliminate erosion problem and trail duplication. The trail will be crowned, a series of water bars and a low water crossing will be installed to remediate the problems.

WGS84 UTM Grid Location

Description	Easting	Northing
Water Bar 1	604920.63	4162503.64
Water Bar 2	604794.25	4162556.58
Water Bar 3	604707.63	4162609.73
Water Bar 4	604565.31	4162623

Task 14-101 **Priority - Medium**
Fort Carson TA 55 Low Water Crossing

Project Description
A deep hole has formed in the trail dissecting a low lying area where water tends to accumulate. The hole has become deep enough that water is continuously present, seeping up through the soil.
This area will be excavated to a total depth of 1.7 meters in the center and 1.0 meters on either end and completely filled with 5-12" rip rap and capped with 2-4" rip rap. The trail will be crowned and two water bars installed to divert water away from the trail and into the low lying areas.

WGS84 UTM Grid Location

Description	Easting	Northing
Center of Mass	508288	4254256

Task 14-102 **Priority – Medium**

TA 18 New Dam and Bank Slope

Project Description
A large gully has formed in TA 18 with sharp drop offs and head cuts close to the trails in the area. A new erosion control dam, with an 18" culvert, will be constructed and the banks of the gully will be sloped. The head cuts will be armored with 5-12" rip rap, check dams will be installed in the bank sloped areas, and the entire area will be seeded. All sloped areas will be constructed on a 4:1 ratio.

WGS84 UTM Grid Location

Description	Easting	Northing
New TA 18 Dam Spillway	513447	4271926
Dam Toe	513509	4271952
Bank Slope 1 Top	513402	4272378
Bank Slope 2 Top	513329	4272292
Bank Slope 3 Bottom	513363	4272123
Bank Slope 4 Top	593468	4272113

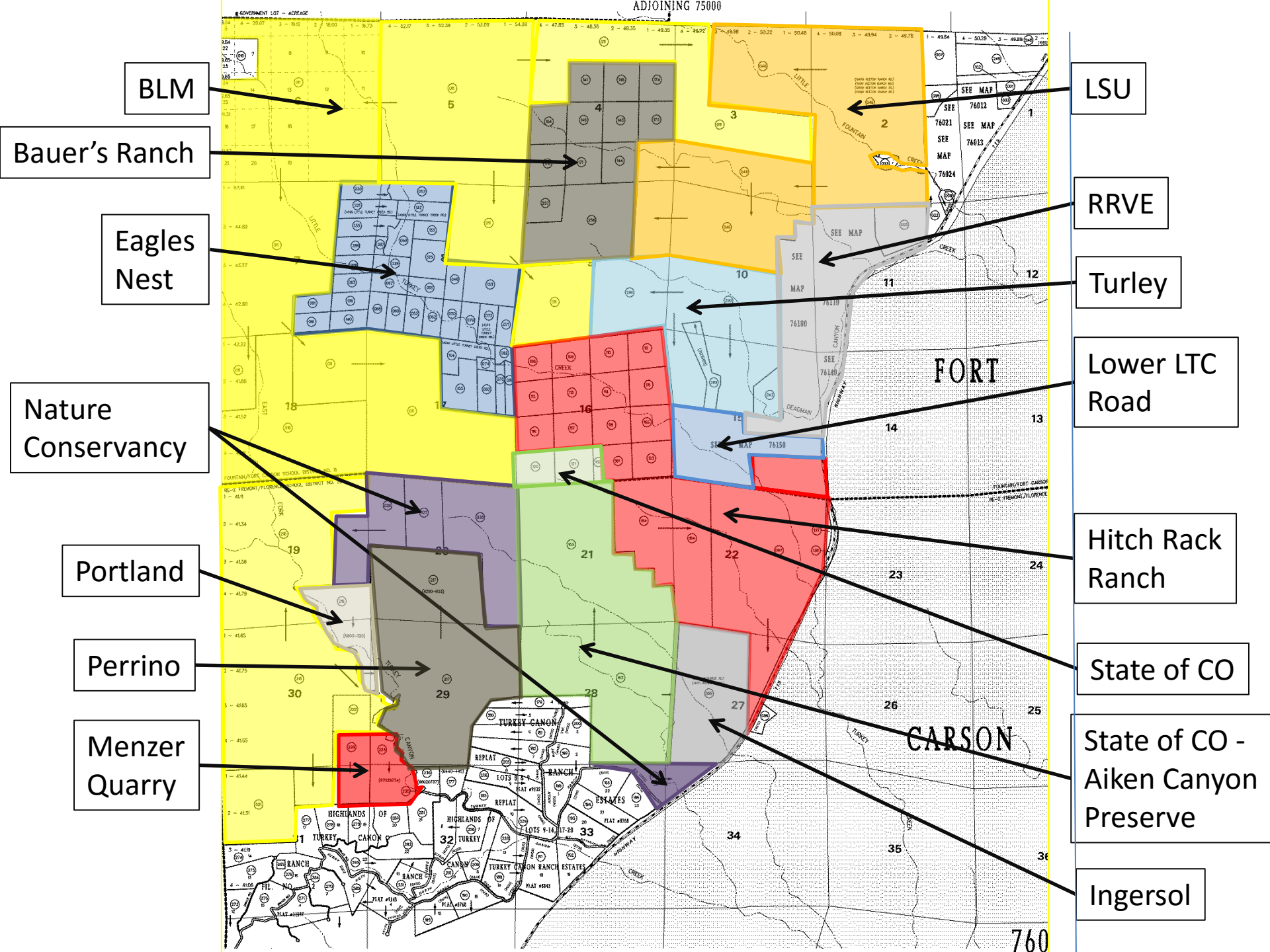
Task 14-501 **Priority - Medium**
PCMS TA 7 Low Water Crossing

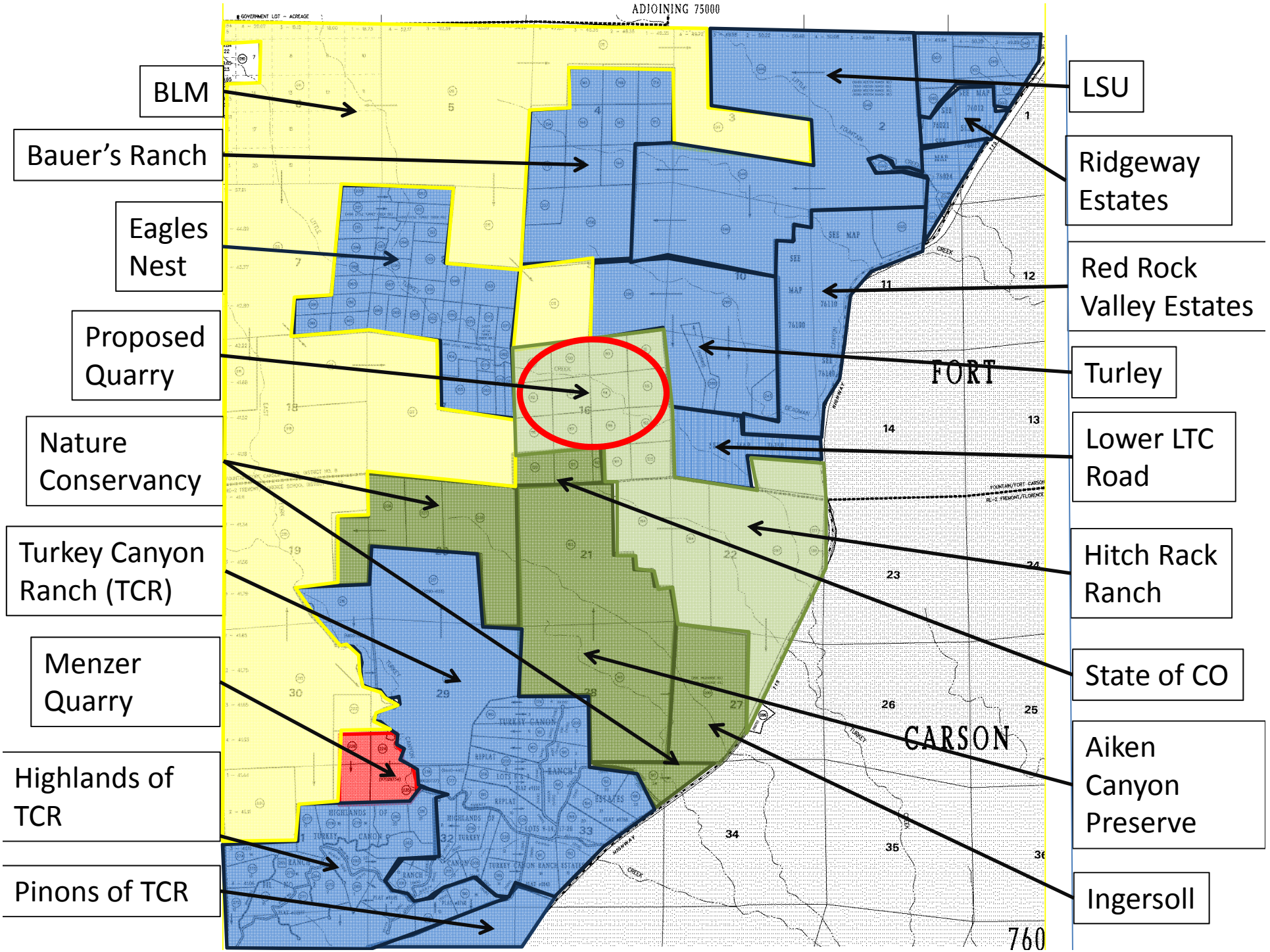
Project Description

This trail in TA 7 at PCMS is in need of repair and a low water crossing, to allow safer & more efficient training in the vicinity. The trail will be crowned for a length of ninety feet, and thirty-five foot water bar will be constructed at the upper end of the trail crowning. The low water crossing will be one hundred and four feet long. The curve in the trail will be removed at the low water crossing point.

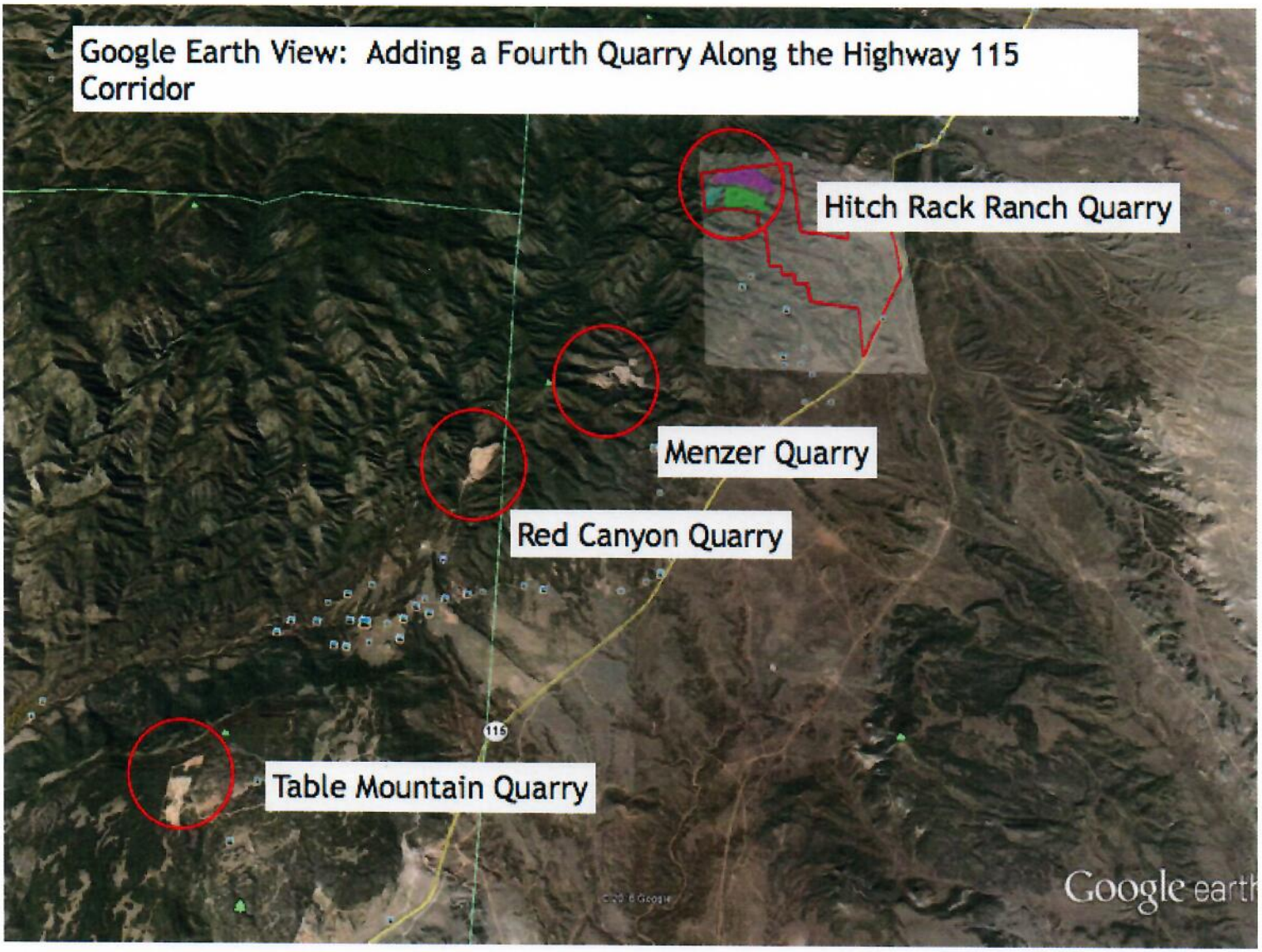
WGS84 UTM Grid Location

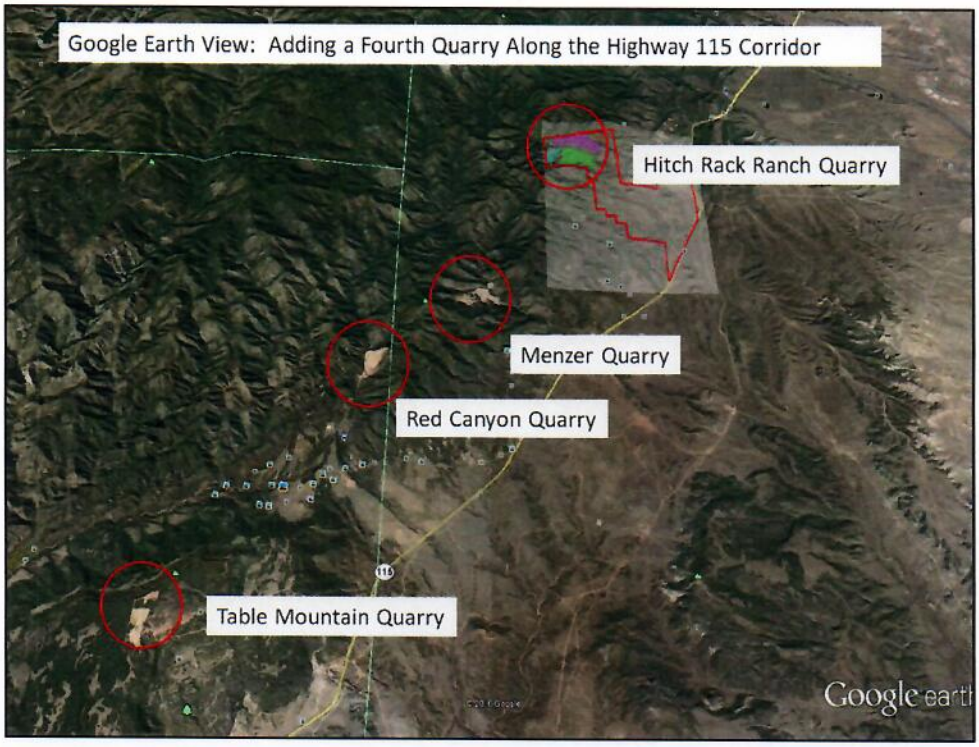
Description	Easting	Northing
Center of Mass	581271.44	4141395.43


BLM
Bauer's Ranch
Eagles Nest
Nature Conservancy
Portland
Perrino
Menzer Quarry
LSU
RRVE
Turley
Lower LTC Road
Hitch Rack Ranch
State of CO
State of CO - Aiken Canyon Preserve
Ingersol
ADJOINING 75000
FORT
CARSON
TURKEY CANON RANCH ESTATES
HIGHLANDS OF TURKEY CANON
760


BLM
Bauer's Ranch
Eagles Nest
Proposed Quarry
Nature Conservancy
Turkey Canyon Ranch (TCR)
Menzer Quarry
Highlands of TCR
Pinons of TCR
LSU
Ridgeway Estates
Red Rock Valley Estates
Turley
Lower LTC Road
Hitch Rack Ranch
State of CO
Aiken Canyon Preserve
Ingersoll
ADJOINING 75000
FORT
CARSON
760

There are <u>three</u> operational quarries located immediately to the south of the proposed quarry on Hitch Rack Ranch that contain substantial reserves of aggregate.





This will be the fourth quarry within an 8 mile stretch of State Highway 115.

Hitch Rack Ranch Quarry in El Paso County (Permit M2016010)

- Permit filed in February 2016
- Requested permit acreage: 392.75

Menzer Quarry in El Paso County (Permit M1976009HR)

- Permit first approved in 1977 for 40 acres. Its current permit acreage is 172.5
- Number of acres currently affected: 103.6

Red Canyon Quarry in Fremont County (Permit M1985043)

- Permit first approved in 1985 for 38 acres. Its current permit acreage is 675.
- Number of acres currently affected: 47.

Table Mountain Quarry in Fremont County (Permit M1999004)

- Permit first approved in 1999. Its current permit acreage is 561.4.
- Number of acres currently affected: 40.

Management Plan for Aiken Canyon Preserve
El Paso County, Colorado



December 2013

Aiken Canyon Management Plan

The original Aiken Canyon Management Plan was written by Leigh Rouse in 1991, revised by Alan Carpenter (Land Steward, The Nature Conservancy) and Tom Light (Southeastern Colorado Area Manager, The Nature Conservancy) in 1995, and revised again by the Aiken intern in 2006. The previous plan from 2006 was used as a reference to update current conditions in this plan. The Management Plan should be updated at least every 5 years to reflect any changes to conservation targets and changes in management. The purpose of this plan is to direct on-the-ground management of Aiken Canyon Preserve by defining ecological and programmatic goals and presenting possible ways to achieve these goals.

Executive Summary

PROPERTY VISION

Ecological goals are directed toward conservation targets - species, ecological communities, or ecological systems - that provide justification for the selection of a portfolio site. Threats to targets were assessed and rated in order of priority. Conservation and Programmatic Goals seek to protect the ecological values and provide public access. Ecological objectives and strategic actions aim to decrease the highest impact threats and maintain the high quality condition of the conservation targets. Programmatic objectives at Aiken Canyon Preserve include education and outreach, and facilities maintenance and upkeep. Aiken Canyon Preserve has public access and is one of the most visited Nature Conservancy Preserves in Colorado. Because of this, the programmatic objectives for the preserve include the added component of upkeep and maintenance of structures and facilities.

AIKEN CANYON CONSERVATION AND PROGRAMMATIC OBJECTIVES

1) Maintain shrubland bird populations and habitat condition.
2) Maintain high quality examples of the globally-rare plant associations.
3) Address altered fire regime as resources are available and appropriate.
4) Reduce the impact of invasive species on biodiversity of Aiken Canyon Preserve.
5) Maintain public interaction through operation of the Field Station.
6) Provide opportunities for environmental learning.

AIKEN CANYON ACTIVITIES

Shrubland birds

1. Monitor the presence of key bird species by conducting "bird counts" at established points along the trail.
2. Distribute bird count forms and compile information on database.

Lower Montane/ Foothills Shrubland

1. Every 5-10 years, assess the quality of the rare plant community using CNHP methodology.
2. Research fire needs in the fire-dependent oakbrush community.
3. Establish monitoring plots before and after any prescribed burns to assess impact of burn.

Pinyon-Juniper/ Scribner's needlegrass Woodland

1. Every 5-10 years, assess the quality of the rare plant community, using CNHP methodology.
2. Research fire needs in the fire-dependent community.
3. Establish monitoring plots before and after any prescribed burns to assess impact of burn.

Tallgrass Butterfly Community

1. Monitor for the existence of Arogos skipper and Ottoe's skipper (G3-G4) that have been reduced throughout their range.

Canyons

1. Contact BLM and obtain any monitoring information on spotted owl habitat and/or presence in adjacent wilderness study area.
2. If owls are found near the preserve conduct assessment of habitat on Aiken Canyonlands.

Education and Outreach

1. Open Field Station Saturdays, Sundays, and Mondays during the summer months, from 10:00 AM to 3:00 PM.
2. Monitor the number of visitors.
3. Distribute information about The Nature Conservancy and encourage membership in the Colorado Springs community and beyond.
4. Schedule interpretive hikes about Aiken Canyon's natural environment each summer month lead by a volunteer.
5. Accommodate and coordinate volunteer lead activities and hikes with student and visiting groups.

Stewardship

1. Maintain hiking trails while minimizing erosion and other impacts to biodiversity
2. Encourage positive land stewardship.
3. Contact and engage scientists from the community to continue monitoring and inventories.

BACKGROUND

Aiken Canyonlands Site

The Aiken Canyonlands site is a priority for conservation in the Colorado Springs area. The site extends from the southern border of Colorado Springs into Teller, Fremont, and Pueblo Counties; including western portions of the Fort Carson U.S. Military Base. Lower elevations along the eastern portion of the site are dominated by grasslands. Oak shrubland is interspersed with the grassland and is also found on steep, sunny slopes. Pinyon-Juniper woodland dominates along the Fountain Formation sandstone areas and Douglas fir/white fir forests with scattered Ponderosa pine are confined to cool, steep, north-facing slopes (Rouse 1991).

CONSERVATION ACTION PLAN

The "Conservation Action Planning (CAP)" process was developed by the Nature Conservancy as a way to plan, implement, and measure conservation success for a landscape-scale site. This standardized process guides teams to identify specific strategies to meet conservation goals. The CAP Process was used to identify the key conservation targets and highest ranking threats to those conservation targets for the Aiken Canyonlands' Conservation Site. The information form the Conservation Action Plan is shown below then the information is focused to the smaller Aiken Canyon Preserve core management area.

Target Justification

The following were identified as key conservation targets using the CAP process for the Aiken Canyonlands Conservation Site. Targets are species, ecological communities, and ecological systems.

1: Shrubland birds:

Included in this community are bird species that breed in shrublands along the Front Range. Species include: Virginia warbler, Lazuli bunting, green-tailed towhee, black-headed grosbeak, bluegray gnatcatcher, and bushtits. Aiken Canyon has been observed as a diverse habitat for birds and this is a large reason for the area's preservation. A total of 101 bird species have been identified at Aiken Canyon Preserve (Aiken Canyon Brochure 1996). This bird species diversity and especially the shrubland dependent bird species provide an indicator for ecosystem health. (See bird species list in Appendix B).

2: Lower Montane/Foothills shrubland:

The lower montane/foothills shrubland includes 2 rare plant communities: mountain mahogany/needle and thread grass and gambel oak communities (G2 and GU communities). The oak and choke cherry shrubs included in these communities are important forage for black bear in winter. The foothills shrubland region provides an important transition between grasslands and mountains. The preservation of this transition is important in protecting the migratory and breeding habitats of many species (Neely, and Kipfer 1993). Since foothill systems have been significantly impacted through subdevelopment and other human uses, it is especially important to protect high quality examples such as those found in this area.

3: Pinyon-juniper/Scribner's needlegrass woodland:

This rare plant community is found mainly in the Fountain Formation sections of the Aiken Canyonlands Conservation Site. It is one of the globally-rare plant associations that is found in this productive section of the foothills environment. A Site Conservation Plan (Neely, and Kipfer 1993) states that this plant association has only been found in Colorado in the foothills of El Paso, Fremont, Saguache, and Alamosa Counties. At Aiken, this community is not affected by heavy grazing and has remained in good condition. Aiken Canyon Preserve supports the northern limit of the range of one-seeded juniper (*Juniperus monosperma*) (Neely, and Kipfer 1993).

4: Tallgrass Butterfly Community: There are six species of note in the area, four have been sighted throughout Aiken Canyonlands. These locally common species are Red-headed skipper, dusted skipper, cross-line skipper, blazing star skipper, Hesperia ottoe, and Arogos skipper. The Arogos skipper (G3-G4) and Ottoe's skipper (G3-G4) populations have been reduced throughout their range. None have been captured on the Aiken Canyon Preserve but they still live in the other areas of Aiken Canyonlands. These species depend on big bluestem and other warm season grasses in the tallgrass prairie plant community. (A list of all Lepidoptera species identified at Aiken Canyon is in Appendix B).

5: Canyons: Canyons within the Aiken Canyonlands Conservation Site contain old growth mixed-conifer including white fir. Many canyon systems along the Front Range are imperiled and degraded. The Aiken Canyonlands are near the northern end of the range of white fir. The mixed conifer forests occur on north-facing slopes as in Aiken Canyon. Peregrine falcon and spotted owl habitat are found within this system.

6: Foothills Riparian Woodland and Shrubland: High-quality foothills riparian and shrubland on the Fort Carson U.S. Military base are along the eastern side of the conservation site. These riparian environments support a high diversity of bird species.

Assessment of Target Viability

The following table assesses the current condition of the biodiversity within Aiken Canyonlands Conservation Site. On Aiken Canyon Preserv the viability and integrity of these conservation targets is as good or better than those shown in the table. In the areas with lower viability, such as the Tallgrass Butterfly Community and Lower Montane/Foothills Shrubland, further actions will be taken to restore the viability and elevate the condition of the area. For future management purposes, consult the list of targets and habitat association for each system below.

1: Shrubland Birds
   Type of Target: Animal Community
   Habitat Association: Foothills shrubland
2: Lower Montane/Foothills Shrubland
   Type of Target: Plant Community
   Habitat Association: Shrubland

3: Pinyon-juniper/Scribner's needlegrass woodland
    Type of Target: Plant Community
    Habitat Association: Shrubland – mixed
4: Tallgrass Butterfly Community
    Type of Target: Invertebrate Community
    Habitat Association: Tallgrass prairie
5: Canyons
    Type of Target: Ecological System
    Habitat Association: Mixed Conifer Forest
6: Foothills Riparian Woodland and Shrubland
    Type of Target: Plant Community
    Habitat Association: Riparian

Table 1. Summary of Conservation Target Viability and Integrity at the Aiken Canyonlands Conservation Site
(From CAP program printout – Terri Schulz, TNC)

Systems (Target) Viability	**Size**	**Condition**	**Landscape Context**	**Viability Rank**
	Grade	Grade	Grade	
Shrubland Birds	Good	Good	Fair	Good
Lower Montane/ Foothills Shrubland	Good	Fair	Fair	Fair
Pinyon-Juniper/Scibner's needgrass Woodland	Good	Good	Fair	Good
Tallgrass Butterfly Community	Fair	Fair	Fair	Fair
Canyons	Very Good	Good	Good	Good
Foothills Riparian Woodland and Shrubland	Good	Fair	Fair	Fair
Site Biodiversity Health Rank				**Good**

Very Good *Functioning at its ecologically desirable status. Requires little human intervention.*

Good *Functioning within its range of acceptable variation. May require human intervention to maintain this status.*

Fair *Outside its range of acceptable variation. Requires human intervention. Vulnerable to serious degradation if left unchecked.*

Poor *If condition remains for extended period, restoration or prevention of extirpation will be practically impossible.*

Conservation Target Stresses and Sources of Stress (Threats)

The following table assesses the target stresses and sources of stress (threats) within Aiken Canyonlands Conservation Site. Since the threat to the conservation targets is high or medium, threats are likely to seriously degrade the ecological system over much of the area. The Conservancy will concentrate the majority of their efforts on preventing future degradation of Aiken Canyonlands. In the areas with high levels of stress, such as the Tallgrass Butterfly community and the canyons, further actions will be taken to decrease threats to conservation targets. For future management purposes, consult the list of targets stress and sources of stress listed below the table.

Table 2. Threats to Conservation Targets at the Aiken Canyonlands Conservation Site (From CAP program printout – Terri Schulz, TNC)

Threats Across System	Shrubland Birds	Lower Montane/Foothills Shrubland	Pinyon-Juniper/Scribner's needlegrass woodland	Tallgrass Butterfly Community	Canyons	Foothills Riparian Woodland and Shrubland	Overall Threat Rank
1.Primary home development	High	High	High	High	High	----------	High
2.Invasive/alien Species	----------	Medium	----------	High	Low	Medium	Medium
3.Fire suppression	Medium	High	Medium	----------	---------	----------	Medium
4. Roads or utilities	----------	----------	----------	----------	High	Medium	Medium
5.Mining practices	----------	Medium	----------	----------	High	----------	Medium
6.Development of roads or utilities	High	----------	----------	Medium	----------	----------	Medium
7.Operation of drainage or diversion systems	----------	----------	----------	----------	----------	High	Medium
8.Grazing practices	Medium	Medium	----------	Medium	----------	----------	Medium
9.Incompatible recreational development	Medium	Medium	----------	Medium	----------	----------	Medium

1: Residential development: Residential development is the primary threat to ecological integrity of the foothills environment. Development of residential communities has increased along the Front Range, with particular interest in the scenic areas of the Aiken Canyonlands Conservation Site. Along Highway 115, much of the area has been divided into 35-acre and 5-acre plots that are bought by private owners. The density and number of residences fragment natural habitat for plants and animals, create edge effects, and eliminate migration corridors (Neely, and Kipfer 1993). Domestic pets pose a threat to wildlife, especially to birds. Noxious weeds can become a problem if landowners do not become aware of them and leave them to spread seed in the surrounding area. Aiken Canyon Preserve provides a relatively large protected foothills system allowing animals to move from higher to lower elevations and back again.

2: Invasive/alien species: Invasive plant species become a threat to ecological systems when they outcompete native populations and alter natural community structure. In 2002, a report by Kundtz described the most harmful noxious weed species at Aiken Canyon Preserve and the effects of mitigation efforts over a period of three years (1999 – 2002). The results were a drastic reduction (91%) in weed species on the preserve, but attributed much of this reduction to drought conditions (Kundtz 2002). Invasive weeds pose a threat to many plant communities of the Aiken Canyonlands Conservation Site. Currently, priority is given to the removal of: Diffuse knapweed (*Centaurea diffusa*), Russian thistle (*Acroptilon repens*), Common mullein (*Verbascum thapsis*), and Canada thistle (*Cirsium arvense*) that have all impacted the Aiken Canyon Preserve. Volunteers have greatly reduced weeds within the area through physical removal.

3: Fire Suppression: Fire plays a major role in shaping and maintaining many of the plant communities contained in the Aiken Canyonlands Conservation area including tall grass prairie, lower montane/foothills shrubland, Pinyon-juniper/Scribner's needlegrass woodland, and Ponderosa pine woodland (Boggs 2005). The historical role of fire was assessed at Aiken Canyon by Wieder (1999) and found that the current fire-free interval for major fires is 67 years (1933-1999; when this study was conducted). This was longer than any of the other intervals dating back to 1753. Various factors may alter a fire regime, but human induced vegetation change can be calculated against the background of regional climatic variability to gear management objectives toward a desired future condition (Kundtz 1999). The tall grass prairie, located in lower elevations of the preserve, has been the focus of monitoring to administer prescribed fire. In this plant community, fire is a tool to prevent tree encroachment, reinvigorate warm season species, and curb the invasion of exotic species (Boggs 2005).

Fee Land Management and Inspections

Legal Property Description-
Preserve:

The following real property located in El Paso County, Colorado:

Parcel A: E1/2NW1/4 of Section 20, T16S, R67W of the 6th P.M., El Paso County, Colorado; and
Parcel B: Lot 5 (NE1/4SE1/4) and the SE1/4NE1/4 of Section 19, and the W1/2NW1/4 Section 20, all in T16S, R67 West of the 6th P.M. in El Paso County, Colorado; and
Parcel C: The NE1/4 and the E1/2 of the SE1/4 of Section 20, T16S, R67 West of the 6th P.M., together with any and all water rights, ditch and ditch rights belonging with and appertaining to the above described property or used in connection therewith, including any interest in and to the Akin Springs, according to the filing thereof on 14 September 1928 in the Office of the Clerk and Recorder of El Paso County, Colorado.

And,

Lot 24, Turkey Canyon Ranch Estates according to the plat thereof recorded December 29, 1993 in Plat Book F-5 at Page 165 of the El Paso County Records.

Lease:
State Land Board Agricultural Lease No. S-39636
PRIMARY PROPERTY:
TOWNSHIP 16 SOUTH RANGE 67 WEST, 6TH PM, EL PASO COUNTY

Section 16:	S1/2 SW1/4	80.00 acres,±
	W1/2 W1/2 SW1/4 SE1/4	10.00 acres,±
		80.00 acres,±
Section 21:	W1/2 NW1/4	
	SW1/4	160.00 acres,±
	S1/2 SE1/4	80.00 acres,±
Section 27:	West 165 feet of	20.00 acres,±
Section 28:	N1/2	320.00 acres,±
	SE1/4	160.00 acres,±
	TOTAL	910.00 acres,±

Along with the right to use the access reserved to the State in Patent 7835, dated January 28, 1985, as the State's Lessee, across Section 27, T16S, R67W, subject to maintenance and upkeep of this access as may be reasonably required resulting from the Lessee's use thereof.

SECONDARY PROPERTY:
TOWNSHIP 16 SOUTH, RANGE 67 WEST, 6TH PM, EL PASO COUNTY

Section 21:	W 1/2 W 1/2 NE 1/4	40.00 acres,±
	E 1/2 NW 1/4	80.00 acres,±
	NW 1/4 SE l/4	40.00 acres,±
	SW 1/4 NE 1/4 SE 1/4	10.00 acre,±
	TOTAL	170.00 acres,±

- Below are listed the CLS Tract Names and IFMS ID Numbers: .

10006485 LEHOUILLIER
10013900 TURKEY CANON RANCH LIMITED LIABILITY COMPANY
XXXXXXX STATE LAND BOARD LEASED ACRES
XXXXXXX STATE LAND BOARD LEASED ACRES
The MABR IFMS ID number is 600000059.

Location and Access

Aiken Canyon Preserve is located approximately 16 road miles south of Colorado Springs. It is on the west side of Colorado Highway 115 between Colorado Springs and Penrose. Aiken Canyon Preserve is a 1,621 acre parcel within the larger Aiken Canyonlands Conservation Area monitored by The Nature Conservancy. For the purposes of this management plan,

ecological targets and threats are identified for the extended conservation area and management goals will focus on the core management area, Aiken Canyon Preserve.

To access the Aiken Canyon Preserve, turn west off of Colorado Highway 115 onto Turkey Canyon Ranch Road and continue ¼ mile. A public parking area is located on the north side of Turkey Canyon Ranch Road. This parking area provides access to the trailhead, the Aiken Canyon Field Station, and public restrooms. Nature Conservancy staff and established volunteers have access to the Field Station through a private driveway just inside an access gate to the Turkey Canyon Ranch residential area.

Legal Restrictions (Interests Held By Others) and Relevant Laws -

The Nature Conservancy holds a 99 year conservation lease for the State Land Board property which requires management. Relevant laws include Colorado Noxious Weed Act and current Rules which designates weed species and how they should be managed.

DESCRIPTION OF AIKEN CANYON PRESERVE

Landscape Description

Aiken Canyon is a portion of a foothills ecosystem on the eastern slope of the Rampart Range, within the larger Front Range of Colorado (Neely, and Kipfer 1993). Elevations at Aiken Canyon Preserve range from 6,400 to 8,487 feet (USGS topographic map, Mt Pittsburgh quad). Red sandstone spires throughout lower elevations are Fountain Formation conglomerate. A narrow band of dipping Manitou limestone lies on Pre-Cambrian granite called the Silver Plume Quartz Monzonite (Beidleman 1985). Granite outcrops make up the steep, upper canyon portions of the Aiken Canyon region as well.

Streams in the area are predominantly intermittent and Aiken Creek itself has had little water in the most recent years. Riparian ecosystems in Aiken Canyon Preserve contain Ponderosa pine forest and other conifers but no deciduous trees (Beidleman 1985).

Neighboring public lands are managed by the Bureau of Land Management Beaver Creek Wilderness Study area to the west and Fort Carson, U.S. Military Reservation to the east. The Nature Conservancy works in cooperation with these entities to preserve the area's biodiversity as well as habitat for common mammals including black bear, mule deer, Rocky Mountain elk, mountain lion, bobcat, gray fox, badger, and tuft-eared and pine squirrels (Aiken Canyon brochure 1996).

Aiken Canyon supports two rare plant associations and is one of the largest known, high-quality foothills environments along the Front Range. The first globally rare plant association is the one-seeded Juniper – Pinyon pine / Scribner's needlegrass (*Juniperus monosperma – Pinus edulis / Stipa scribneri*) community. The second is the Gambel oak – mountain mahogany association (*Quercus gambelii – Cercocarpus montanus*) (Rouse 1991). The diversity of fauna in this area is a reflection of plant species diversity, the transitional location of the site between the plains and mountains, and the overlap between northern and southern plant communities (Neely, and Kipfer 1993).

History

Aiken Canyon Preserve was established on April 22, 1991, when the Nature Conservancy signed a 99-year conservation lease with the State Board of Land Commissioners. An up-front sum of approximately $250 per acre, approximately equal to the fee title of the property, was paid in exchange for the exclusive rights to manage the property as a nature preserve for the next 99 years. This lease arrangement followed a controversy between a proposed gravel mine in Aiken Canyon and community members that wanted to preserve the natural area. Cooley Gravel Company of Denver, Colorado initiated a lease on the land to mine the Silver Plume quartz monzonite contained in the upper canyon area. The State Board of Land Commissioners approached The Nature Conservancy to establish an area that would generate revenue and protect the natural features of the canyon (Rouse 1991). The Nature Conservancy has additionally acquired title to 541 acres since that time (Aiken Canyon brochure 1996). Aiken Canyon is a component of a larger ecosystem along the eastern slope of the Rampart Range, a smaller portion of the Front Range (Neely, and Kipfer 1993). The site is bordered to the west by the Bureau of Land Management Beaver Creek Wilderness Study Area and on the east by the Fort Carson, U.S. Military Reservation.

The canyon and preserve are named after Charles Edward Howard Aiken, the first to study the diversity of bird species at the canyon in the late 1870's. Aiken studied, collected, mounted, and preserved hundreds of bird species and is known as "Colorado's Pioneer Ornithologist" (Beidleman 1985).

Since the designation of this preserve, The Nature Conservancy has added a visitor-use component to management priorities. First, a hiking trail system was constructed in 1993 by Volunteers for Outdoor Colorado (VOC). Also, a straw-bale Field Station was constructed in 1996, a design chosen for its energy efficiency, alternative to tree-derived materials, and use of an otherwise wasted material. The preserve was opened to the public in 1996 three days per week to experience nature and to provide a hub for interaction between The Nature Conservancy and the community.

Objectives and Strategic Actions

The Conservation Action Planning process was used to determine the conservation targets for the entire Aiken Canyonlands Conservation Site. The plan was then used to determine the key Ecological Goals and Strategic Actions at Aiken Canyon Preserve.

Objective 1: Maintain shrubland bird populations and habitat condition

Action 1.1: Monitor shrubland birds focusing on presence of key species as resources allow (see monitoring section)

Action 1.2: Allow and encourage any non-detrimental research on shrubland birds to occur on the preserve.

Action 1.3 Maintain open, road-free space in shrublands of the preserve to protect habitat

Objective 2: Maintain high quality examples of the globally-rare plant associations (Pinyon-juniper/Scribner's needle grass, Gambel's oak – mountain mahogany shrubland, grassland, mixed conifer forest)

Action 2.1: Monitor plant communities ensuring that these communities remain high quality as resources allow (see monitoring section)

Action 2.3: Control harmful invasive species as found

Action 2.4: Allow and encourage any non-detrimental research on plant associations to occur on the preserve

Action 2.5: Monitor tall grass butterfly community as an indicator of grassland ecosystem health as resources allow (see monitoring section)

Objective 3: Address altered fire response as appropriate

Action 3.1: Develop and maintain a wildfire response plan for Aiken Canyon that describes suppression actions and contact information in the event of a fire (see appendix)

Action 3.2: Develop and implement prescribed burn program and plan at Aiken Canyon Preserve as resources allow

- Research the impact of prescribed fire within ecological communities of Aiken Canyon.
- Encourage regeneration of tall grass prairie species and reduce encroachment of juniper trees with prescribed fire and mechanical control

Objective 4: Reduce the impact of invasive species on biodiversity of Aiken Canyon Preserve.

Action 4.1: Implement the invasive/alien plant species management plan

- Continue to recruit volunteers to assist in invasive plant removal
- Distribute information to volunteers and interns about the key species to monitor and control at Aiken Canyon Preserve (list found in Appendix B)
- Volunteers and/or interns will monitor weed occurrences and control methods using GPS and paper forms

Action 4.2: Monitor size and impact of control actions on invasive species (see monitoring section)

- Volunteers and/or interns will monitor weed occurrences and control methods using GPS and paper forms

Target and Threat Monitoring, Research, and Next Steps

Targets Monitoring:

<u>Shrubland birds</u>

- Monitor the presence of key bird species by conducting "bird counts" at established points along trail as resources allow.
- Distribute bird count forms and compile information on database (volunteers)

<u>Lower Montane / Foothills shrubland</u>

- Every 10 years, assess the quality of the rare plant community using established methodology as resources allow
- Establish monitoring plots before and after any prescribed burns to assess impact of burn.

<u>Pinyon-juniper/Scribner's needlegrass woodland</u>

- Every 10 years, assess the quality of the rare plant community using established methodology as resources allow
- Establish monitoring plots before and after any prescribed burns to assess impact of burn.

Tallgrass Butterfly Community

Actively pursue partners to monitor for the existence of Arogos skipper and Ottoe's skipper (G3-G4) that have been reduced throughout their range as resources and expertise allow

Canyons

- Every 5 years, contact Colorado Parks and Wildlife to obtain information on any peregrine falcons and other key species that utilize Aiken Canyon and adjacent area. As of June 2013 Colorado Parks and Wildlife has not surveyed the area since 2008.

Threats Monitoring:

Invasive/alien Plant Species

- Map key weed species occurrences using GPS and assess the success of control activities

Fire Suppression

- Update monitoring of tallgrass prairie (previously monitored in 1995) to quantify any changes in vegetative composition as resources allow

PROGRAMMATIC OBJECTIVES

Education and Outreach

Education and outreach are an important part of the goals at Aiken Canyon Preserve and provide an excellent way for the public to appreciate local biological diversity. Aiken Canyon provides an outstanding opportunity to promote the mission of The Nature Conservancy. For this reason, the preserve has been open to the public and has offered various recreational and educational experiences to visitors since the Field Station was built in 1996.

The preserve is open for drop-in visitation on Saturdays, Sundays, and Mondays, throughout the summer. Volunteers coordinate a schedule to open the Field Station on Sundays when weather permits. The Field Station and hiking trail are generally not open for the remainder of the week to reduce impact on flora and fauna of the area.

The following rules were established in 1995 and continue to be essential for safety and protection of the conservation targets (Carpenter, Light 1995):

- No overnight camping
- Foot traffic only – no bicycles, horses, or motorized vehicles unless disabled. Trail is not designed to accommodate the above types of uses.
- Pets are not allowed
- No hunting
- No collection of plant, animal, or mineral specimens (except for approved Research projects and invasive species control efforts)
- No picnicking or other organized recreation without staff or volunteer permission

- Visitors will stay on the trails and pack out anything they bring

Objective 1: Maintain public interaction through operation of the Field Station

Action 1.1: Maintain a volunteer base to staff the Field Station on Saturdays and Sundays during summer months, from 10:00 am to 3:00 pm

Action 1.2: Monitor the number of visitors (visitor sign-in sheets and count of cars and people visiting the Field Station) and provide that information to the Colorado TNC office if volunteers are able to do so.

Action 1.3: Distribute information about The Nature Conservancy and encourage membership in the Colorado Springs community and beyond

Objective 2: Provide opportunities for environmental learning

Action 2.1: Schedule guided interpretive hikes as staff is available and promote self-guided visitation through our website and social media.

Action 2.2: Accommodate requests for group visitation such as students, hiking clubs, etc. (i.e Catamount Institute) and seek to provide a volunteer leader if available.

Stewardship

Stewardship activities at Aiken Canyon Preserve promote caring for the land in a thoughtful and careful manner, such as preserving healthy populations of native plant, animal, and ecological communities in perpetuity. Aiken Canyon Preserve depends on the actions of the volunteers and interns to continue the stewardship and monitoring goals established by staff. The main purpose of monitoring is to assess the success of current management and to motivate needed changes. Volunteers perform much of the stewardship activities that accomplish the ecological objectives determined for Aiken Canyon Preserve.

One method that has been established at the preserve is to hold a volunteer work day on the third Saturday of each summer month. The focus of these work days is typically trail maintenance, noxious weed removal, or facilities maintenance. Volunteers have enjoyed sharing a potluck lunch at the Aiken Field Station following a morning of work. Stewardship goals at Aiken Canyon Preserve are to preserve natural communities in perpetuity and to monitor to assess success of stewardship activities.

Objective 1: Maintain hiking trail minimizing erosion and other impacts to the biodiversity

Action 1.1: Continue trail work by advertising to the community

Action 1.2: Volunteers construct rock walls and stairways to maintain trail as needed

Action 1.3: Volunteers remove rocks and branches from trail to promote hiker safety

Action 1.4: Volunteers maintain drainage on trail by re-digging dips and building diversion walls as needed

Action 1.5: Maintain interpretive signs along trail as needed (repainted in 2006)

Objective 2: Encourage positive land stewardship

Action 2.1: Continue to remove harmful noxious weeds as found

Action 2.2: Continue bird count monitoring activities by volunteers

Action 2.3: Engage volunteers in monitoring for invasive plant species focusing on new populations or new species to the preserve

Action 2.4: Encourage visitors to report wildlife sightings at the Field Station

Objective 3: Respond to requests from scientists to continue research, monitoring, and inventories as needed and identified in activities above

Facilities Up-keep and Maintenance

The Aiken Canyon Field Station, living area, public restrooms, and retaining wall require up-keep and maintenance. The Field Station is a straw-bale design that is heated by radiant heating in the floors, powered by a Rheem 21V50-4P water heater that was replaced after 10 years of use in August 2006. All maintenance activities are documented in the Aiken Canyon Field Station office file cabinet. A previous 'Intern Manual,' (Appendix C) provides complete instructions for maintenance and upkeep procedures of the Aiken Canyon Preserve facilities. Management goals in this document highlight the essential tasks of interns and volunteers to maintain the Aiken Field Station.

Objective 1: Volunteers keep up-to-date on annual maintenance requirements

Action 1.1: Change water filter under kitchen sink annually

Action 1.2: Seal tops of timber beams around Field Station/living area annually

Action 1.3: Contact Academy Pest Control to evaluate presence of mice annually

Action 1.4: Fill cracks in adobe walls of the Field Station and retaining wall to prevent leaking

Objective 2: Volunteers maintain a clean and safe environment in and around the field station

Action 2.1: Volunteers regularly sweep, mop, dust, and clean windows in the Field Station

Action 2.2: Volunteers regularly clean public restroom and restock toilet paper and paper towels

Actions 2.3: Volunteers bring garbage to dumpsters at the top of Turkey Canyon Ranch Road (at the gravel company) and bring recycling to an appropriate facility in town

Action 2.4: Volunteers reoil and paint seal the signs.

Action 2.5: Volunteers test and replace smoke detector batteries when needed

Action 2.6: Volunteers place pest strips inside butterfly cases to eliminate pests and protect specimens

- Maintenance procedures are described in detail in the Intern Manual. There is also contact information for maintenance requirements provided in Appendix C. Dates of maintenance activities are documented in the Aiken Canyon Field Station office file cabinet.

References

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*Data for CAP Process compiled by Terri Schulz, Conservation Ecologist, The Nature Conservancy

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Rouse, L. 1991. Management Plan for Aiken Canyon Preserve, El Paso County, Colorado. On file at Aiken Canyon Preserve office.
*Revised in 1995 by Carpenter, A. and Light, T.

Wieder, W. 1999. Fire history for Aiken Canyon in the foothills ecotone of the Southern Rockies on the Front Range, Colorado. Prepared by intern/student of The Colorado College, Biology.



Appendix A
Maps

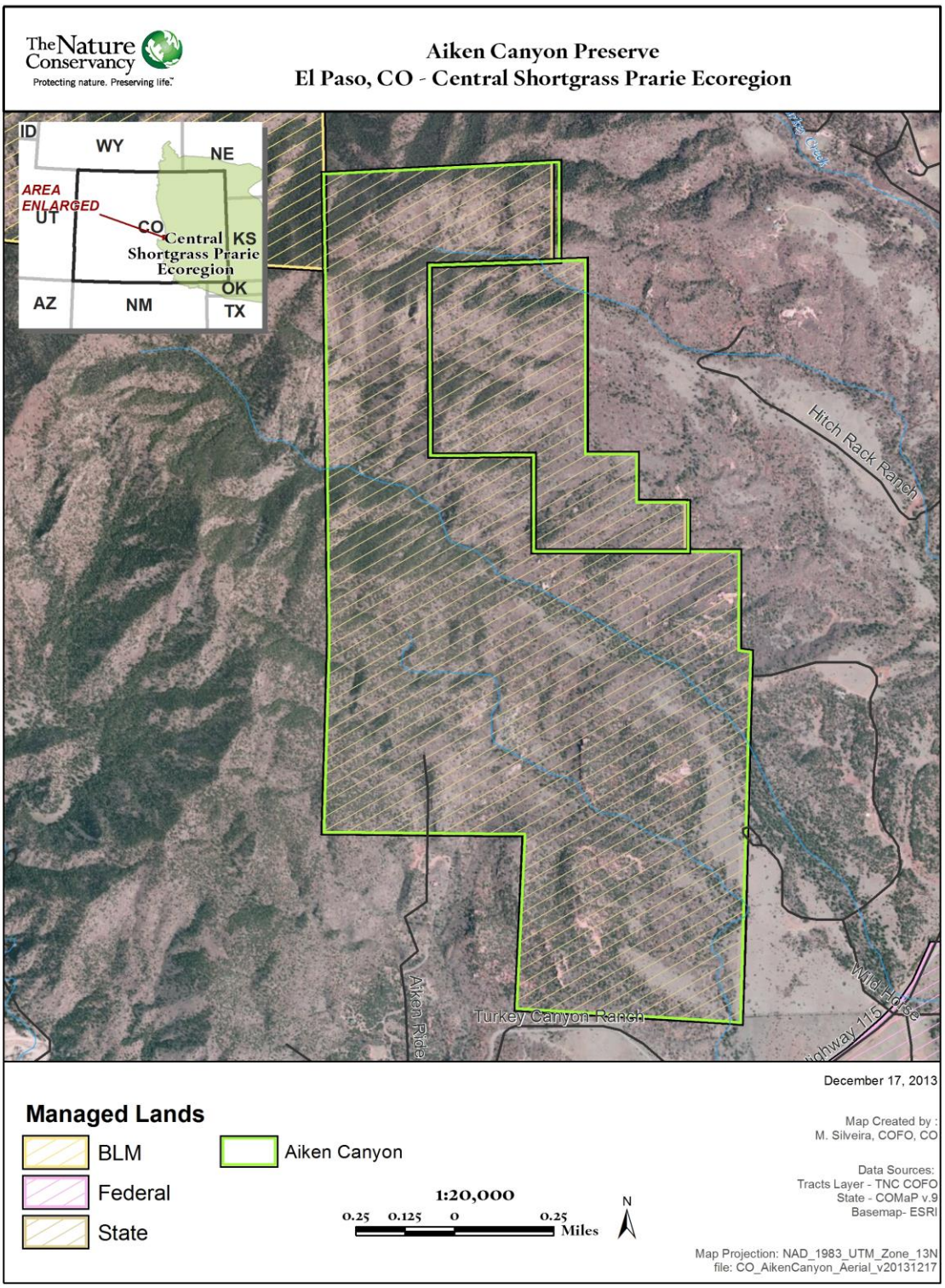


Figure 1. Aiken Canyonlands Conservation Site and Aiken Canyon Preserve

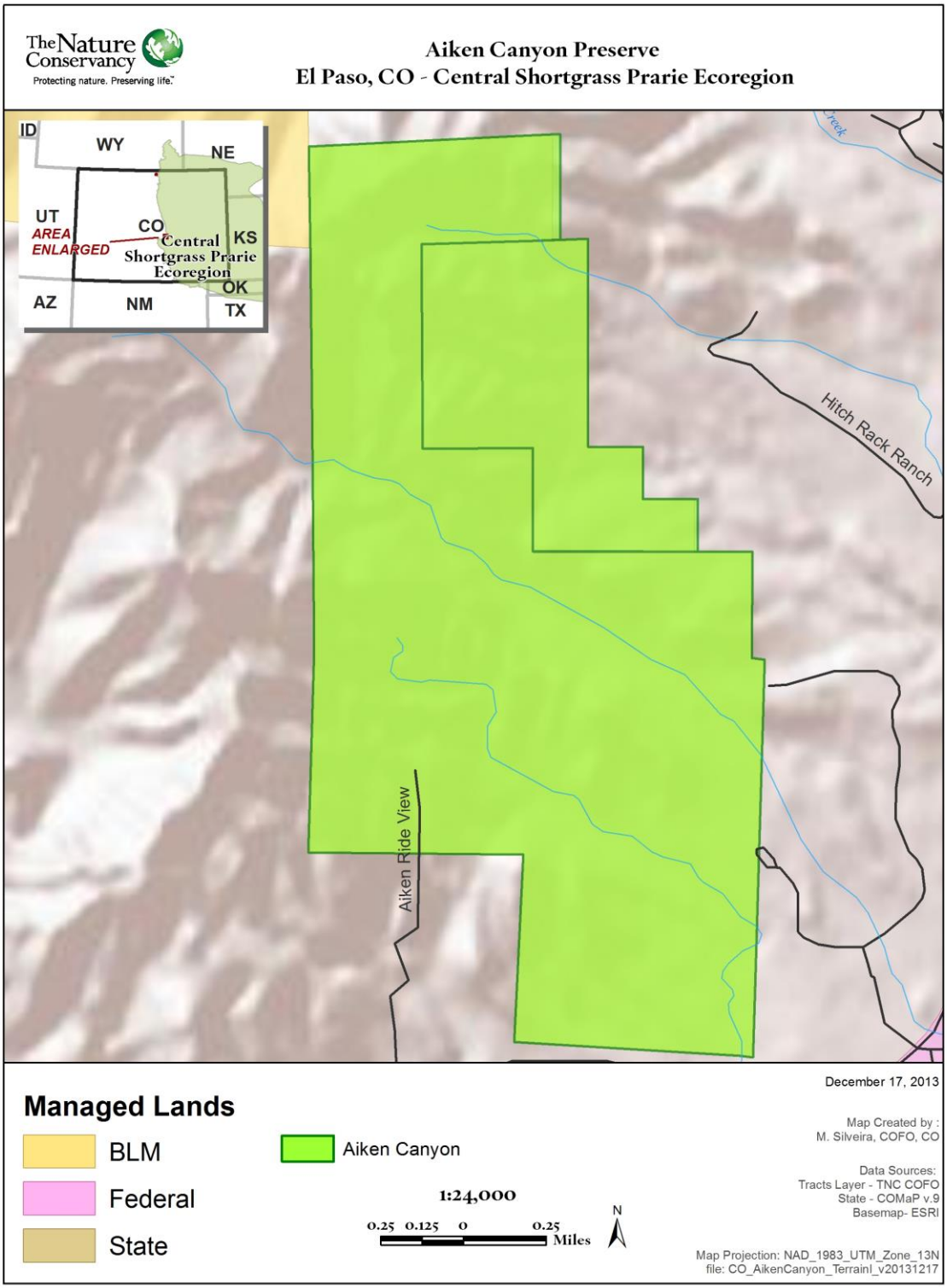


Figure 2. Vegetative Communities at Aiken Canyon Preserve

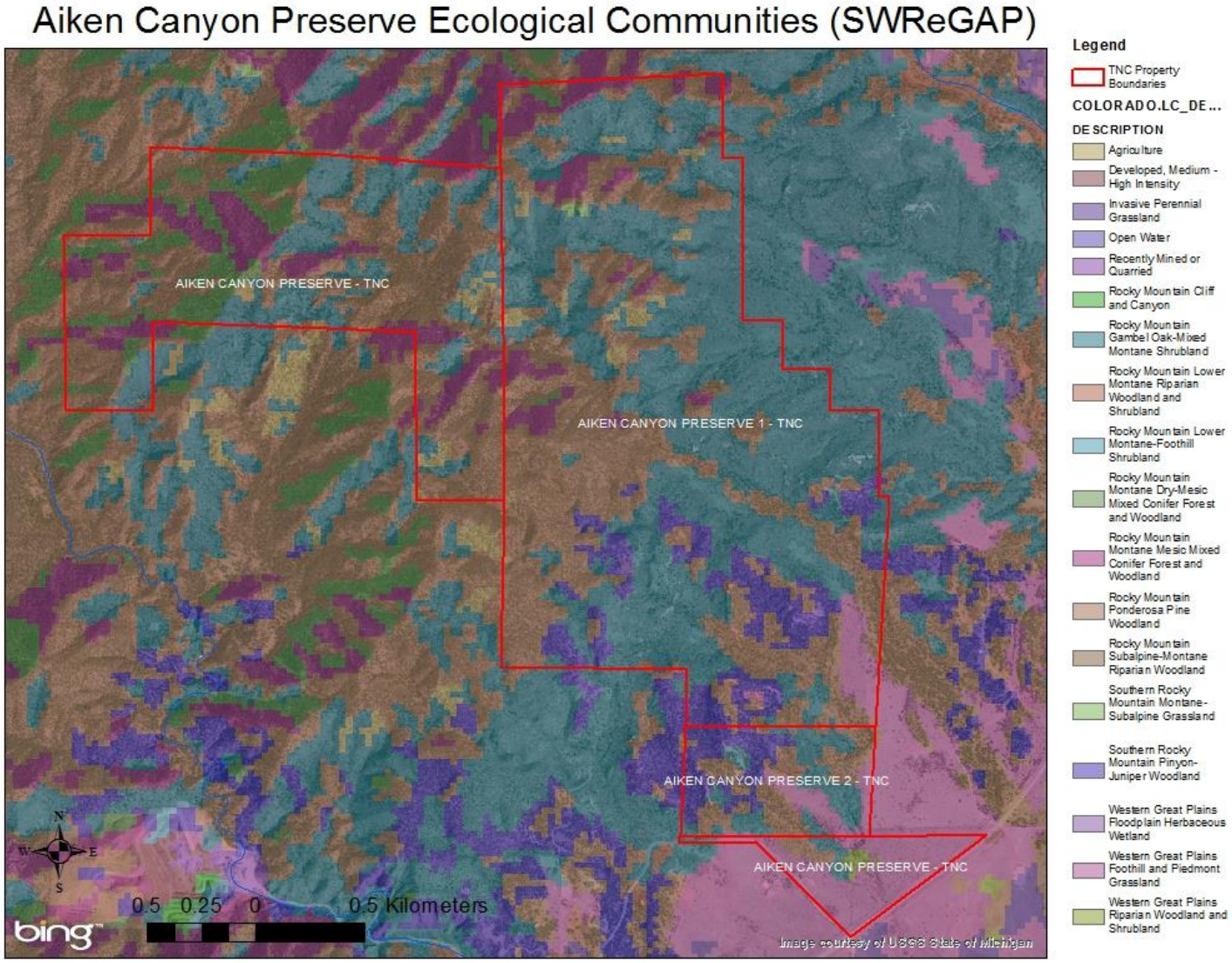
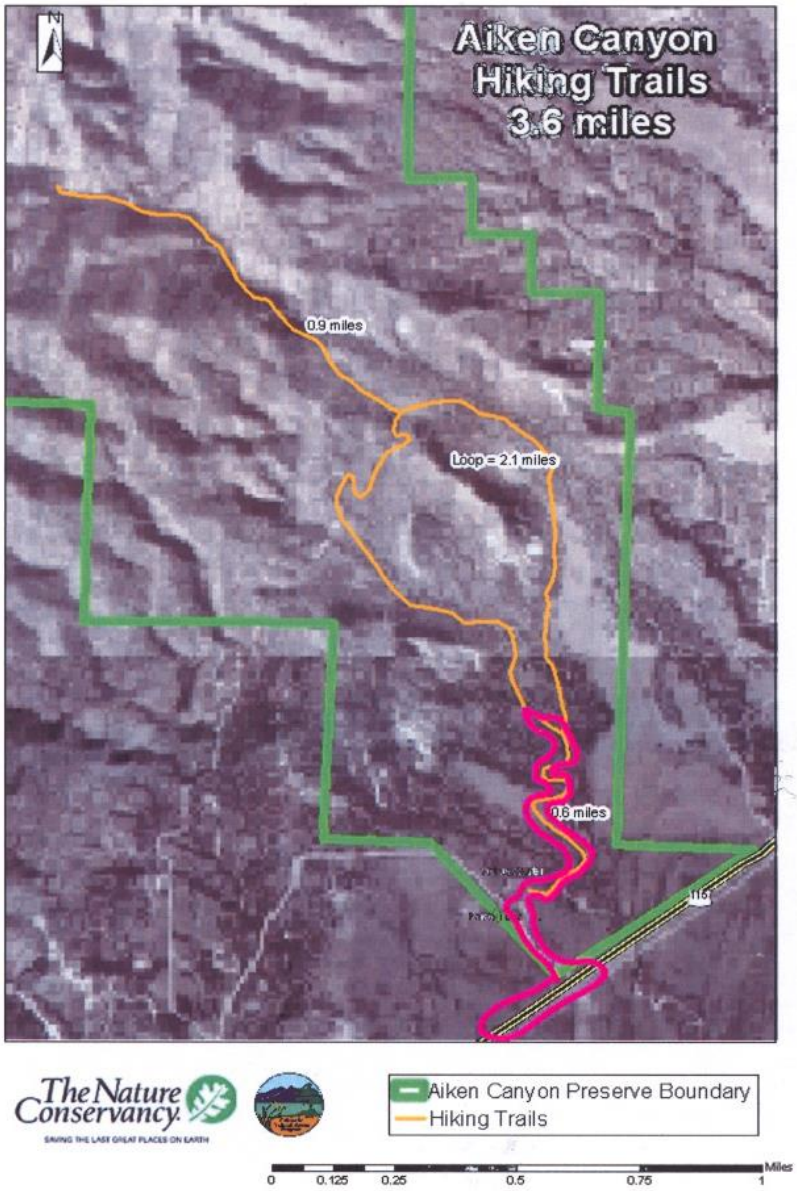


Figure 3. Ecological Systems at Aiken Canyon Preserve

Land Cover Description	Acres on Preserve	Percent of Preserve
Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	65.307	3.949
Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	113.560	6.867
Rocky Mountain Ponderosa Pine Woodland	616.248	37.263
Southern Rocky Mountain Pinyon-Juniper Woodland	110.653	6.691
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	633.493	38.306
Southern Rocky Mountain Montane-Subalpine Grassland	1.357	0.082
Western Great Plains Foothill and Piedmont Grassland	82.166	4.968
Rocky Mountain Subalpine-Montane Riparian Woodland	2.519	0.152
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	1.744	0.105
Western Great Plains Riparian Woodland and Shrubland	2.325	0.141
Agriculture	23.642	1.430
Invasive Perennial Grassland	0.775	0.047

Note: this table refers to land cover types within the Preserve boundaries, not the entire extent of Figure 3

3. Aiken Canyon Preserve trail system map



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Protecting nature. Preserving life.™

The Nature Conservancy in Colorado
2424 Spruce Street
Boulder, CO 80302

tel [303] 444-2950
fax [303] 444-2986

nature.org/colorado

DATE: July 19, 2016
TO: Whom it May Concern
FROM: The Nature Conservancy
RE: Science Evaluation of Impacts at Aiken Canyon of the proposed Transit Mix Quarry

---

The Nature Conservancy has conducted a high level science evaluation of the impacts of the quarry that has been proposed by Transit Mix Concrete in El Paso County and that is adjacent to The Nature Conservancy's Aiken Canyon Preserve. This memo sets forth The Nature Conservancy's assessment, based on our knowledge of the site, a visit to the proposed quarry site, evaluation of the plan for the proposed quarry, and an evaluation and review of the available ecological data.

Summary: Nearly the entire proposed quarry and the proposed access road lie within the Aiken Canyon Potential Conservation Area (PCA), a site considered "of Very High Significance" by the Colorado Natural Heritage Program. This site contains numerous and diverse conservation values. The shrublands and mix-grassed prairie remnants on the site are in excellent condition and represent ecosystems that were far more abundant before widespread development along the Front Range. Now they are so imperiled that they cannot sustain additional loss or impact. The rare and unique nature of these conservation values makes impacts difficult or impossible to fully mitigate, even with the best planning. The Nature Conservancy's Aiken Canyon Preserve and Lease lands (which are immediately adjacent to the proposed quarry area) would likely experience indirect impacts from numerous causes, including noise disturbance and loss of habitat for animals that require lands adjacent to the preserve. Given the high value of the conservation values in this area, it is our conclusion that development of a quarry in the proposed location would irreparably impact globally-imperiled and globally-vulnerable conservation values, and these impacts could not be fully mitigated. In addition, by impacting the Aiken Canyon site, the quarry would also impact a large, connected landscape that the Conservancy and partners have worked to conserve for more than two decades.

Site Description

According to the Colorado Natural Heritage Program (CNHP)[1], the Aiken Canyon site supports two rare plant communities and provides refuge for numerous plant and animal species. This site is within the Front Range oak-shrub foothills zone that is rapidly being converted to developed uses. Located at the ecotone between the prairie grasslands of the Great Plains and the forests of the

[1] Doyle, Georgia, John Armstrong, Jim Gionfriddo, Dave Anderson, Joe Stevens, and Robert Schorr. 2001. *Survey of Critical Biological Resources, El Paso County, Colorado*. Colorado Natural Heritage Program, Colorado State University. Fort Collins, CO.

lower montane zone, the shrubland and woodland communities at Aiken Canyon are interspersed with meadows of mixed-grass and tallgrass species. As used here, "Aiken Canyon" refers to the entire CNHP Potential Conservation Area (see figure), including but not limited to The Nature Conservancy parcels.

Aiken Canyon and the surrounding landscape support numerous conservation values. Some of these values will be directly impacted by locating a quarry at the proposed site. Others may be directly or indirectly impacted. Among the values on this site are:

- An excellent-to-good occurrence of a globally-imperiled mountain mahogany (*Cercocarpus montanus*) and needle and thread grass (*Stipa comata*) shrubland
- An excellent occurrence of a globally-vulnerable two-needle pinyon (*Pinus edulis*) and Scribner needle grass (*Stipa scribneri*) woodland community
- An excellent occurrence of Gambel's oak and mountain mahogany shrubland (*Quercus gambelii-Cercocarpus montanus/Muhlenbergia montana*)
- Mixed-grass prairie remnants that provide habitat for two skipper butterflies, the dusted skipper (*Atrytonopsis hianna*), and the Simius roadside skipper (*Amblyscirtes simius*), which are restricted to remnant patches of mixed grasslands where their hostplants big bluestem (*Andropogon gerardii*) and blue grama (*Bouteloua gracilis*) occur
- The state critically-imperiled birdbill day-flower (*Commelina dianthifolia*)
- Habitat for numerous species of wildlife, including black bear, mule deer, elk, mountain lions, bobcats, gray foxes, badgers, and tuft-eared pine squirrels
- More than 100 species of birds, including three species of nuthatches, western bluebirds, wild turkeys, hairy and downy woodpeckers, and several raptors, including golden eagles, prairie falcons, northern harriers, Cooper's hawks, and sharp-shinned hawks

Aiken Canyon is adjacent to two other large, important areas for wildlife: the Bureau of Land Management's Beaver Creek Wilderness Study Area (WSA) and the Fort Carson Military Reservation. As with all WSA's, the Beaver Creek WSA is a large, roadless area with wilderness characteristics. In 2005, Fort Carson received the first U.S. Fish and Wildlife Service Military Installation Conservation Partnership Award for its outstanding environmental resource conservation and management leadership achievements oriented at many declining native species, including the Mexican spotted owl, mountain plover, swift fox, peregrine falcon, greenback cutthroat trout and the Arkansas darter. The Conservancy has worked with Fort Carson to expand conserved wildlife habitat by more than 23,000 acres by putting conservation easements on ranchlands adjacent to the military reservation. Recently, the endangered black-footed ferret was reintroduced to these conserved ranchlands. Many of the animals in the WSA (elk, deer, mountain lion, bobcat, black bear, and numerous raptors and other birds) move across the landscape, including onto Aiken Canyon and across highway 115 onto Fort Carson and back. The connectivity among these various parcels is essential for sustaining the area's wildlife and declining species.

The quarry site is entirely in Critical Habitat for the Mexican Spotted Owl (*Strix occidentalis lucida),* a federally listed threatened species. Critical habitat is a term defined and used in the

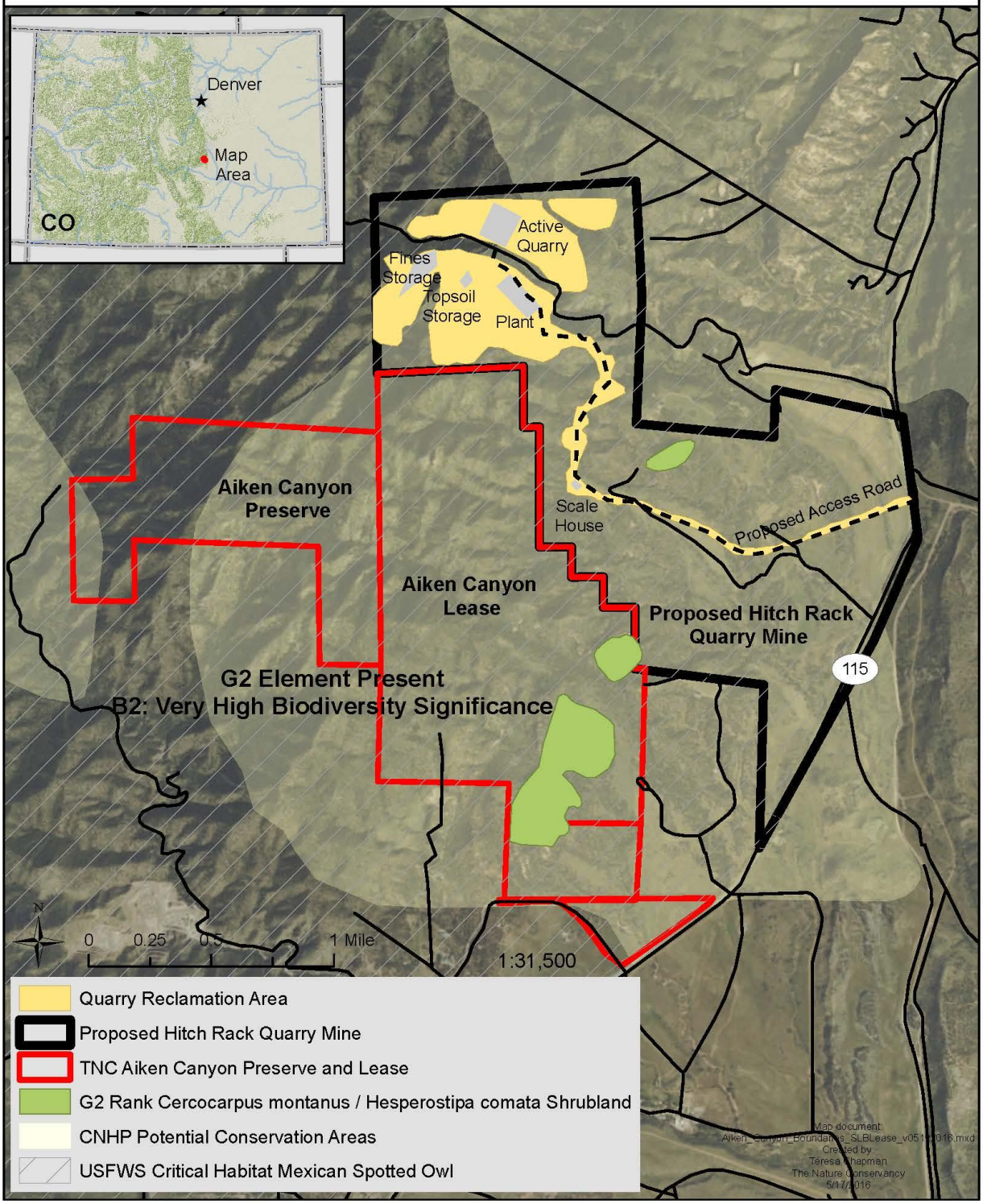
Endangered Species Act. It is specific geographic areas that contain features essential to the conservation of an endangered or threatened species and that may require special management and protection. Critical habitat may also include areas that are not currently occupied by the species but will be needed for its recovery.

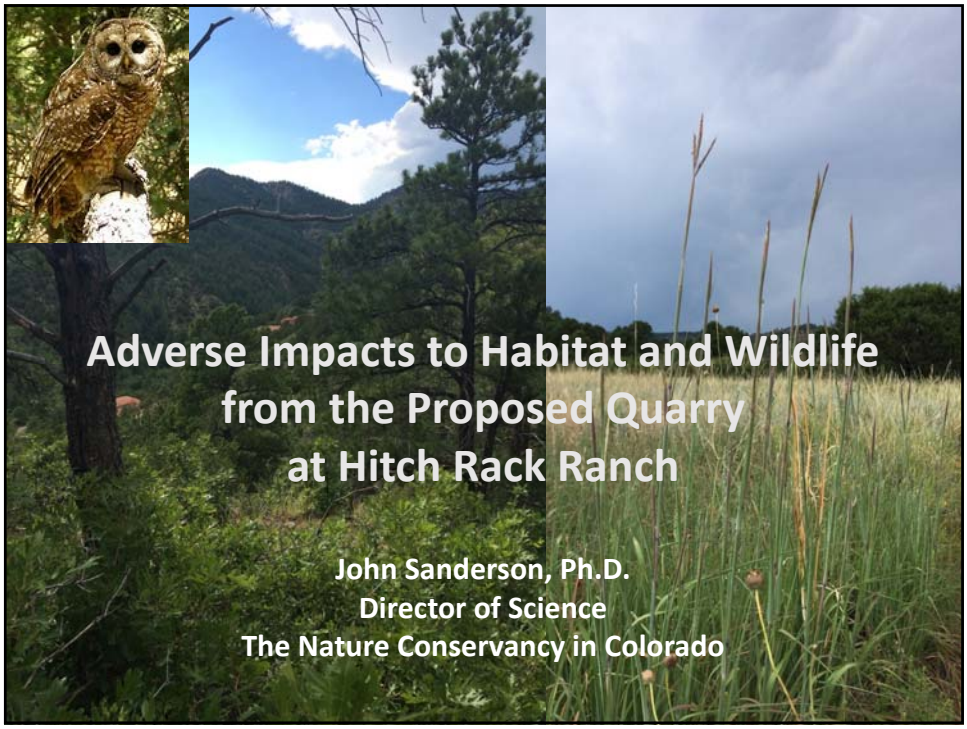
Conclusions

Aiken Canyon and the surrounding area contain important conservation values that would be directly and indirectly impacted by a quarry. Likely and potential impacts include but are not limited to, (1) direct loss of species and habitat due to removal of native vegetation and the topographical characteristics of the site; (2) harmful impacts from dust to plants, insects and other small organisms that are important components of the ecosystem; and (3) disruption of resident and migrating wildlife populations from quarry traffic and operations. Some impacts of a quarry could possibly be reduced if close consultation and careful planning with the relevant agencies is conducted, and those plans are rigorously adhered to if the project moves forward. However, it is important to recognize that some of the adverse impacts to Aiken Canyon's unique conservation values cannot be fully avoided or mitigated even with the best planning. Some of the site's conservation values—in particular the shrublands and mix-grass prairie along with the dusted skipper, Simius roadside skipper, and other animals that depend on them—were far more abundant before widespread development along the Front Range occurred, and are now so imperiled that they cannot sustain additional loss or impact. It is therefore The Nature Conservancy's conclusion that a quarry should not be developed in the proposed location because of the unacceptable degree of impact it would have on rare and imperiled conservation values, including some that are global in significance.

The Nature Conservancy
Protecting nature. Preserving life.

Conservation Targets at Aiken Canyon and Vicinity





Adverse Impacts to Habitat and Wildlife from the Proposed Quarry at Hitch Rack Ranch

John Sanderson, Ph.D.
Director of Science
The Nature Conservancy in Colorado



MINERAL RULES AND REGULATIONS
OF
THE COLORADO MINED LAND
RECLAMATION BOARD

Legislative Declaration in Section 34-32.5-102 of The Colorado Land Reclamation Act for the Extraction of Construction Materials states that:

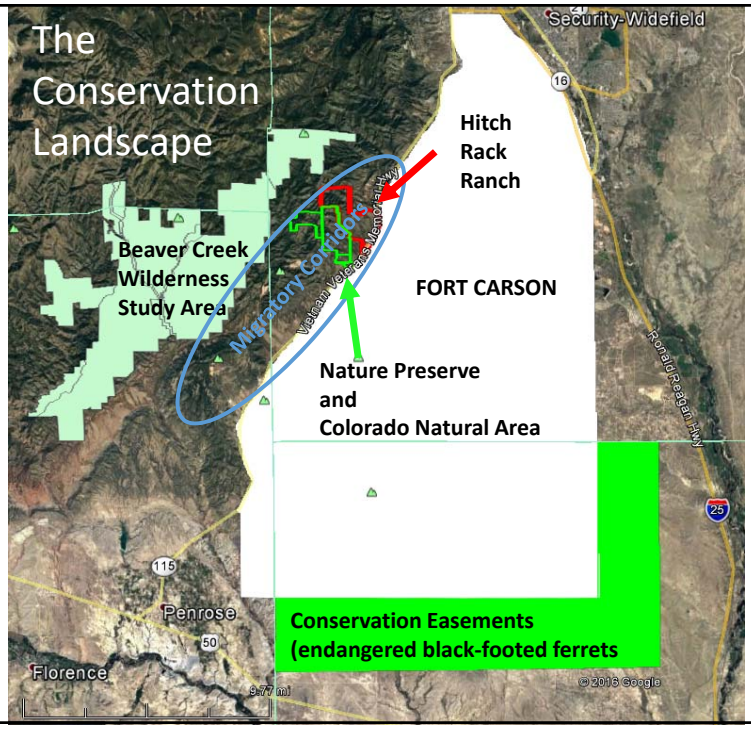
(1) "It is the further intent of the general assembly by the enactment of this article to conserve natural resources, to aid in the protection of wildlife and aquatic resources . . .

Mineral Rules and Regulations of the Colorado Mined Land Reclamation Board for the Extraction of Construction Materials states that:

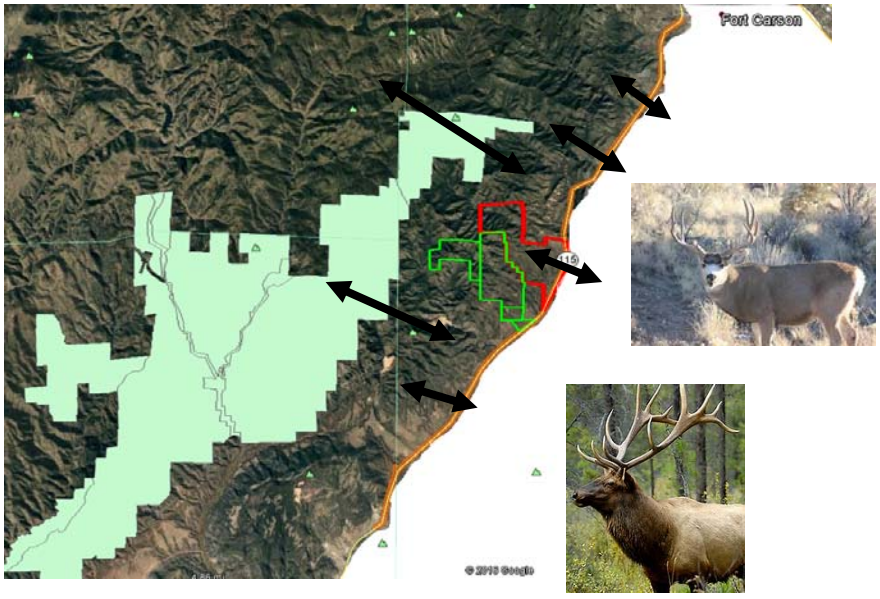
3.1.8 Wildlife
(2) *Habitat management and creation, if part of the Reclamation Plan, shall be directed toward encouraging the diversity of both game and non-game species, and shall provide protection, rehabilitation or improvement of wildlife habitat.*

Five reasons why the quarry plan does *not* conserve natural resources and protect habitat :

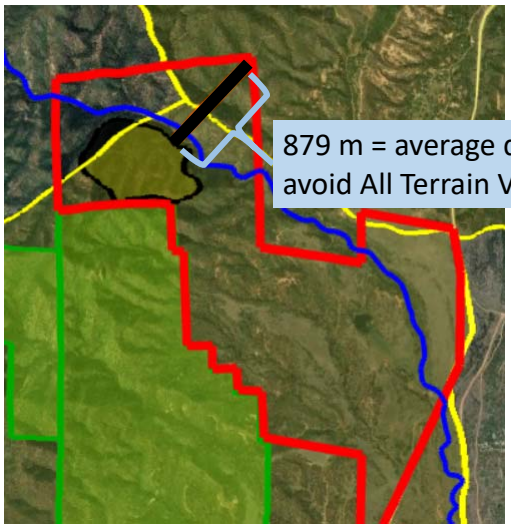
1) Hitch Rack Ranch is a key location in a 400 mi^2 landscape that conserves habitats and species from “mountains to plains.”
2) Hitch Rack Ranch comprises ~40% of an area of “high biodiversity significance.”
3) Hitch Rack Ranch abuts an established 1600+ acre nature preserve and official Colorado Natural Area.
4) The proposed quarry will destroy critical habitat for the Mexican Spotted Owl, a threatened species under the Endangered Species Act.
5) The effects of the quarry will be severe, and the reclamation plan will mitigate only a small fraction of these effects.



"Migratory Corridors" for elk, and "Road Crossings" for mule deer and elk show high wildlife use of connections from Mountains to Plains



Elk Response to Activity



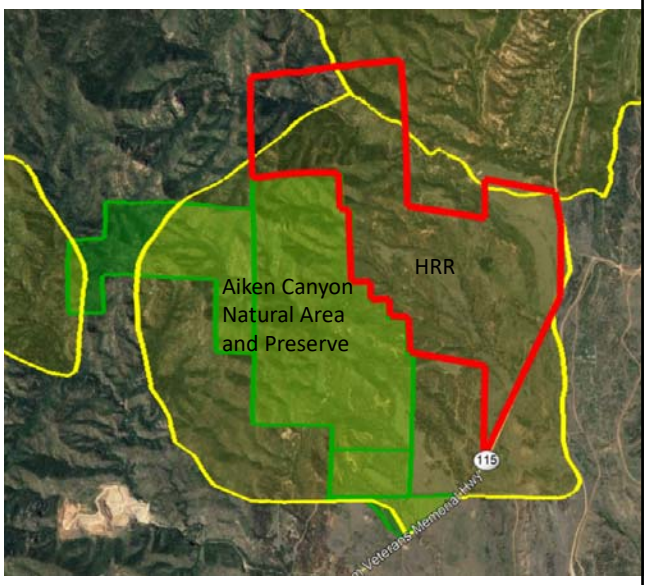
879 m = average distance by which elk avoid All Terrain Vehicles

Source: Wisdom, Michael J., Haiganoush K. Preisler, Leslie M. Naylor, Robert G. Anthony, Bruce K. Johnson, and Mary M. Rowland. "Elk Responses to Trail-Based Recreation on Public Forests." *Forest Ecology and Management* 411 (March 1, 2018): 223–33. https://doi.org/10.1016/j.foreco.2018.01.032.

Aiken Canyon Potential Conservation Area (yellow boundary and light yellow fill)

"High Biodiversity Significance"

Source: Doyle et al. 2001. Survey of Critical Biological Resources, El Paso County, Colorado, later modified and expanded by the Colorado Natural Heritage Program.





Aiken Canyon Conservation Values



- Excellent examples of globally imperiled foothills shrublands → destroyed up and down the Front Range.
- Excellent examples of globally vulnerable two-needle pinyon woodland.
- Excellent examples of uncommon Gambel's oak and mountain mahogany shrubland.
- Mixed-grass prairie remnants → invaded and destroyed along the Front Range. Two butterflies depend almost exclusively on these prairie remnants.
- The imperiled birdbill day-flower, found here and only a tiny handful of other places in Colorado.
- Habitat for black bear, mule deer, elk, mountain lions, bobcats, gray foxes, badgers, and tuft-eared pine squirrels
- More than 100 species of birds, including three species of nuthatches, western bluebirds, wild turkeys, woodpeckers, and several raptors.
- More than 600 species of plants → Only 25 species mentioned in the reclamation plan for permanent revegetation.



Management Indicator Species



- This concept has been discredited numerous times.
- *"The notion that a single species can serve as an indicator for a suite of species is an untested premise and generally not supported by research studies or ecological theory."*

Source:

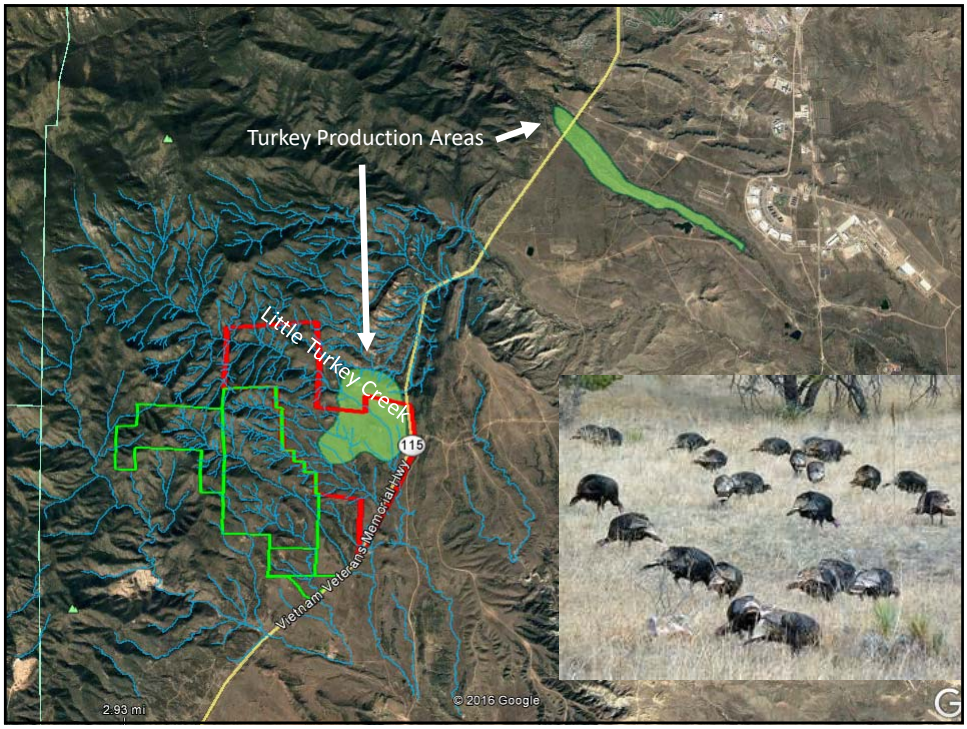
- Cushman, S. A., K. S. McKelvey, B. R. Noon, and K. McGarigal. 2010. Use of abundance of one species as a surrogate for abundance of others. Conservation Biology 24:830–840.
- Noon, B. R., K. S. McKelvey, and B. G. Dickson, 2009. Multispecies conservation planning on U.S. federal lands. Pages 51–84 in J. J. Millspaugh and F. R. Thompson, III, editors. Models for planning wildlife conservation in large landscapes. Academic Press, New York, New York, USA.



Colorado Department of Natural Resources
Colorado Parks and Wildlife
Colorado Natural Areas Program

Aiken Canyon Natural Area

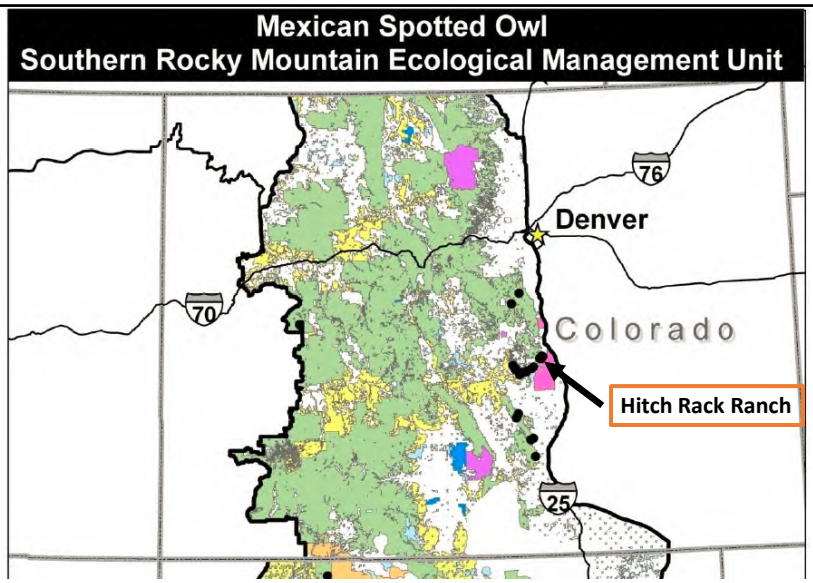
- *"The largest intact foothills ecosystem known from the Front Range."*
- *"Contains an unusual diversity and concentration of wildlife. Mountain lion, black bear, wild turkey, elk, golden eagles and an abundance of neotropical migratory birds are present in the area."*



MEXICAN SPOTTED OWL RECOVERY PLAN,
FIRST REVISON
(Strix occidentalis lucida)

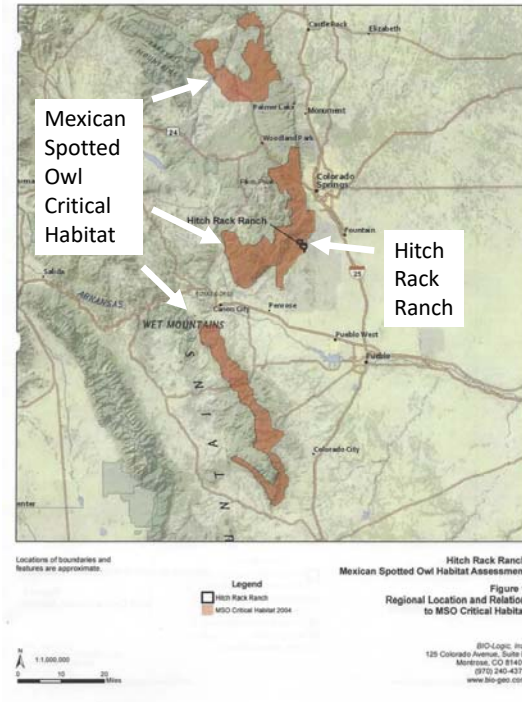


- Listed as "threatened" in 1993.
- Requires "old-growth" conifer forests, and rocky cliffs and canyons.
- Habitat is lost by:
  - Logging
  - Wildfire
  - Forest insects and disease
  - Grazing
  - Land Development
  - Roads and trails
  - Recreation
  - Water development



Black dots = Mexican Spotted Owl sites = *"an area with a high probability of being used by a single or a pair of adult or subadult owls for nesting, roosting, or foraging"*

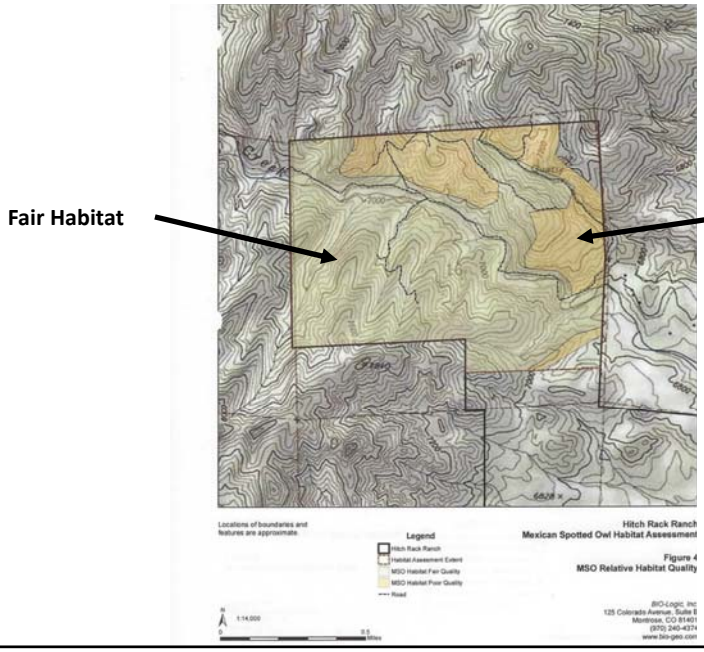
Canyon City to Colorado Springs is the best place in Colorado for MSO, a "hotspot", a "stronghold," "by far the biggest concentration of nesting birds in Colorado." -- US FWS Biologist

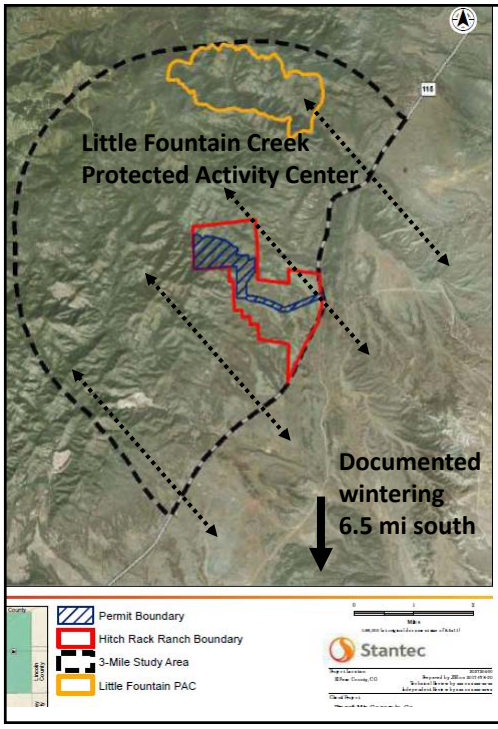


Hitch Rack Ranch lies entirely within mapped "critical habitat" for the Mexican Spotted Owl, a threatened species.

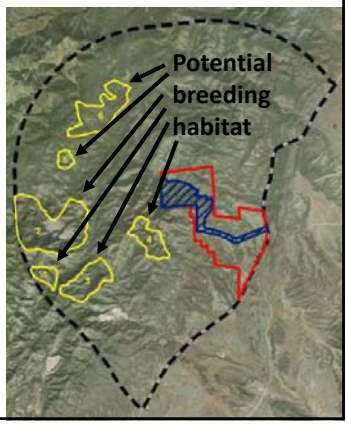
Critical habitat is "specific geographic areas that contain features essential to the conservation of an endangered or threatened species and that may require special management and protection. ***Critical habitat may also include areas that are not currently occupied by the species but will be needed for its recovery.***"

Mexican Spotted Owl Habitat in Quarry Location





- Protected Activity Centers encompass are known owl nest/roost sites.
- Stantec concluded there are 6 areas of potential MSO breeding habitat within 3 miles of HRR, the nearest just 0.4 miles away.



7th INFANTRY DIVISION AND FORT CARSON
FORT CARSON, COLORADO

Biological Assessment and Management Plan for the Mexican Spotted Owl on Fort Carson

- Live owls have been found on Fort Carson in winter (December – February).
- Two dead owls have been found on the western edge of Fort Carson.
- Fort Carson MSO management plan *"provides guidance to allow the U.S. Army to manage the Mexican Spotted Owl"*
- No winter use on Hitch Rack Ranch was evaluated.

Conclusions

- The Hitch Rack Ranch and its surroundings have high conservation value:
  - HRR makes up ~40% of the Aiken Canyon Potential Conservation Area.
  - A critical connection point in a 400 square mile conservation landscape.
  - This area supports abundant and diverse wildlife supported by habitats that have been lost along the Front Range.
  - The property contains habitat for the Mexican Spotted Owl, a threatened species.
- A quarry would adversely impact natural resources and wildlife and the reclamation plan would mitigate a small percentage of this impact.

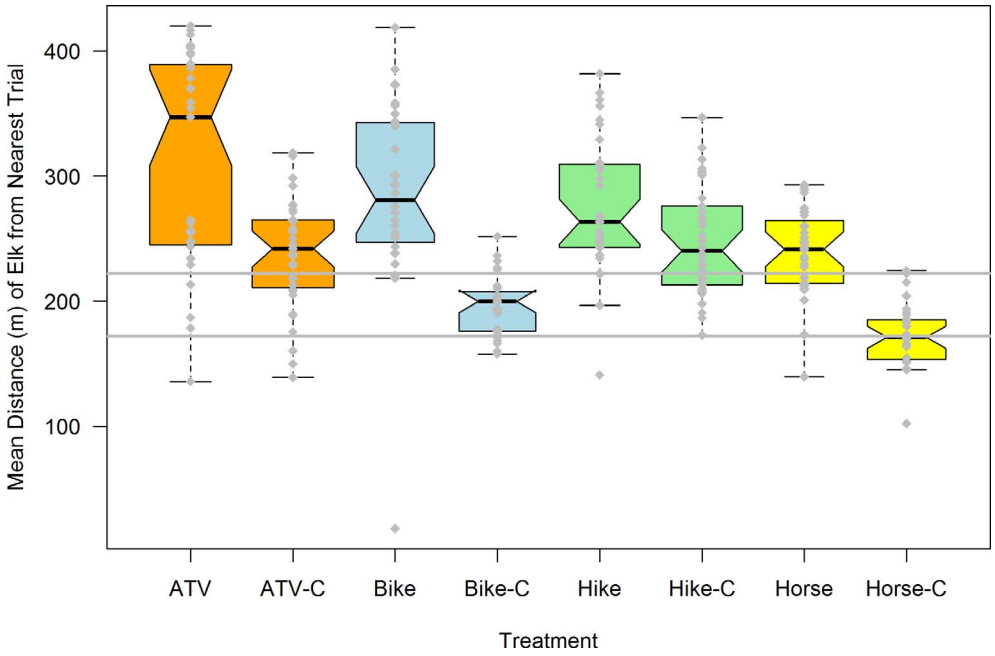


Fig. 3. Parallel boxplots showing the variability among elk (variability within each box) and among treatments (variability between boxes) in mean distances of telemetered elk (n = 35) from the nearest recreation trail during four types of recreation (all-terrain vehicle riding [ATV], mountain biking [Bike], hiking [Hike], horseback riding [Horse]) and corresponding control (C) periods, 2003–2004, Northeast Study Area, Starkey Experimental Forest and Range, northeast Oregon, USA. Non-overlapping notches provide 'strong evidence' that the two medians differ (Chambers et al. 1983, p. 62; Benjamini, 1988). Silver dots show mean distances of individual elk. The two horizontal grey lines indicate the mean near (172 m) and mean far (222 m) viewing distances from trails.

biking. Shifts away from and back toward trails during the hiking treatment versus control periods were more subtle, as reflected in the small overlap of CIs of mean values (Table 1) and overlapping median notches (Fig. 3).

Mean and median distances of elk from the recreation trails were farther during ATV riding than during the three non-motorized types of recreation (non-overlapping CIs and notches); these distances were not different between mountain biking, hiking, and horseback riding (overlapping CIs and notches, Fig. 3; Table 1). Boxplot distributions, however, indicated an overall trend of strongest avoidance during ATV riding, followed by mountain biking, hiking, and horseback riding (Fig. 3). These trends were supported by the rank order of both mean and median values among the four treatments (Fig. 3; Table 1).

Variability in mean distances among individual elk, however, was highest (least precise) during ATV riding. Lower precision of elk response to ATV riding was evident in the longer boxplot below the median, and high number of individual mean distances farther below the median, compared to other types of recreation (Fig. 3), suggesting that ATV riding elicited either a hiding (stationary) or a flight (active) response (see Section 4). Higher precision was associated with elk responses to horseback riding and hiking, and during all control periods except hiking.

Mean distances of elk from the trails also were farther (non-overlapping CIs) during all four recreation activities than the mean near and far viewing distances (Table 1). The large majority of elk locations were well beyond the mean near and far viewing distances from trails, and 44% of all elk locations during the recreation treatments were beyond the maximum viewing distance of 300 m (Fig. 2B). This pattern was stronger during ATV riding and mountain biking, when 52% and 50% of all elk locations occurred > 300 m from the trails. The pattern was weaker during hiking and horseback riding, when 37% and 25% of elk locations were beyond the maximum viewing distance (Fig. 2B).

Almost one-half (44%) of elk locations occurred on just 15% of the study area farthest from trails and out of view (Fig. 2B). The large majority (85%) of the study area was within the maximum viewing distance of 300 m from the recreation trails, but only 56% of elk locations occurred in these distance intervals (Fig. 2B). These patterns were evident in the kernel densities of treatment versus control periods (Fig. 4).

3.3. Elk avoidance of recreationists

Mean minimum separation distances that elk maintained from recreationists were highest during ATV riding (879 m, ± 68 m), lowest and similar during hiking (547 m, ± 44 m) and horseback riding (558 m, ± 45 m), and intermediate during mountain biking (662 m, ± 53 m). Boxplot distributions and median notches followed this same pattern (Fig. 5): median distances were highest during ATV riding, followed by mountain biking, both of which had non-overlapping notches with each other and with the overlapping notches of hiking and horseback riding. The taller height of the boxplot above the median during ATV riding compared to other types of recreation (Fig. 5) further illustrated the stronger but less precise elk response to motorized recreation.

Separation distances from recreationists were significantly farther than elk distances from trails (non-overlapping CIs with those in Table 1), illustrating the difference in real-time responses of elk to recreationists (five-minute time windows each morning and afternoon) versus the more static responses to trails (8-h time window each day). Specifically, mean minimum distances of elk from recreationists (558–879 m) were 2–4 times farther than mean distances from trails (239–310 m, Table 1) during the same recreation periods. Differences in elk distances from recreationists also were more distinct and consistent (more precise) between the four treatments than those for distances from trails (boxplot variability across treatments in Fig. 3 versus 5), suggesting that the direct responses of elk to recreationists was more predictable than their indirect responses to trails.

Minimum separation distances also were 3–5 times farther than the mean near and far distances of 172 and 222 m at which elk could be viewed from the trails (non-overlapping CIs with those in Table 1), and 2–3 times farther than the maximum viewing distance of 300 m. Over 75% of the minimum distances between elk and recreationists exceeded the maximum viewing distance of 300 m (see boxplot portions above 300 m, Fig. 5), indicating a strong tendency of elk to be hidden from view of recreationists. This percentage of elk distances from recreationists beyond 300 m, estimated for a 5-min time window (Fig. 5), was higher than the estimate of 44% of elk locations beyond 300 m based on the more generic 8-h time window (Fig. 2B). The long "tails" of elk distances extremely far from recreationists (e.g., 1500–4000 m distances, per dotted lines in uppermost part of each boxplot, Fig. 5) were evident during all four recreation activities, indicating avoidance

CHAPTER 3

Multispecies Conservation Planning on U.S. Federal Lands

Barry R. Noon, Kevin S. McKelvey, and Brett G. Dickson

Numerous laws directly, or indirectly, mandate the conservation of all species on public lands in the United States (Goble and Freyfogle 2002, Nagle and Ruhl 2002). Key laws relevant to the management of biodiversity on federal lands include the National Forest Management Act (NFMA; Noon et al. 2003) and the Federal Endangered Species Act (ESA; 1973). However, there are also many companion laws that govern the use of these same lands that are in conflict with a goal of maximizing the conservation of species and their habitats (e.g., Multiple Use Sustained Yield Act, 1960). Consequently, land managers must balance the trade-offs between the conservation of species and the exploitation of resources for short-term human use. It is commonplace for species and people to compete for the same set of limiting resources.

Most prominent among the laws protecting species and their habitats is the ESA, which stipulates that no federal action, or federally sanctioned action, on public or private lands shall jeopardize the continued existence of any species. Given the importance of maintaining biodiversity for both ethical and practical reasons—for example, to sustain environmental goods and services critical to human welfare (Hooper et al. 2005)—it is imperative that the scientific community provide land managers with the knowledge and tools needed to meet their conservation mandate.

Despite the importance of multispecies conservation planning from both a legal and practical perspective, we believe that current scientific understandings and methods provide only limited guidance to land managers. Studying multiple species and the range of spatial and temporal scales that they span has been identified as one of the key challenges in conservation biology (e.g., MacNally et al. 2002, Fischer et al. 2004*a*). However, as we discuss in the following text, progress is slow in part due to the complexity of the problem and to the lack of sufficient information on the abundance, distribution, life histories, and ecological relations of most species. In addition, much conservation science has been crisis driven, responding to the conservation needs of individual species experiencing threats to their persistence. A clear expression of the crisis-driven nature of conservation biology is that the vast majority of scientific

7. Further filter species by retaining only those that can be monitored with available resources, but retaining several species within each focal category.

8. Select a final set of focal species that spans the range of focal species categories, encompasses a wide range of ecological attributes, and, if possible, represents different taxonomic groups. This list should be critically evaluated to see whether it meets the criteria of comprehensiveness and complementarity.

After one follows these steps, the hope is that a near optimal set of fine filter species will have been identified. The set of focal species should complement and provide an opportunity to evaluate the utility of the vegetation-based coarse filter approach. In addition, if the set of focal species is sufficiently small with well-known distributions, habitat relationships, and demographic characteristics, many of the new methods for multiple species assessment discussed previously may be feasible.

APPLICATION TO FEDERAL PUBLIC LANDS

Conservation practice on public land areas in the United States is constrained by a plethora of often conflicting legal statutes and by profound limits on data availability. These points can be illustrated by considering the management of Forest Service lands in the United States. Probably the most important statute to consider is the NFMA, which requires the Forest Service to maintain biological diversity in perpetuity. Thus, the Forest Service has a formal legal mandate to engage in multispecies conservation. Between 1982 and 2005, the biodiversity requirements in NFMA were interpreted to mean maintaining the viability of native vertebrate species across their ranges. The approach was to choose "management indicator species," similar in intent to focal species, and to manage for and monitor their populations. Although the efficacy of this approach has been questioned (Landres et al. 1988, Landres 1992), there is no way to evaluate its effectiveness because the requirements were never fully implemented. To the best of our knowledge, the Forest Service has never monitored the populations of the indicator species designated in their management plans in a manner that would allow a rigorous and comprehensive assessment of their response to management and the degree to which unmeasured species were being conserved.

In 2005, the Forest Service issued new regulations to implement the NFMA, dropped their requirements for viability assessments of selected vertebrate species, and shifted over to a coarse filter model for conservation (Noon et al. 2005). The agency asserts that maintaining a diversity of natural vegetation

Contributed Paper

Use of Abundance of One Species as a Surrogate for Abundance of Others

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Abstract: *Indicator species concepts have a long history in conservation biology. Arguments in favor of these approaches generally stress expediency and assume efficacy. We tested the premise that the abundance patterns of one species can be used to infer those of other species. Our data consisted of 72,495 bird observations on 55 species across 1046 plots distributed across 30 sub basins. We analyzed abundance patterns at two spatial scales (plot and sub basin) and for empirical and a priori grouping. There were few significant indicator relationships at either scale or under either grouping rule, and those few we found did not explain a substantial portion of the abundance of other species. Coupled with the lack of proven efficacy for species surrogacy in the literature, our results indicate the utility of indicators and similar types of surrogate approaches must be demonstrated rather than assumed.*

Keywords: bird communities, biodiversity monitoring, indicator species, surrogate species

Uso de la Abundancia de una Especie como Sustituta de la Abundancia de Otras

Resumen: *Los conceptos de especies indicadoras tienen una larga historia en la biología de la conservación. Los argumentos a favor de estos generalmente enfatizan la viabilidad y asumen eficacia. Probamos la premisa de que los patrones de abundancia de una especie pueden ser usados para inferir los de otras especies. Nuestros datos consistieron de 72,495 observaciones de aves de 55 especies en 1,046 parcelas distribuidas en 30 subcuencas. Analizamos los patrones de abundancia a dos escalas espaciales (parcela y subcuenca) para agrupación empírica y a priori. Hay escasas relaciones indicadoras significativas en ambas escalas y bajo ambas reglas de agrupamiento, y las pocas que encontramos no explicaron una porción sustancial de la abundancia de otras especies. Asociado con la falta de eficacia probada de las especies sustitutas en la literatura, nuestros resultados señalan que la utilidad de los indicadores y de enfoques similares debe demostrarse y no asumirse.*

Palabras Clave: comunidades de aves, especies indicadoras, especies sustitutas, monitoreo de biodiversidad

Introduction

Species surrogacy is a core concept in the field of conservation biology (Landres et al. 1988; Lambeck 1997; Wiens et al. 2008). Its appeal lies in the hope of gaining effective and efficient means to evaluate status and trends of multiple species from monitoring a few surrogate species. There are many variants of this concept and different uses. Variants include ideas associated with shared habitat or functional requirements (guild membership), trophic dependencies (keystone species), area requirements (umbrella species), ecological function (engineer species), and ecological associations (focal species as defined by Lambeck 1997). (See Noon et al. [2008] for a more complete list of surrogate types.) Uses include assessing the efficacy of reserve design or the status and trends of unmeasured species. Wiens et al. (2008) proposed that species can be grouped through the use of multivariate clustering and that a surrogate can be chosen from each of the resulting groups to represent the group

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abundance for the same data set than are a set of independently derived groups. The empirically derived groups can be considered a best-case scenario which provides the maximum possible strength of surrogacy. These results are likely close to the maximum possible variance explained by grouping these data. Nevertheless, they may be idiosyncratic to the particular data set and study area used to produce them.

Species groupings assigned objectively based on a priori consideration of species autecological characteristics are likely to be more generalizable across populations and ecosystems than empirical groupings and their observed surrogacy patterns. In addition, a priori groupings are more easily interpreted ecologically than empirical groupings in that they are based on definable ecological characteristics, such as seral-stage association, migratory status, or functional group, rather than on the happenstance of the patterns of co-occurrence in a given ecosystem at a given time.

Splitting species into 13 a priori groups on the basis of migratory status, seral-stage association, microhabitat association, and functional group produced few statistically significant surrogate relationships. Seral-stage association showed the strongest surrogacy, with significant within-group correlations for closed- and open-canopy-associated species at both the plot and sub basin level. All the other grouping categories were largely devoid of statistically significant surrogacy relationships. Statistically significant patterns of co-occurrence in relation to seral-stage association are not surprising in this system, given that the major differences among plots and sub basins that formed the samples for this study were related to seral-stage conditions of forest succession (McGarigal & McComb 1995). One would expect to find significant patterns of co-occurrence among species with similar seral-stage associations in a data set in which sample locations primarily differ along gradients of seral development. Even here, however, little variance was explained. No seral-condition groupings at either the plot or sub basin level explained more than 18.2% of within-group variance in abundance. The absence of significant patterns of co-occurrence for any of the other groups suggests that coarse habitat-association attributes may be the only characteristics useful for defining species surrogacy.

Utility of Species Surrogacy

Monitoring efficacy is often judged on the basis of power to detect change. Manley et al. (2004) suggest that being able to detect a 20% change in abundance, 80% of the time is a reasonable expectation for change-detection monitoring. In our analysis, the average variance in species' abundance explained by the group assignment was 9.4% at the sub basin scale and 2.7% at the plot scale (Table 2). It is nearly impossible for surrogate monitoring to have sufficient power to detect change when over 90% of the variability of a species assemblage is independent of the abundance of indicator species.

Our results indicate that with a priori omniscience one could pick indicators that perform better than the group averages we identified (Table 3). For example, at the plot level, 3 of 13 groups had a member species that could explain more than 20% of in-group variance, whereas 6 of 13 could at the sub basin level. This, however, does not provide much encouragement because identifying these "best" indicators for each group would require a priori data collection and evaluation for all member species. Thus, the average in-group surrogate ability is the more meaningful measure of the success of group surrogacy. Nevertheless, even selection of the "best" group indicators (Table 3) for each group did not give substantial power to monitor in-group abundance. The average variance explained by the best indicator across groups was 12.6% at the plot level and 19.5% at the sub basin level. A two-stage inference is required to use a surrogate for monitoring the group; the power to measure group change would be reduced by the product of the uncertainty of the estimate of the surrogate species' abundance and the imprecision with which that surrogate species reflects abundances of its group. A useful and reliable surrogate species must be tightly associated with the group it represents. On the basis of these considerations, we believe that the rarity of statistically significant indicator relationships and the weakness of those that were found suggest that guild-level indicator species for birds are not effective in this system.

Surrogacy is a key concept in ecosystem management and the movement into multispecies conservation paradigms. Effective species surrogates, however, appear to be rare. Ecological theory provides a possible explanation. No two species can long occupy the same niche (Gause 1934; Hutchinson 1957; Pulliam 2000). Thus, all coexisting, sympatric species must differ along at least one critical niche dimension. There must be some limit to the similarity of coexisting species (MacArthur 1967), and it is expected that species that are similar in some aspects of their niche will displace others so as to minimize competition. This would tend to lead to weak or negative patterns of co-occurrence for species sharing functional ecological characteristics, as we found in our study (see also Sherry 1979). Niche displacement processes would appear destructive to the stable existence of strong species surrogacy on the basis of functional ecological characteristics.

Conclusions

We present a limited evaluation of the surrogate species concept. We limited the evaluation to bird species in a temperate forest environment. We evaluated patterns in

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space and not in time. Nevertheless, the lack of strong surrogacy is compelling. The data set was large (over 75,000 bird locations at over 1000 point-count stations. These data have been used in numerous studies (McGarigal & McComb 1995; Cushman & McGarigal 2002; Cushman & McGarigal 2004; Cushman et al. 2008) and have sufficient power to detect patterns in community structure (McGarigal & McComb 1995; Cushman & McGarigal 2003). In addition, we considered two spatial scales and both a priori and empirical species grouping, which provided a comprehensive evaluation of the surrogate-species concept.

Our results suggest that certain types of surrogacy are unlikely to reliably exist. For example, groups formed on the basis of migratory status, microhabitat association, and functional group did not receive any support. Thus, the guild-indicator concept (Block et al. 1987) and management-indictator species (Landres 1992; Landres et al. 1988) do not appear to have merit, at least for these species. The idea that the dynamics of one species will represent those of others that share its functional or migratory characteristics (Wiens et al. 2008) should be verified rather than assumed. We did find significant relationships among the co-occurrence patterns of species with shared seral-stage associations. Nevertheless, these relationships were weak in terms of the ability of one of the group to predict abundance patterns of other group members.

To monitor ecosystems one must study them, determine the critical elements within the ecosystems, formulate specific hypotheses concerning ecosystem function, and collect data to evaluate those hypotheses (Nichols & Williams 2006; Cushman et al. 2008; Cushman & McKelvey 2009). For such approaches to produce stable and reliable inferences to the ecosystem, the monitored elements should be chosen on the basis of strong causal chains and be linked explicitly to either top-down or bottom-up controls. One should not, however, make the error of assuming that by monitoring any species or group of species one is monitoring an ecosystem. There is no statistical basis to believe a priori that the dynamics or distribution of an individual species is representative of a species group. These relationships need to be demonstrated rather than assumed. Lacking these understandings, the emphasis for species monitoring should be on the perceived importance of the species itself and not on its presumed ecological surrogacy.

Acknowledgments

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Supporting Information

Results for analysis of all four forms of the data set are available as part of the on-line article (Appendix S1) and include results for Mantel analysis of within-group correlation that are interpreted the same as in Table 1. The authors are responsible for the content and functionality of these materials. Queries (other than absence of the material) should be directed to the corresponding author.

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Master of Science in Botany/Field Naturalist Program, 1994
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Bachelor of Science in Aeronautical and Astronautical Engineering, 1986
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Leadership Excellence – Continuing Education, The Nature Conservancy, 2016

Negotiation and Leadership, Program on Negotiation at Harvard Law School, 2015

Leadership Excellence Program, The Nature Conservancy, 2014 - 2015

Emerging Leaders Program, The Nature Conservancy, 2009 - 2010

TNC Rocky Mountain Conservation Region Climate Change Workshop, January 2008

U.S. Army Corps of Engineers, Regulatory IV—Interagency Wetlands Identification and Delineation, August 1998

The Nature Conservancy, Introduction to Biohydrology, May 1996

Eagle Hill Wildlife Research Center, Field Ornithology, May 1993

WORK EXPERIENCE

Director of Science
The Nature Conservancy of Colorado, Boulder, CO 80302 Oct 2010 – Present

Lead and supervise a team of eight scientists to drive conservation outcomes at The Nature Conservancy in Colorado. Plan and implement strategic and tactical science program function to achieve maximum leverage and on-the-ground conservation outcomes. Coordinate a research and applied conservation science portfolio of projects. Ensure clear and effective communication among staff, trustees, donors, partners, and other stakeholders. Plan and execute, and also participate in, cooperative workshops and projects with state and federal agencies, universities, non-governmental organizations and private entities. Serve as a source of technical expertise on conservation, ecology, hydrology, botany, and applied climate change science. Review, prepare and present oral and written reports, including peer-reviewed articles.

Water Program Director
The Nature Conservancy of Colorado, Boulder, CO 80302 June 2009 – Jan 2015

Led the water program for The Nature Conservancy of Colorado, including science, policy, development, outreach, and protection components. Managed a $1.7M/yr budget. Participated in statewide and regional water planning for conservation outcomes, including coordination and collaboration with multiple water users and agencies. Synthesized, interpreted and applied research and conservation plans to execute on-the-ground conservation and management actions including instream flow and land protection. Serve on graduate committees. Contract and supervise development of conservation tools.

Senior Freshwater Ecologist
The Nature Conservancy of Colorado, Boulder, CO 80302 September 2007 – Jan 2015

Provided technical support and guidance to conservation planning efforts for wetlands, riparian areas, and aquatic ecosystems, including Ecoregional Planning and the Colorado Non-consumptive Needs Assessment. Interpreted and applied ecological theories and principles, research results, and conservation plans to on-the-ground conservation and management actions. Synthesized, analyzed and interpreted data, wrote reports and manuscripts, and reviewed and published to peer-reviewed literature. Wrote technical components of grants and research proposals. Served on graduate committees. Contracted and supervised development of conservation tools. Represented TNC's conservation science to landowners, donors, and other public and private entities.

Conservation Ecologist
The Nature Conservancy of Colorado, Boulder, CO June 2005 – August 2007

Interpreted and applied conservation plans to execute on-the-ground conservation actions. Conducted site assessments, identified management needs, and wrote management plans. Wrote grant and research proposals. Wrote and supervised contracts for site inventory and monitoring, and site management. Represented TNC's conservation science to landowners, donors, and other public and private entities.

Instructor
Punta Cana, Dominican Republic, July – August 2005
through Columbia University, New York, NY

Co-instructed a 5-week upper level undergraduate course in field ecology, conservation biology, and statistics.

Biohydrologist/Owner 1998 – 2005
Paluster Environmental Services, Fort Collins, Colorado

Conducted a wide range of studies and projects in botany and/or hydrology, often with emphasis on water management as it affects species and ecosystems. Identified plants and plant communities, specializing in Colorado flora. Surveyed Rare, Threatened, & Endangered species and habitat. Delineated and assessed wetlands. Measured, analyzed, and modeled water budget components, particularly evapotranspiration and surface water flows. Managed all aspects of a small company, including preparation of proposals and reports, budgeting and accounting, and employees.

Research Technician June 2003
ABR, Inc., North Slope Burrough, Alaska

Located and collected data on nests of geese, ducks, loons, jaegers, and other large birds in patterned tundra habitat as part of an environmental impact assessment.

Research Assistant 1999 – 2003
Dr. David Cooper, Boulder, Colorado

Served as Co-Principal Investigator on this long-term study of groundwater evapotranspiration, resulting in three peer-reviewed publications. Collected micrometeorological data using a Bowen Ration Energy Balance System. Analyzed data and developed statistical models relating evapotranspiration to environmental variables.

Teaching Assistant 1999, 2001
Department of Biology, Colorado State University

Organized and taught labs for General Biology and for Poisonous Plants.

Ecology Team Leader/Wetland Ecologist July 1997 – July 1998
Colorado Natural Heritage Program

Led and supervised the community ecology staff of 15 scientists at the Colorado Natural Heritage Program. Represented The Nature Conservancy on a state-wide committee to select projects to be funded by the $10.5 million Colorado Wetlands Initiative that protected over 15,000 acres of wetlands. Wrote grant proposals and procured funding for projects. Oversaw budgets for all ecology projects.

Wetland Ecologist June 1994 – July 1997
Colorado Natural Heritage Program

Developed a plant community classification for a portion of Colorado's West Slope. Identified, characterized, and prioritized Colorado's most biologically significant wetlands. Supported public and private conservation and planning organizations with technical expertise. Procured and managed grant funding.

Botanist/Consultant April 1994 - June 1994
U.S. Fish and Wildlife Service, Portland, Oregon

Developed vegetation section of an Environmental Impact Statement under section 4(d) of the U.S. Endangered Species Act.

Teaching Assistant December 1993-January 1994
Department of Botany, University of Vermont

Assisted in preparing and teaching Winter Ecology at a remote site in central Maine. Taught field-related subjects (e.g., species i.d., cold adaptation) under field conditions.

Peace Corps Volunteer--Forestry Extension Agent October 1987 - September 1989
U.S. Peace Corps, Mali, West Africa

Trained groups and individuals in techniques of soils erosion control, nursery and woodlot establishment, live fence construction, and agroforestry. Served on the Small Projects Assistance Fund Committee, evaluating proposals for project funding.

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GRADUATE STUDENT COMMITTEES

Ph.D. Committee for Jeremy Sultenfuss, Graduate Degree Program in Ecology, Colorado State University. Sensitivity of Wetland Floristic Composition to Hydrologic Alteration

Ph.D. Committee for David Martin, Graduate Degree Program in Ecology, Colorado State University. A Social-ecological Decision Support Framework for Environmental Flows Management

M.S. Committee for Julie Kray, Graduate Degree Program in Ecology, Colorado State University. Differential water source use among four desert phreatophytes.

Ph.D. Committee for Thomas Wilding, Department of Biology, Colorado State University. Evaluating the effects of flow alteration on stream ecosystems

M.S. Committee for Dave Schimelpfenig, Graduate Degree Program in Ecology, Colorado State University. Changes in the physical properties of sedge peat following the hydrologic restoration of fens, San Juan Mountains, Colorado.

PROFESSIONAL MEMBERSHIPS

Ecological Society of America

Society of Wetland Scientists

American Water Resources Association

Society for Conservation Biology

HONORS

2014-2015 Colorado State University Honor Alumnus

2014 The Nature Conservancy Ethical Hero: honored for acting *"ethically and with absolute integrity, and as a role model for ethical behavior at TNC."*

2012 The Nature Conservation Award for extraordinary contributions to conservation in Colorado

University Fellowship, Colorado State University, 1998

Switzer Foundation Environmental Fellowship, 1992

Mellon Foundation Field Naturalist Fellowship, 1991

LANGUAGES

Spanish

1978-1983: Four years of high school study and 3 college credit hours
1989: Translated written documents 5 hours per week for four months
1990: Spoke daily for six months while Co-Manager of Casa Nicholas, a shelter sponsored by the Apostolado Latinoamericano of New Orleans, LA
1990: Spoke daily of six weeks while leading a live-in Summer Abroad trip in Mexico
2005: Spoke daily for six weeks while teaching in Punta Cana, Dominican Republic

French

1987-1989: Spoke daily for two years while a Peace Corps Volunteer in Mali

Bambara

1987-1989: Spoke daily for two years while a Peace Corps Volunteer in Mali

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Review of the Hitch Rack Ranch Quarry Application

At the Request of Ted D. Kerr of Red Rock Valley Estates Water District, I have reviewed documents related to the Construction Materials Regular112 Operation Reclamation Permit application by Transit Mix Concrete Company (hereinafter, TMCC) for a new aggregate quarry to be located in the drainages of Little Turkey Creak and Deadman Creek. The proposed quarry, to be called Hitch Rack Ranch Quarry (hereinafter, HRRQ), is in El Paso County approximately 10 miles southwest of Colorado Springs and off the west side of State Highway 115. The quarry pits and bulk of the proposed operations would occur in Section 16 of Township 16 South and Range 67 West (6th Colorado Principal Meridian). The material to be extracted is identified in the permit as "granite" and the product from the granite would be construction aggregates.

I was retained to review the application materials, consider additional public and scientific literature and data as pertinent, and conduct roadside reconnaissance of the proposed quarry area. Based upon that review, I was asked to author a report of the likely existing hydrogeologic conditions in the area of the quarry and of the range of likely impacts of that quarrying. This document is that report. In it I consider the potential impacts in that area for both for the quarry site and on residents and water users both upstream and downstream of the proposed quarrying should it occur.

I reviewed three sets of documents (in electronic format) produced by TMCC with respect to sections pertaining to hydrogeologic issues, data and discussions. The included files that are part of the original permit application, files that are part of the 1st Adequacy Response, and files that are part of the 2nd Adequacy Response. I conducted roadside reconnaissance of the area above, within, and downstream of the HRRQ area in July 2016. References that I reviewed and considered are listed in footnotes where appropriate.

Hydrogeologic Conditions at and adjacent to HRRQ

All evidence indicates that the land that is proposed to be mined is typical of stream-cut valleys draining Front Range crystalline bedrock terrains from Wyoming to New Mexico.[1] In such valleys, stream characteristics and water well characteristics are strongly influenced by fracturing in the granite. Granite is an almost nonporous rock made of tightly interlocked crystals. It is generally solid and hard, but it does frequently fracture.

The size of the fractures, the number of the fractures and the orientation of fractures all influence stream characteristics. Water wells that are completed in granite terrain are completely dependent upon the nature and distribution of fractures. There is no water available to well(s) in a granite terrain except the water in fractures. The well(s) must intersect one or more fractures to produce water. The intersected fractures must contain and recharge enough water for uses of the well(s) or must interconnect with enough other fractures to supply the uses of the well(s). If something blocks recharge to the fracture network, intercepts water entering the network, or drains water from the network, existing wells that lose their water permanently lose it. Groundwater from fractured granite terrain is an exceptionally fragile resource.

Stream characteristics are also influenced by precipitation – rainfall and snowmelt – that occur within the drainage area. In all valleys, some of the precipitation will evaporate and/or be taken up by plants. In all valleys, some of the precipitation will run off the hillsides whenever it rains or snow melts. The biggest differences among streams are related to the fractures.

When granite fractures, some of the precipitation enters the fracture. If the fractures are few, or don't interconnect significantly, the water will fill the fracture, but it has nowhere to go. So, unless it is used by tree roots, or grass, or a homeowner with a well, it stays where it is. If it's near the surface, and subject to freezing in the winter, as it freezes and thaws, it can pry the granite apart, widening or extending its length. If it feeds a tree root, the growing root can similarly expand the fracture(s). But except for seasonal refilling of water that is used from the fracture, the existence of

[1] The crystalline bedrock is of various composition, mineralogy, and derivation as one moves along the Front Range. In this area, it is granite or granodiorite and for simplicity of discussion, I will refer to it as *granite*.

the fracture is pretty isolated from the stream in the valley. As a result, the stream gets water when it rains, when snow melts, or when those things happen somewhere on the flanks of the valley and runs off into the stream. Other times, the stream bed is dry. Such a stream is called an *ephemeral* stream.

Where sufficient fracturing occurs (or is enhanced by ice or root wedging) to develop an integrated system in intersecting fractures, part of the precipitation will use the fracture network to traverse the hillsides as groundwater, eventually migrating to the stream. This groundwater is water that would run off the surface to the stream were it not for the fracture network. So, overall, the stream still conveys about the same amount of water, but there are important differences.

Although the source of the water is the same – precipitation – and the endpoint of the flow is the same – the stream, the stream has different characteristics because groundwater flows through the fractures more slowly than surface water runs off the hill. For a given precipitation event, rain that moves as surface water gets to the stream just as quickly, while the rain that goes the groundwater route may take days, weeks, or even months to get there. The same amount of rain sustains stream flow over a longer period of time and it generates a lower peak flow than does simple runoff. *I.e.*, the flow pattern is less *flashy* (a trough to peak to trough pattern). If a stream gets some of its water by discharge of groundwater but it still goes dry parts of the year, it is an *intermittent* stream. If the groundwater discharge is high enough and/or persistent enough that the stream flows all year long, the stream is called *perennial*. It's pretty clear that a perennial stream has real advantages if you're a deer or a fish or, for that matter, a hunter or a fisherman.

The area proposed to be quarried has two streams, Little Turkey Creek and one the local residents call Deadman Creek. Deadman Creek is ephemeral in the area of the proposed granite quarry; it flows only in response to precipitation events. Little Turkey Creek is perennial in the area of the granite. Both creek valleys have similar looking granite on the valley walls. The granite in the valley walls looks similarly fractured. But the different stream characteristics document two different hydrologic regimes.

The fracturing in the valley that holds Deadman Creek is not sufficiently interconnected to provide significant transport of groundwater to the stream bed. There are fractures – they are easily seen. They capture precipitation and help support the trees that cover the hillside. But they don't convey

significant groundwater to the stream. Virtually all of the water that doesn't evaporate or isn't taken up by plants runs off to the ephemeral stream.

The fracturing in the valley that holds Little Turkey Creek is sufficiently interconnected to provide significant transport of groundwater to the stream bed. There are fractures here too, and they are also easily seen. They too capture precipitation and help support the trees that cover the hillside. And, here, they do convey groundwater to the stream. Some of the water that doesn't evaporate or isn't taken up by plants runs to Little Turkey Creek immediately as surface flow and some of it moves through the fracture system to discharge as groundwater. In the case of Little Turkey Creek, the groundwater component is sufficient to create a perennial stream, *i.e.*, year-round stream flow.

In its simplest conceptualization, Little Turkey Creek is a stream being fed throughout the year by groundwater coming through the granite hills flanking the stream. Groundwater in the hill flows through and down the fractures in the granite to the stream at the bottom. It is a simple concept, topographically driven groundwater moving through an integrated fracture network.

The clearest evidence of an integrated fracture system with an active groundwater flow system in the area of the proposed quarry is that Little Turkey Creek is perennial. It is not only perennial within the granite terrain; it is a gaining stream. Well upstream of the proposed quarry, it wouldn't take much of a jump to cross the creek. By the time you come downstream to the proposed quarry area, you'd better have waders. Within the granite terrain, the creek gets bigger as you move downstream, *i.e.*, the creek gains groundwater as it passes through more miles of hillside.

There is other evidence of an active water table on the valley walls above Little Turkey Creek. There are seeps and springs in the stream valley above the level of Little Turkey Creek. Some of the springs and seep areas will be mined out by the quarry.[2] Seeps and springs occur where the water table – the top of groundwater – is at the surface of the ground.

[2] Figure 2, Transit Mix Hitch Rack Ranch Surface Water Feature Location Map, in Attachment G-2 of the original application, depicts one such mapped seep area. This mapped area of groundwater seepage is depicted with a yellow oval. Attachment G-2 also discusses these areas on page 4 of 13.

Seemingly in conflict with all of the surface data, exploration drilling by TMCC failed to find evidence of groundwater in the granite that was drilled and cored. The only evidence of groundwater reported from borings cored by the company was a single well that encountered evidence of groundwater below Little Turkey Creek. This absence of evidence is the basis of the company's proffered expectation that groundwater will not be intercepted by the excavation and, therefore, that no groundwater impacts are expected.[3] There is in fact no conflict. As the company noted, "*However, it is important to note that the test drilling utilized water and mud during the drilling process and observations regarding ground water conditions were limited and in some cases infeasible*."[4] (emphasis added) The absence of evidence (of groundwater) is not, in this case, evidence of an absence (of groundwater).

Impact of HRRQ on Little Turkey Creek Valley

The impacts on the hydrogeology of the Little Turkey Creek valley from the excavation of the proposed quarry into the fractured granite aquifer can be clearly depicted. Based upon the regional geology, the limited degree of site characterization performed by TMCC, studies of analogous terrain along the front range, and well-understood principals of geology and hydrology, we can reliably describe what will happen. The anticipated impacts are described in subsections below for the quarried reach of Little Turkey Creek and for reaches upstream and downstream of the quarry.

Here, a disclaimer is needed. The details of those impacts – the magnitudes, locations, distances, timings and durations – necessarily remain qualitative, not quantitative. We do not know enough about the fractured granite aquifer, upon which the citizens and the ecosystem rely, to predict specifically who or what will be impacted, how badly they will be impacted, or when they will be impacted. One can, of course, explore a wider area, explore it in more depth, and develop a more

[3] Original application at file page 5 of *Page 161 - 173 G-2 Water Resources Summary.pdf.*

[4] *Ibid*.

sophisticated understanding of the fractured granite aquifer in the Little Turkey Creek valley. Such studies have been done in other crystalline terrains along the front range and they are valuable.[5]

While such studies have value, their value is still limited. One's understanding of an area is improved. One can appreciate, based upon such a detailed study, that in the immediate area of the study an activity such as a pumped well (or an excavated quarry) is likelier to impact a stream or that someone's well is in a likelier direction to be impacted. Or, one can establish that dewatering impacts to wells may be total within ¾ mile but perhaps only half that severe two miles away. But, fractured aquifers in crystalline rock terrains are too random to allow deterministic predictions of exact impacts at specific locations.

No matter how detailed the understanding, the best you can quantify is a relative statistical likelihood of an outcome, not quantify a specific event. Whether or not dewatering a quarry will impact a resident's well can be known only after the fact. It is, if you will, a roll of the dice. You can improve your statistics with more intense characterization. You can modify your bet based on what you need to roll. But until you roll, you don't know what will happen. For the same reasons, monitoring is unreliable. You might serendipitously put a monitoring well in the same fracture network from which John Doe's well produces, but you can't do it predictively. You'll only know both wells are in the same network when dewatering the quarry dewaters both the monitoring well and John Doe's well. Correspondingly, not impacting a monitoring well says nothing about impacts to residential wells in networks not common to the monitoring well.

Impact at HRRQ

HRRQ will mine out parts of the fractured granite aquifer on both the north and south sides of Little Turkey Creek over the reach of the stream that is adjacent to the quarry. Figure 2, Transit Mix Hitch Rack Ranch Surface Water Feature Location Map of Attachment G-2, depicts the area in cross-

[5] Bossong, Clifford R., Jonathan Saul Caine, David I. Stannard, Jennifer L. Flynn, Michael R. Stevens, and Janet S. Heiny-Dash, *Hydrologic Conditions and Assessment of Water Resources in the Turkey Creek Watershed, Jefferson County, Colorado, 1998-2001*, Water-Resources Investigations Report 03-4034, United State Geological Survey, Prepared in cooperation with the Jefferson County Planning and Zoning Department, Denver Colorado, 2003.

hatched purple where the mining will excavate the granite that contains the groundwater flow system. *i.e.*, fractured granite that is below the water table and above Little Turkey Creek. This is the aquifer that is supporting perennial flow in Little Turkey Creek.

That HRRQ will excavate the fractured granite aquifer beneath the water table cannot be overemphasized. On page D-3 of the July 21, 2016 Permit Application asserts "… mining activities will be staying 10 feet above the groundwater table, …" This is assertion is simply false. The application documents this. The original application (Attachment G-2 at page 4) acknowledges that seeps and springs are known and that they would be mined through. Seeps and springs *are* groundwater emerging at the surface of the earth, *i.e.*, they directly document the water table at elevations above the level of Little Turkey Creek. Mining through them unquestionably establishes that mining will excavate below the groundwater table and will do so at elevations significantly above the elevation of Little Turkey Creek. [6]

The impact of mining out a significant portion of the groundwater system sustaining perennial flow in Little Turkey Creek cannot be quantified for the reasons discussed above, but the following is known. North of Little Turkey Creek, to the surface water drainage divide with Deadman Creek, the entire existing groundwater system between the water table and the depth of the quarry will be excavated. South of Little Turkey Creek, the quarrying will excavate the existing groundwater system from water table and the depth of the quarry for a distance of about 2500 feet southward from the creek. In each of these excavations, groundwater from fractures in the back, west and east walls of the quarry will drain from the aquifer into the quarry. In each of these excavations, fractures in the bottoms of the quarry will discharge water from the aquifer into the quarry, at least until the aquifer beneath is de-pressured. The groundwater flow into the quarry will be discharged as surface water. Precipitation that falls on the quarry will be discharged from the quarry as surface

[6] The documentation that the water table is above the elevation of Little Turkey Creek also establishes that the depictions of groundwater elevations in cross-sections depicted in Figures C-13 and C-14 of Exhibit C of the final permit application are similarly erroneous and do not depict site conditions. These cross-sections will be discussed further later in this report.

water. The total volumes of water that will discharge from the quarry is not known, nor is the timing of those discharges.

Impacts West (upstream) of HRRQ

Were the quarrying being done in a domain of sedimentary rocks, where groundwater flow is through interconnected pores throughout rock with discreet bedding, the lateral impact to the west might be relatively predictable. However, the quarried groundwater system is not one of intergranular permeability in porous rock. It is one of fractured permeability in impervious granite. No effort has been given to characterizing the fracture system(s) of the area to be quarried or of the granitic terrain to the west. Fracture orientations are very important in fracture flow systems.

Draining the groundwater from the fractured-granite aquifer eastward to the wall of the quarry could clearly impact residential wells on the valley sides by draining fracture networks directly being used by those residents. The distance of such impact cannot be quantified. The permit application hypothesizes there is a fault running up the valley under Little Turkey Creek adjacent to the quarry and both west and east of the quarry. If so, the valley walls may likely have a dominant fracture orientation parallel to the that fault (and, therefore, the creek). If direct downslope fractures (at right angles to the creek) are secondary in the overall flow pattern in the granite aquifer, quarrying across the dominant (parallel to the creek) fracture system, and opening that system to drainage into the quarry, could redirect groundwater flows in the major fractures from miles upstream in the Little Turkey Creek valley eastward into the quarry.

Diverting that groundwater to the quarry downstream may fundamentally change the character of Little Turkey Creek, as well. Beyond the loss of water available to residents in the valley above the creek bottom and west of the quarry, the water available to the creek would also be reduced by the drainage of groundwater to the quarry. As, or more important, than well losses of hillside residents, Little Turkey Creek would be deprived of its baseflow of groundwater. The creek could cease being perennial above the quarry, and perhaps become ephemeral over that reach. This would unquestionably impact the valley-bottom residential wells that rely on the perennial contribution of groundwater to the axial fractures postulated to be beneath the creek. It would also greatly impact the wildlife that presently use the ecosystems associated with the perennial.

Impacts East (downstream) of the HRRQ

The removal by quarrying of a significant area of the groundwater system that supports the perennial flow in Little Turkey Creek would have substantial (and similarly unquantifiable) impacts in the fractured-granite aquifer east of the quarry, just as it did west of the quarry. The fractured-granite aquifer east of the quarry that is above the base of the excavation will drain into the pits and thereby will decrease the baseflow contributing to perennial flow in Little Turkey Creek and increasing surface water discharge from the quarry pits contributing to a change in the flow regime of Little Turkey Creek.

At a direct distance of about 700 feet east (and downstream) from the eastern edge of the proposed quarry, Little Turkey Creek crosses one or more high-angle reverse faults that collectively comprise the geologic structural boundary at the east side of the Front Range. Beyond that geologic boundary Little Turkey Creek is no longer within the granite terrain of crystalline bedrock and is now flowing across a terrain of much younger sedimentary rocks, initially the Fountain Formation of sandstone and conglomerate. Whether or not these sedimentary rocks are significantly fractured, the aquifers within them are traditional aquifers with permeability throughout interstitial porosity. Also east of the boundary front there are both ground- and surface water users that rely upon the flow patterns of Little Turkey Creek. Those characteristics are going to change to a degree that remains unknown, and unknowable, prior to the excavation of the proposed quarry.

The total amount of water moving down Little Turkey Creek over the course of a year may not significantly change once the quarry is fully developed. But, in a dry climate that has strongly seasonal distribution of precipitation, it is not just the quantity, but also the timing of water availability that is important. Eliminating a significant component of the existing groundwater flow system from the quarry reaches of Little Turtle Creek, and potentially replacing the groundwater flow with surface runoff, risks making the stream even flashier. Discharges in a given year become more closely tied with precipitation events than with seasonal patterns, robbing diversions of water rights during interspersed dry periods. Dry years become more distinct from wetter years. These changes do not impact simply those with water rights in the vicinity of Little Turkey Creek. Changes in the flow regime of a headwater stream of the Front Range of Colorado impacts water

rights through to the Mississippi River, as well as obligations of the State of Colorado under interstate compacts on Arkansas River waters.

In addition to concerns of impacts to surface water rights on the water of Little Turkey Creek downstream of the quarry, there are many groundwater users east of the Front Range faults. *Figure 3 Transit Mix Hitch Rack Ranch Water Well Location Map (February 18, 2016)*[7] shows the distribution of permitted wells on either side of the Little Turkey Creek upstream and downstream of the boundary fault(s). There are more wells, a far wider spatial distribution of wells, and more people reliant on groundwater east of the boundary fault(s) and outside of the granite terrain. The wells in these areas are similarly at risk to impacts of groundwater supply due to interception of groundwater by the proposed upstream and upgradient quarry.

Front Range Boundary Fault(s) as Flow Barrier(s)

TMCC's consultant for groundwater issues, Bishop-Brogden Associates, Inc. (BBA), argues in its initial memorandum[8] that the granite terrain to be quarried comprises a completely separated groundwater regime from the terrain of sedimentary rocks east of the boundary faults. This premise is explored by discussions of differences of rock types between the two terrains, differences in levels of water between the two terrains, and different aquifer water storage characteristics between the two terrains. All of these differences exist. None of these difference is evidence of disconnected groundwater regimes.

The initial BBA memorandum further asserts that the Front Range boundary fault(s) are ("probably", "very likely", "effectively") barriers to the flow of groundwater from the granite terrain into the sedimentary terrain. That assertion is supported in the memorandum by zero site, area, or regional data suggestive of such impermeability for the Front Range boundary faults in this area.

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[7] This figure is found on file page 12 of the file *Page 161 - 173 G-2 Water Resources Summary.pdf* submitted as part of TMCC's initial Application submittal.

[8] BBA prepared a memorandum for the purpose of supporting the TMCC quarry Application in February 2016. That memorandum is included in the application as the file *Page 161 - 173 G-2 Water Resources Summary.pdf.*

Rather, BBA's own interpretation of groundwater flow relationships among the granite bedrock, Deadman Creek, and Little Turkey Creek requires that the bounding faults be conductive of groundwater flow across them, not sealing against such flow. Four cross-sectional views of the quarry area depict these relationships.[9] The proposed north pit of HRRQ lies between Little Turkey and Deadman Creeks and west of the west boundary fault. Cross-sections A-A' (Figure C-13) and C-C' Figure C-14) cross this pit and intersect within it.

As depicted by BBA, water flows south from Deadman Creek into the granite aquifer, north from Little Turkey Creek into the granite aquifer, and from west to east within the granite aquifer. The only way for all these inflows of water to leave this block is to the east, passing through the boundary fault. Were the fault a barrier to groundwater flow, the water table configurations that are depicted could not exist. The two concepts are mutually exclusive; one or both must be wrong.

When the assertion of faults acting as barriers to groundwater flow was challenged in public comment, BBA doubled down. In a second memorandum included as part of TMCC's 1st Adequacy Response, BBA offered three literature citations in support of its assertion that the boundary faults act as flow barriers.[10]

BBA's first citation is a global review of recent literature on transmissivity across fault planes.[11] Considering the global population of all faults from all settings described in the literature reviewed, the reviewers concluded that fault zone cores typically (not always) restrict (not preclude) flow across faults. It was also concluded that not all faults, even those of a given type of movement, developed comparable cores. When faults occurred in crystalline rocks (as at Little Turkey Creek), fault cores were less consistently produced and were less persistent along the fault than in other types of faults. The reviewers also observed that while the fault core in crystalline rocks had the lowest permeability *within the fault zone*, the core permeability was often greater than that in the

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[9] The Figures C-13 and C-4 that depict the relationships are found on file pages 15 and 16 of the 2nd Adequacy Response file *2016-07-21_PERMIT FILE - M2016010 (3) pg 071 - 089 Exhibit C Maps.pdf.*

[10] The BBA responses are in its memorandum of July 11, 2015 on file page 2 of *2016-07-14_PERMIT FILE - M2016010 (3) Pg 190-191 Response to Comments on Ground Water Pt 1.pdf.*

[11] Bense, V.F., Gleeson, *T.*, Loveless, S.E., Bour, O. Sconek, J. (2013). Fault Zone Hydrogeology. *Earth-Science Reviews,* /24 *(20/3),17/-/92.*

country rock. *I.e.*, in crystalline rocks like the site granite, the fault zone including the core, provides easier flow between the two terrains than exists within the granite itself.

BBA's second citation is specific to a Colorado site in South Park, where the Elk Horn thrust fault is found.[12] The permeability of this fault was not measured. A numeric computer model established a low permeability core could reproduce monitoring data observed in the field but that such assumption was a non-unique condition. As the authors note (p. 331), "…, it is unrealistic to attempt to provide a definitive answer to the question, whether or not the fault acts as a barrier by model analysis alone." It is also important to note that the geologic nature of the faulting is dramatically different. The Elkhorn Fault in South Park is a low-angle thrust fault overriding relatively soft young sedimentary rocks, not a nearly vertical reverse fault adjacent to much older relatively brittle sedimentary rocks. The low-angle geometry and softer rocks are much more likely to produce a low-permeability sheared zone than the high-angle faults and harder rocks of the HRRQ site.

BBA's third citation is, like the second, a Colorado site with significantly different geology than that in the immediate area of the HRRQ.[13] The third citation describes a nearby Front Range site just north of Colorado Springs, Manitou Springs. At Manitou Springs, the geology and the hydrogeology argue strongly that the boundary faults are sealing to flow across them. The mineralized hot springs are exactly what is expected when water recharging into a fractured granite aquifer at high elevation cannot simply flow transparently across the bounding fault. Pressurized water is driven deep, becomes heated and mineralized, and discharges at the lowest breach of the locally impermeable fault, where it is cut by a stream. The local existence of an impermeable boundary is evidenced by the artesian mineralized hot springs. Little Turkey Creek is not the site of artesian mineralized hot springs, not the site of historic spas, precisely because the boundary fault(s) adjacent to the HRRQ are <u>not</u> a boundary to eastward groundwater flow from the fractured granite aquifer.

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[12] Marler, John and Shemin Ge, The permeability of the Elkhorn Fault Zone, South Park, Colorado, *Ground Water,* Vo1 41, No.3, May - June 2003, pp. 321- 332.

[13] Shomaker, J.W., McCoy, A.M., Kirk, M. (2011). *Studies Relating to the Mineral Springs Manitou Springs, Colorado.* Albuquerque, New Mexico.

Conclusions

The valleys of Little Turkey Creek and Deadman Creek drain significant terrain of fractured crystalline granite before they cross the Front Range fault boundary and enter a terrain of sedimentary rocks. Just as the surface water system is common to both terrains, all evidence indicates that the groundwater system is similarly common to both terrains.

Within the terrain of the granite, the extent of granite fracturing in the Deadman Creek valley is not sufficient to create an integrated groundwater flow system that conveys groundwater to the creek in enough quantity and with enough persistence to produce year-round stream flow. Deadman Creek is ephemeral, flowing in response to precipitation events and snow melt.

Proposed quarrying (*i.e.*, shallow excavation) within the granite-terrain valley of Deadman Creek would not be expected to significantly impact the hydrologic significance of the creek itself, would not be expected to disturb the creek's contribution to function of the groundwater system, and would not be likely to impact the creek's direct contribution to water users outside the immediate vicinity of any excavation.

The immediately adjacent and significantly deeper excavation south of the Deadman Creek valley would be expected to disturb the function of the groundwater system beneath the Deadman Creek valley and would likely impact groundwater users outside the immediate vicinity of the proposed quarry, including areas east of the Front Range boundary faults.

Within the terrain of the granite, the extent of granite fracturing in the Little Turkey Creek valley is sufficient to create an integrated groundwater flow system that conveys groundwater to the creek in enough quantity and with enough persistence to support perennial flow. Little Turkey Creek flows throughout the year.

Quarrying within the granite-terrain valley of Little Turkey Creek is expected to disturb the function of the groundwater system, is expected to significantly impact the hydrologic significance of the creek, and is likely to impact water users outside the immediate vicinity of any excavation.

Quarrying portions of the integrated groundwater system(s) in Little Turkey Creek destroys and removes that system within the footprint of the quarry. It drains groundwater from portions of the integrated groundwater system(s) intersected by the sides, back (including fractured-granite aquifer

north of the north pit and under Deadman Creek valley), and bottom of the quarry. It intercepts groundwater that previously migrated across the quarry in the integrated groundwater system(s) prior to excavation, precluding eastward migration of that groundwater across faults.

The extent and locations of the integrated groundwater system(s) that will be excavated are unknown with the current characterization of the site and surrounding areas. Therefore, the distances, locations, and severities of the impacts are unknown. Improved and wider characterization will improve understanding, but the who, what, when, where, and how impacts will propagate remain fundamentally unknowable prior to excavation.

Anticipatable impacts include permanent or seasonal loss of or reduced yield from wells, interception of groundwater baseflow to streams, interception of groundwater flow down-basin to users outside the granite terrain, conversion of perennial flow to intermittent or ephemeral flow, conversion of intermittent flow to ephemeral flow, and disruption of surface water flow patterns relied upon by those with surface water rights.

As excavation occurs, the impacts will become known and, from the impacts, the integrated groundwater systems(s) involved will become discerned. The impacts will be perpetual. The impacts cannot be remedied.

TMCC's application is predicated on assertions that the proposed quarry should put no one and nothing at risk. It is predicated on the premise that, were something unanticipated somehow to occur, mechanisms exist by which the damage could be reversed or made good. Granting this permit would convey upon TMCC substantial and inappropriate shields against responsibility for a proposed activity that, if properly evaluated, must be expected to irrevocably, and severely, impact people and the environment, leaving both without any real means of redress.

Granting this permit wouldn't be fair. It wouldn't be right.

Charles H. Norris

September 30, 2016

Charles H. Norris, P.G.

SUMMARY OF QUALIFICATIONS

Thirty plus years of professional experience in geology, hydrogeology and management in the applied and theoretical geosciences. Experience includes performance, oversight review, or management of site assessment; RI/FS; computer modeling of fluid flow, contaminant transport, and geochemistry (applications and code development); policy and rule making procedures; aquifer evaluation; resource development; and litigation support; nationwide and internationally.

PROFESSIONAL EXPERIENCE

Geo-Hydro, Inc., (1996-present), Principle, CEO

Hydro-Search, Inc., (1992-1996), Director of Hydrogeology

University Of Illinois at Champaign, (1987-1992), Research Associate; Manager, Industrial Consortium for Research and Education for the Laboratory for Supercomputing in Hydrogeology

Consulting Hydrogeologist/Geologist, Champaign, Illinois and Denver, Colorado, (1980-1992)

MGF Oil Corporation, (1985 - 1986), Manager Geological Engineering

Emerald Gas and Oil, (1980 - 1986), President and Owner

Petro-Lewis Corporation, (1980), District Geologist

Tenneco Oil Company, (1977-1980), Senior Geological Engineer

Amoco International Oil Company, (1975-1977), Senior Geologist

Shell Oil Company, (1972-1975), Exploration Geologist

PROFESSIONAL REGISTRATIONS, MEMBERSHIPS, AND AFFILIATIONS

Professional Geologist: Illinois (No. 196-001082), Indiana (No. 2100), Kentucky (No. KY-2470), Missouri (No. 2011012527), Pennsylvania (PG003994), Utah (No. 5532631-2250), Virginia (No. 2801 001834), Wisconsin (No. 924), Wyoming (No. 2989)

Registered Environmental Professional (#5350), State of Colorado, Petroleum Storage Tank Fund

National Ground Water Association

Colorado Groundwater Association (Vice President 1999, President 2000, Past-President 2001)

Phi Beta Kappa, Phi Kappa Phi, Sigma Xi

EDUCATION

B.S., Geology, University of Illinois, High Honors and Distinction in Geology, 1969

M.S., Geology, University of Washington, National Science Foundation Fellow, 1970

University of Illinois, all but dissertation completed for Ph. D., Hydrogeology, 1992

Select Project Experience

RI/FS and Site Investigations

- Manager for technical assistance through a Technical Assistance Program (TAP) grant from PRPs to local citizens' group. Assistance through grant to provide assessment and feedback on site work products as they are developed and implemented, explain the remediation processes and activities to the citizens, and serve as technical liaison between citizens and remediation team.

- Modeler and hydrogeologic consultant at industrial tank farm adjacent to the Chicago Sanitary and Ship Canal in northeastern Illinois. Assess hydrogeologic data, interpret aquifer testing, and model groundwater flow in soil and fractured carbonate bedrock in area of DNAPL accumulation as part of site characterization and voluntary remediation design.

- Manager and Hydrogeologist of groundwater investigation at an industrial dump site adjacent to the Illinois River in north Central Illinois. Investigated fate and transport of 3-4 decades of disposal of mixed, hazardous industrial wastes at a non-engineered floodplain dump site. Expert testimony and legal support. Pre-trial settlement provided for installation of monitoring system in lieu of site characterization.

- Manager of groundwater flow modeling performed as part of the groundwater characterization effort and as part of the preliminary remedial designs. The site is a Superfund site involving both organic and metals contaminants at a wood treating facility in an urban area in Alabama adjacent to a major commercial waterway.

- Manager of groundwater flow modeling performed as part of the groundwater characterization effort and as part of the 90% and final remedial designs. The site is a high profile Superfund site involving both organic and metals contaminants at a wood treating facility in Northern California.

- Technical Advisor assisting in the evaluation of aquifer properties and well performances for an extraction well field near Sacramento CA. A high volume pump and treat system for chlorinated solvents showed strong and anomalous decline in productivity. Detailed evaluation identified both possible causes and recommended operations changes to alleviate the problems.

- Technical Advisor assisting in the evaluation of aquifer properties and well performances for initial installation of a high volume extraction well field in Southern California. The chlorinated solvent plume associated with a Superfund site impacted a large area in a layered, heterogeneous groundwater basin managed intensively for public water supplies.

- Senior oversight and review in the evaluation of aquifer and soil properties, and the remediation of the soils contamination and groundwater impacts associated with compressor facilities of interstate gas transmission companies. Various projects and sites in western Colorado, Wyoming, and the Texas panhandle.

- Technical Advisor for the Remedial Investigation/Feasibility Study (RI/FS) of the Landfill Solids and Gases Operable Units at the Lowry Landfill CERCLA site located near Denver, Colorado. This project involves the characterization of the extent of potential contamination within the unsaturated zone adjacent to this high profile site. Work involves extensive coordination and interaction with multiple PRP groups as well as various regulatory agencies.

- Project Manager for independent oversight of a proposed low-level radioactive waste disposal site. Task was to develop technical and legal program for governmentally funded intervener's case as part of adjudicatory hearings on a high-profile, proposed disposal facility and involved

identifying, retaining and educating legal staff, retaining a team of technical experts, negotiating fees, coordinating work product and presentations, providing liaison with citizen's groups, responding to press and integrating personal testimony on hydrogeology and modeling. Expert testimony and legal support.

Landfill Services

- Project Manager and Hydrogeologist for a geologic and hydrogeologic assessment of existing water quality and off-site migration from existing licensed landfill near Joliet IL. Work includes groundwater flow modeling of remedial alternatives and groundwater impact assessments of various alternatives for submittal to IEPA.

- Project Manager and Hydrogeologist for a geologic and hydrogeologic assessment for siting of a proposed expansion for a hazardous waste landfill in Peoria County, Illinois. Expert testimony and legal support. Review identified errors in application, unaddressed contamination on facility property, and inappropriate modeling design and implementation.

- Project Manager and Hydrogeologist for a geologic and hydrogeologic assessment for siting of a proposed regional landfill by expansion of local landfill in Ogle County, Illinois. Expert testimony and legal support. Review identified in errors application, unaddressed existing leakage, and potential risk to public water supply. (Three hearings)

- Project Manager and Hydrogeologist for a geologic and hydrogeologic assessment for siting of a proposed regional landfill by expansion of local landfill in Kankakee County, Illinois. Expert testimony and legal support. Review identified errors in application, unaddressed existing off-site leakage, and inappropriate modeling design and implementation. (Two hearings)

- Project Manager and Hydrogeologist for a geologic and hydrogeologic assessment of a proposed regional landfill in Will County, Illinois. Expert testimony and legal support. Research documented numerous errors in application which resulted in underestimation of infiltration rates and potential migration rates. Identified evidence of sub-karstic migration pathway from site to nearby stream.

- Project Manager and Hydrogeologist for a geologic and hydrogeologic assessment of a proposed regional landfill expansion at East Peoria, Illinois. Research documented current leakage from the existing landfill into the regional unconfined aquifer within the cone of depression of the municipal water supply wells. In part as a result of the evaluation, the proposed expansion has been abandoned. Expert testimony and legal support.

- Project Manager and Hydrogeologist for a geologic and hydrogeologic assessment of a proposed regional landfill at Ottawa, Illinois. Provided testimony at county hearings identifying and documenting site-specific conditions that invalidated part of the ground water evaluation testing, necessitating the need to re-evaluate the groundwater flow system and redesign the monitoring system. Expert testimony and legal support.

- Project Manager and Hydrogeologist for a geologic and hydrogeologic assessment of existing municipal landfills and a proposed landfill redesign and expansion at Salem, Illinois. Provided testimony at city hearings documenting existing landfill leakage and identifying site-specific conditions that complicate the design of a reliable monitoring system. Expert testimony and legal support.

- Project Manager and Hydrogeologist for site evaluations of the geology and hydrogeology of several proposed municipal landfills and a landfill expansion in Bartholomew County, Indiana. The review of the expansion demonstrated inadequate monitoring of the existing facility. One

proposed site showed possible, current ground water usage from under the proposed facility and conditions that may preclude state-level site approval.

- Project Manager and Hydrogeologist serving in consultation to the Board of Wayne County, Illinois, regarding a proposed expansion to a regional landfill. Investigation and oversight established viability of the physical site and improvements that were needed in operating procedures and monitoring efforts. Expert testimony and legal support.

- Project Manager and Hydrogeologist for an assessment of an existing regional municipal landfill at Urbana, Illinois. Principle problems included ground water contamination, unplugged well(s) within the facility boundary that penetrated the aquifer serving public water supplies and a monitoring system inadequate to evaluate the contaminant migration. Results of the evaluation include an expanded system of monitoring wells, improved protocols for ground water sampling and revised statistical procedures to determine background water chemistries.

- Project Manager and Hydrogeologist for a site assessment of a proposed municipal landfill expansion in west central Indiana. Established feasibility of using the engineering and design features of the expansion to prevent contamination from the pre-existing non-engineered facility.

- Project Hydrogeologist for a site assessment of a proposed saturated-zone, regional balefill in central Illinois. Principal problems involved the evaluation of the hydrogeologic characteristics of the strip mine spoils within which excavation would occur, the blasted mine bottom upon which the liners would be built and the materials available for liner construction. Expert testimony and legal support.

- Project Manager and Hydrogeologist for a site assessment of a proposed municipal landfill expansion in Livingston County, Illinois. Principal problems involved the evaluation of the impact of shallow coal tunnel mining beneath the site and reaction of waste leachate with unusual clay mineralogy important to waste isolation at the site. Expert testimony.

- Technical Reviewer of site assessment and re-assessment of a proposed inter-governmental regional landfill in central Illinois. Verified unanticipated, politically unacceptable risks to major aquifer system serving public water supplies. Assisted in drafting of technical policy statement that permitted new siting efforts to proceed in the jurisdiction. Expert testimony.

WATER RESOURCE EVALUATION & DEVELOPMENT

- Manager for ground water modeling effort associated with the development of a high-volume ground-water supply and delivery project in Colorado. The effort included investigating and evaluating a previously used, court-accepted model, adapting and updating the model, and applying the model to assess the impacts of a proposed private ground-water diversion project that would be the largest in the United States. Ongoing effort includes subsequent review of alternative proposed model and further litigation support.

- Manager for review of an application for an expansion of a large long-wall mine in southeastern Ohio. The review identified extensive unrecognized mining-related impacts to water supplies from historic mining and identified hydrologic risks to a unique old-growth forest adjacent to the proposed expansion, and resulted in an appeal of the application. Expert testimony and legal support.

- Manager for ground water modeling effort associated with the development of a surface reservoir designed for conjunctive use of ground and surface water to reduce peak ground water pumping demands in Denver metro area. The effort included investigating and evaluating a previously

used, model, adapting and updating the model, and applying the model to assess the impacts of project on other water rights. Study is a component of the EIS.

- Project Manager for multi-company effort to model thermal loading of northern Nevada surface waters as a result of mine dewatering project. Successful liaison among technical staffs and regulators and modeling work for a high profile EIS resulted in approval of discharge permit.

- Project Hydrogeologist for the feasibility study of a small lake for a northern Illinois nursery, to be used for recreation, fishing and irrigation. Evaluated shallow and intermediate ground water and surface run-off, reviewed engineering design and directed ground and surface water sampling program to determine nutrient levels.

HYDROCHEMISTRY

- Principal Investigator for grant to research the geochemical implications of using alkaline addition as one means for preventing and/or remediating inorganic contamination resulting from acid mine/rock drainage. Empirical and modeling evidence showed conditions under which alkaline addition can cause or exacerbate contamination of some constituents of concern.

- Project Manager, hydrogeologist, geochemist for ongoing investigation of metals contamination of a trout stream in West Virginia. Impacts from natural and industrial sources , present and past, evaluated to segregate relative significance of various sources. Includes expert testimony and legal support.

- Project Geochemist and Hydrogeologist for evaluation and critique of modeling protocols used by USEPA for risk assessments performed as part of regulatory determinations for various solid wastes. Identified errors in methodology and input that had caused previous modeling to mischaracterize risks for settings with observed damage cases. Computer modeling.

- Geochemist and Hydrogeologist for evaluations of inorganic groundwater chemistry at an industrial RCRA site near Joplin MO. Federal lawsuit filed pursuant to PRP contribution and sources and timing of contamination. Was able to use geochemical interpretations to establish significant elements of aquifer characteristics and implications for contamination routes. Expert testimony.

- Project Hydrogeologist and Geochemist for evaluations of proposed coal combustion waste disposal as part of reclamation activities at surface coal mines in Southwestern Indiana. Ongoing efforts are targeted toward refining regulatory framework for disposal efforts, establishing effective characterization and monitoring programs and determining appropriate operation and engineering practices. Project involves extensive interdisciplinary effort and expert testimony.

- Project Geochemist for the investigation of the impacts of remediating acid mine drainage by installing bulkheads to flood exhausted mine working. Predictively modeled water chemistries in situ, within flooded mine, along flow paths and upon surface discharge. Assisted in preparation of testimony that resulted in permit approval for the San Juan County, Colorado project.

- Project Manager and Project Geochemist/Hydrogeologist for investigation of potential environmental impacts of disposal of coal combustion wastes (CCW) as part of a reclamation plan at a surface coal mine in northern New Mexico. Performed or directed geochemical, infiltration and flow modeling of the proposed project to identify optimum disposal methods and worst case impacts. Presentation to State resulted in approval of this precedent-setting project.

- Project Manager, Geochemist and Hydrogeologist for an investigation of a proposed disposal/construction project to build a central Illinois ski mountain from fly ash produced by a co-generating plant operated by a major food products manufacturer. The investigation involved

overseeing an engineering review of project plans, a site investigation and evaluation, geochemical modeling of initial and final mineralogical composition of the mass and of the leachate chemistry and evolution and the impact on the hydrogeologic and structural integrity of the project. Expert testimony and legal support.

PETROLEUM INDUSTRY EXPERIENCE

- Project Manager for the environmental assessment of 82 Texas producing properties targeted for acquisition. Evaluations included site walk-overs, surface soil and liquid sampling, radiological monitoring and geoprobe sampling of soils and ground water. The assessments documented a multitude of impacts from both exempt and non-exempt wastes that, unrecognized, could have resulted in substantial financial exposure to the client.

- Project Geologist and Petrophysicist for an investigation of resource potential of coal bed methane in San Juan Basin of New Mexico and Colorado. Study focused on innovative log analysis techniques; formation water chemistries, production rates and disposal problems; well drilling, completion and re-completion practices; and detailed subsurface facies and structural mapping and stratigraphic correlation in shallow coal beds of Kirtland/Fruitland/Pictured Cliffs shoreline complex and relationships to overlying Tertiary sandstones.

- Developed a successful play in the Hunton and Mississippi Lime formations of northwest Oklahoma. The play recognized the secondary porosity systems of both formations (dolomitization and fracturing, respectively) and the genetic significance to each of the buried topography at the intervening unconformity.

- Managed a detailed reservoir study of a Cotton Valley gas field in east Texas that resulted in RRC approval of non-standard spacing based upon the recognition of secondary porosity and a dual-conductivity system that resulted from drape-induced fractures. The revised spacing both protected resource ownership and conserved the costs of infill drilling. Expert testimony and legal support.

- Project Geologist, Petrophysicist and Expert for various contested adjudicatory hearings apportioning oil and gas ownership. Cases involved primary recovery of both oil and gas and secondary recovery of oil. Accepted as expert (geology, hydrogeology, and/or geological engineering) in Oklahoma, Texas, and Wyoming.

ADDITIONAL PROFESSIONAL EXPERIENCE

- Invited presenter to National Research Council of the National Academy of Sciences, Committee on Mine Placement of Coal Combustion Wastes.

- Appointed member of a Quality Assurance Committee under the West Virginia Department of Environmental Protection. The committee, comprised of representatives of state and federal regulators, industry , and interveners, was charged with a year-long review of state mining applications and approval practices relative to mining under the state and federal surface mining laws.

- Invited presenter to National Research Council of the National Academy of Sciences, Subcommittee on Alternatives, Study on Coal Waste Impoundments.

- Project Manager and Hydrogeologist for the review of Proposed and Revised Proposed Criteria for the Siting of a Low Level Radioactive Waste Disposal Facility in Illinois. Evaluation was targeted toward both technical content and processes of selection. Testimony and written

comments led to significant improvements and flexibility in the Criteria as finally published.

- Project Hydrogeologist testifying at hearings before the Illinois Pollution Control Board on regulatory language for the Illinois Ground Water Protection Act. Contributed major conceptual and specific language changes to the final promulgated rules for Ground Water Quality Standards and Regulations for Existing and New Activities with Setback Zones and Regulated Recharge Areas. Expert testimony and legal support.

- Project Hydrogeologist and Log Analyst for three applications to U.S. EPA for permits to continue deep well disposal of hazardous wastes in east central Illinois and southern Ohio. Project required evaluation of geophysical logging data to determine injection zone and confining layer properties, regional flow systems, chemical interactions of the waste stream with the native rock and the ability of the injection system to isolate the waste from the environment.

REPORTS, PRESENTATIONS, AND PUBLICATIONS

Norris, Charles H., 2005, "Water Quality Impacts from Remediation Acid Mine Drainage with Alkaline Addition", draft version released to National Research Council of the National Academy of Sciences, Committee on Mine Placement of Coal Combustion Wastes, Geo-Hydro, Inc., Denver CO, July 3, 2005

Norris, C. H., "notes from the front. . . Overview of three sites", invited paper before National Research Council of the National Academy of Sciences, Committee on Mine Placement of Coal Combustion Wastes, Evansville IN, March 2005.

Norris, Charles H**.,** 2004, "Environmental Concerns and Impacts of Power Plant Waste Placement in Mines", Presented at Harrisburg PA, May 4-6, 2004. Published in Proceedings of State Regulation of Coal Combustion By-Product Placement at Mine Sites: A Technical Interactive Forum, Kimery C Vories and Anna Harrington, eds, by U. S. Department of Interior, Office of Surface Mining, Alton IL, and Coal Research Center, Southern Illinois University, Carbondale IL.

Norris, C. H., "Developing Reasonable Rules for Coal Combustion Waste Placement in Mines. Why? When? Where? How?", USEPA Contract 68-W-02-007, IEI Subcontract 7060-304, Invited paper at USEPA MRAM meeting, Rosslyn VA, September, 2003.

Norris, C. H., "So, You Think You're a Geologist? (F. Kafka to A. Liddell, In Wonderland)", Colorado Ground Waster Association Monthly Meeting,, Denver CO, September, 2002.

Norris, C. H., "Assessment of the Anker Energy Corporation proposal for mining and reclamation, Upshur County, West Virginia." Independent evaluation on behalf of Anker Energy Corporation and West Virginia Highlands Conservancy, July, 2002.

Norris, C. H., "Coal Combustion Waste: Coming soon to a neighborhood (and maybe a faucet) near you." Colorado Ground Waster Association Monthly Meeting,, Denver CO, May, 2001.

Norris, C. H., "Slurry-to-ashes, and ashes-to . . . A case of a coal company and citizens working together to evaluate alternatives." Invited paper before National Research Council of the National Academy of Sciences, Subcommittee on Alternatives, Study on Coal Waste Impoundments, St. Louis MO, June, 2001.

Norris, C.H., and C. E. Hubbard, "Use of MINTEQA2 and EPACMTP to Estimate Groundwater

Pathway Risks from the Land Disposal of Metal-Bearing Wastes", for Environmental Technology Council, submitted as public comment to USEPA on regulatory determination for Fossil Fuel Combustion Wastes, May, 1999.

Norris, C.H., "Report on the Determination of Intermittent Streams and the Potential Impacts of Valley Fill on Area Drainages, Southern West Virginia", expert report for litigation prepared for Mountain State Justice, Inc, Charleston WV, March, 1999.

Norris, C.H., "Report on the Geology and Hydrogeology of the Caterpillar Levee Site with an Evaluation of Potential Pathways on- and off-site for the Movement of Solid and Hazardous Wastes", expert report for litigation prepared for Citizens for a Better Environment, Chicago IL, March, 1998.

Norris, C.H., "Dr Pepper, Biorhythms, and the Eight-Hour Pumping Test ", Colorado Ground Waster Association Annual Meeting, Golden CO, December, 1997.

Norris, C.H., "Characterizing Ash Composition and (vs.) Projecting Environmental Impact for Purposes of Permitting CCW Disposal ", Coal Combustion By-Products Associated with Coal Mining - Interactive Forum, Southern Illinois University at Carbondale, Carbondale IL, October, 1996.

Norris, C.H., "Geochemical Modeling". Co-instructor for Short Course on Hydrogeologic Issues Related to Mine Permitting, Reclamation and Closure, SME Annual Convention, Phoenix AZ; March, 1996.

Norris, C.H., An Improved Method for Middle Time Analysis of Slug and Bail Test. Unpublished. 1994.

Norris, C.H., "Evolution of the Landfill", presentation as part of a Telnet program, *Garbage Dilemma Educational Series*, sponsored by Illinois Farm Bureau and Cooperative Extension Service of the College of Agriculture, University of Illinois, Urbana, Illinois, April 20, 1992.

Norris, C.H., "Technical Analysis or Political Acceptability: The Domesticated Fowl or its Ovum", Solid Waste Management and Local Government Workshop, sponsored by Institute of Government and Public Affairs, University of Illinois, Urbana, Illinois, Jan-Apr, 1992.

Norris, C.H., Report on the Geology and Hydrogeology [of the] SWDA Proposed Landfill Site, Township 8 North, Range 6 East, Section 31, Bartholomew County, Indiana, for Central States Education Center, Champaign, Illinois, 1991.

Norris, C.H., Hydrogeology and Modeling of the Proposed Illinois Low Level Radioactive Waste Disposal Site at Martinsville, Illinois; testimony before the LLRW Siting Commission, October and November, 1991, Martinsville, Illinois.

Norris, C.H., Ground Water Quality Standards for the Illinois Ground Water Protection Act; testimony before Illinois Pollution Control Board, Chicago, Illinois; February, May, October and December, 1990; May, 1991.

Norris, C.H., Hearing on a Petition for a Special Use Permit for the Construction of a Ski Mountain in Oakley Township, Macon County, Illinois; testimony before the Macon County Zoning Board of Appeals; February 16, 1990.

Norris, C.H., Hearing on a Solid Waste Disposal Permit for the Siting of a Municipal Landfill for Streator, Illinois; testimony before the Livingston County Board; August 6, 1990.

Norris, C.H., In the matter of the Gallatin National Company Proposed Balefill, Fulton County, Illinois, written comments to the Illinois Environmental Protection Agency, Springfield, Illinois, 1990.

Norris, C.H., 1990, Log Analysis of the Allied Chemical Corporation Waste Injection Well, Danville, Illinois, for Alberto Nieto, Champaign, Illinois.

Norris, C.H., 1989, Log Analysis of the Cabot Corporation Waste Disposal Wells, Tuscola, Illinois, for Alberto Nieto, Champaign, Illinois.

Norris, C.H., Regulations for Existing and New Activities Within Setback Zones and Regulated Recharge Areas for the Illinois Ground Water Protection Act; testimony before Illinois Pollution Control Board, Chicago, Illinois, June, 1989.

Norris, C.H., and C.M. Bethke, (Abstract) "Mathematical Models of Subsurface Processes in Sedimentary Basins", Conference on Mathematical and Computational Issues in Geophysical Fluid and Solid Mechanics, Society for Industrial and Applied Mathematics Annual Meeting, Houston, Texas, September 28 (invited paper), 1989.

Norris, C.H., "An Evaluation of the Geology and the Monitoring Well Data [at the] City of Urbana Regional Landfill", report submitted to the City of Urbana, Champaign County, Illinois, for Central States Education Center, Champaign, Illinois, 1989.

Norris, C.H., Gallatin National Proposed Balefill/Landfill [at] Fairview, Illinois; testimony before Fairview Town Council, Fairview, Illinois, November, 1988.

Norris, C.H., "Evaluation of the Hydrogeologic Factors Influencing Risk [at the] ISWDA Regional Landfill Site B", report submitted to the Inter-Governmental Solid Waste Disposal Association, Champaign County, Illinois, 1988.

Norris, C.H., and C.M. Bethke, "Status and Future Directions of Quantitative Flow Modeling in Sedimentary Basins", Workshop on Quantitative Dynamic Stratigraphy (QDS), Colorado School of Mines, Lost Valley Ranch, Colorado, February 14-18, 1988.

HITCH RACK RANCH QUARRY ASSESSMENT

Jerald S. Fifield, Ph.D., CISEC
HydroDynamics Incorporated
Parker, CO

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Jerald S. Fifield, Ph.D., CISEC

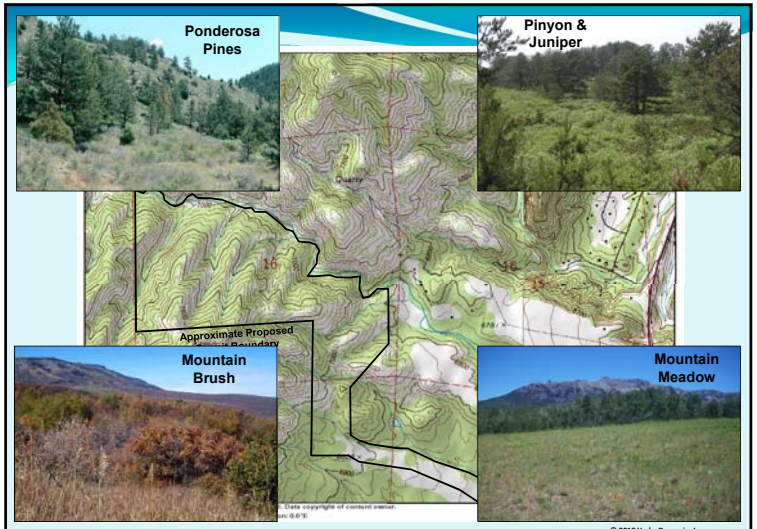
- **Ph.D. from Utah State University**
  - Engineering
- **Consulting since 1979**
  - Established HydroDynamics Incorporated in 1983
    - Drainage Assessments
    - Water Rights Evaluation
    - Sediment and Erosion Control
    - Education
- **Professional Achievements**
  - Founded the Certified Inspector of Sediment and Erosion Control (CISEC) world wide program in 2005
  - Published and presented numerous papers
  - Author of four manuals on sediment and erosion control
  - Teach about sediment and erosion control on construction sites

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Hitch Rack Ranch Quarry

- **Drainage Assessment**
- **Sediment Pond Design**
- **Sediment and Erosion Control**

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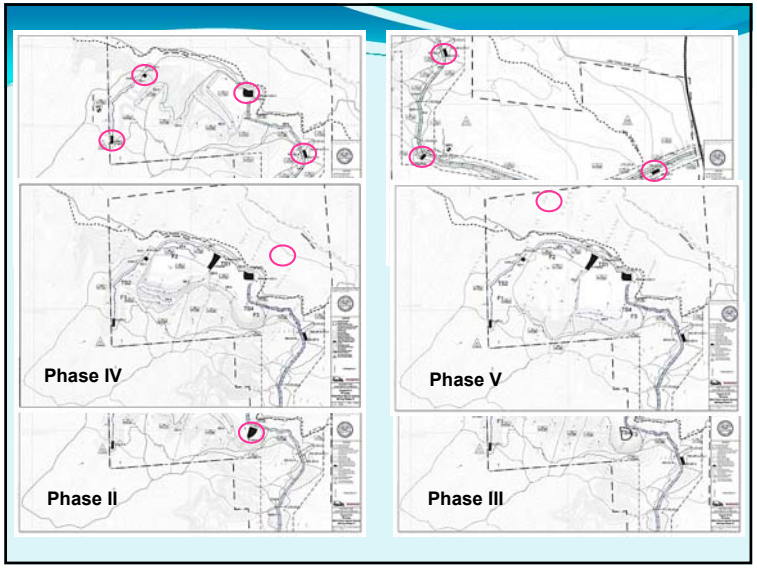


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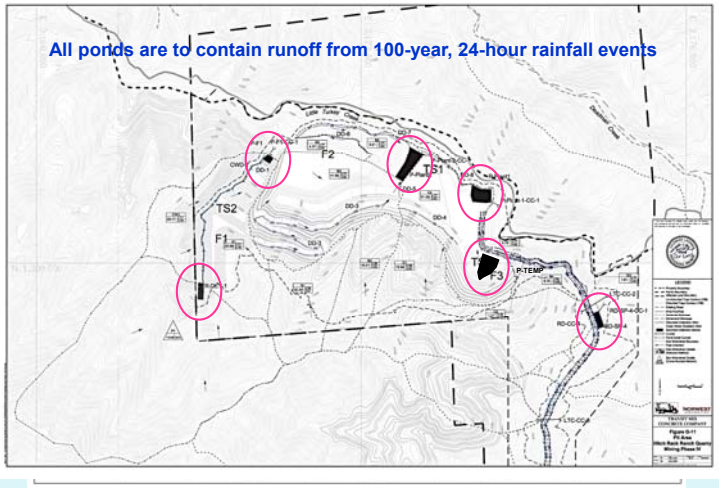
Modelling Drainage

Impacts to Sediment and Detention Ponds

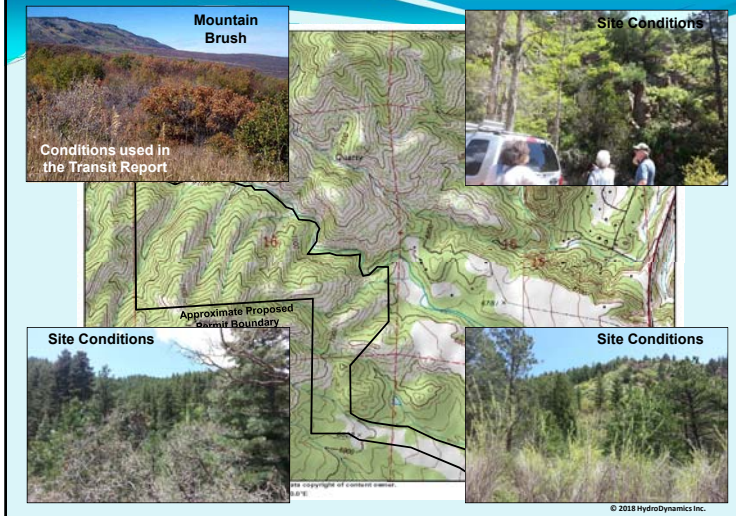
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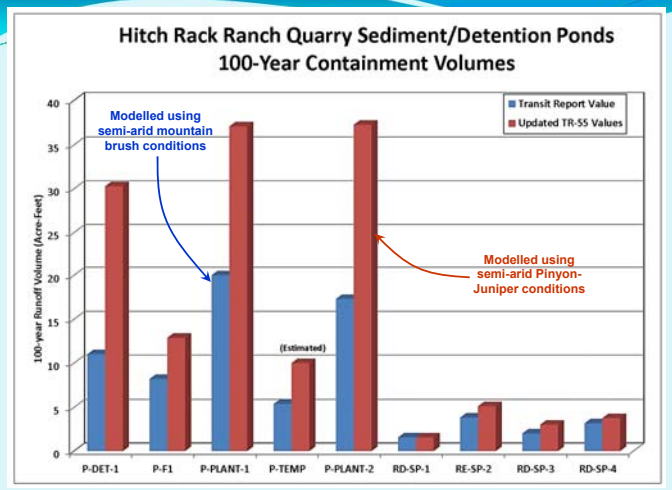
All ponds are to contain runoff from 100-year, 24-hour rainfall events



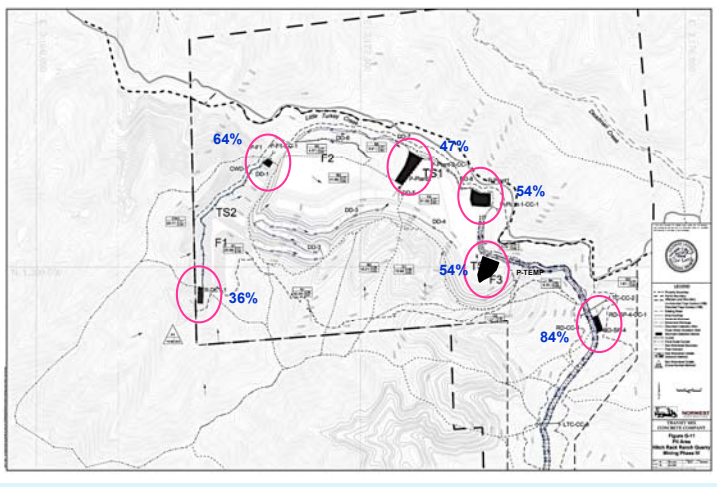
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What is Not Adequately Addressed

- Impact of releases from detention ponds
  - Longer duration of historic peak flows
  - Longer duration of flooded roadways
- Discussion on flood discharges from each structure greater than 100-year, 24-hour rainfall events
- Justification as to why the ponds will not be jurisdictional dams
- Justification as to why containment of runoff will not impact downstream water rights
- Maintaining minor (e.g., 2-year) historic discharges and potential impacts to downstream properties

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Summary of Drainage Assessment

- Hydrologic modelling results do not accurately represent historic or developed conditions
- Detention ponds containment volumes appear to be undersized
- Culvert diameters may be undersized
- Scant information on impacts to downstream properties when longer durations of historic discharges occur

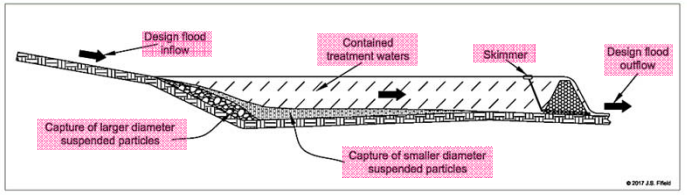
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Hitch Rack Ranch Quarry

- Drainage Assessment
- Sediment Pond Design

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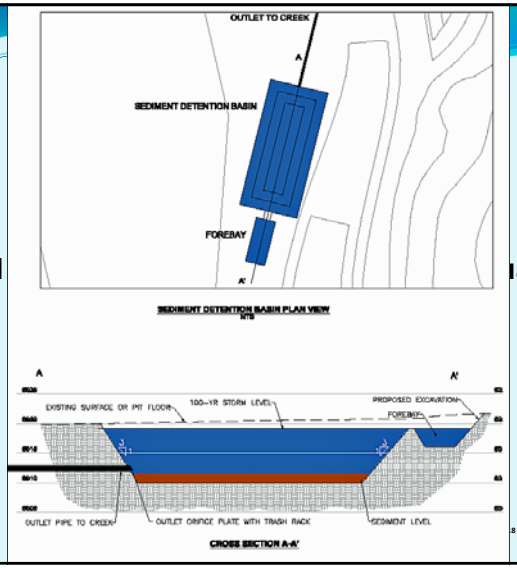
Sediment Pond/Trap



- Needs to accommodate flood inflows
- Needs to contain and detain inflow waters
- Needs to release discharges at controlled rates
- Needs to accommodate flood discharges
- Needs to capture large diameter sediments
- Needs to capture small diameter sediments

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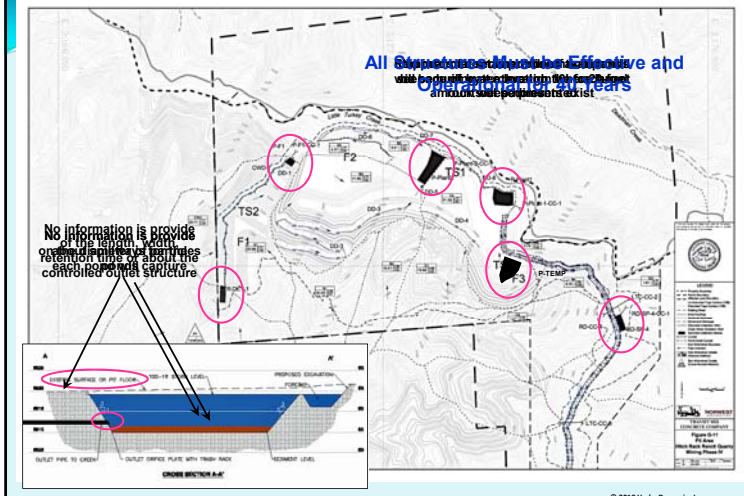
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All Structures Must be Effective and Operational for 30 Years



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Summary of Sediment and Detention Pond Assessment

- Inadequate information on structural design including possible jurisdictional dam conditions
- No information on the diameter of suspended particles to capture
- Conceptual pond will not be effective in removing suspended sediments from contained waters
- Water quality of Little Turkey Creek will be continually impacted whenever discharges due to storm events occur

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Hitch Rack Ranch Quarry

- Drainage Assessment
- Sediment Pond Design
- Sediment and Erosion Control

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Sediment Control Statement (Pg. G-26)

Best Management Practices (BMPs) for sediment control are standard practices on construction sites. Unlike the primary water management structures which are designed to remove silt-sized particles from the runoff, BMPs are most effective for settling out fine sand and coarser material. Some examples of BMP sediment barriers include:

- Sediment barriers (bales, silt fences, and earthen berms), and
- Check structures.

Sediment barriers are placed below affected areas subject to sheet and rill erosion, below the toes of exposed and erodible slopes, and along the toes of streams and channel banks. Check structures are small temporary structures constructed across a swale, gully, or small drainage to reduce gully erosion until stabilization occurs. The check structures reduce flow velocities and trap and store larger-size sediment.



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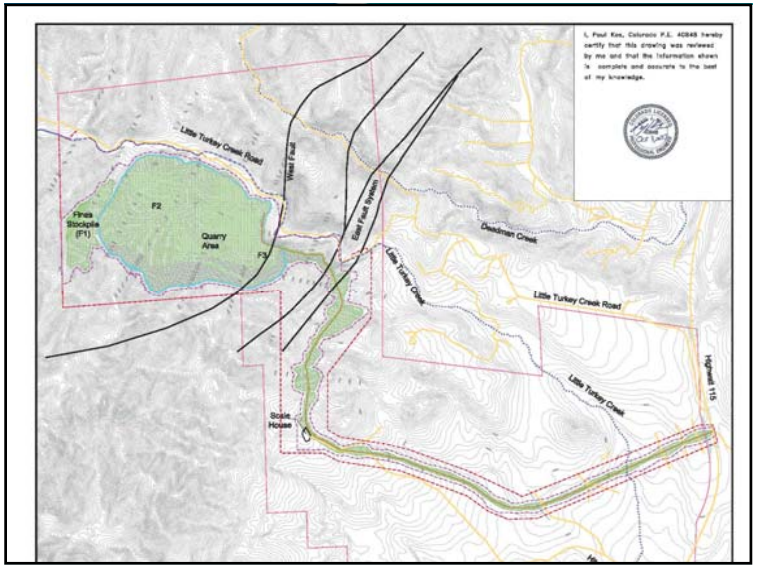


Table D-2 Quantities by Mining Phase (Pg. D-7)

	Affected Area (acres)	Topsoil Volumes[1] (cy)	In Place Overburden and Fines Volume (bcy)	Fines Volumes[1] (bcy)	In-Place Stone (tons)	Saleable Stone[2] (tons)	Mine Life (years)
Phase I	88.47	71,365	250,108	472,362	5,290,619	4,272,175	2.8
Phase II	22.13	17,853	90,303	362,468	4,062,964	3,280,843	2.2
Phase III	46.33	37,369	282,683	1,306,964	14,655,845	11,834,595	7.9
Phase IV	34.26	27,638	185,888	1,239,837	17,991,648	14,528,256	9.7
Phase V	47.85	38,596	370,316	3,299,906	33,002,534	26,649,546	17.8
Total	239.03	192,820	1,179,299	6,681,539	75,003,610	60,565,415	40.4

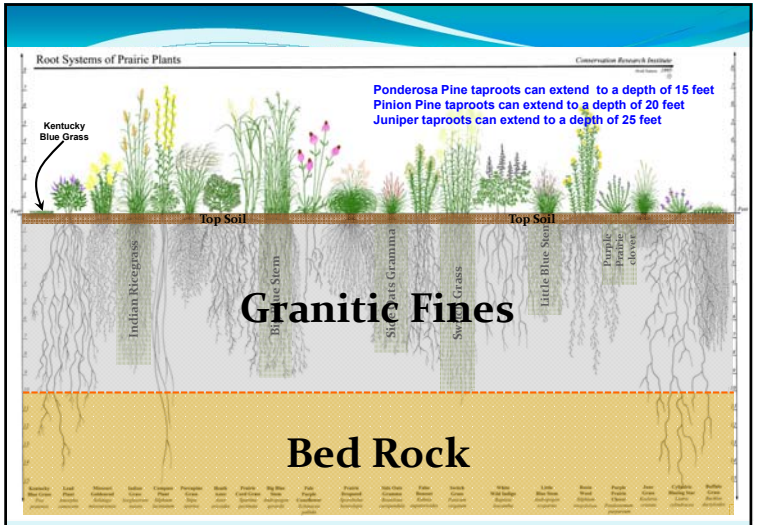
Note:
1. Fines from Mining and Plant losses
2. Saleable stone (million tons/year): Average 1.5 million tons. Maximum 2.0 million tons

Topsoil = 71,365 yds^3 ▲ = volume of topsoil

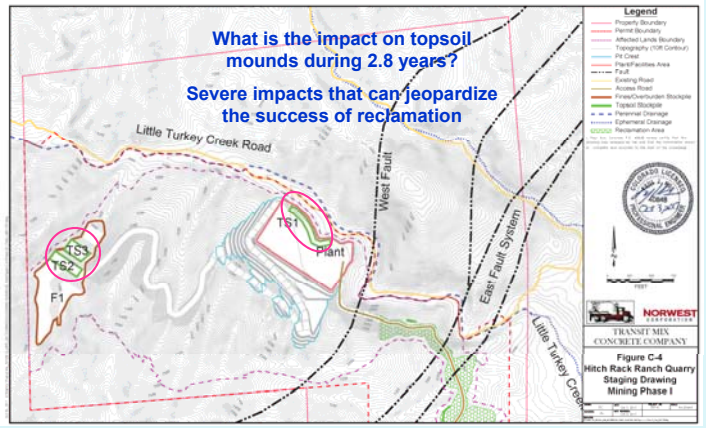
Fines = 472,362 billion yds^3

6,618,958,873

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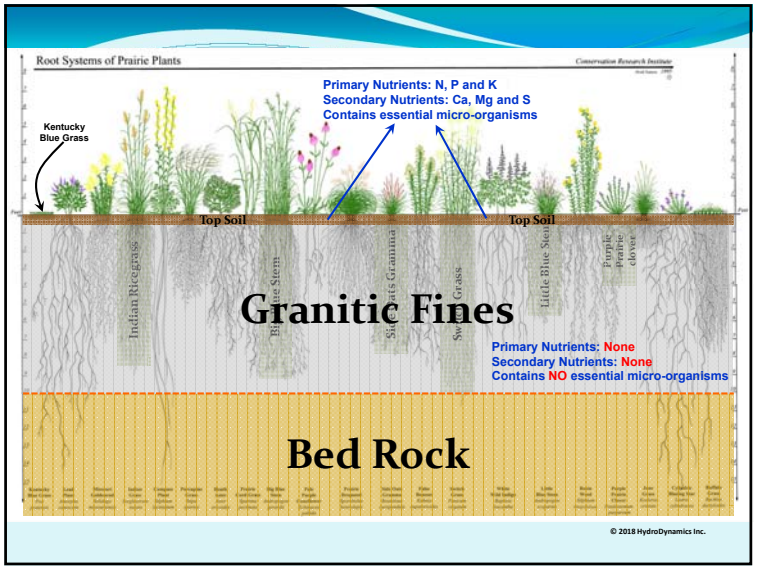


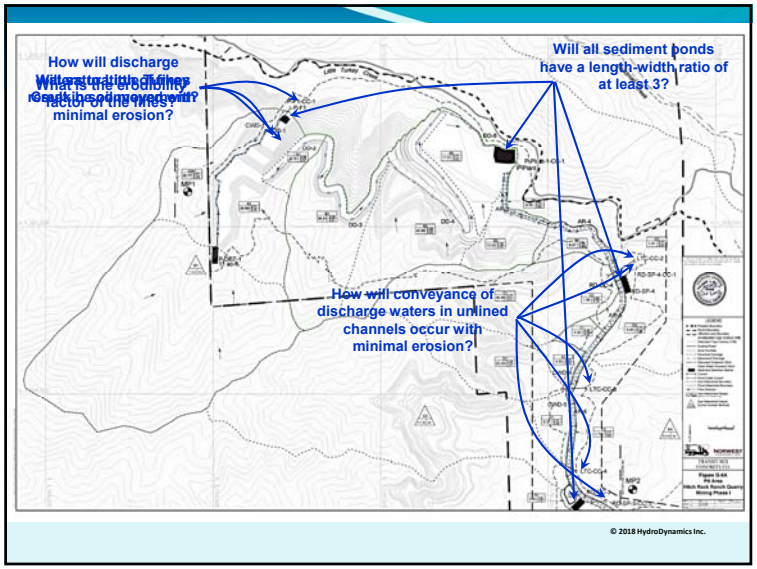
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Topsoil Comments

- **AASHTO Recommendations**
  - Stockpile Mounds ≤ 4.0 feet
    - No information in report
  - Stockpile Mounds should exist for no more than 1.0 year
    - Preference for 6-months
- **Potential Impacts of Long Storage**
  - Destroys critical elements for vegetation establishment
  - Deprives micro-organisms of oxygen and moisture
    - Bacteria
    - Mycorrhizal fungus
    - Algae
    - Other

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Summary of Sediment and Erosion Control Assessment

- Inadequate sediment and erosion control program
- Inadequate information on how topsoil mounds will remain viable
- Inadequate information about granitic fines including how establishment of vegetation will occur

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Summary on Surface Hydrologic Conditions

- Modelling of surface drainage has not been completed in a correct manner.
- Ponds and (perhaps) culverts are undersized.
- Conceptual sediment pond design is not adequate.
- Discharges from sediment ponds will impact and reduce the water quality of Little Turkey Creek.
- Establishment of vegetation in sterile granitic fines will be difficult and impact reclamation.
- Sediment and erosion control is not adequately addressed.

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THANK YOU

Jerald S. Fifield, Ph.D., CISEC
HydroDynamics Incorporated
Parker, CO

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HydroDynamics Incorporated
PO Box 1327
Parker, CO 80134

PRINCIPAL: Dr. Jerald S. Fifield, P.H., CPESC, CISEC

NUMBER OF EMPLOYEES: Three

YEARS IN PARKER: 1982 to Date

HydroDynamics Incorporated offers professional services in sediment and erosion control, nonpoint pollution control, civil and water resource engineering, hydrology, water rights, and expert testimony. The clients **HDI** serve include municipalities, developers, mining companies, attorneys, private individuals, and engineering firms.

HYDROLOGIC/ENGINEERING SERVICES

Return Flow Studies
Master Drainage Planning
Hydrologic Analysis
Water Quality and Stream Flow Monitoring
Water Supply and Storage
Drainage Reviews and Analysis
Expert Testimony

ENVIRONMENTAL RELATED SERVICES

SWPPP/SWMP Criteria Development
Sediment and Erosion Control Studies and Plan Design
Sediment and Erosion Control Inspections
Nonpoint Pollution Studies and Mitigation Design
Storm Water NPDES Permitting
Expert Testimony

WATER RIGHTS SERVICE

Water Rights Evaluations
Water Rights Appraisals
Augmentation Plans
Expert Testimony

FEE SCHEDULE
(January 2016)

LABOR CATEGORY	HOURLY RATE
Principal Hydrologist Engineer	$150.00
Project Hydrologist Engineer Project Manager	$125.00
Inspection	$ 65.00
Secretarial	$ 45.00
Mileage	$ 0.55/mile
Copies	$ 0.30/copy

Rates for presentation of expert testimony by senior and project level staff shall be the standard rate + 50%. All expenses incurred may be billed at cost plus a 15% handling fee.

TERMS: A statement of account, itemizing the charges for the current billing period as well as noting any previous balance, will be sent on a monthly basis. Terms shall be NET 30 days. Accounts not paid within 30 days shall be subject to a finance charge of 1.5% per month **(18% Annual Percentage Rate)**.

REPRESENTATIVE CLIENTS

Town of Parker, Colorado
Idaho Transportation Department
Douglas County, Colorado
Williams, Mullen, Clark & Dobbins, P.C.
Hydrokinetics Incorporated
Federal Highway Administration
Urban Drainage & Flood Control District
International Erosion Control Association
Technical Olympic USA
City of Fort Collins, Colorado
Tennessee Department of Transportation
Florida Department of Transportation
Hensel Phelps Construction, Inc.
Ames Construction, Inc.
Cherry Creek Water Users Association
Engle Homes, Colorado
Tennessee Attorney General's Office
Richmond Homes America

REPRESENTATIVE EXPERIENCE

EROSION AND SEDIMENT CONTROL--DESIGNER AND REVIEWER MANUAL

Client: Mr. Josh Boan
Environmental Research Administrator
Florida Department of Transportation
Environmental Management Office
605 Suwannee Street, MS 37
Tallahassee, Fl 32399
(850) 414-5266

HDI is worked with the University of Central Florida to develop an erosion and sediment control manual for the Florida Department of Transportation that clearly identifies what is required of designers to develop practical documents for contractors to implement. Along with being a reference manual that clearly identifies Florida requirements for a SWPPP, emphasis is being placed on providing engineering and scientific procedures for sizing sediment containment systems (a.k.a. sediment basins), selecting Rolled Erosion Control Products for hillsides and drainage channels, selecting slope drains, designing dewatering structures, and so forth.

IDENTIFYING AND CONTROLLING EROSION AND SEDIMENTATION ON HIGHWAY PROJECTS

Client: Mr. William G. Dowd
U.S. Department of Transportation
Federal Highway Administration
400 Seventh Street, S.W., Room 400
Washington D. C. 20590
(202) 366-1580

HDI was retained by the Federal Highway Administration (FHWA) to develop and teach a one-day course for designers and administrators and a one-day course for construction personnel on sediment and erosion control. The five-year project involves developing criteria for use by transportation departments in all 50 states, producing an 18-minute video, writing a field manual and coordinating activities of instructors. Topics covered include regulatory requirements, review of nonpoint pollution problems, evaluating the causes of erosion and sediment yields, assessing non-structural and structural methods to control erosion and sediment and providing guidelines for developing a Storm Water Pollution Prevention Plan (SWPPP).

REPRESENTATIVE EXPERIENCE (CON'T)

PLANNING AND INSPECTING SEDIMENT AND EROSION CONTROL PROJECTS

Clients:

Mr. Robert Stevens
Ames Construction Inc.
18450 E. 28th Avenue
Aurora, CO 80011
(303) 363-1000

Mr. Hunter Stoltz
Hensel Phelps Construction, Inc.
420 Sixth Avenue, PO Box 0
Greeley, CO 80632
(970) 352-6565

HDI has developed and reviewed existing Storm Water Pollution Prevention Plans (SWPPP) to assess whether more practical methods for controlling sediment from construction sites can be implemented. As part of the required duties, inspections and modifications to accepted plans have occurred. Finally, **HDI** has completed SWPPP for roadways, residential developments and municipality's projects for Douglas County, Air Force Academy, Fort Carson, Falcon Air Force Base and Boulder, Colorado.

SEDIMENT AND EROSION CONTROL SHORT COURSE WORKSHOPS

Client:

Mr. Russ Adsit, Executive Director
International Erosion Control Association
3401 Quebec Street, Suite 3500
Denver, CO 80207-2339
(303) 640-7554

HDI coordinated and taught a series of short courses throughout the United States on the principles of effective and practical erosion control from construction sites. Specific topics include information on water and wind erosion, general theory of sediment transport, quantifying and designing for control of sediment, an evaluation of BMP's, determining performance standards and effectiveness of proposed mitigation measures, preparing erosion control plans and what is required for plan review, inspections and enforcement.

DEVELOPMENT OF SEDIMENT AND EROSION CONTROL PLANS

Representative Clients

Mr. Phil Rumsey
Idaho Transportation Department
208-239-3300

Mr. Kevin Archer
David E. Archer & Associates
303-688-4642

Mr. Ron Skarka
Village Homes
303-795-1976

HDI develops plans that meet or exceed EPA requirements for issuance of NPDES permits that meet Phase I and Phase II criteria. Along with writing SWPPP, sediment and erosion control drawings are completed that identify BMP measures to be implemented, text written that identify location of structures, development of seed and mulching specifications, and what mitigation measures will be used to control wind erosion. Plans are submitted to the Colorado Department of Health, Idaho Transportation Department, and local regulatory agencies for approval.

JERALD S. FIFIELD, Ph.D., CPESC, CISEC

PROFESSIONAL EXPERIENCE

1982 - Present: PRESIDENT/PROFESSIONAL HYDROLOGIST

HydroDynamics Incorporated, Parker, Colorado

Principal of a consulting firm offering services in sediment and erosion control, nonpoint pollution control, criteria development, surface water hydrology, ground water hydrology and water rights. Serves as managing surface water hydrologist with specialized expertise in sediment and erosion control, nonpoint source pollution control, water rights, drainage analysis, augmentation plans, hydrologic inventory, stream/water quality monitoring, and expert testimony. Also, he teaches throughout the United States and Canada about sediment and erosion control to designers, inspectors, and contractors.

1980 - 1982: MANAGER, SURFACE WATER DIVISION

Willard Owens Associates, Inc., Denver, Colorado

Managed surface water projects, supervised division staff and responsible for division business development. Project management of hydrologic studies of watersheds, hydrologic mass balance analysis, review mine permit studies (Office of Surface Mining), water rights analysis, completed augmentation plans, stream flow/water quality monitoring and consumptive use evaluations.

1979 - 1980: ENVIRONMENTAL HYDROLOGIST/WATER RESOURCES ENGINEER

Wright Water Engineers, Denver, Colorado

Responsible for water rights evaluations, augmentation plan analysis, depletion studies, watershed hydrologic analysis, erosion control and evapotranspiration studies.

EDUCATION

Ph.D., Engineering (Water Resources, Hydrology, Water Quality), Civil Engineering Department, Utah State University, Logan, UT, 1979.

M.S. Physical Science (Limnology, Oceanography, Mathematics, History of Science), Oregon State University, Corvallis, OR, 1969.

B.S. Physics and Mathematics, California Polytechnic State University, San Luis Obispo, CA, 1966 and 1961, respectively.

PUBLICATIONS

Are Professional Engineers Qualified to Design, Sign, and Review Sediment and Erosion Control Plans? Presented at StormCon 13, Myrtle Beach, SC on August 19, 2013. 5 pages.

Designing and Reviewing Effective Sediment and Erosion Control Plans. 2011. ForesterPress, Santa Barbara, CA 335 pages.

Designing an Effective SCS by Treating Sediment with Polymers. 2009. International Erosion Control Association, Proceedings of EC09. February 16-19. 9 pages.

Field Manual on Best Management Practices for Contractors and Inspectors. 2005. ForesterPress, Santa Barbara, CA 150 pages.

Designing for Effective Sediment and Erosion Control on Construction Sites. 2004. ForesterPress, Santa Barbara, CA. 305 pages.

Construction Site Inspectors Must Be Independent. 2004. StormCon'04, Proceedings of Conference III. July 27-29. 5 pages.

Communication: The Most Important (and Overlooked) Construction Site BMP. 2002. Grading and Excavation Contractor. November/December.

Performance Goals and Effectiveness of Sediment and Erosion Control Plans. 2001. International Erosion Control Association, Proceedings of Conference XXXII. February 5-9. 15 pages.

Effective Sediment and Erosion Control for Construction Sites. 1999. Erosion Control. Forester Communications, Santa Barbara, CA. 6 pages.

When Best Management Practices Become "Bad Management Practices." 1999. International Erosion Control Association, Proceedings of Conference XXX. February 22-26. 13 pages.

Controlling Sediment with Curb Inlet Filter Barriers--Fact or Folly? 1997. International Erosion Control Association, Proceedings of Conference XXVIII. February 26-28. 13 pages.

Field Manual for Effective Sediment and Erosion Control Methods. 1997. HydroDynamics Incorporated, Parker, CO. 42 pages.

Evaluating the Effectiveness of Sediment Control Structures. 1995. International Erosion Control Association, Proceedings of Conference XXVI. February 28-March 3, 1995. 15 pages.

How Effective are Erosion Control Products in Assisting with Dry Land Grass Establishment with no Irrigation? 1992. International Erosion Control Association, Proceedings of Conference XXIII. February 18-21, 1992. 13 pages.

What are Acceptable Sediment Yields from Sites Undergoing Construction? 1991. International Erosion Control Association, Proceedings of Conference XXII. February 19-22, 1991. 13 pages.

Erosion Control Materials Vs a Semi-Arid Environment: What has Been Learned by Three Years of Testing? 1990. International Erosion Control Association, Proceedings of Conference XXI. Co-authored with L. K. Malnor. 17 pages.

Determining Average Annual Sediment Yield From a Basin Due to Rainfall. 1989. American Water Resources Association Headwaters Hydrology Symposium, Missoula, Montana. June 27-30, 1989. 15 pages.

Effectiveness of Erosion Control Products on Steep Slopes to Control Sediment and to Establish Dry Land Grasses. 1989. International Erosion Control Association, Proceedings of Conference XX. 11 pages.

Why Erosion Control Methods Don't Work. 1988. Urban Runoff Water Quality Seminar, Denver, Colorado. September. Co-authored with L. K. Malnor. 10 pages.

Field Testing Erosion Control Products to Control Sediment and to Establish Dry Land Grasses Under Arid Conditions. 1987. International Erosion Control Association, Proceedings of Conference XIX. 17 pages. Co-authored with L. K. Malnor and L. E. Dezman.

Testing of Erosion Control Products. 1987. International Erosion Control Association Report, Fall Edition. 7 pages.

Erosion Control Methods - Are They Effective? 1986. Proceedings of Conference XVII, International Erosion Control Association, February 27 & 28, 1986. 16 pages.

The 100-Year 24-Hour Event: Fact or Fiction. International Symposium on Hydrometeorology. 1982. American Water Resources Association, June, 1982. 4 pages.

Manual of Erosion Control Principles and Practices During Highway Construction. 1980. Co-authored with C.G. Clyde, J.E. Fletcher, C.E. Israelsen, E.K. Israelsen, F.W. Haws. Utah Water Research laboratory, Logan, UT.

Pre-impoundment Water Quality Studies for U.S. Bureau of Reclamation, Colorado Projects. Co-authored with L. Baker, V.D. Adams, L.G. Terry, D. Sorensen, 1979. Utah Water Research Laboratory, Logan, UT, seven reports.

Ph.D. Dissertation

Watershed Constituent Loading Analysis Utilizing Empirical Hydrochemical Modeling Techniques. Utah State University, Logan, Utah, 1979. 201 pages.

M.S. Research Paper

Physical Limnological Study of Clear Lake, Willamette National Forest. Oregon State University, Corvallis, Oregon, 1969. 47 pages.

PROFESSIONAL AFFILIATIONS

American Geophysical Union
American Institute of Hydrology
American Water Resources Association
International Erosion Control Association
Society of Soil and Water Conservation

PROFESSIONAL REGISTRATION

Certified Professional in Erosion and Sediment Control, CPESC No. 477
Certified Inspector of Sediment and Erosion Control, CISEC No. 6
Professional Hydrologist, AIH No. 364

TINA R. EVANS, PE, CISEC

PROFESSIONAL EXPERIENCE

2000 - Present: PROJECT ENGINEER

HydroDynamics Incorporated, Parker, Colorado

Responsible for drainage analyses, development of SWPPPs/SWMPs, NPDES assessments, construction site inspections, and design of sediment and erosion control plans. Serves as project engineer with specialized expertise in sediment and erosion control and drainage evaluations for engineering firms, highway departments, developers, builders, and contractors. In addition, she teaches throughout the United States about sediment and erosion control and inspection procedures to designers, inspectors, and contractors.

1999: SUMMER INTERN

HydroDynamics Incorporated, Parker, Colorado

Sediment and erosion control inspector, revisions of plans for sediment and erosion control for highway departments, preliminary analysis of drainage plans, abandonment of monitoring wells, and background research for expert testimony.

1998: SUMMER INTERN

HydroDynamics Incorporated, Parker, Colorado

Sediment and erosion control inspector services for the City of Aurora, Colorado.

EDUCATION

BS Engineering degrees with Civil and Mechanical specialties, Colorado School of Mines, Golden, Colorado, 1999.

PROFESSIONAL AFFLIATIONS

American Society of Civil Engineers
International Erosion Control Association
Order of the Engineer

PROFESSIONAL REGISTRATION

Professional Engineer, Colorado PE No. 39313
Certified Inspector of Sediment and Erosion Control, CISEC No. 95

Notice that initial abstractions are dependent upon the CN number. Major factors that determine CN values are the hydrologic soil group (HSG), cover type, treatment, hydrologic conditions, and antecedent runoff condition (ARC). Hydrologic soil types are defined according to their infiltration and transmission rates (see SCS, 1980) as follows:

- HSG A soils have high infiltration rates even when thoroughly wetted, consist chiefly of deep, well to excessively drained stands or gravels, and have a high rate of water transmission. The potential of runoff is low.
- HSG B soils have moderate infiltration rates when thoroughly wetted, consist chiefly of moderately fine to moderately coarse textures, and have a moderate rate of water transmission.
- HSG C soils have slow infiltration rates when thoroughly wetted and a slow rate of water transmission. They consist chiefly of soils having a layer that impede the downward movement of water or soils with moderately fine to fine textures.
- HSG D soils have very slow infiltration rates when thoroughly wetted and a very slow rate of water transmission. These are chiefly clay soils with high swelling potential, soils with a permanent high water table with a clay pan or clay layer at or near the surface, as well as shallow soils over nearly impervious material. The potential of runoff is high.

Table 3-5 provides CN values for various cover types, treatment, and hydrologic conditions associated with urban area construction sites when average antecedent runoff conditions exist.

Calculating the volume of runoff from a contributing watershed can be found by the following equation:

$$\mathbf{V_{RO} = \alpha \times A_{RO} \times RO} \qquad \textbf{Equation 14}$$

Where V_{RO} = Volume of runoff (m^3 *or ac.-ft.*)
α =10 for SI Units and 0.083 for Imperial Units
A_{RO} = Contributing runoff area (ha *or acres*)
RO = Runoff (mm *or inches*)

Example: *Compare the volume of runoff from Type A and Type C soils for newly graded ground conditions when 145 mm (5.7 in.) of rainfall falls on a 5.0 ha (12.4 ac.) contributing watershed.*

Type A Soils	Type C Soils
From Table 3-5, CN = 77	From Table 3-5, CN = _____
$S = \beta \times [(100 \div CN) - 1]$ $= 254 \times [(100 \div 77) - 1]$ = 75.9 mm (2.99 in.) per unit area	$S = \beta \times [(100 \div CN) - 1]$ = _____ x [(100 ÷ _____) – 1] = 25.1 mm (0.99 in.) per unit area
$RO = (P\text{-}0.2S)^2 \div (P + 0.8S)$ $= (145 - 0.2 \times 75.9)^2 \div$ $(145 + 0.8 \times 75.9)$ = 81.9 mm (3.22 in.) per unit area	$RO = (P\text{-}0.2S)^2 \div (P + 0.8S)$ = (_____ – 0.2 x _____)^2 ÷ (_____ + 0.8 x _____) = 119 mm (4.69 in.) per unit area
$V_{RO} = \alpha \times A_{RO} \times RO$ $= 10 \times 5.0 \times 81.9$ = 4,095 m^3 (3.32 ac.-ft.)	$V_{RO} = \alpha \times A_{RO} \times RO$ = _____ x _____ x _____ = 5,950 m^3 (4.82 ac.-ft.)

Notice that the volume of runoff from Type C soils is nearly 150% greater than from Type A soils due to less infiltration properties.

Reclamation Plan Review

Richard Alward, PhD
Senior Ecologist



Colorado Mined Land Reclamation Board
Hitch Rack Ranch Quarry Permit Application – M-2017-049 – Transit Mix Concrete Co.
25 April 2018

Richard Alward, PhD
Senior Ecologist

Aridlands llc Natural Resource Consulting

Plant Ecologist	(since 2004) – 15th year of private consulting based in Grand Junction, CO
Commissioner	(2007-2016) – Colorado Oil and Gas Conservation Commission
Senior Ecologist	(since 2015) – highest certification awarded by the Ecological Society of America
Ecologist	(since 1987) – U.S. Geological Survey; U. of Nebraska; Antarctica; Mlawula Nature Reserve
Ph.D.	(Ecology 1999) – Colorado State University (NASA Fellow in Global Change Research)
Member	(since 1990) – Ecological Society of America
Member	(since 2010) – Society for Ecological Restoration

Mineral Rules and Regulations

of the Colorado Mined Land Reclamation Board

Legislative Declaration in Section 34-32.5-102 of The Colorado Land Reclamation Act for the Extraction of Construction Materials States That:

(1) … It is the further intent of the general assembly by the enactment of this article to conserve natural resources, aid in the protection of wildlife and aquatic resources …

Rule 3.1.8 Wildlife

(2) Habitat management and creation, if part of the Reclamation Plan, shall be directed toward encouraging the diversity of both game and non-game species, and shall provide protection, rehabilitation or improvement of wildlife habitat. …

Rule 3.1.10 Revegetation

(1) … land shall be revegetated in such a way as to establish a diverse, effective, and long-lasting vegetative cover … and is at least equal in extent of cover to the natural vegetation of the surrounding area.



Hitch Rack Ranch Quarry Permit Application

Transit Mix Concrete Co., March 20, 2018

Exhibit E. Reclamation Plan

The goal … encourages and *protects* wildlife habitat. … [p. E-2]

The post-mining land use for project area will be wildlife habitat. … maximize and *improve* the long-term amount and quality of wildlife habitat. … [p. E-2]

… will be revegetated in such a way as to encourage a *diverse*, effective and long-lasting vegetative cover … and is *at least equal* in extent of cover to the natural vegetation of the surrounding areas … [p. E-7]

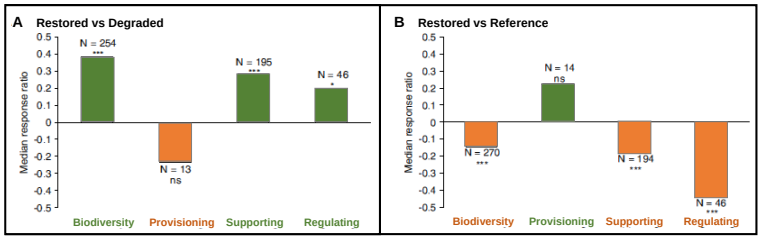
… this reclamation plan has been designed to encourage the diversity of wildlife species … *improve* wildlife habitat … not only reestablish the existing wildlife habitat, but also enhance and *improve* the area … [p. E-14]

… *improve* wildlife habitat … provide *more value* to wildlife than currently exists … *more robust* wildlife habitat … [p. E-17]



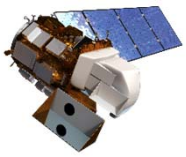
Reclamation Plan is Inadequate to Achieve Goals

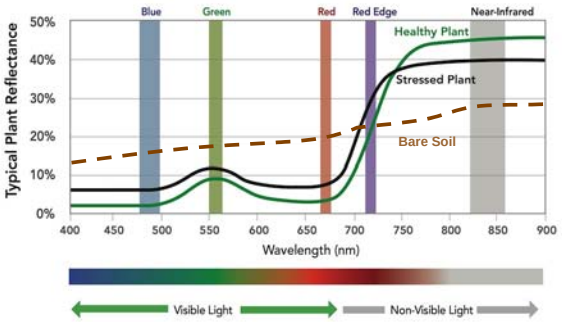
- This quarry represents a catastrophic ecosystem disturbance
  - o loss of vegetation cover and diversity means loss of ability to support diverse wildlife species
- The introduction of non-native grasses will lead to further damage to surrounding ecosystems
- Local visible evidence and scientific evidence concur: extraordinary effort is necessary for reclaimed areas to out-perform undisturbed reference areas

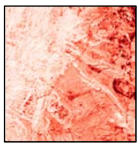


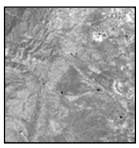
Benayas et al. 2009. *Science*.

Tools for Comparing Vegetation Across the Landscape









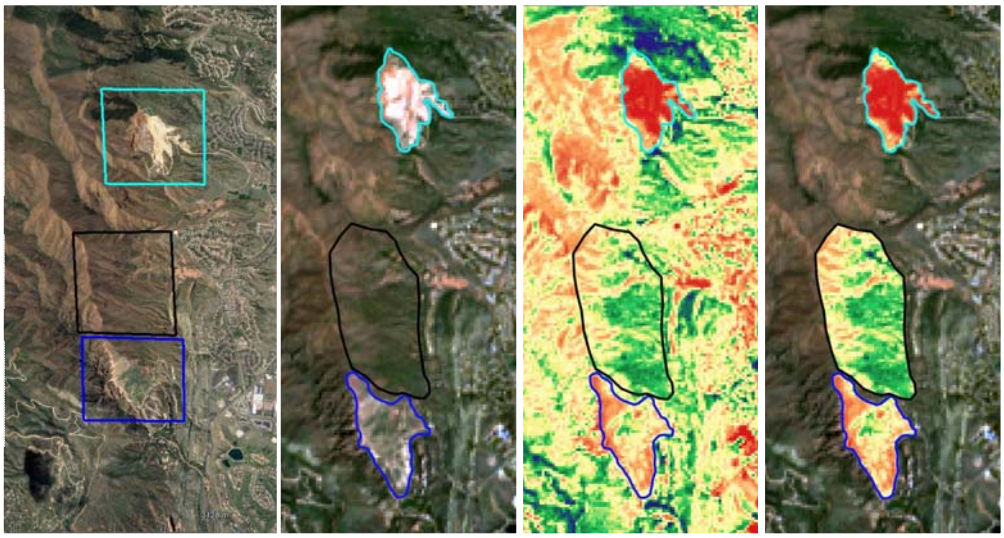
Pike View & Queens Canyon – Low NDVI

plant biomass on July 19, 2017

Pike View Quarry

Hope Springs

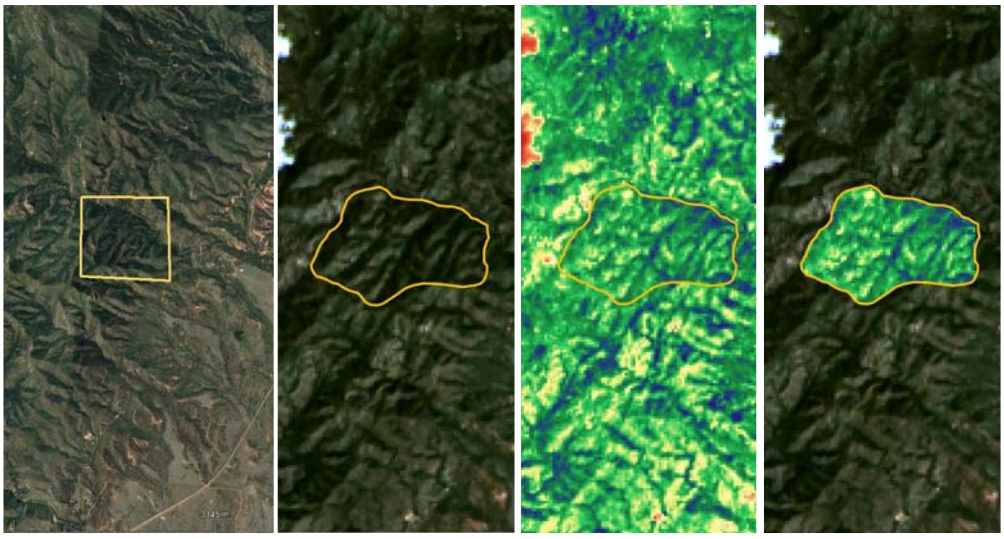
Queens Canyon Quarry



Hitch Rack Ranch – High NDVI

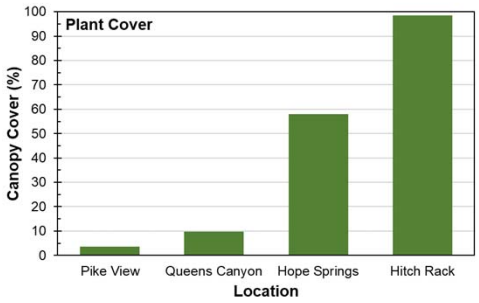
plant biomass on July 19, 2017

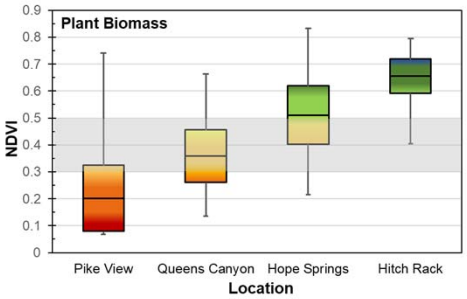
Hitch Rack Ranch



Summary of Current Vegetation Status

"… is *at least equal* in extent of cover to the natural vegetation of the surrounding areas …"



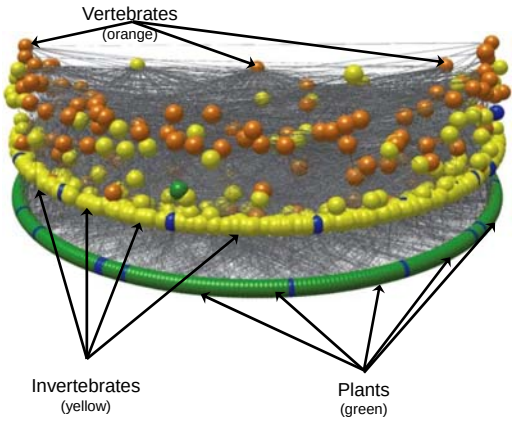




- Hope Springs has rebounded rapidly following the 2012 Waldo Canyon fire
- Queens Canyon resembles Pike View Quarry, despite at least 14 years of recovery
- Hitch Rack Ranch stands out with much greater green plant cover and biomass

A diverse assemblage of wildlife species is built upon the foundation of a diverse plant community

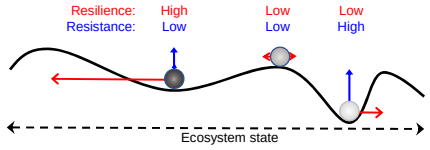
A Forest Food Web



Dunne et al. 2014. Proc. Royal Soc. B DOI: 10.1098/rspb.2013.3280

A diverse plant community includes species & structural & functional diversity

Resistance and Resilience



600 plant species (e.g., the Aiken Canyon PCA) is a strong foundation for a diverse, stable, resistant and resilient ecosystem

Forest Ecosystems are Complex & Heterogeneous

disturbance results in ecosystem simplification & homogenization

The reclamation plan will not result in recovery of the complex, heterogeneous ecosystem.

"Topsoil will be removed and stockpiled …" [p. E-2]

"Stockpiled topsoil will be seeded … temporary seed mixture" [p. E-5]

"… affected areas will be revegetated with native grasses and then shrubs and trees." [p. E-8]

The reclamation plan does not consider tree or shrub death.

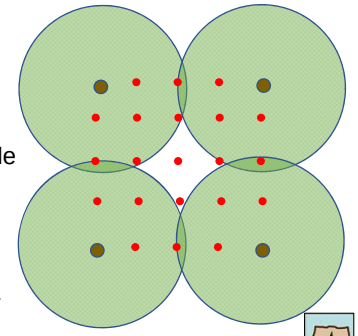
"A mixed conifer forest will be replanted …" [p. E-9]

"… trees will be planted at approximately 25-foot spacing … considering that Douglas fir are 20 feet wide and Ponderosa pine are 25 feet wide when fully grown …" [p. E-9]

- **no allowance for tree mortality**

"… planting clusters of trees with tight spacing (as low as 5 ft) …" [p. E-9]

- **planting density that demands at least 80% tree mortality**



Temporary Seed Mix

80% of the proposed species mix in Table E-6 are introduced species



sheep fescue
Festuca ovina



western wheatgrass
Pascopyrum smithii



Canada bluegrass
Poa compressa

NRCS PLANTS Database

Native

Introduced

Absent / Unreported



perennial ryegrass
Lolium perenne



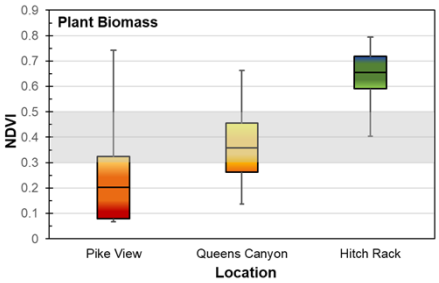
Chewing's fescue
Festuca rubra ssp. *fallax*

Conclusions (1)

The proposed reclamation plan will not:

- … encourage the diversity of both game and non-game species … or improvement of wildlife habitat. … [Rule 3.1.8]
- … reestablish the existing wildlife habitat nor encourage the diversity of wildlife species … [Exhibit E, p. E-14]

Without the foundation of a diverse plant community the wildlife diversity will not be reestablished.

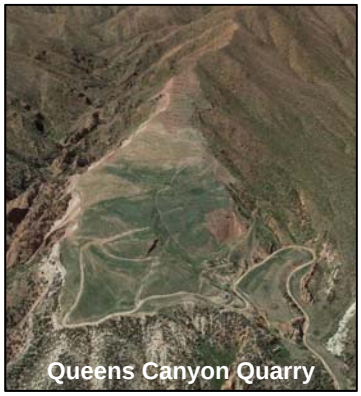


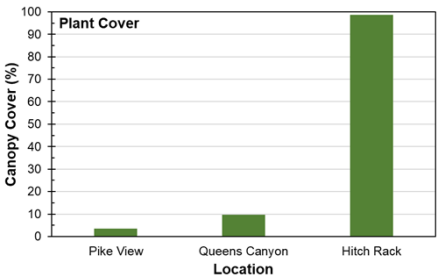
Furthermore, introducing non-native perennial grasses in this plan represents an unnecessary risk of further degradation to the Aiken Canyon PCA and the Front Range ecosystems in which it is located.

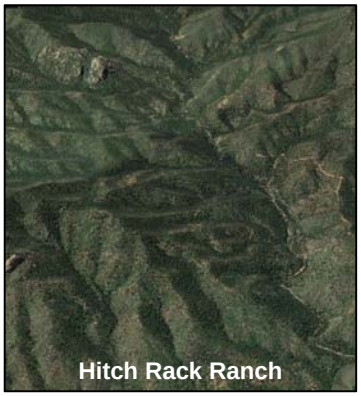
Conclusions (2)

Transit Mix Concrete Co. has not submitted a reclamation plan that will "… establish a diverse … vegetative cover … at least equal in extent of cover to the natural vegetation of the surrounding area …"

[as per Rule 3.1.10 & Exhibit E, p. E-7]







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Curriculum Vitae

PROFESSIONAL EXPERIENCE:

Senior Ecologist. (2004–present) Aridlands, LLC (formerly Aridlands Natural Resource Consulting). Grand Junction, Colorado. Owner/self-employed

Science Advisor. (2016–present) Desert Conservation Program. Clark County, Nevada.

Visiting Research Professor. (2016–present) Colorado Mesa University. Grand Junction, Colorado. Dr. Russell Walker: rwalker@coloradomesa.edu

Commissioner. (2007–2016) Colorado Oil & Gas Conservation Commission. Denver.

Lecturer in Environmental Science. (2005, 2007, 2011) Colorado Mesa University. Grand Junction, Colorado. Dr. Russell Walker:

Ecologist. (2002-03) U.S. Geological Survey–Biological Resources Division. Canyonlands Field Station, Moab, Utah. Dr. Jayne Belnap: jayne_belnap@usgs.gov

Associate Director. (1999-2002) Cedar Point Biological Station. U. of Nebraska–Lincoln. Dr. Alan Kamil: akamil1@unl.edu

Post-doctoral Researcher. (1999) U. of Nebraska–Lincoln. Dr. Tony Joern: ajoern@ksu.edu

NASA Graduate Student Fellow in Global Change Research & **Teaching Assistant.** (1993-99) Colorado State U, Fort Collins. Dr. Jim Detling: james.detling@colostate.edu

Research Associate. (1995) Nematode Ecology Laboratory. McMurdo Station, Antarctica & Colorado State U, Fort Collins. Dr. Diana Wall: diana.wall@colostate.edu

Research Associate. (1993) Natural Resource Ecology Laboratory. Colorado State U.

Instructional Laboratory Preparator. (1992-93) School of Biological Sciences. UN–L.

Graduate Research & **Teaching Assistant.** (1988-92) University of Nebraska–Lincoln.

Ecologist. (1987-88) Mlawula Nature Reserve. Swaziland Ministry of Natural Resources & U.S. Peace Corps, Mbabane, Swaziland.

Science Instructor. (1985-86) Elulakeni Secondary School. Swaziland Ministry of Education & U.S. Peace Corps, Mbabane, Swaziland.

EDUCATION & CERTIFICATIONS:

Senior Ecologist. Ecological Society of America. Jun 2015.

Remote Pilot. Small Unmanned Aircraft Systems. US-FAA. Sep 2016.

Ph.D. Colorado State University. Aug 1999. (Ecology) Advisor: Dr. J.K. Detling.
Dissertation: Grassland ecosystem responses to warmer nights. [GPA: 4.0]

M.S. University of Nebraska-Lincoln. Dec 1992. (Biology) Advisor: Dr. A. Joern.
Thesis: The roles of competition and herbivory in maintaining the local distributions of two native grasses. [GPA: 3.8]

B.S. University of Nebraska-Lincoln. May 1984. (Life Sciences) [GPA: 3.6]

PROFESSIONAL INTERESTS:

1) **Restoration Ecology** – pursuing experimental approaches for evaluating successful restoration practices in arid shrub and grassland ecosystems; 2) **Integrating Technology and Ecology** – incorporating drone-mounted sensors into natural resource assessments for timely, efficient, and informed decision making; 3) **Natural Resource Policy** – contributing to development of policies grounded in scientific understanding; and 4) **Responsible Resource Development** – promoting adaptive management approaches to minimize and mitigate the effects of development in important wildlife habitat.

PUBLICATIONS:

Minnick, T.J. and R.D. Alward. 2015. Plant-soil feedbacks and the partial recovery of soil spatial patterns on abandoned well pads in a sagebrush shrubland. *Ecological Applications* 25:3-10.

Minnick, T.J. and R.D. Alward. 2012. Soil moisture enhancement techniques aid shrub transplant success in an arid shrubland restoration. *Rangeland Ecology and Management* 65:232-240.

Alward, R., C. DeYoung and S. Hall. 2010. Protecting the Parachute penstemon during closure of the Anvil Points oil shale facility. *Proceedings of the High Altitude Revegetation Workshop #19*, March 2010.

Rustad, L.E., J. Campbell, G.M. Marion, R.J. Norby, M.J. Mitchell, A.E. Hartley, J.H.C. Cornelissen, J. Gurevitch, R. Alward, *et al*. 2001. A meta-analysis of the response of soil respiration, net N mineralization, and aboveground plant growth to experimental ecosystem warming. *Oecologia* 126:543-562.

Alward, R.D., J.K. Detling and D.G. Milchunas. 1999. Grassland vegetation change and nocturnal global warming. *Science* 283:229-231.

Alward, R.D. and A. Joern. 1993. Plasticity and overcompensation in grass responses to herbivory. *Oecologia* 95:358-364.

Alward, R.D., editor. 1992. Field and Lab Manual for Introductory Ecology Laboratory at the University of Nebraska-Lincoln.

Joern, A. and R. Alward. 1988. Effect of nitrogen fertilization on choice among grasses by the grasshopper *Phoetaliotes nebrascensis* (Orthoptera: Acrididae*). Annals of the Entomological Society of America* 81(2):240-244.

MANUSCRIPTS IN PREPARATION FOR PUBLICATION:

Alward, R.D. and T.J. Minnick. Plant communities recover slowly on abandoned gas well pads in the Piceance Basin of western Colorado. For *Restoration Ecology*.

Minnick, T.J. and R.D. Alward. The benefits of performance based standards in oil and gas reclamation. For *Environmental Science & Technology*.

Alward, R., S. Boyle and V. Tepedino. Pollen limitation in a threatened cactus influenced by proximity to oil and gas disturbance. For *Western North American Naturalist*.

PROFESSIONAL REPORTS:

Harju, T., S. Harju, C. Rasmussen, D. Hinderle, J. Aycrigg, R. Alward. 2017. Biennial Adaptive Management Report. Prepared for Desert Conservation Program, Clark County, NV. Alta Science & Engineering, Inc., Kellogg, ID.

Harju, T., S. Harju, A. Rayburn, R. Alward, D. Hinderle, J. Aycrigg, H. White. 2016. Adaptive Management and Monitoring Plan. Prepared for Desert Conservation Program, Clark County, NV. TerraGraphics Environmental Engineering, Kellogg, ID.

Harju, T., S. Harju, H. White, R. Alward, D. Hinderle, J. Aycrigg. 2016. Biological Goals and Objectives for the Clark County, NV Multiple Species Habitat Conservation Plan - Final. Prepared for Desert Conservation Program, Clark County, NV. TerraGraphics Environmental Engineering, Kellogg, ID.

Boyle, S., R. Alward and V. Tepedino. 2014. A Study of the Impacts of Oil and Gas Development on *Phacelia submutica* and three *Sclerocactus* spp. Final Report. Prepared for Colorado Natural Areas Program. BIO-Logic, Inc., Montrose, CO.

Boyle, S., R. Alward and V. Tepedino. 2013. A Study of the Impacts of Oil and Gas Development on *Phacelia submutica* and two *Sclerocactus* spp. 2012 Interim Field Study Report. Prepared for Colorado Natural Areas Program. BIO-Logic, Inc., Montrose, CO.

Alward, R., S. Hall and T. Doenges. 2012a Debeque Milkvetch (*Astragalus debequaeus*) 2012 Monitoring Report Update. Bureau of Land Management Anvil Points Facility (LO9PA00507). Prepared for BLM-CRV Field Office. URS, Inc., Denver, CO.

Alward, R., S. Hall and T. Doenges. 2012b. Parachute Penstemon (*Penstemon debilis*) 2011 Monitoring Report. Prepared for BLM-CRV Field Office. URS, Inc., Denver, CO.

Alward, R., S. Hall and T. Doenges. 2012c Debeque Milkvetch (*Astragalus debequaeus*) 2011 Monitoring Report. Bureau of Land Management Anvil Points Facility (LO9PA00507). Prepared for BLM-CRV Field Office. URS, Inc., Denver, CO.

Alward, R. and S. Boyle. 2012. A Study of the Impacts of Oil and Gas Development on *Phacelia submutica*. 2011 Interim Field Study Report. Prepared for Colorado Natural Areas Program. BIO-Logic, Inc., Montrose, CO.

Graff, A.W. and R.D. Alward. 2012. Quantifiable Effects of Oil and Gas Development on Dudley Bluffs Twinpod (*Physaria obcordata*) and Dudley Bluffs Bladderpod (*Physaria congesta*) and their Habitats in Western Colorado. Final Report. Prepared for Colorado Natural Areas Program. BIO-Logic, Inc.

Alward, R.D., S.K. Hall and T. Doenges. 2011. Debeque Milkvetch (*Astragalus debequaeus*) 2010 Monitoring Report. Bureau of Land Management Anvil Points Facility. Prepared for BLM-CRV Field Office. URS, Inc., Denver, CO.

Hall, S.K. and R.D. Alward. 2011. Parachute Penstemon (*Penstemon debilis*) 2010 Monitoring Report. Prepared for BLM-CRV Field Office. URS, Inc., Denver, CO.

Graff, A.W. and R.D. Alward. 2011. Quantifiable Effects of Oil and Gas Development on Dudley Bluffs Twinpod (*Physaria obcordata*) and Dudley Bluffs Bladderpod (*Physaria congesta*) and their Habitats in Western. Interim 2010 Field Report. Prepared for Colorado Natural Areas Program. BIO-Logic, Inc.

Hall, S.K., R.D. Alward and N. Ripley. 2010. Debeque Milkvetch (*Astragalus debequaeus*) Transplantation and 2009 Monitoring Report. Bureau of Land Management Anvil Points Facility (LO9PA00507). Prepared for BLM-GS Field Office. URS, Inc., Denver, CO.

Hall, S.K. and R.D. Alward. 2010. Parachute Penstemon (*Penstemon debilis*) 2009 Monitoring Report. Prepared for BLM-CRV Field Office. URS, Inc., Denver, CO.

Alward, R.D., J.P. Gray and M.W. Klish. 2009. North Parachute Ranch Vegetation Reference Study. Prepared for EnCana Oil & Gas, USA. WestWater Engineering, Grand Junction, CO.

Grode, M.R., R.D. Alward, J.W. Gumber and M.W. Klish. 2009. Revegetation Survey: Garfield Creek State Wildlife Area Hilton Pipeline. Prepared for Orion Energy Partners. WestWater Engineering, Grand Junction, CO.

Spears, R.E., S.K. Hall and R.D. Alward. 2009a. Bureau of Land Management Mitigation Plan for Parachute Penstemon (*Penstemon debilis*) at Anvil Points Facility (NAQ080014). Prepared for BLM-GS Field Office. URS, Inc., Denver, CO.

Spears, R.E., R.D. Alward and S.K. Hall. 2009b. Debeque Milkvetch (*Astragalus debequaeus*) Relocation Field Report. Prepared for BLM-GS Field Office. URS, Inc., Denver, CO.

Hall, S.K. and R.D. Alward. 2009. Parachute Penstemon (*Penstemon debilis*) protection and relocation interim field report. Prepared for BLM-GS Field Office. URS, Inc., Denver, CO.

Alward, R.D. and M.W. Klish. 2008. Biological Survey Report: Dudley Bluffs twinpod and Dudley Bluffs bladder pod surveys at the Yellow Creek Meter Station. Prepared for Williams Pipeline. WestWater Engineering, Grand Junction, CO.

Spears, R.E., R.D. Alward, and others. 2008. Mitigation Plan for Sensitive Species at Anvil Points Facility. Prepared for BLM-GS Field Office. URS, Inc., Denver, CO.

Alward, R.D. and M.W. Klish. 2007a. The Distribution and Abundance of Grand Buckwheat (*Eriogonum contortum*) related to the Red Cliff Mine Project, Central Appalachian Mining, LLC. Prepared for BLM-GJ Field Office. WestWater Engineering, Grand Junction, CO, in cooperation with URS Corporation, Denver, CO.

Alward, R.D. and M.W. Klish. 2007b. EnCana Parachute to Logan Wash 24-inch Pipeline Adobe thistle (*Cirsium perplexans*) Re-survey. Prepared for EnCana Oil & Gas (USA). WestWater Engineering, Grand Junction, CO.

Klish, M.W. and R.D. Alward. 2007c. BLM TESS Survey, Laramie Energy, LLC, Logan Trail Master Plan of Development. Prepared for Cordilleran Compliance Services. WestWater Engineering, Grand Junction, CO.

Alward, R.D. and M.W. Klish. 2006a. Biological Assessment Report: BLM Special Status Species, Vegetation, Weeds & Raptors. Chevron Oil Shale RDD Site. Prepared for Cordilleran Compliance Services. WestWater Engineering, Grand Junction, CO.

Alward, R.D. and M.W. Klish. 2006b. Twin Basin Gathering System: Biological Surveys Report. Prepared for Enserca Engineering. WestWater Engineering, Grand Jnct., CO.

Klish, M.W, S. Moore and R.D. Alward. 2005. Hamm Canyon Natural Gas APD: Environmental Assessment CO-800-04-073EA. Bureau of Land Management, Dolores Public Lands Office. WestWater Engineering, Grand Junction, CO.

Alward, R.D. and M.W. Klish. 2005a. Biological Assessment for the Dawson Geophysical Ryan Gulch 2D Seismic Survey Project, Rio Blanco County, Colorado. Prepared for U.S. Fish and Wildlife Service. WestWater Engineering, Grand Junction, CO

Alward, R.D. and M.W. Klish. 2005b. Biological Assessment: EnCana-Meeker Pipeline and Gas Plant Project, Garfield and Rio Blanco Counties, Colorado. Prepared for U.S. Fish and Wildlife Service. WestWater Engineering, Grand Junction, CO.

Klish, M.W., S. Moore and R.D. Alward. 2004. Abbey 2D Seismic Survey: Environmental Assessment CO-800-2004-056-EA. Bureau of Land Management, Dolores Public Lands Office. WestWater Engineering, Grand Junction, CO.

Klish, M.W. and R.D. Alward. 2004a. BLM Special Status Species Plants Survey. Canyon Gas Porcupine Loop Pipeline Project. Garfield County, Colorado. WestWater Engineering, Grand Junction, CO.

Klish, M.W. and R.D. Alward. 2004b. BLM Special Status Species Plants and Raptor and Birds of Conservation Concern Surveys. Dawson Geophysical Hamm Canyon 2D Seismic Project. San Miguel and Montrose Counties, Colorado. WestWater Engineering, Grand Junction, CO.

Klish, M.W. and R.D. Alward. 2004c. BLM Threatened, Endangered and Sensitive Species Survey. Encana Horsethief Canyon 2D Seismic Project. Garfield and Mesa Counties, Colorado. WestWater Engineering, Grand Junction, CO.

Klish, M.W. and R.D. Alward. 2004d. BLM Special Status Species Plants Springtime Survey. Encana Parachute to Logan Wash Pipeline, Garfield County, Colorado. WestWater Engineering, Grand Junction, CO.

Alward, R. 2003. NCPN Invasive Plant Prevention Guidelines and Best Management Principles. *In* Evenden, A. *et al*. Northern Colorado Plateau Vital Signs Network and Prototype Cluster, Plan for Natural Resources Monitoring: Phase II Report. National Park Service, Northern Colorado Plateau Network, Moab, UT.

Schelz, C., M. Moran and R. Alward. 2003a. Vegetation Long-term Monitoring. Arches National Park 2002. Resource Management Division, Southeast Utah Group, National Park Service, U.S. Department of the Interior. Moab, Utah.

Schelz, C., M. Moran and R. Alward. 2003b. Vegetation Long-term Monitoring. Canyonlands National Park: Volume 1–Needles District 2002. Resource Management Division, Southeast Utah Group, National Park Service, U.S. Department of the Interior. Moab, Utah.

Schelz, C., M. Moran and R. Alward. 2003c. Vegetation Long-term Monitoring. Natural Bridges National Monument, 2002. Resource Management Division, Southeast Utah Group, National Park Service, U.S. Department of the Interior. Moab, Utah.

MEMBERSHIPS:

Professional:

- Ecological Society of America
- Society for Ecological Restoration
- Coalition of UAS Professionals
- Assoc. Unmanned Vehicle Systems Inter'l

Other:

- The Wilderness Society
- Conservation Colorado
- Colorado Canyons Association

PRESENTATIONS, SEMINARS, AND WORKSHOPS:

2018 ▪ Ecological Society of America 103rd Annual Meeting (in prep; New Orleans, LA)
Riparian recovery and re-invasion: assessing restoration effectiveness using a drone-mounted very high resolution multi-spectral sensor. Alward, RD, TJ Minnick, G Koenemann, AM Langton, Q Barnett, E Tighe & C Berg.

& Using a drone and multispectral camera to obtain accurate and complete information on reclamation success: well pad and habitat modification studies in western Colorado. Minnick, TJ, RD Alward, AM Langton, G Koenemann & DB Johnston

▪ XPONENTIAL – Association for Unmanned Vehicle Systems International (poster in prep; Denver, CO)
Seeing the forest and the trees: habitat restoration assessments using drones. Alward, R, T Minnick, A Langton, G Koenemann & TBA

▪ Riparian Restoration Conference (Grand Junction, CO)
100 hectares per hour: comprehensive restoration monitoring using drones & multi-spectral sensors. Alward, R & T Minnick

▪ Colorado Plateau Native Plant Program Annual Meeting (Grand Junction, CO)
Surveyor in the sky: using very high-resolution drone-collected data to monitor restoration. Kroenemann, G, A Langton, R Alward & T Minnick

2017 ▪ Colorado Mesa University, Natural Resources of the West (Grand Junction, CO)
Seeing the forest and the trees: very high resolution remote sensing using sUAS

▪ High Altitude Revegetation Conference & Central Rockies Chapter of the Society for Ecological Restoration (Fort Collins, CO)
Drones for restoration: very high resolution aerial imagery for monitoring ecological restoration. Alward, R, D Johnston & T Minnick

2016 ▪ Colorado Mesa University, Natural Resources of the West (Grand Junction, CO)
Are two birds in the bush worth one in hand? Habitat conservation plans for endangered species.

2015 ▪ Central Rockies Chapter of the Society for Ecological Restoration (GJ, CO)
Ecological restoration in Colorado's oil and gas fields. Alward, RD & TJ Minnick

▪ High Altitude Revegetation Conference & Central Rockies Chapter of the Society for Ecological Restoration (Fort Collins, CO)
Can bees, cactus, and energy development coexist on the Colorado Plateau? Alward, R, S Boyle & V Tepidino

▪ Energy & Environment Symposium: Oil & Gas Ed. for Local Gov. (Rifle, CO)
Successful ecological restoration provides diverse benefits to the public, local government and industry. Minnick, TJ & RD Alward

▪ Colorado Mesa University, Natural Resources of the West (Grand Junction, CO)
Can bees, cactus, and energy development coexist on the Colorado Plateau?

▪ Chinle Cactus and Succulent Society (Grand Junction, CO)
Colorado hookless cactus: flowers, fruits and bees.

▪ League of Women Voters – Mesa County (panel member; Grand Junction, CO)
Oil and gas in Colorado: implementing legislation into rules.

▪ Mesa County Medical Society (panel member; Grand Junction, CO)
Health impacts of oil and gas development in western Colorado.

2014 ▪ 25th Annual South Platte Forum (panel member; Longmont, CO)
When life gives you gas, make energy.

▪ Colorado Mesa University, Natural Resources of the West (Grand Junction, CO)

Science informing policy: wildlife, water, and public welfare.

2012 ▪ Society for Ecological Restoration, Australasian 1st Annual Meeting (Perth, Aus.)

▪ Between Mountains and Desert: Environmental Issues in Western Colorado (panel member; Grand Junction, CO)

▪ High Altitude Revegetation Workshop (Fort Collins, CO)
Vegetation recovery on abandoned well pads in a western Colorado semi-arid shrubland ecosystem. Alward, RD & TJ Minnick

2010 ▪ Ecological Society of America 95th Annual Meeting (two papers; Pittsburgh, PA)
Vegetation diversity and heterogeneity on abandoned gas well pads in the Piceance Basin of western Colorado. Alward, RD, TJ Minnick, S Wilson & M Gibson.

& *Soil heterogeneity of abandoned gas well pads in the Piceance Basin of western Colorado.* Minnick TJ, RD Alward, M Gibson & S Wilson.

▪ High Altitude Revegetation Workshop (poster; Fort Collins, CO)
Protecting the Parachute penstemon during closure of the Anvil Points oil shale facility. Alward, RD, C DeYoung & S Hall.

▪ Mesa State College, Natural Resources of the West (Grand Junction, CO)
Soil and vegetation recovery on abandoned well pads in the Piceance Basin of western Colorado. Minnick TJ & RD Alward.

▪ WSERC Natural Gas Symposium (panel member; Hotchkiss, CO)

2009 ▪ Mesa County Energy Vision Forum (moderator; Grand Junction, CO)

2008 ▪ The Wildlife Society – Colorado Chapter (Denver, CO)
Pursuing wildlife-friendly approaches to oil and gas development in Colorado.

▪ Mesa State College, Natural Resources Seminar (Grand Junction, CO)
Science informing policy: new rules for oil and gas development in Colorado.
[Also: GJ Chamber of Commerce, Mesa Bar Assoc, League of Women Voters, Audubon Soc]

▪ High Altitude Revegetation Workshop (Fort Collins, CO)

2007 ▪ Society for Ecological Restoration (poster; San Jose, CA)
Resource enhancement techniques to aid shrub transplant success in an arid shrubland restoration. Minnick, T, R Alward, J Christiansen, K Lambert & K Burden.

▪ Mesa State College, Mathematics Seminar (Grand Junction, CO)
Determining Grand buckwheat distribution and abundance along a proposed railway.

2005 ▪ Uncompahgre Plateau Project PJ & Sagebrush Conference (poster; Montrose, CO)
Evaluating the efficacy of fuels reduction treatments: developing management tools for promoting biodiversity and controlling cheatgrass in west-central Colorado.
Alward, RD, A Clements, H Metz & TJ Minnick.

2002 ▪ Cedar Point Biological Station Summer Seminar Series (Ogallala, NE)
Hot nights on the prairie: grassland responses to increasing T_{MIN}.

RESEARCH FUNDING:

2017-18	UEC: Restoration & Habitat Monitoring with Drones	$ 25,865
2016	CO Parks & Wildlife: Habitat Monitoring Using Drones	2,000
2011-14	CO DNR: Effects of O&G on Rare Plants in Western Colorado (co-PI)	168,000
2010-12	CO DNR: Effects of O&G on *Physaria* spp. in Piceance Basin (co-PI)	59,864
2008-10	ExxonMobil: Well Pad Habitat Restoration Assessment (co-PI)	93,500
2000-02	NSF-FSML: Infrastructure Expansion of Field Station (co-PI)	241,000
1994-97	NASA: Graduate Student Fellowship in Global Change Research	66,000
1994-97	Shortgrass Steppe LTER Summer Fellowship Awards	14,554
1995-97	CSU Graduate Degree Program in Ecology Research Fellowships	4,724
1989-91	UNL School of Biological Sciences, Research Support Awards	1,250

COMMUNITY SERVICE AND LEADERSHIP:

- Project Sponsor, CMU-MechE Freshman Student Design Project (2018)
- Project Sponsor, CMU-ENVS Senior Student Capstone Projects (2017, 2018)
- Volunteer Judge, Student Showcase, Colorado Mesa University (2016-present)
- Commissioner, Colorado Oil & Gas Conservation Commission (2007-2016)
- Reviewer for *Ecology*, *Oecologia* and *Restoration Ecology*
- Peer Reviewer: Proposed Rule to List *Ipomopsis polyantha*, *Penstemon debilis*, and *Phacelia submutica* Under ESA (FWS-R6-ES-2010-0015; 2010)
- Briefings for the staffs of U.S. Representative John Salazar and U.S. Senator Mark Udall on the status of Colorado Oil & Gas rules (2009)
- Board Member, Desert Ecosystems Analysis and Research Project (2009-2011)
- Participant, Audubon Christmas Bird Count (2006, 2010)
- Board Member, Western Colorado Congress of Mesa County (2004-2007; VP 05-06)
- Volunteer, National Park Service, Colorado National Monument (2004-09)
- Volunteer, Bureau of Land Management, Grand Junction Field Office (2004-08)
- Volunteer Judge, Western Colorado Science Fair (2003-09)
- Co-organizer, Ecological Research at CSU, Student Symposium (1996)
- Co-founder and organizer, CSU Dept. of Biology Student Symposium (1994-95)
- Area Commissioner, Shiselweni District, Swaziland National Scouters Council (1986)
- Scout Master, Elulakeni Boy Scout Troup (1985-86)

HONORS AND AWARDS:

- The Phi Kappa Phi Honor Society (inducted Dec. 1999)
- Antarctica Service Medal. The National Science Foundation (1999)
- Outstanding Student Contribution to the Graduate Degree Program in Ecology (1997)
- Outstanding Oral Presentation, Ecological Research at CSU Symposium (1996)
- Best Oral Research Presentation, CSU Dept. of Biology Student Symposium (1995)
- Colorado Fellowship, Colorado State University (1993-1994 & 1995)
- Carl W. Gugler Memorial Award for Best Presentation, UNL School of Biological Sciences Student Symposium (1990) & Runner-up (1991)
- Member, Tri-Beta, Biological Honor Society (1983)

Colorado Natural Heritage Program's Review of Hitch Rack Ranch Proposal



Renee Rondeau
Colorado Natural Heritage Program
Colorado State University
www.cnhp.colostate.edu

WARNER COLLEGE OF NATURAL RESOURCES
COLORADO STATE UNIVERSITY

The Five Key Biodiversity Conservation Questions

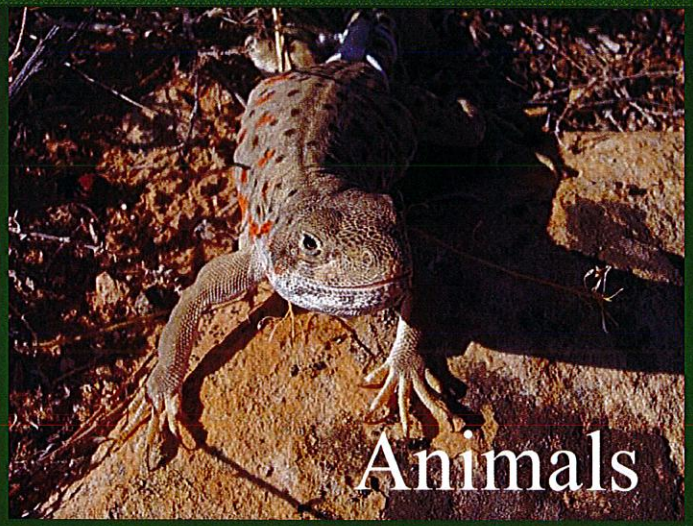






1. What species and ecosystems exist?
2. Which are at risk or otherwise significant?
3. Where precisely are those found?
4. How are they doing at those locations?
5. What are the most important and urgent places to protect?

We track the locations and status of rare and imperiled…

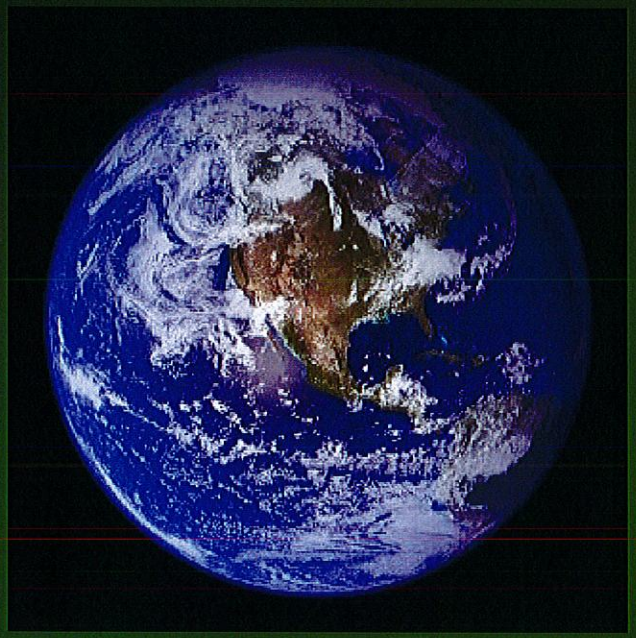






We are part of the NatureServe Network







NatureServe

A Network Connecting Science With Conservation

Which are at risk or otherwise significant?

NatureServe Conservation Status Ranks:

- **Global (G) Ranks** show the degree of rarity on the global scale.
- **State (S) Ranks** show the degree of rarity on the state scale.

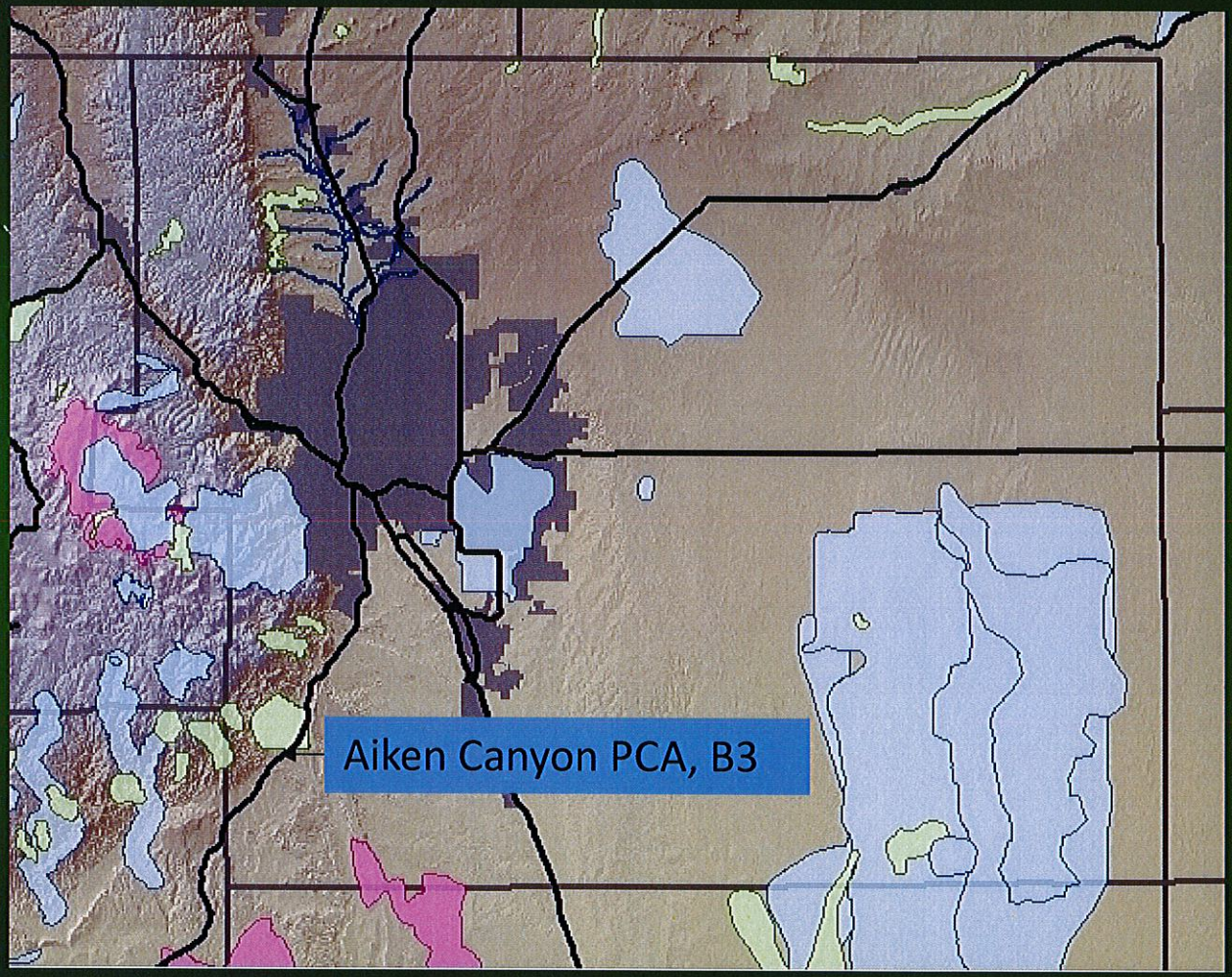
- 1 – Critically Imperiled
- 2 – Imperiled
- 3 – Vulnerable to Extirpation or Extinction
- 4 – Apparently Secure
- 5 – Demonstrably Widespread, Abundant, and Secure

Potential Conservation Areas (PCAs)

- Our PCA's focus on capturing the ecological processes that are necessary to support the continued existence of a set of element occurrences. The boundaries are our best estimate of the primary areas supporting the long-term survival of targeted elements of biodiversity.

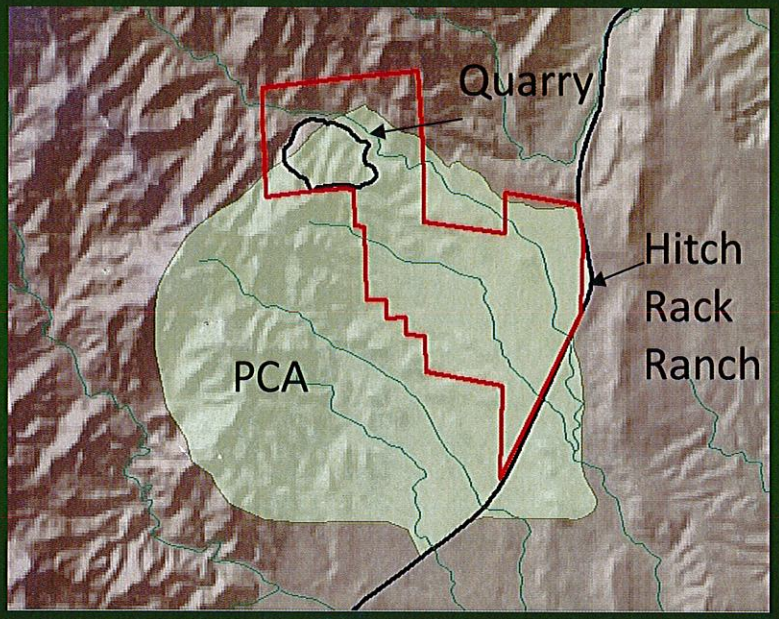
- B-Ranks for PCAs:
  - B1 Outstanding Significance
  - B2 Very High Significance
  - **B3 High Significance (of state and national significance)**
  - B4 Moderate Significance

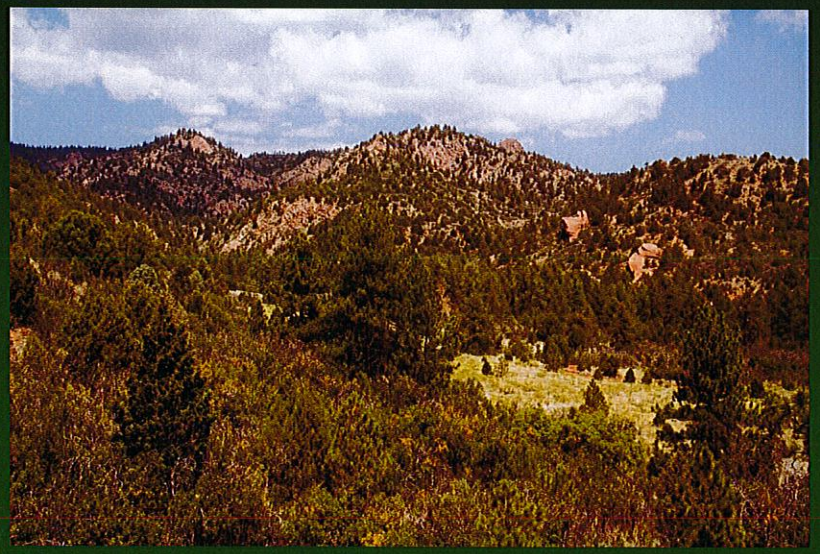
Colorado's Potential Conservation Areas

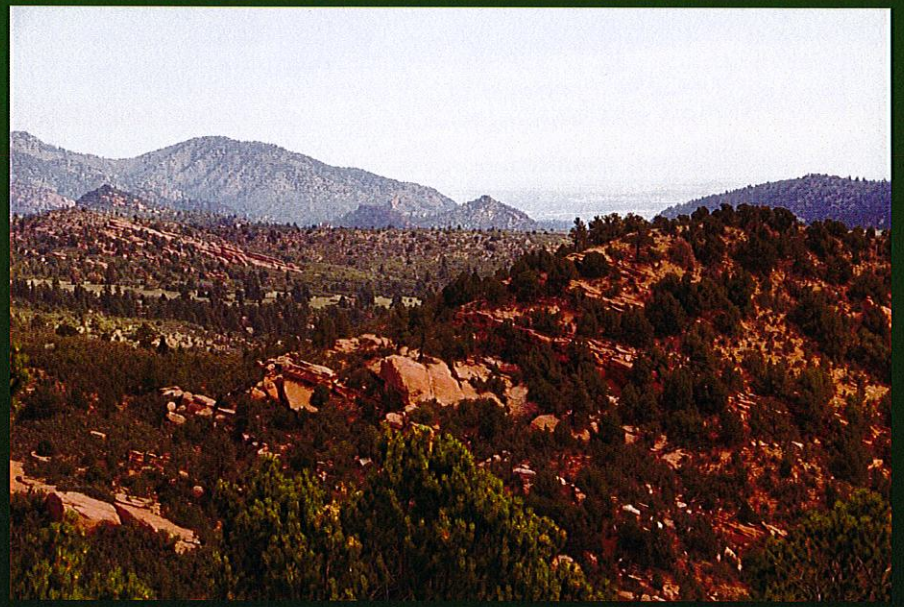


The Aiken Canyon PCA was identified in 2001 (Doyle et al. 2001)

Aiken Canyon PCA







The Aiken Canyon PCA, Identified in 2001 (Doyle et al. 2001)

- This site includes excellent occurrences of globally-vulnerable foothill shrublands (G3/S3) and low elevation woodlands and rare plants
- **Protection Urgency Rank** (2001) P3: Private lands within and adjacent to Aiken Canyon Preserve remain vulnerable to development
- **Management Urgency Rank** (2001): M4: Current management appears adequate. Weed management may become a serious concern

The Setting

- This site is located at the ecotone between the prairie grasslands and the montane forests
- This site supports a plethora of wildlife and its habitat





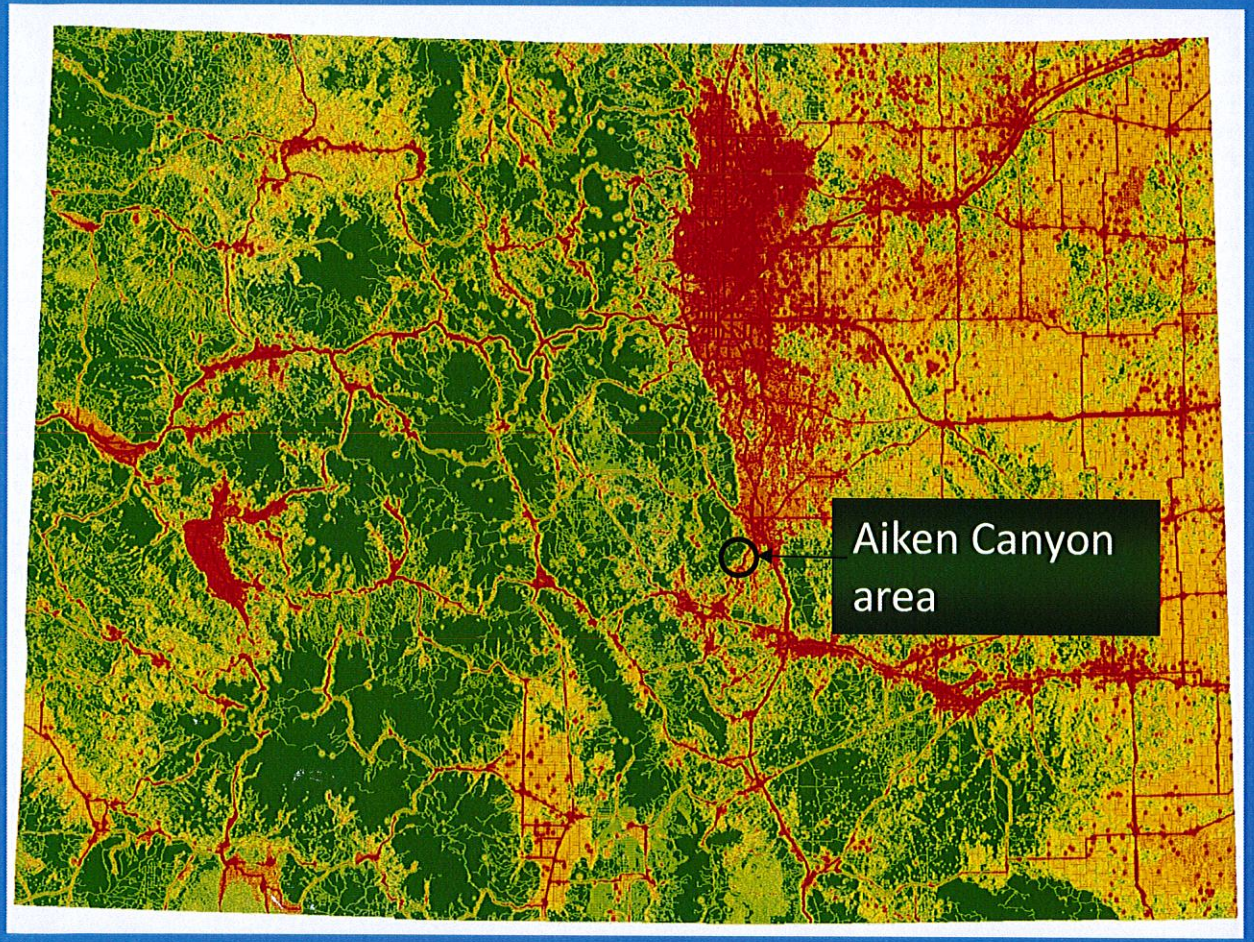
The Mountains to Plains Ecotone

The Front Range unique features:

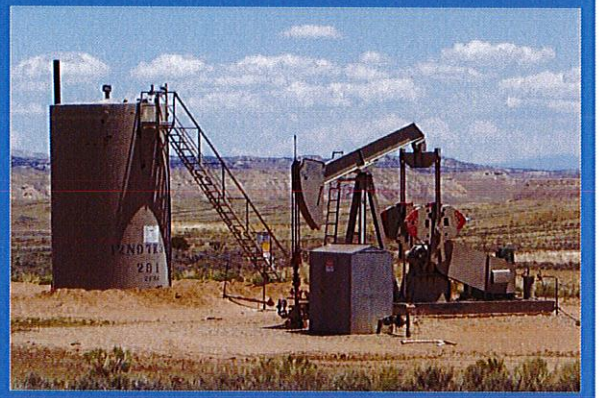
- Is an ecotone that is also a corridor from the mountains to plains which is critical for wildlife and it also has unique plant and animal assemblages.
  - Aiken Canyon PCA is largely designed around the unique plant assemblages that include forests, shrublands, and grasslands
  - As we will see in the next map the Front Range corridor is highly impacted

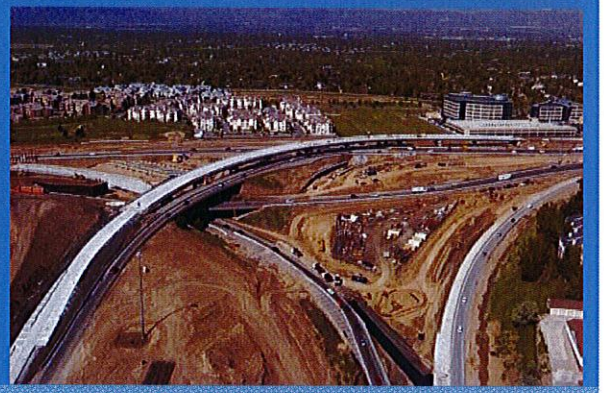
Conservation Planning

The Human Footprint









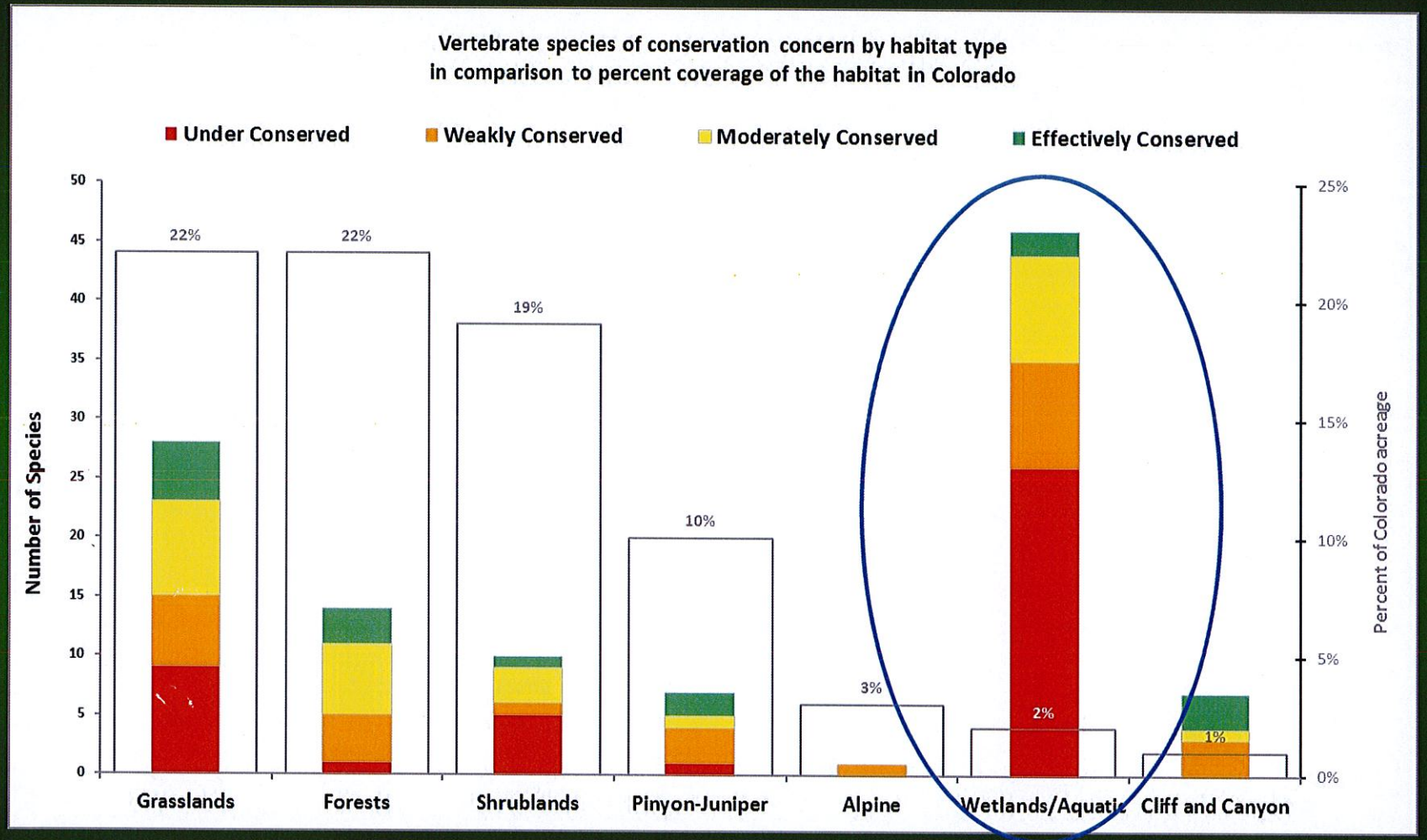
Impacts from Proposed Quarry

- Direct (mined area)
  - Complete loss of Ponderosa Pine and Mixed-Conifer forest, and habitat for Mexican Spotted Owl
  - Loss of connectivity for wildlife
- Indirect (outside of mined area)
  - Impacts on Little Turkey Creek cannot be avoided and thus the riparian corridor and the aquatic wildlife will be negatively impacted
    - High quality riparian areas in the foothills are rare!

Impacts From Road

- The haul road is likely to have an equally high negative impact:
  - Altered flow pattern as ditches along the side of the road divert the natural water flow
  - Direct reduction of wildlife habitat
  - High noise levels impact birds in their mating season
  - Direct wildlife kill
  - Altered species composition, e.g., weed infestations move into the intact foothills shrublands, degrading the habitat
  - Increased wildfire risk from truck traffic
  - Increased pollutants into Little Turkey Creek

Animal habitats





From The State of Colorado's Biodiversity, 2011

In Summary

- The Aiken Canyon PCA has been designated as one of Colorado's high biodiversity (B3) sites with a high quality landscape that is within a threatened ecotone.
- While CNHP supports compatible uses within a PCA, they do not consider the proposed rock quarry and haul road to be compatible due to the size, location and irreversible impacts, i.e, direct loss of habitat and indirect impacts to Little Turkey Creek and the surrounding habitat.

Thank You!



Renee Rondeau
Ecologist and Conservation Planner
Colorado Natural Heritage Program
Colorado State University
(970) 217-9041

Renee.Rondeau@colostate.edu

RENÉE RONDEAU

EDUCATION

MASTERS OF SCIENCE, BOTANY,
University of Arizona, Tucson Arizona May 1991

Developed skills in field research, plant taxonomy, soil science, statistics, scientific and expository writing, and public speaking. Conducted field research in Tucson Mountains-Sonora Desert, Baja, Mexico--Viscaino. Thesis: "Flora and Vegetation of the Tucson Mountain, Pima County, Arizona"

BACHELOR OF SCIENCE, BOTANY
University of Florida, Gainseville, Florida December 1981

OTHER, graduate courses in Entomology
University of Tennessee, Knoxville, Tennessee 1986-1987

PROFESSIONAL EXPERIENCE

CONSERVATION PLANNER AND ECOLOGIST March 2008-present
Colorado Natural Heritage Program, Colorado State University, Ft. Collins, Colorado

As team leader of the Colorado Natural Heritage Program's Conservation Planning team Renée coordinates projects that integrate biological conservation data, threats (including climate change) and protection into on-the-ground planning. Recent projects where she is the primary author include "The State of Colorado's Biodiversity, 2011" and the development of an ecosystem climate change vulnerability assessment for the Gunnison Basin. The Conservation Plannning team has been collaborating with Colorado state and federal agencies, and NGO's to develop conservation frameworks that allow for climate adaptation, development and management/protection of Colorado's biodiversity. As an ecologist she conducts on-the-ground long-term monitoring projects for species, ecosystems, and invasive weeds as well as survey for rare plants. Renée has been gathering ecological data in Colorado since 1992 and has an in-depth understanding of all of Colorado's ecoregions and ecosystems.

DIRECTOR /SENIOR RESEARCH ASSOCIATE January 2003-March 2008
Colorado Natural Heritage Program, Colorado State University, Ft. Collins, Colorado

Responsible for overseeing the Colorado Natural Heritage Program's 30 employees and the associated 2 million dollar operating budget. Responsibilities included securing funding for administrative staff and science projects. This included working with partners: The Nature Conservancy, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service, Colorado Division of Wildlife, Colorado State Parks, Great Outdoors Colorado, and others. As a sponsored program within the Fish, Wildlife and Conservation Department of CSU, I also coordinated CNHP's work with the College of Natural Resources program. Other primary responsibilities included overseeing the quality of CNHP's conservation database and ensuring that it meets minimum standards set by NatureServe.

ECOLOGIST/BOTANIST/SENIOR RESEARCH ASSOCIATE June 1996-December 2002
Colorado Natural Heritage Program, Colorado State University, Ft. Collins, Colorado

Responsible for building the international Biological Conservation Data System with information on the location and condition of rare, threatened, and endangered plant communities and species known to occur in Colorado. Responsibilities included: ecology team leader; advisory team member for CNHP Director; principal investigator on 3 to 5 research projects each year; lead ecologist for ecoregional planning; primary contact for The Nature Conservancy; and building relations with major partners, e.g., Great Outdoors Colorado.

ASSISTANT RIPARIAN ECOLOGIST April-1993-December-1996
The Nature Conservancy and The Colorado Natural Heritage Program, Boulder and Fort Collins, Colorado

Studied riparian vegetation and soils in the Upper Colorado River Basin, Gunnison Basin, and upper Arkansas Basin as part of the Colorado Riparian Classification Project. Documented the location and condition of populations of rare plants, animals, and plant communities. Identified sites which merit priority for conservation protection.

ECOLOGIST June 1992-December-1992

The Nature Conservancy and The Colorado Natural Heritage Program, Boulder and Fort Collins, Colorado

Studied upland and riparian vegetation in Jefferson County, Colorado as part of the biological inventory of Jefferson County. Documented the location and condition of populations of rare plants, animals, and plant communities. Identified sites which merit priority for conservation protection.

BOTANIST 1988

Bureau of Land Management, Phoenix Arizona

Served as field botanist for BLM lands in Arizona. Surveyed for threatened, endangered, and candidate plants.

FIELD ZOOLOGIST parts of 1988 1997

University of Arizona, Tucson Arizona; Biological Resource Division, Fort Collins Colorado

Studied Brown Treesnakes in both the native range (New Guinea and Solomon Islands) and Guam. This was part of an ongoing project to understand the ecological implications of an introduced snake into an ecosystem free of predators.

PUBLICATIONS or REPORTS OF INTEREST

Fink, M., D. Hanni, D. Klute, J. Sovell, and R. Rondeau. 2007. A conservation blueprint for neotropical migratory birds in western Colorado. Prepared for USFWS by the Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO. http://www.cnhp.colostate.edu/download/documents/2007/Neotrop_Birds_in_W_CO.pdf

Neely, B., R. Rondeau, J. Sanderson, C. Pague, B. Kuhn, J. Siemers, L. Grunau, J. Robertson, P. McCarthy, J. Barsugli, T. Schulz, and C. Knapp. Editors. 2011. Gunnison Basin: Vulnerability Assessment for the Gunnison Climate Working Group by The Nature Conservancy, Colorado Natural Heritage Program, Western Water Assessment, University of Colorado, Boulder, and University of Alaska, Fairbanks. Project of the Southwest Climate Change Initiative.

Rondeau, R. J., B. Kuhn, J. Handwerk. 2014. Rare plant surveys at Mesa Verde National Park. A report to Mesa Verde National Park.

Rondeau, R. J., M. Fink, G. Rodda, and M. Kummel. 2012. Treeline monitoring in the San Juan Basin tundra: a pilot project 2012. Report to Tres Rios Office by the Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO. http://www.cnhp.colostate.edu/download/documents/2012/Climate_Change_Monitoring_of_the_San_Juan_Basin_Tundra_final.pdf

Rondeau, R. J., K. Decker, J. Handwerk, J. Siemers, L. Grunau, and C. Pague. 2011. The state of Colorado's biodiversity 2011. Prepared for The Nature Conservancy by the Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO. http://www.cnhp.colostate.edu/download/documents/2011/Scorecard_march1_2012_final.pdf

Rondeau, R. J., K. Pearson, T. Kelso. 2013. Vegetation response in a Colorado grassland-shrub community to extreme drought: 1999-2010. *American Midland Naturalist* 170 (1): 14-25.

Rocchio, J., G. Doyle, and R. Rondeau. 2004. Survey of critical wetlands and riparian areas in Gunnison County, CO. Prepared for Colorado Department of Natural Resources, Denver CO by the Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO. http://www.cnhp.colostate.edu/download/documents/2004/Gunnison_County_Wetlands.pdf

Rondeau, R. J. 2001. Ecological system viability specifications for Southern Rocky Mountain ecoregion. Prepared for The Nature Conservancy by the Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO. http://www.cnhp.colostate.edu/download/documents/2001/Viability_specs_for_all_systems.pdf

Rondeau, R. J. and A. Lavendar. 2012. Noxious weed monitoring at the U.S. Air Force Academy: 7th year results. Prepared for USFWS and U.S. Air Force Academy by the Colorado Natural Heritage Program, Colorado State Univiersity, Fort Collins, CO.

Effects of Blasting on Water Wells

Brett A. Lewis, Ph.D. P.E.

My Background

- Currently co-owner of Dakota Ridge Engineering

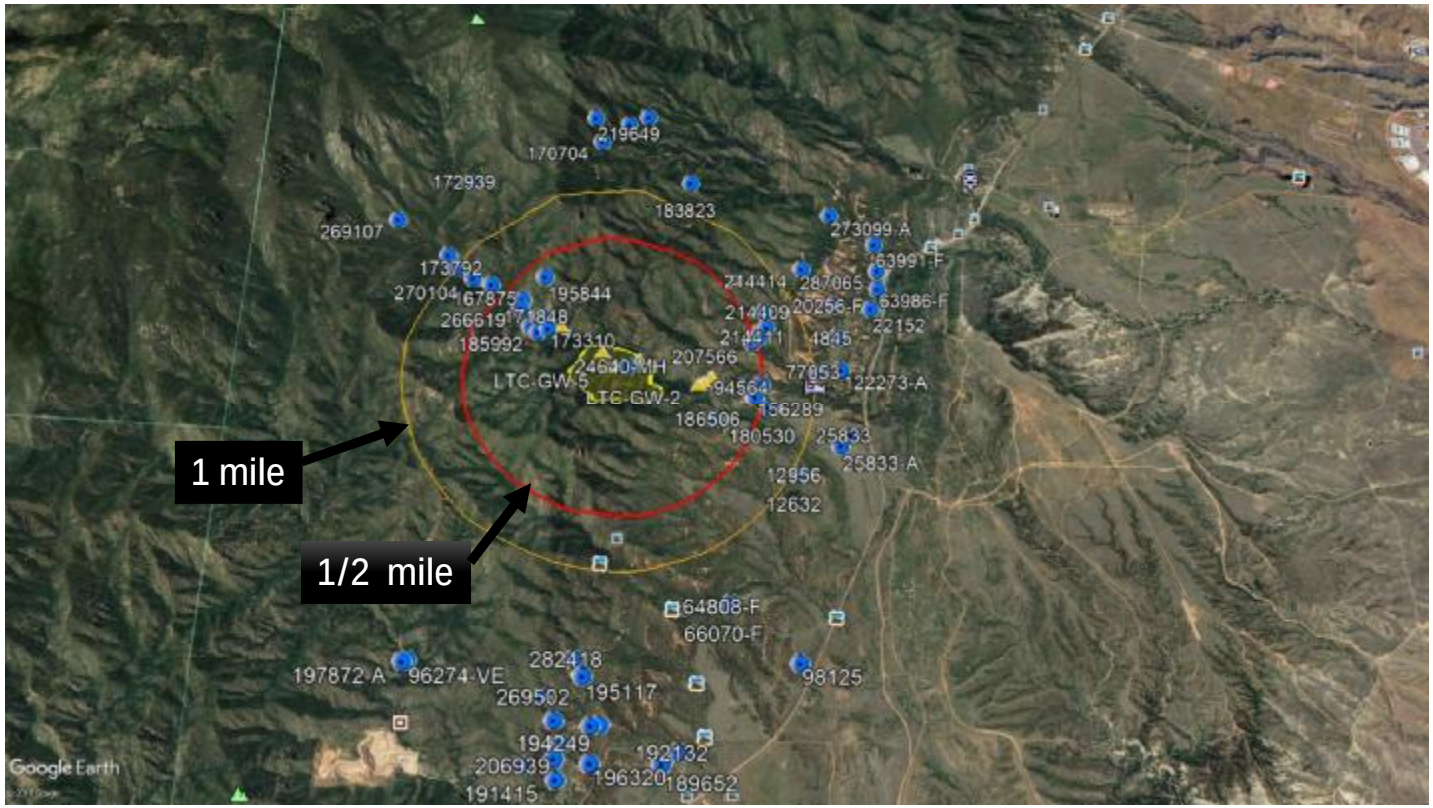
  Forensic Engineering and Structural Engineering
- ~ 20 years experience analyzing and testing effects of shock waves
  - Underground – buried structures
  - Aboveground – terrorist attacks
  - Conventional
  - Nuclear
- Ph. D. Dissertation
  - Improving the computer simulation of underground explosions

Water Wells

- Wells near the quarry are fragile
- Personal Experience
  - First 3 wells were dry. 4th well, 100' from dry wells, produces 10+ gal/min
  - CDOT performed a pre-blast survey on our well, when CDOT was contemplating blasting for Highway 115 widening. Our well is 2500' from the proposed blast area. CDOT did not perform any blasting during widening.

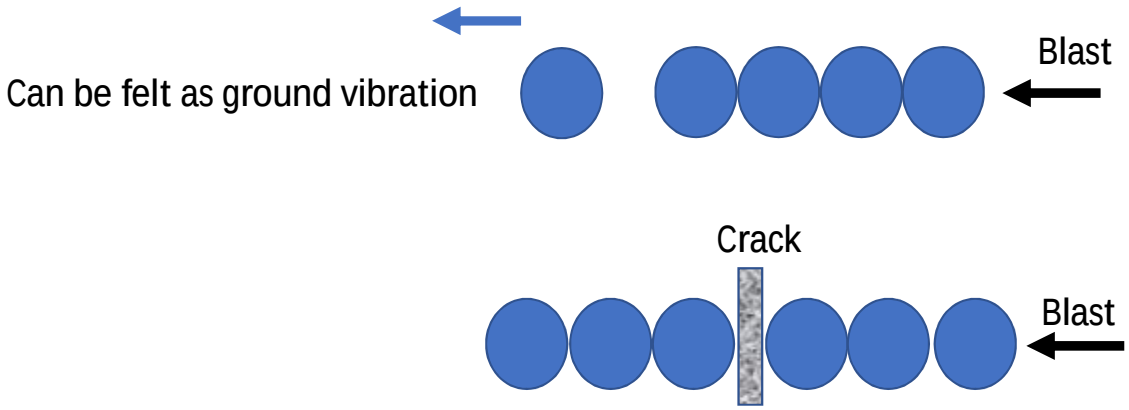


Wells Near Quarry



Blast Waves Caused by Quarry Blasting

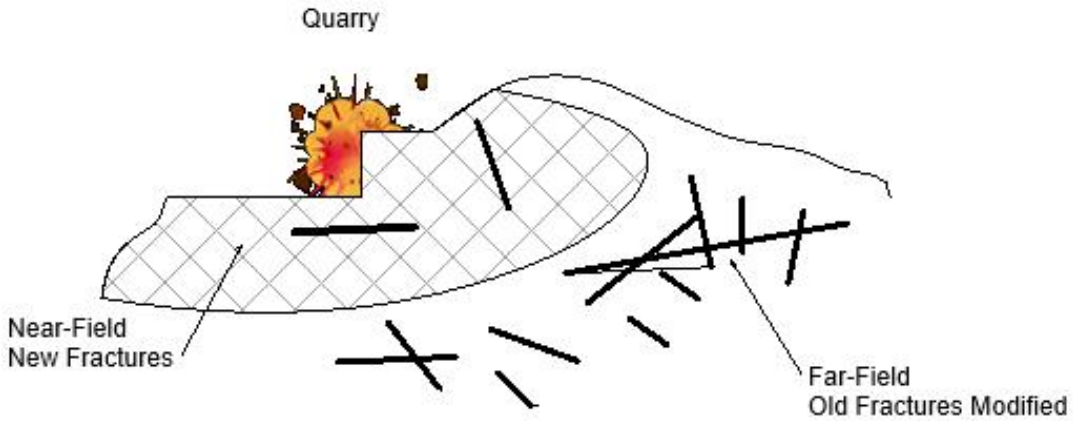
- Billiard Ball Analogy



- Crack Closes or Opens

Cracks Are Affected by Blast Waves

- Cracks are created and/or modified by blast waves (shock waves).
  - Depends on rock material properties, crack material, stress wave characteristics/path, and blast characteristics
  - Close to the blasting new fractures are created
  - Away from the blasting old fractures are modified



Blast Waves in Granite

- Experimental evidence has shown that blast waves are transmitted over 200 times farther in granite than in alluvium (sand, silt).
- Current monitoring wells are not sufficient.
  - They will not intercept the fissures (cracks) that supply the property owners wells.
- High Potential for Affecting 6 Nearby Wells

Changes to Fractures Are Problematic

- The Effects on Nearby Water Wells is Unknown and NOT Predictable
- Underground Water Will have its Path Changed
- Blasting Will Change the Fractures in the Rock
  - New Fractures will be Added – Near Field
  - Far Field cracks will be modified – opened or closed
- The modifications to cracks will be progressive over time
  - Damage will be cumulative, it may take years for damage to show at far wells

Brett A. Lewis PE, PhD

11050 South Hwy 115, Colorado Springs, CO 80926

Tel: (719) 330-3490 Brett@brettnbarb.com

SUMMARY

Extensive experience in research and analysis: material models, blast effects on structures, shock wave effects on materials. Registered Professional Engineer (Colorado PE #24373). U.S. Citizen. Doctorate in Mechanical Engineering , Master of Science in Civil Engineering, Bachelor of Science in Civil Engineering.

EXPERIENCE

Owner, Dakota Ridge Engineering, Inc, Colorado Springs, CO 2015-present

Provide forensic evaluation and design of commercial and residential structures. Structures consist of steel, concrete and wood framed structures, both new and renovated.

Neumann Systems Group, Colorado Springs, CO 2011-2015

- Provide analyses and design in support of prototype pollution control system. First commercial application of the system. Provide design concepts and support construction of full size system

Owner, Dakota Ridge Engineering, Inc and Dakota Ridge Home Inspections, Inc. 2000-2011
Colorado Springs, CO

- Provide evaluation and design of commercial and residential structures. Structures consist of steel, concrete and wood framed structures, both new and renovated.
- Developed finite element analysis material models(soil and concrete) for Federal Highway Administration as a consultant to APTEK, Inc
- Owner of local franchise for Pillar to Post Home Inspections.

Principal Engineer, APTEK, Inc, Colorado Springs, CO 1983-2000

- Competed for, obtained and completed research on blast effects on structures (Military and civilian, Pentagon, World Trade Center, etc). This research included analysis of shock waves on buried structures. Also developed predictive analysis methods and test correlation methods and participated in competitive analytical predictions of field test results.
- Managed projects with Defense Threat Reduction Agency(DTRA), Defense Nuclear Agency (DNA), U. S. Air Force, Federal Highway Administration.
- Provided analysis and research in design of composites
- Provided analysis of nuclear weapon effects on structures
- Developed analysis methods for non-linear structural behavior modeling

Member of Technical Staff, Sandia National Laboratory Albuquerque, NM 1980-1983

- Developed computer methods for non-linear analysis of impact on structures.
- Developed computer graphic methods.
- Analyzed structures with finite element methods.

Research and Teaching Assistant, University of Arizona, Tucson AZ 1978-1980

- Taught strength of materials and statics to undergraduates Civil Engineering dept. Awarded 2 teaching awards
- Performed structural finite element analysis of optics for Airborne Laser Laboratory, Optical Science Dept
- Performed analysis and testing for design methodology of steel connections, Civil Engineering Dept.

EDUCATION

University of Colorado, Boulder

Doctor of Philosophy, Mechanical Engineering, 1994

Dissertation- Doubly asymptotic approximations for non-reflecting boundaries in transient elastodynamics. The use of computer simulation in predicting the effects of underground blasts.

University of Arizona, Tucson

Master of Science, Civil Engineering, 1980

Master Report – The analysis and design of single plate framing connections.

Bachelor of Science, Civil Engineering, 1978.

SELECTED ARTICLES, PAPERS, REPORTS,

Lewis, Brett A., **Manual for LS-DYNA Soil Model 147**, Federal Highway Adminstation, FHWA-HRT-04-095, Nov 2004

Lewis, B.A., Murray, Y.D., Lewis, B.B., **Behavior of Concrete Structures Subjected to Ballistic Impacts**, Presented ASME International Mechanical Engineering Congress and Exposition, 1997

Geers, T. L., Lewis B. A., **Doubly Asymptotic Approximations for Transient Elastodynamics, Int. J. of Solids and Structures,** Vol 34, No 11, 1997

Lewis, B. B., Lewis, B. A., **Analysis of Reinforced Concrete Structures Subjected to Airblast and Fragment Loads**, Engineering Mechanics Proceedings of 10th Conference**,** May 1995.

Lewis, Brett A., **Verification and Validation of a Damage Degradation Model for Concrete**, 65th Shock and Vibration Symposium, San Diego, CA., Oct 1994.

May, R. A., Preece, D. S., Lewis, B. A., **Analysis of Nuclear Material Shipping Containers Using a Three-Dimensional, Dynamic Finite Element Program**., 7th Int. Symp. Packaging and Transportation of Radioactive Materials, May 1983.

Richard, R. M., Gillett, P.E., Kriegh, J.D., Lewis, B.A., **The Analysis and Design of Single Plate Framing Connections**, Eng Journal AISC, 1980.

INTERESTS

Teaching, material modeling of non-linear materials, risk engineering.

REFERENCES

Will be provided upon request.

McGrane Water Engineering, LLC

1669 Apple Valley Rd. , Lyons, CO 80540 • Office: (303)823-5933, Cell: (303) 917-1247
E-Mail: dennis@mcgranewater.com. Website: www.mcgranewaterengineering.com

April 9, 2018

Mr. Steve Mulliken
Mulliken Weiner Berg & Jolivent, P.C.
102 South Tejon Streeet, Ste., 900
Colorado Springs, Co. 80903

Via email at: mulliken@mullikenlaw.com

RE: Hitch Rack Ranch Quarry Permit Application – Opinions of Dennis McGrane Regarding Groundwater Issues

Steve:

This report summarizes my opinions to date concerning the application for the Hitch Rack Ranch (HRR) quarry permit application (File NO. M-2017-049) submitted by Transit Mix Concrete Company (Applicant) to the Colorado Division of Reclamation Mining and Safety (CDRMS). My focus was on ground water impacts as described in Section G of the Transmit Mix Application cited below.

I have reviewed the following documents:

1) Bishop Brogden and Associates (BBA), February 18, 2016. Attachment G-2 Water Resources Summary; Memo titled *"Transit Mix – Hitch Rack Ranch – Review of Potential Ground and Surface Water Impacts Associated with the Proposed Hitch Rack Ranch Quarry."*
2) Colorado Division of Reclamation Mining and Safety (CDRMS), April 3, 2018. *Recommendation to Approve a 112c Permit Application with Objections, Transit Mix Concrete Co. Hitch Ranch Quarry, File N-2017-049*
3) Colorado Division of Water Resources (CDWR), January 4, 2018. Response to Reclamation Permit Application Consideration (File no. M-2017-049). Memorandum from Caleb Foy, P.E. to Amy Eschberger, Environmental Protection Specialist.
4) Transit Mix (TM), November 9, 2017, Hitch Rack Ranch Quarry 112 Permit Application – Attachment G – Groundwater and G-2 (Hydro-Logic Solutions (HLS), Inc. October, 4, 2017. *"Hitch Rack Ranch Hydrogeology and Impact Analysis")*
5) Transit Mix, February 19, 2016, Hitch Rack Ranch Quarry 112 Permit Application; Exhibit G – Water Information and Exhibit 6.5 –Geotechnical (Includes Norwest, January 26, 2015. Memo titled *"HRR Pit Wall Geotechnical Assessment –Rev. B"*

This letter presents my technical concerns and comments to the above referenced reports on behalf of Mr. Warren Dean who lives immediately downstream of the proposed pit. Mr. Dean owns two decreed bedrock wells within a few thousand feet of pit so he will be adversely impacted. I also have also

reviewed the expert report by Bill Sanford, Ph.D. (Water Telluric, llc) and share his technical concerns about the model. Based on my review of all the Applicant's reports and my independent analysis briefly described below and in the attached PowerPoint presentation (Appendix A), I conclude that the Applicant's proposed mine:

1. will upset the hydrologic balance;
2. will impact surface and groundwater rights;
3. will result in impacts that cannot be mitigated; and
4. will unfairly impact dozens of people's lives.

Hydrologic Balance

The hydrologic balance includes the inflow and outflow components of the groundwater and surface water system. Groundwater recharges upstream from the site and works its way through fractures in granitic rock and feeds downstream streams. Just downstream from the proposed mine site is a fault where the bedrock changes from granite to sandstone. We identified over 50 permitted wells within two miles of the mine that use groundwater. If the mine is installed, it will disturb groundwater pathways to the wells and streams that are not well understood.

We will demonstrate in Appendix A and in our testimony that the Applicant did not:

1) Adequately characterize the aquifer including:
    a) Conduct any geologic mapping of fracture locations, densities, or orientation that is necessary to understand how water actually moves through the bedrock aquifer across the mine site and in what direction;
    b) Evaluate existing well data from vicinity wells including well depth, water table elevation, saturated thickness, permeability, and water quality that are critical to understanding the hydrologic system;
    c) Determine the permeability and storage properties of the granitic or sandstone bedrock aquifers by conducting pumping tests on test wells they installed;
    d) Install monitoring wells on either side of the fault to evaluate the hydraulic connection;
    e) Install enough nested piezometers to characterize the site and provide adequate future monitoring;
    f) Consider vicinity well levels, perennial stream elevations, and seep elevations to prepare an accurate pre-mine condition "average" water table map;
2) Select a model software that simulates fracture flow at a scale consistent with observed gradients and "dry holes" on the site;
3) Conceptualize a model that is consistent with multiple level observations:
4) Properly define boundary conditions that allow flow through or along the fault;
5) Show their model grid, mass balance, or mass balance error;
6) Calibrate the model to observed vertical gradients and regional water levels across the fault;

7) Evaluate the sensitivity and uncertainty of the model results to a range of critical model parameters including bulk aquifer permeability, aquifer thickness, and storage properties;
8) Provide a worst case scenario resulting from a combination of geologic and model parameter uncertainty;
9) Install a broad effective monitoring network that could detect changes in water levels, water quality or the hydrologic balance;
10) Provide any assurance that their groundwater model would be validated and updated based on future data collection efforts.

These inadequacies alone justify that the Applicant's permit be denied.

Impacts to Water Rights

The Applicant relied heavily on a BBA (2016) to evaluate the impacts on senior groundwater and surface water rights. BBA states that "the mining plan does not include the exposure of ground water," and because "ground and surface water will not be developed for water supply, there is no potential for depletion to local ground and surface water supplies or water rights." HSI's (2017) Hydrologic Impact report contradicts this previous (submitted in support of the 2016 Application) conclusion. HSI "predicts mine inflows will range from less than 20 gpm to about 50 gpm over most of the mine life with a maximum of about 100 gpm during Phase 4 of the mining operations when the mining intercepts the thickest sequence of saturated rock." Using HSI's Figure 4-1, we estimate an average inflow of approximately 50 gpm over 40 years, and calculate over one billion gallons of water (over 3,226 acre-feet) will drain from the pit area over that period as shown in Table 1.

Table 1 - Mine Inflows Per HSI, 2017 Fig. 4-1		
Mine Life =	40	Years
Avg. dewatering rate =	50	gpm
Avg. dewatering rate =	81	af/yr
Total over 40 years =	1,051,200,000	gallons
	3,226	af

This represents a continuous average depletion rate of approximately 81 af/yr. This volume could be more than the entire cumulative pumping of all vicinity wells.

HSI's model results, although inaccurate, contradict BBA's 2016 conclusion that "groundwater will not be exposed." I believe, as the model confirms, that thousands of acre-feet of groundwater are going to exposed. The exposed groundwater is going to: evaporate in detention ponds; be consumed by proliferating vegetation in the stream channel; recharge downstream; and consumed by diverters who may or may not be in priority. This disruption of the hydrologic balance will affect Mr. Warren Dean whose adjudicated wells (case no.16CW3064) are located approximately ½ mile downgradient from the pit. It will also cause depletions to surface water rights on LTC belonging to Ft. Carson (case no. 81CW0110, CA13693) and

Walker Ranch (case no. CA13693). It is unfortunate that the Applicant did not construct a model large enough to actually quantify these impacts. This disruption to the hydrologic system and impact to downstream water rights is irresponsible, unfair and cannot be mitigated.

Regulatory Mistake

Stunningly, having reviewed the 2017 Application, the CDWR (2018) literally "checked the box" on their condition of approval stating, "the proposed operation does not anticipate exposing groundwater, but does anticipate small amounts of water will be incidentally encountered during the mining process. Therefore, the Office of the State Engineer has determined that a well permit to expose ground water….and an associated substitute water supply plan for augmentation is unnecessary." In the next sentence, the author of the CDWR memo, Caleb Foy, P.E. states that "exposure of ground water must not occur during or after mining operations and any water that is incidentally encountered ……must be returned to Little Turkey Creek, or the ground water system within the permit area, immediately without consumption." CDWR also requires in their approval letter that the Applicant "shall consult with the local Water Commissioner (Doug Hollister) regarding any activity that might affect the flow of water to any stream system and /or ditch." We are uncertain whether Mr. Hollister has ever been contacted or asked to evaluate potential impacts.

According to their April 3, 2018 "Recommendation to Approve," the CDRMS relies on CDWR to determine whether the Application is in compliance with Colorado water laws and regulations governing injury to existing water rights. CDWR states, "that the DWR determined a well permit and substitute water supply plan, or plan for augmentation, would be unnecessary given the incidental amount of water encountered during the mining process."

It is a huge mistake that CDWR believes that over 3,200 acre-feet of groundwater intercepted over 40 years (~81 af/yr) is "incidental." When I called Mr. Foy on March 27, 2018, to discuss the State's opinion of the HSI model, he said that CDWR "did not evaluate it." He said, there was "no administrative need" because "the Applicant claimed that groundwater would not be permanently exposed or put to beneficial use. In other words, CDWR did not critically evaluate the Impact Report prepared by the Applicant ….unbelievable! Therefore, they did not require a well permit."

<u>This regulatory mistake needs to be corrected and it is within the power of the CDRMS board to do so by denying this permit.</u>

Conclusions

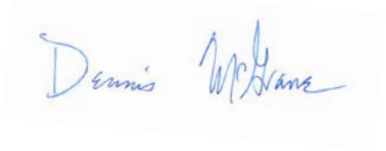
I conclude:

1) Over 50 permitted water wells are located within approximately two miles of the HRR mine site;
2) For most neighbors, their well is their only source of water;

3) The site hydrogeology is extremely complex as evidenced by the lack of groundwater encountered in over half of the test holes drilled around the HRR mine site, while other monitoring wells experience steep upward and downward gradients.
4) The model used to evaluate Hydrologic Impacts is overly simplified, poorly conceptualized, and not calibrated; therefore it cannot accurately predict hydrologic impacts.
5) The mine will dewater approximately 150 feet of rock and intercept groundwater going to wells and downgradient streams.
6) Although the model predictions are uncertain, the model reveals that thousands of acre-feet of groundwater will be exposed during the life of the quarry.
7) Based on a water table map we prepared (Appendix A), numerous downgradient wells will be impacted by water level declines and contaminated source water. Impacts cannot be reliably mitigated.
8) The Applicant did not evaluate impacts to senior water rights which will occur.
9) Ironically, the CDWR failed to evaluate the Applicant's Impact report (HSI, 2017) and therefore did not require a well permit and therefore no plan for augmentation;
10) Transit Mix also apparently failed to contact the CDWR division surface water engineer, Doug Hollister to obtain his written opinion concerning impacts to water rights.

<u>We request that the CDRMS do the right thing, and despite CDWR's mistaken approval, deny the permit based on undeniable, irreversible hydrologic impacts simulated by the Applicant's groundwater model (HSI, 2017).</u>

Sincerely,
McGrane Water Engineers, Inc.



Dennis McGrane, P.E., C.P.G

Appendix A – PowerPoint Presentation

Technical Review of HRR Quarry Application – Impacts to the Hydrologic Balance and Existing Water Rights



By: Dennis McGrane P.E, C.P.G

April 6, 2018

QUALIFICATIONS

- Professional Engineer and Geologist
- Education: Dartmouth College B.A. in Geology, 1985;
- ~33 years of consulting engineering and hydrogeology experience;
- ASCE Certified Expert Witness (#50) in groundwater hydrology, groundwater modeling, and groundwater rights engineering;
- Experienced groundwater modeler to support other mine applications (See Resume).
- Conducted a site visit in October, 2017.

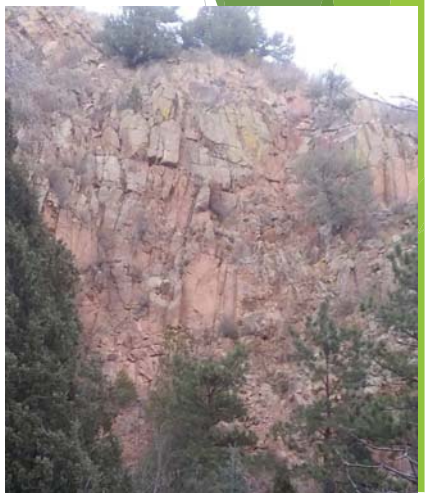
OUTLINE

- Hydrogeology;
- New well data;
- Aquifer Characterization;
- Model Selection and Conceptualization;
- Model Results; and
- Regulatory Review

COMPLEX HYDROGEOLGY

Faults and Fracture Flow

- "Major geologic structural features have a significant hydrogeologic influence on the ground water systems (Hydrologic Solutions Inc. (HSI), 2017.pg. 2-13)"



COMPLEX HYDROGEOLGY



- Open fractures in fault zone allow flow through fault. Any change in quantity or quality of groundwater is an impact to homeowners



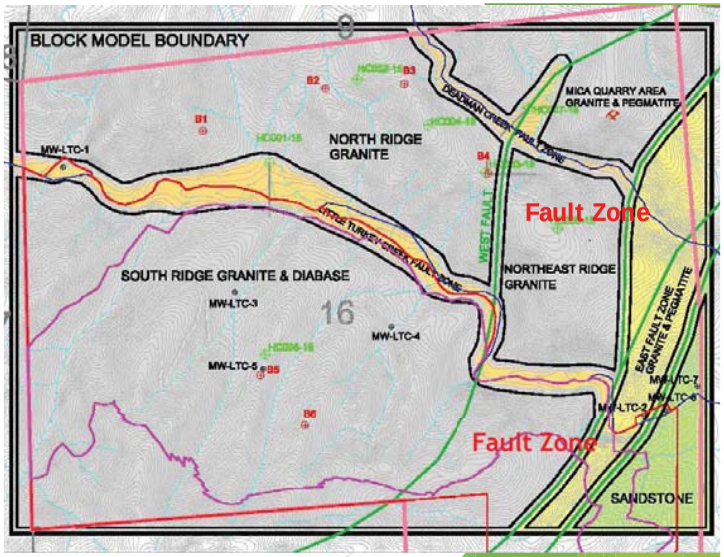
NEW DATA

- 7 nested piezometers
  - Reveal upward and downward gradients;
- Stream gages
  - Large variation in flow
  - synoptic measurements - Oct., 2016 (base flow)
- Groundwater model to evaluate impacts

ALL GEOHYROLOGIC DATA

- Red: 2014 Boreholes
- Green: 2015 Core holes
- Black 2016 Monitoring Wells

Source: HSI, 2017



NEW DATA

6 New Test Wells and SW monitoring Sites

- Purple: 2017 Monitoring Wells
- Blue: SW monitoring points

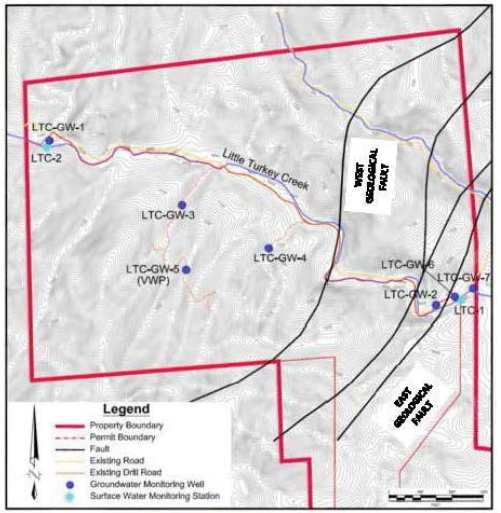


FIGURE 2-5: SURFACE AND GROUNDWATER MONITORING STATIONS AT THE HRR QUARRY AREA

NEW DATA – 7 Nested Wells

Depth ID	Monitoring Well Name						
	LTC-GW-1	LTC-GW-2	LTC-GW-3	LTC-GW-4	LTC-GW-5	LTC-GW-6	LTC-GW-7
1	30	30	15	12	345	24-29	27
2	55	46.5	40	36.8	395	44-49	48
3	90	69	100	51			87
4			180	100			
				164.5			
				190			
Used for "Potentiometric Elevations for Groundwater" Map (Fig. HSA_Fig. 3-2)							

Source: HSI, 2017

HSI IMPACT ANALYSIS

- Target water levels "~100 feet below the surface" using 7 data points.

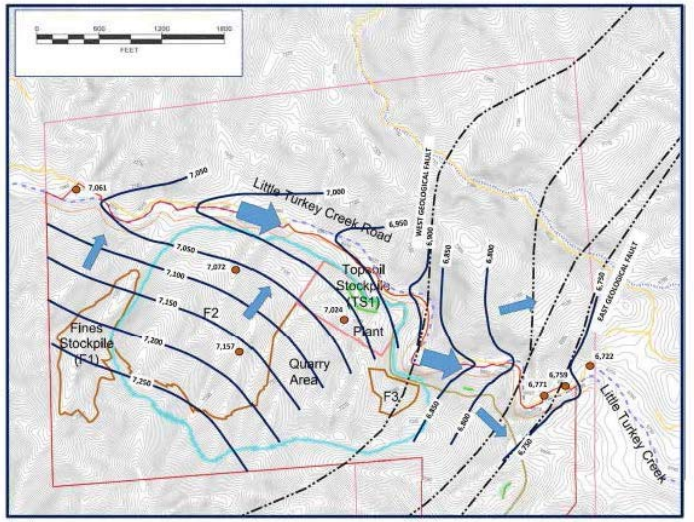


FIGURE 3-2: POTENTIOMETRIC ELEVATIONS FOR GROUNDWATER

Source: HSI, 2017

NEW DATA – Surface Water Measurements

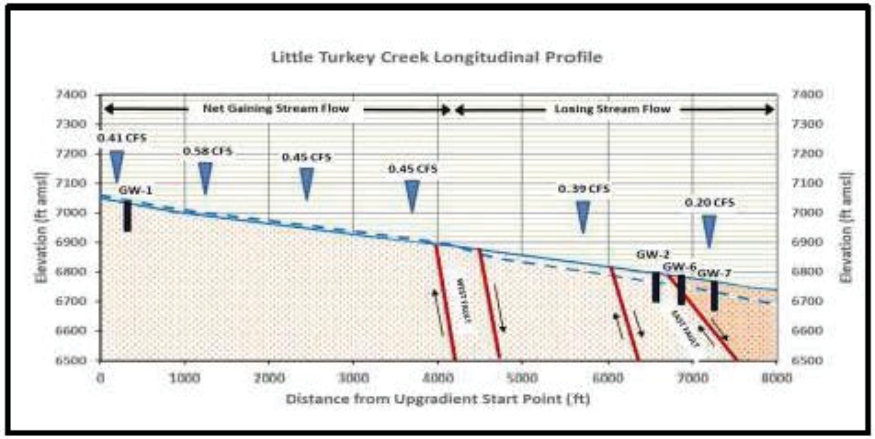
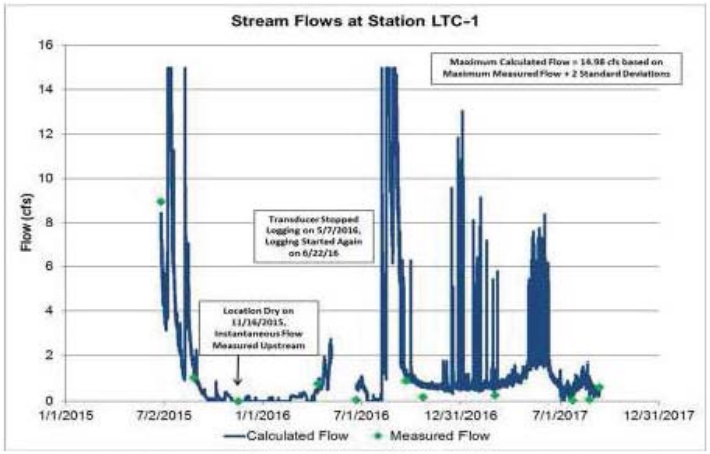


FIGURE 2-8: GAINING AND LOSING REACHES ALONG LITTLE TURKEY CREEK (OCTOBER 24, 2016)

NEW DATA – Surface Water Measurements

- Base Flow = 0.04 cfs



Source: HSI, 2017

FIGURE 2-6: DISCHARGE HYDROGRAPH (JUN 2016 TO AUG 2017) FOR LTC-1 STATION

Aquifer Characterization – TM failed to:

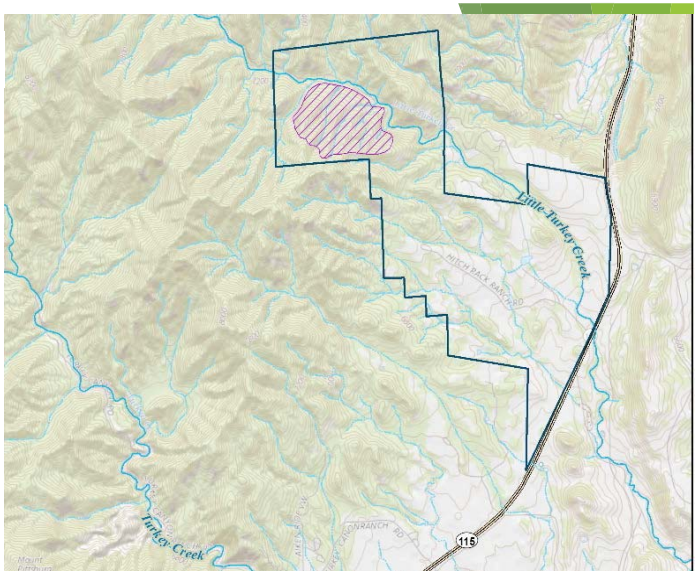
- Conduct any detailed geologic mapping (measure strike and dips of joints, fractures); measure fracture density; map zones of lower permeability that would support the use of a "no flow" fault boundary;
- Utilize any of the vicinity well completion and testing reports to define well depth, water table elevation, saturated thickness, permeability, and water quality;
- Conducting any pumping tests to determine granitic or sandstone aquifer permeability and storage properties;

AQUIFER CHARACTERIZATION – TM failed to:

- Install monitoring wells on either side of the fault;
- Install enough nested and "average" water level piezometers;
- Prepare a pre-mine "average" water table/potentiometric surface map that includes: vicinity wells, and stream and seep elevations.

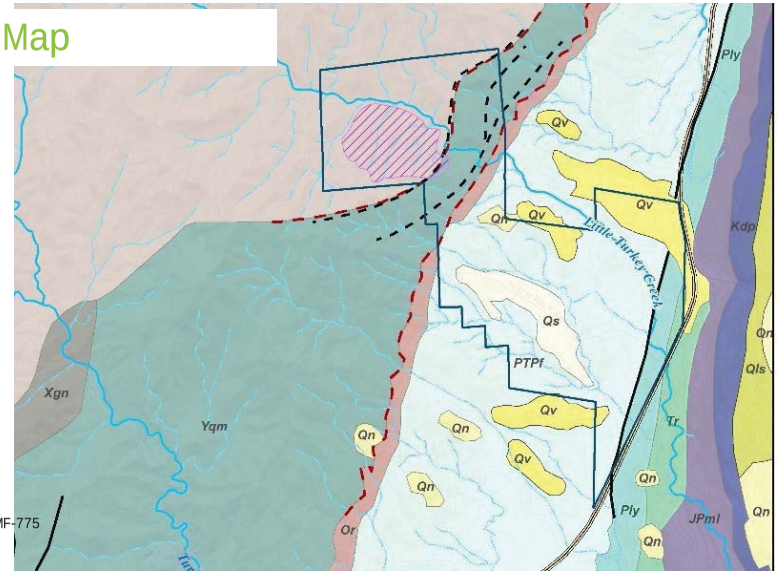
Water Table Map

- Using "Average" water levels on a regional scale.



Water Table Map

- Geology and faults



Source: Scott et al., 1976. USGS MF-775

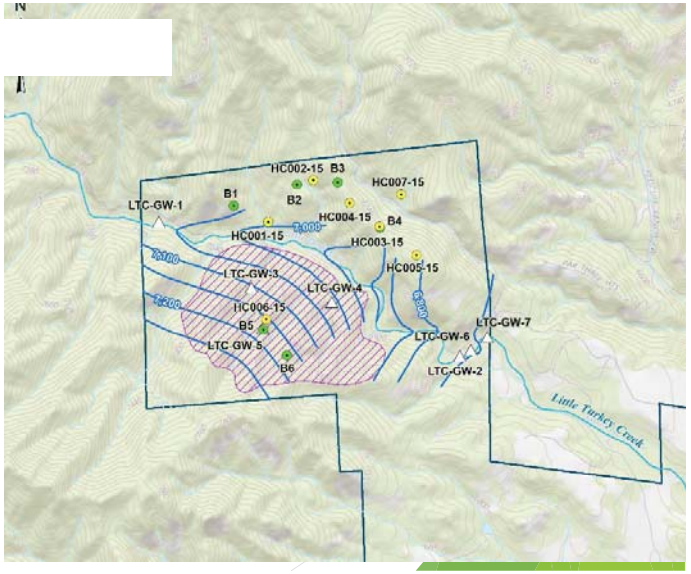
Water Table Map

- HRR data:

Green: Test holes

Yellow: Core holes

White: Monitoring wells



Water Table Map

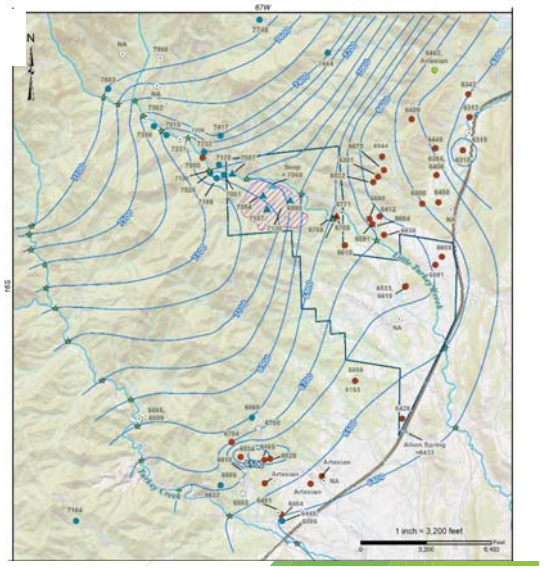
- Approximately 50 domestic wells within 2 miles of the site

Source: SEO well database: http://www.dwr.state.co.us/WellPermitSearch/default.aspx



Water Table Map

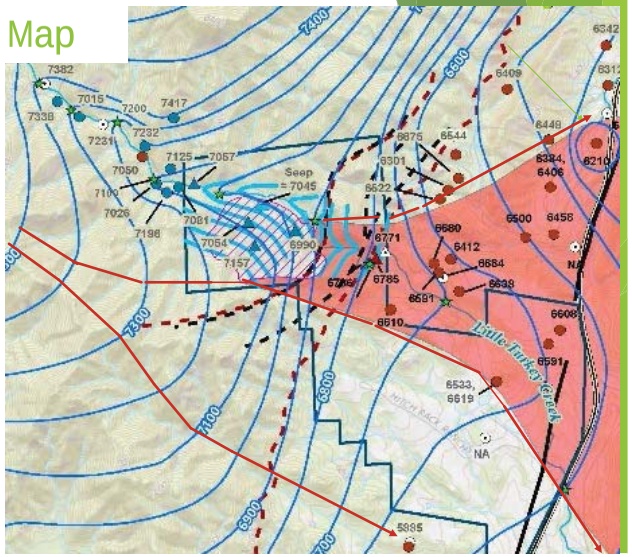
- Contoured water levels crosses the fault
- "Average" fracture flow on regional scale is perpendicular to the contours
- Flow through individual fractures at the mine scale is difficult to predict



Regional Water Table Map

- Numerous "downgradient" wells will be significantly impacted

"Average" groundwater flow direction



MODELING – What is a model?

- Used to simulate groundwater flow and surface water interactions using mathematical relationships;
- Uses "boundary conditions" to simulate the edges of the model, surface water features, and model inflow and outflow characteristics;
- Needs to be "calibrated" to real world conditions; and
- Can be used to simulate impacts (ie. changes);
- Should be validated to confirm it works

MODEL CONCEPTUALIZATION - TM did:

- Assumes a single model layer;
- Assumes "fault core" is a "no-flow" boundary;
- Assumes all groundwater inflows = the net stream gain (0.04 cfs);

MODEL CONCEPTUALIZATION – TM did not:

- Consider numerous "dry" test/core holes;
- Consider multiple water level observations;
- Consider flow through or along the fault;
- Consider any possible error in their assumptions or results
- Show their model grid, model mass balance, or mass balance error;

MODEL CALIBRATION

- Targeted .04 cfs and seven measured water levels 100 ft below the surface ????
- Did not calibrate the model to observed vertical gradients or water levels across fault?;

MODELED IMPACTS

- 40 year drawdown (150-200 feet)

Exposure of groundwater in Pit

Source: HSI, 2017

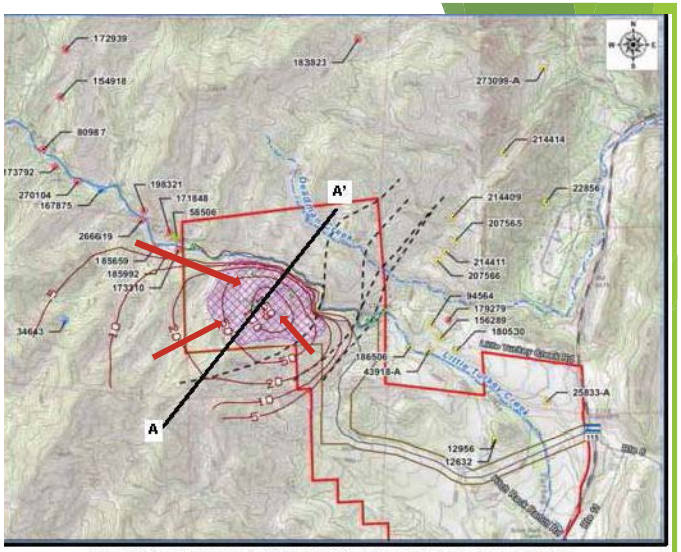


FIGURE E-9: PROJECTED POTENTIOMETRIC DRAWDOWN AT THE END OF PHASE 4 OF MINING

MODELED IMPACTS – Dewatered Rock

- Dewatered vol. ~ 288 af

Groundwater in Rock Removed (per HSA, 2017, Fig. C-11)		
Pit Radius	1000	ft
Avg. drop in water level	100	ft
Porosity	0.04	
Volume	12,560,000.00	ft^3
	288	acre-feet

Source: HSI, 2017

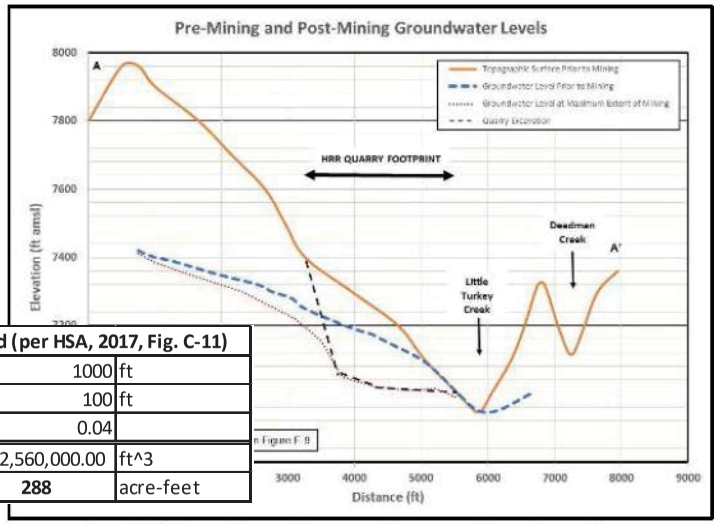


FIGURE E-11: X-SECTION OF PROJECTED POTENTIOMETRIC DRAWDOWN AT MAXIMUM EXTENT OF MINING

MODELED IMPACTS – Intercepted Groundwater (HSI, 2017, p. 4-3)

- Dewatering Rate 20-100 gpm for ~40 years

Source: HSI, 2017

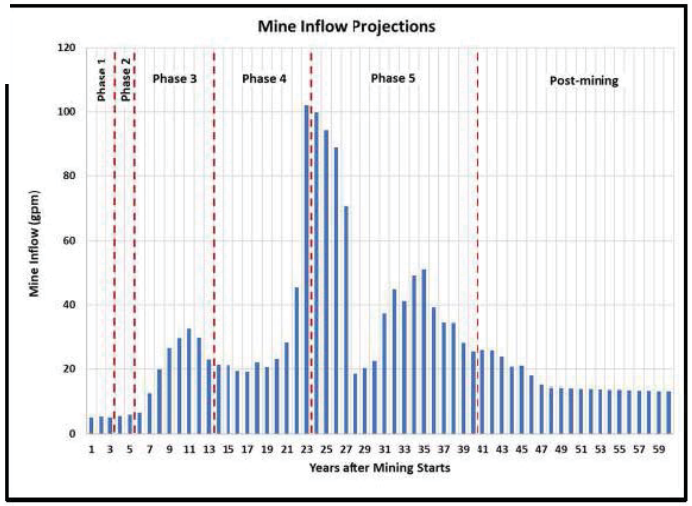


FIGURE 4-1: PROJECTED MINE INFLOW OVER THE COURSE OF MINING AND RECLAMATION OPERATIONS

MODELED IMPACTS – Intercepted Groundwater (per HSI, 2017, p. 4-2)

Table 1 - Mine Inflows Per HSI, 2017 Fig. 4-1		
Mine Life =	40	Years
Avg. dewatering rate =	50	gpm
Avg. dewatering rate =	81	af/yr
Total over 40 years =	1,051,200,000	gallons
	3,226	af

MODELED IMPACTS – Intercepted Groundwater (HSI, 2017, p. 4-3)

- Dewatering Rate 20-100 gpm for ~40 years

Source: HSI, 2017

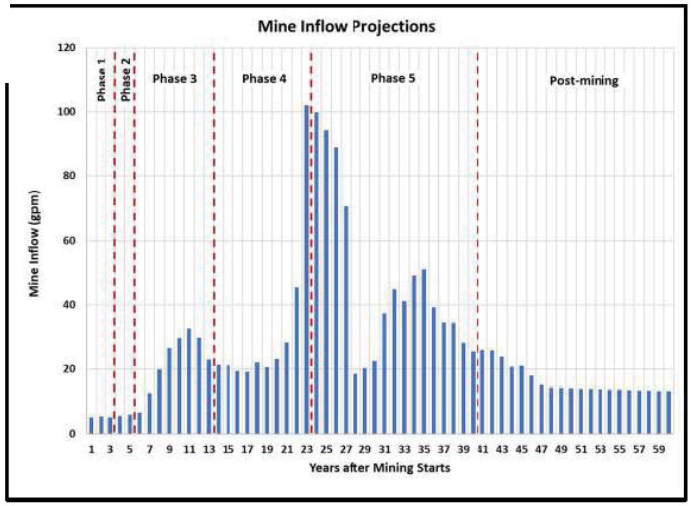
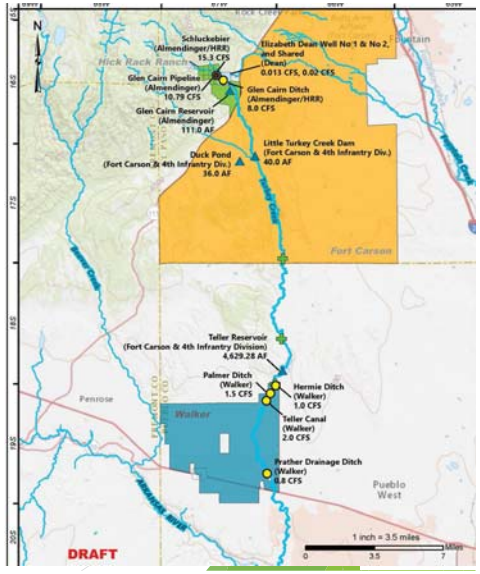


FIGURE 4-1: PROJECTED MINE INFLOW OVER THE COURSE OF MINING AND RECLAMATION OPERATIONS

IMPACTS TO SENIOR WATER RIGHTS



Sources: SEO database: http://cdss.state.co.us/onlineTools/Pages/StructuresDiversions.aspx



IMPACTS TO SENIOR WATER RIGHTS

WDID	Structure_Name	Structure_Type	Water_Source	Associated_Case_Numbers	Contacts
1000769	GLEN CAIRN DITCH	DITCH	LITTLE TURKEY CR	79CW0180, 79CW0181, CA19693	ALMENDINGER, ROSEMARY; HITCH RACK F
1000770	GLEN CAIRN PIPELINE	PIPELINE	LITTLE TURKEY CR	79CW0181, 84CW0053, 89CW0014, CA19693	ALMENDINGER, ROSEMARY
1003754	LITTLE TURKEY CREEK DAM	RESERVOIR	LITTLE TURKEY CR	81CW0110	FORT CARSON & 4TH INFANTRY DIVISION
1003912	DUCK POND	RESERVOIR	TURKEY CREEK	81CW0110	FORT CARSON & 4TH INFANTRY DIVISION
1400547	HERMIE DITCH	DITCH	TURKEY CREEK	CA13693	WALKER, GARY
1400548	PALMER DITCH	DITCH	TURKEY CREEK	CA13693	WALKER, GARY
1400597	PRATHER DRAINAGE DITCH	DITCH	TURKEY CREEK	CA13693	WALKER, GARY
1400604	TELLER CANAL	DITCH	TURKEY CREEK	CA13693	WALKER, GARY
1003608	TELLER RESERVOIR	RESERVOIR	TURKEY CREEK	CA13693, CA13693-25	FORT CARSON & 4TH INFANTRY DIVISION
1003530	GLEN CAIRN RESERVOIR	RESERVOIR	LITTLE TURKEY CR	79CW0180, 79CW0181, CA19693	ALMENDINGER, ROSEMARY
1000882	SCHLUCKEBIER DITCH	DITCH	LITTLE TURKEY CR	83CW0015, 84CW0053, 89CW0014, W4734	ALMENDINGER, ROSEMARY; HITCH RACK F
1009522	TURKEY CREEK AB TELLER RES NEAR STONE CITY, CO.	STREAM GAGE	TURKEY CREEK		
1009523	TURKEY CREEK BELOW HWY 115 AT FORT CARSON, CO	STREAM GAGE	TURKEY CREEK		
1009524	TURKEY CREEK NR STONE CITY, CO	STREAM GAGE	TURKEY CREEK		
1008450	ELIZABETH DEAN WELL NO 1	WELL	GROUNDWATER:	16CW3064	
1008451	ELIZABETH DEAN WELL NO 2	WELL	GROUNDWATER:	16CW3064	
1008452	ELIZABETH DEAN SHARED WELL	WELL	GROUNDWATER:	16CW3064	

MODELED IMPACTS - TM did not:

- Conduct an uncertainty analysis;
- Evaluate the sensitivity of the model results to a range of possible parameter values;
- Discuss or model a “worst-case” scenario;
- Use results to improve monitoring network;
- Require the model be “validated” or updated.

REGULATORY MISTAKE

- CDWR (2018) "mistakening" does not acknowledge that groundwater is going to be exposed;
- CDWR did not acknowledge impacts discussed in Applicant's Impact Model (HSI, 2017);
- CDWR did not require a well permit;
- CDRMS staff is apparently following DWR's recommendation

CONCLUSIONS

- The groundwater hydrology is complex;
- Very little field work was done;
- The model is overly simplified and not calibrated to observed gradients;
- The modeled impacts to the hydrologic balance are immense (81 af/yr of depletions);
- The mine will "break the pipes" going to vicinity wells;
- No water rights impacts were evaluated;
- Hydrologic balance will be disrupted and "impacts" will not and cannot be mitigated;
- CDWR should not have approved this permit; and
- It's imperative that CDRMS board recognize this regulatory mistake the permit.

DENNIS R. McGRANE, P.E., C.P.G.

1669 Apple Valley Rd. Lyons, Co. 80540. Phone: W. 303.823.5933, C. 303.917.1247

Email: dennis@mcgranewater.com

EDUCATION

B.A., Geology, Dartmouth College, New Hampshire, 1985

Colorado School of Mines Short-Course: Beyond Porosity: Lithology from Logs for Geologists, March, 2015.

PROFESSIONAL REGISTRATIONS AND CERTIFICATIONS

-Professional Engineer, Colorado, #33232
-Registered Geologist, Arizona #26038
-Professional Geologist, Utah #8696882-2250
-Professional Engineer, Utah #8696882-2202
-A.I.P.G. Certified Professional Geologist#9621
-Professional Geologist, Wyoming, PG-422

-ACEC Certified Expert Witness (#50), 2009 (Groundwater hydrology, groundwater modeling, and groundwater rights engineering)

EXPERIENCE

McGrane Water Engineering, LLC. (April, 2013 – present). Position: President.

Expertise includes groundwater supply studies, groundwater modeling, well and pumping system design, well rehabilitation, and Aquifer Storage and Recovery (ASR). Recent clients and projects include:

- J&T Consulting, Inc. MWE provided groundwater modeling services to evaluate the impacts associated with new gravel pits along the South Platte River (See Expert Testimony Section).
- Elbert County, Co. MWE used the USGS Denver Basin Groundwater Model (Paschke, 2011) to evaluate county wide the 2018-2050 groundwater declines and estimate aquifer life and sustainability within designated study areas (with Forsgren and Associates).
- Northern Water Conservancy District, City of Fort Lupton, Co., City of Fort Lupton, Co., and The Consolidated Mutual Water Company, Co. Ongoing water rights expert witness support services involving preparing and reviewing augmentation plans and computer modeling groundwater/surface water interactions (See Expert Testimony Section).
- Holsinger Law. Expert testimony services on behalf of the defendant who was involved in a deep water well fracking project near Castle Rock, Co.
- City of Ft. Lupton and Consolidated Mutual Water Company. 2013-2015 work involved conducting aquifer testing and expert witness services to support water rights cases 12CW180 and 07CW230 related to the Perry Pit alluvial wellfield.
- Alex Swank and Paul Swank, 2017. Evaluated the Feasibility of a Managed Aquifer Recharge Project in the Lost Creek Designated Groundwater Basin, Co. for Co. Division 1 Case No. 16CV30058 (See Expert Testimony Section).
- Green Valley Ranch Golf Course, Aurora, Co. Ongoing water supply planning (water level and yield projections) and well pump replacement design services to the for their eight deep (1,100 – 1,800 foot) wells.
- Castle Pines Metro District. Ongoing on-call engineering and O&M support for the District's 8 Denver Basin wells and pumps and conducting well level and production forecasts for long-term planning. Recently conducting a drilling and testing program to evaluate the feasibility of a horizontal well.
- City of Phoenix (with TetraTech, Phoenix, Az.). Designed a 4,000 gpm production well and 600 hp pumping system and conducted construction observation and testing.

- Peabody Energy, Kayenta, Az. (with TetraTech). MWE designed and implemented abandonment and rehabilitation procedures for 4 deep (3,700 – 5,000 feet) wells that involve perforating and sealing off various casing sections using "squeeze" cement techniques.
- Intrepid Potash, Wendover, Ut. Designed and observed construction, development and testing of a 1,500 foot deep nested piezometer and 1,300 foot 8-in. diameter test well. Also, evaluated the maximum annual aquifer pumping volume and pumping rates for 6 Brackish Aquifer wells.
- Eagle River Water and Sanitation District and Upper Eagle Regional Water Authority, Vail, Colorado. Provided plans and specifications and contractor management services to replace pumps for wells F3, F6, R6 and R7 (5 to 300 horsepower).
- Salt River Project, Phoenix, Az. Evaluated the feasibility of expanding the New River – Aqua Fria Underground Storage Project (NAUSP) with Leonard Rice Engineers, Inc.
- The Broe Group, Johnstown, Co. Evaluated the groundwater supply potential of "nontributary" aquifers in Northeastern Colorado.
- Triview Metropolitain District (with JDS Hydro Inc.), Monument, Co. Evaluated well logs and well completion reports to estimate sand thickness and potentiomentric surface; and review geophysical logs after drilling to determine screen locations for new Arapahoe Aquifer well.

Leonard Rice Engineers, Denver, Co. (1989-2000 and 2004-March, 2013). Position: Principal. Responsible for leading the Groundwater Section of LRE, project management and technical performance on groundwater related projects including:

- Expert witness for cases involving groundwater and surface water interactions in Arizona, Colorado and Idaho.
- Prepared a regional C-Aquifer MODFLOW computer model to industrial and municipal water uses in Northern Arizona (for the Salt River Project). Results were used for industrial water use planning; water rights negotiations (Gila River Adjudication); and evaluate groundwater/surface water interactions in the Little Colorado Basin.
- Creating a spreadsheet mass balance model (~250 worksheets) of the Phoenix Basin that involves annual surface water/groundwater interactions from 1859 - 1998. The database includes inflow and outflow parameters for numerous entities and includes over 200 linked worksheets.
- Characterizing the South Platte alluvial aquifer in the vicinity of Brighton using MODFLOW for the purpose of siting additional wells and determining the timing and location of stream depletions.
- Evaluating of the potential yield of a Montana groundwater basin for a large industrial facility using MODFLOW.
- Evaluated the feasibility of Artificial Recharge (ASR) Projects in Colorado and Arizona.
- Designing and observing drilling and testing of numerous alluvial wells (yielding 150 to 3,000 gpm), and numerous mountain bedrock wells.
- Designing and observing drilling and testing of deep, Denver Basin wells (yielding 150 to 450 gpm).
- Forecasting well yields for Front Range water districts, corporations, and golf courses; recommended well and pump replacement schedules; and designed and supervised installation of wells, pumps, motors, and controls for 1 hp to 200 hp (460 - 2,300 volt) systems.
- Appraisal of decreed groundwater rights for numerous Colorado entities.

Layne-Western Inc., Aurora, Co. (2001- 2004). Position: Project Manager.

Responsible for all aspects of Contractor project management including well and pumping system design, well testing and interpretation, aquifer evaluation and development, well rehabilitation design and implementation, and construction management.
Significant projects include:

- Design-build of the Saratoga National Fish Hatchery Upgrades that included replacing wells, pumping systems, pipelines, controls; and reprogramming the SCADA system.
- Design-build of the ASLAN Water Districts deep well pumping, control and SCADA system, and discharge piping and metering vaults.
- Design-build of the Tagawa Gardens and City of Fountain alluvial wells and pumping systems.

Bechtel Civil Inc., San Francisco, Ca. (1985-1988). Position: Staff Geologist.
Field experience included characterization of hazardous waste sites in New York, New Jersey, and Missouri. Contaminants were typically radionuclides and heavy metals. Responsible for borehole drilling, monitoring well installation, soil and water sampling, permeability testing, designing and implementing engineering testing programs, and writing geological reports. Supervised all subcontractor activities.

PUBLICATIONS AND CONFERENCE PRESENTATIONS

Monitoring and Modeling of Nonrenewable Groundwater supplies for Municipal Use. American Water Resources Association - Annual Water Resources Conference, Denver, Co., November, 2015.

Screening Level Subsidence Modeling Using MODFLOW. NGWA Summit Conference, Anaheim, Ca. May, 2012. Poster Session.

Determining Stream Depletions in Colorado Using MODFLOW, MODFLOW '98 Conference, Golden, Colorado; October, 1998.

Evaluation of the Pagosa Springs Geothermal Reservoir and Implications of Potential Additional Reservoir Development, ASCE Water Resources and Management Conference. Denver, CO, 1994 (w/Jon Ford).

Gila River Recharge Project as an Alternative to Buttes Dam, CONSERV90 National Conference and Exposition. Phoenix, AZ, 1990.

Complementing Radiologic Data with Geology: A Case History, Second Annual International Conference on Case Histories in Geotechnical Engineering. St. Louis, MO, 1988.

PROFESSIONAL ACTIVITIES

-Colorado Groundwater Association - Member
-American Institute of Professional Geologists – Member
-AWRA (Colorado Section) President-2011-2012; Vice President-2010-2011. Currently a member.
-American Society for Civil Engineers (ASCE) Managed Aquifer Recharge (MAR) Committee: Author: Chapter 9 – Data Collection and Analysis – Anticipated publication - 2015.
-Member 1984 and 1988 US Olympic Teams - Ski-Jumping.

EXPERT TESTIMONY

Colorado and Idaho cases include:

Gravel Pit Applications

McGrane Water Engineering, May 10, 2017. Letter report titled, "Bennett Pit – Slurry Wall Assessment" provided to J&T Consulting, Inc., Ft. Lupton, Co. The report was part of the Bennett Pit mine plan application File No. M-2016-085.

McGrane Water Engineering, July 13, 2015. Letter report titled, "Loloff Pit – Slurry Wall Assessment" provided to J&T Consulting, Inc., Ft. Lupton, Co. The report was in response to Loloff Contruction, Inc. – Loloff Pit – Adequacy Review Comments File No. M-1985-112.

Water Rights Cases - Last 5 Years (2012 - 2017)

Division 1 Cases No. 13CW3158. McGrane Water Engineering, LLC., June, 2017. Opinions to Date of Dennis McGrane Regarding Case 13CW3158, "Application for Conditional Underground Water Rights by Mertens. A 26(A)(2) Objector Disclosure. Prepared for the Northern Water Conservancy District.

Division 1 Case No. 16CV30058. Henrylyn Irrigation District v. Alex Swank and Paul Swank. Expert letter report titled, "Swank Parcel – Aquifer Recharge Evaluation." Dated December 27, 2017.

Division 2 Case No. 14CW4. Mountain Mutual Water Augmentation Company. Expert report titled, "Mountain Mutual Substitute Supply Plan" dated June 27, 2016.

Colorado Division 1 Cases No. 13CW3144 and 13CW3134. McGrane Water Engineering, LLC., October, 2015. Engineering Report titled, "Application for Conditional Underground Water Rights by Timbro Ranch Cattle Company, LLC." 26(A)(2) Objector Disclosure. Prepared for the Northern Water Conservancy District.

Colorado Division 1 Case No. 12CW180. McGrane Water Engineering, LLC., February, 2014. Engineering Report titled, "Perry Pit Wells – Stream Depletion Analysis." Response to Objector's 26(A)(2) Objector Disclosure for the Heit Pit Plan for Augmentation. Prepared for the City of Fort Lupton.

Colorado Division 1 Case No. 07CW230. McGrane Water Engineering, LLC., February, 2014. Engineering Report titled, "Perry Pit Wells – Stream Depletion Analysis." Response to Objector's 26(A)(2) Objector Disclosure for the Heit Pit Plan for Augmentation. Prepared for the Consolidated Mutual Water Company.

Water Rights Cases – Prior to 2012

Division 1 Case No. 2008CW163. Leonard Rice Engineers, Inc., September 13, 2010. 2 - Case No. 01CW258. Response to Objector's 26(A)(2) Objector Disclosure for Arapahoe Pit Plan for Augmentation. Prepared with Greg Roush and Jennifer Ashworth.

Division 1 Case No. 2006CW288. Leonard Rice Engineers Inc., and Miller Groundwater Engineering LLC, June 30, 2009 "Response to Objector's 26(A)(2) Disclosure Statements pertaining to The City

and County of Broomfield's 2006CW288 Storage and Exchange Case – Ground Water Related Issues." Expert report to Harvey Curtis and Associates.

Leonard Rice Engineers Inc., and Miller Groundwater Engineering LLC, August 14, 2009 "Response to Objector's Supplemental Expert Disclosures pertaining to Ground Water Issues in the City and County of Broomfield's 2006CW288 Storage and Exchange Case". Expert report to Harvey Curtis and Associates.

Division 1 Case No. 2004CW084. Leonard Rice Engineers, Inc., December 6, 2006. Expert Rebuttal to W&EST, Inc. Report – Case No. 2004CW084. (Subject: Rebuttal to Hydrosphere Ground Water Model of OWW site

Leonard Rice Engineers, Inc., December 6, 2006. Expert Rebuttal to W&EST, Inc. Report – Case No. 2004CW084. (Subject: Rebuttal to W&EST Inc. Ground Water Model of OWW site

Leonard Rice Engineers, Inc., January 23, 2007. Expert Disclosure – Case No. 2004CW084. (Subject: OWW Pumping Test OWW-4).

Leonard Rice Engineers, Inc., March 6, 2008. Supplemental Expert Disclosure – Case No. 2004CW084. (Subject: Revised Figures 1 and 3 to LRE January 23, 2007 Report.

Leonard Rice Engineers, Inc., March 6, 2008. Supplemental Expert Disclosure – Case No. 2004CW084. (Subject: Alluvial Aquifer properties and Aquifer Clay Distribution).

Leonard Rice Engineers, Inc., March 26, 2008. Supplemental Expert Disclosure – Case No. 2004CW084. (Subject: Response to Objectors).

Leonard Rice Engineers, Inc., August 1, 2008. Supplemental Expert Disclosure – Case No. 2004CW084. (Subject: Interpretation of OWW Pumping Test OWW-1).

Leonard Rice Engineers, Inc., August 14, 2008. Supplemental Expert Disclosure – Case No. 2004CW084. (Subject: Response to Objectors Questions Concerning August 1, 2008 Disclosure).

Division 1 Case No. 2001CW258. Leonard Rice Engineers, Inc., May 21, 2010. Opinions concerning SACWSD - Case No. 01CW258. Prepared with Ed Armbruster.

Idaho Department of Water Resources

Affidavit before the Idaho Department of Water Resources. Case Numbers: 36-02356A, 36-07210, and 36-07427 (Blue Lakes Delivery Call); and NOS. 36-04013A, 3604013B, and 36-07148 (Clear Springs, Snake River Farm Delivery Call). Subject: Opinions concerning the East Snake Plain Aquifer Model (ESPAM), September 12, 2007.

William E. Sanford Ph.D.
Hydrogeologist
Water Telluric, LLC

!967 Sandalwood Lane
Fort Collins, CO 80526
970-988-7256
watertelluric@gmail.com

Expertise: Flow and transport through fractured rock; development and application of groundwater tracers; use of isotopes and tracers to determine groundwater ages and sources; groundwater/surface water interactions; hydrogeophysics

Education:	Ph.D.	Soil and Water Engineering	Cornell University
	M.S.	Geophysics	Cornell University
	B.S.	Geology	Beloit College

Employment:	Colorado State University	1996 - present
	Research Scientist at Oak Ridge National Laboratory	4.5 years
	Independent Groundwater Consulting	1998 - present

Relevant Projects and Experience:

- 22 years of university teaching and research: Hydrogeology, Flow and Transport in Fractured Media, Use of Environmental and Applied Tracers in Hydrogeology, Estimating Groundwater Recharge, Applied Geophysics, Environmental Impacts of Mining
- Development and application of novel groundwater tracers
- Determining the connection of water between Turquoise Lake and surrounding mine dewatering tunnels near Leadville, CO.
- Use of isotopes to determine the effects of coalbed methane extraction on groundwater flow in the San Juan Basin, CO and NM
- Field and laboratory work on flow and transport of radionuclides in fractured rocks
- Use of stable and radio-isotopes to determine recharge timing and paleoclimate in the Nubian Sandstone, Libya
- Applied tracers to characterize flow and transport of TCE in fractured granite in California
- Use of stable isotopes to characterize deep water fracture flow into Henderson Mine, CO to study microbial diversity
- Field investigations and groundwater modeling to predict results of developing new wetlands near Telluride, CO
- Chemical analysis of water in a hydrothermally altered watershed near a porphyry molybdenum deposit in Questa, NM
- Applied Geophysics: Electrical resistivity, temporal gravity, reflection and refraction seismology

- Potential influence of electric powerline installation on groundwater springs, southern Colorado.
- Advisory board for the Deficit Irrigation Strategies and Return-flow Maintenance Group
- Formerly on Editorial Board of *The Hazardous Waste Consultant*
- Flow and transport of nanoparticles through porous and fractured media.
- Summarize technical reports into lay-person terms for the EPA Bonita Peaks Superfund Site – western Colorado
- Use of water chemistry and stable isotopes to quantify groundwater flow to headwater streams
- Modeling groundwater resources in an aquifer near Todos Santos, Mexico
- Measuring deep percolation of water beneath corn fields under various irrigation schemes
- Flow characterization of constructed wetlands used for treatment of landfill leachate
- Hillslope drainage.

Relevant Publications:

Al Faitouri, M. and **W. E. Sanford**, 2015, Stable and radio-isotope analysis to determine recharge timing and paleoclimate of sandstone aquifers in central and southeast Libya: Hydrogeology Journal v. 23, pp. 707-717, doi: 10.1007/s10040-015-1232-7.

Gehman, C. L., D. L. Harry, **W. E. Sanford**, J. D. Stednick, and N. A. Beckman, 2009, Estimating specific yield and storage change in an unconfined aquifer using temporal gravity surveys: Water Resources Research, v. 45, W00D21, doi: 0.1029/2007WR006096.

Sahl, J. W., R. Schmidt, E. D. Swanner, K. W. Mandernack, A. S. Templeton, T. L. Kieft, R. L. Smith, **W. E. Sanford**, R. L. Callaghan, J. B. Mitton, and J. R. Spear, 2008, Subsurface microbial diversity in deep-granitic-fracture water in Colorado: Applied and Environmental Microbiology, v. 74, no. 1, pp. 143-152, doi:10.1128/AEM.01133-07.

Sanford, W. E., P. G. Cook, N. I. Robinson, and D. Weatherill, 2006, Tracer mass recovery in fractured aquifers estimated from multiple well tests: Ground Water, v. 44, no. 4, pp. 564-573.

Gwo, J-P., P. M. Jardine and **W. E. Sanford**, 2005, Modeling field-scale multiple tracer injection at a low-level waste disposal site in fractured rocks: effect of multiscale heterogeneity and source term uncertainty on conceptual understanding of mass transfer processes: Journal of Contaminant Hydrology, v. 77, pp. 91-118.

Gwo, J.-P., P. M. Jardine, and **W. E. Sanford**, 2005, Effect of advective mass transfer on field scale fluid and solute movement: Field and modeling studies at a waste disposal site in fractured rock at Oak Ridge National Laboratory, Tennessee, USA: Hydrogeology Journal, 13:565-583.

Novotny, M. M. and **W. E. Sanford**, 2004, Groundwater residence time and recharge temperature estimates of the Denver and Arapahoe Aquifers, Denver Basin, Colorado: The Mountain Geologist, v. 41, no. 4, pp. 161-167.

Engblom, J.N, **W.E. Sanford**, and J.D. Stednick, 2004, Tracing the hydrologic connection between Turquoise Lake and local mine dewatering tunnels with dissolved sulfur hexafluoride (SF_6): Proceeding of The American Geophysical Union Hydrology Days 2004 Conference, Fort Collins, CO, March 10-13, 2004, pp. 84-94.

Woodard, L. L., **W. E. Sanford**, and R. G. Raynolds, 2002, Stratigraphic variability of specific yield within bedrock aquifers of the Denver Basin, Colorado: Rocky Mountain Geology, v. 37, no. 2, pp. 229-236.

Sanford, W. E., P. G. Cook, and J. C. Dighton, 2002, Analysis of a vertical dipole tracer test in highly fractured rock: Ground Water, v. 40, no. 5, pp. 535-542.

L.D. McKay, **W. E. Sanford**, and J.M. Strong, 2000, Field-scale migration of colloidal tracers in a fractured shale saprolite: Ground Water, v. 38, no. 1, pp. 139-147.

Jardine, P. M., **W. E. Sanford**, J. P. Gwo, O. C. Reedy, D. S. Hicks, J. S. Riggs, and W. B. Bailey, 1999, Quantifying diffusive mass transfer in fractured shale bedrock: Water Resources Research, v. 35, no. 7, pp. 2015-2030.

Sanford, W.E., J.-Y. Parlange, and T.S. Steenhuis, 1993, Hillslope drainage with sudden drawdown: Closed form solution and laboratory experiments: Water Resources Research, v. 29, pp. 2313-2321

32 Manuscripts, 4 Book Chapters, 99 Presentations at professional societies

Nancy J. Fishbein

995 Utica Avenue
Boulder, CO 80304
(303) 589-5303
Nancy.fish4@gmail.com

WORK EXPERIENCE

July 2015 - March 2016 — The Nature Conservancy, Boulder, CO
Interim Director of Land. Oversaw newly-formed Land Department, which included directly supervising six staff members responsible for key conservation areas of Land Protection, Asset Management and Sustainable Grazing.

1993 - Present — The Nature Conservancy, Boulder, CO
Director of Protection. Oversee all protection activities of Colorado Program, including strategic planning, negotiating land acquisition, conservation easements, cooperative management agreements, public land projects, completing administrative responsibilities for Protection Department including budgets, supervising staff, and working with Board.

Key Projects:

- Acquisition of 100,000 acre Baca Ranch and transfer to federal government.
- Successful achievement of land conservation goals in major capital campaigns.
- Completion of first conservation easement on State Land Board land.
- Directly responsible for conserving over 350,000 acres of land in Colorado.

1991-1993 — The Nature Conservancy, Boulder, CO
Field Representative. Negotiated real estate transactions throughout Colorado. Coordinated landowner Registry Program which recognized private landowners for excellent stewardship.

1990-1991 — World Wildlife Fund, Washington, DC
Research Fellow in Land and Wildlife Program. Co-authored guidebook on comprehensive state wetland strategies, developed organization's legislative agenda for wetlands, researched issues related to endangered species and national parks.

Jan-May 1990 — School of Natural Resources, The University of Michigan, Ann Arbor, MI
Teaching assistant for graduate level resource policy class. Advised students on research, graded papers, taught several sessions, and developed new course material.

1989-1990 — Environmental Grantmakers Association, Ann Arbor, MI
Coordinated office of association of charitable foundations awarding grants to the environmental community. Set up computer data base to handle growing membership, edited quarterly publication, and organized new office.

- over -

1989 Summer — The Nature Conservancy, Adirondack Chapter, Elizabethtown, NY
Conducted ecological assessment of low elevation boreal ecosystem in Adirondacks, developed site design for Boreal Heritage Reserve based on GIS data, air photo interpretation, field work and protection strategies.

1987-1988 — Adirondack Park Agency, Ray Brook, NY
Legal assistant for state agency regulating land use and development within the Adirondack State Park. Responsible for interpreting laws and applying them to proposed projects.

1983-1987 — Raquette River Bike & Boat Company, Tupper Lake, NY
Owned and operated outfitting and tour business in Adirondacks. Used knowledge of area history and natural history, business, organizational skills. Company honored in 1985 by regional environmental group for exemplary use of Park.

COMMISSIONS AND BOARDS

Colorado Conservation Easement Oversight Commission - Commissioner 2013 to 2016. Elected Chair in August 2015.

CCLT Center of Excellence Commission - Commissioner 2011- 2013

Colorado Coalition of Land Trusts – Board Member 2004-2006

EDUCATION

University of Michigan, School of Natural Resources, Ann Arbor, Michigan.
MS, 1990, natural resource policy/wildland management

Middlebury College, Middlebury, Vermont.
BA, 1982, cum laude, environmental studies/geography.

Sea Education Association, Woods Hole, Massachusetts, 1980.
Semester of marine and nautical science including six week oceanographic study in Northwest Atlantic aboard large research schooner.

SKILLS

Proficient in Word, Excel, PowerPoint.

Completed Highly Effective Team Training.

OTHER ACTIVITIES AND INTERESTS

Avid skier and hiker.

REFERENCES

References provided upon request.

Quarry dispute far from resolved

BY MATT STEINER
matt.steiner@gazette.com

The battle between southwestern El Paso County residents and Transit Mix Concrete over a proposed quarry near Colorado 115 north of Penrose seemed to be over. But a recent move by the concrete company could drag the saga out for several more months.

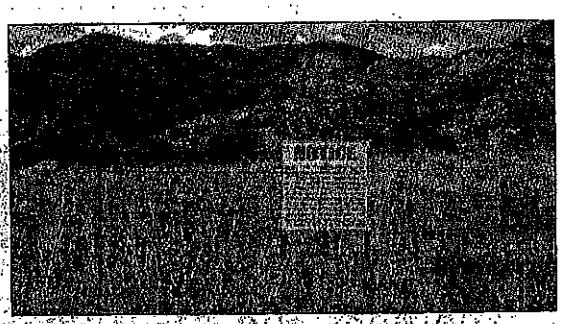
Transit Mix had asked Colorado's Mined Land Reclamation Board in January to reconsider its October decision to deny the company's permit to build the Hitch Rack Quarry on 400 acres off Little Turkey Creek Road. Then last week, the company withdrew that petition and is now planning to reapply.

"As we started working through the adjustments that would need to be made, it became clear that it would make more sense to withdraw the request and work toward submitting a new application," Transit Mix spokesperson Deborah Hileman said.

Transit Mix had applied for the Hitch Rack Quarry project in March. And the board released its findings in mid-December, stating that the company "didn't prove" that it had been given legal right of entry onto the proposed quarry site and didn't show that its plan to minimize impacts on water supply and wildlife were sufficient.

The concrete producer said in January that evidence was submitted illegally by a citizens advisory committee representing more than 100 people who objected to the project during the Oct. 26-27 hearings. It also said the board did not sufficiently explain its 3-2 decision to deny, despite a recommendation to approve by its staff.

The request for reconsideration had been slated for the board's meeting Thursday.



CHRISTIAN MURDOCK, THE GAZETTE

This photograph, taken July 22, shows the view of the hill from Colorado 115 where Transit Mix hopes to build Hitch Rack Quarry on 400 acres off Little Turkey Creek Road.

But Todd Hartman with the Division of Mining, Reclamation and Safety said in an email Wednesday that the matter was removed from the agenda.

The board will discuss a legal complaint by Transit Mix against the state during an executive session, however. The concrete company had filed a complaint for judicial review Jan. 26 against the board and a long list of objectors who live near the quarry site.

Hileman said she wasn't sure if the legal complaint had been dismissed or was still active.

"We've said all along that we want to be a good neighbor and make adjustments to the plan to really make this work," she said.

Transit Mix said in the late spring of 2016 that the Hitch Rack Quarry would eventually replace the more than 100-year-old Pikeview Quarry in operation in the foothills west of Colorado Springs. The Hitch Rack project would have a 50-year mining life and could provide up to 1.5 million tons of granite for the company, she said.

According to Hileman, the new application will mirror the withdrawn request for reconsideration. Transit Mix has offered to alter the mining plan to address the right-to-enter, water and wildlife concerns.

She said the most significant tweak involves moving initial mining to the south side of Little Turkey Creek while Transit Mix obtains full permission to mine the land to the north. Hileman said the move would also help preserve wildlife migration patterns during mining operations. Mining on the land north of the creek wouldn't commence until "significant" reclamation is done on the southern area.

The concrete company also plans to include backup water plans for residents in the area. Transit Mix said it will build cisterns so residents will not be without water if mining operations affect their wells.

"It's going to be a better path forward," Hileman said.

The Transit Mix spokeswoman said her company will be able to use scientific studies that were included in the initial application, saving money during the second go-round.

"While it will be a significant investment to reapply, it will be quite a bit less than the original application," she said.

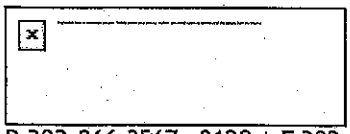
The Gazette on Wednesday contacted Tom Fellows, a spokesman for the Colorado 115 citizens' advisory committee. Fellows had not yet heard about Transit Mix's plans to reapply, adding that he would have to contact leaders of the committee before commenting.

TO BE SUPPLEMENTED UPON AVAILABILITY

From: Eschberger - DNR, Amy [mailto:amy.eschberger@state.co.us]
Sent: Friday, January 19, 2018 9:47 AM
To: Warren Dean
Cc: Steve Mulliken; Kris McGowan gkmccowen@gmail.com; Wally Erickson - DNR; Tony Waldron - DNR; Jeff Fugate; Scott Schultz
Subject: Re: Request for Information

Excellent! Thanks, Warren.

Amy Eschberger
Environmental Protection Specialist



P 303.866.3567 x8129 | F 303.832.8106 | C 303.945.9014
1313 Sherman Street, Room 215, Denver, CO 80203
Amy.Eschberger@state.co.us | http://www.mining.state.co.us

On Thu, Jan 18, 2018 at 11:00 AM, Warren Dean <warren@rosenbaumdean.com> wrote:

Amy, You answered my question directly. Thanks.

Good luck your review.

Warren H. Dean

6 South Tejon Street, Ste 660

Colorado Springs, CO 80903

719-440-1722

warren@rosenbaumdean.com

From: Eschberger - DNR, Amy [mailto:amy.eschberger@state.co.us]
Sent: Thursday, January 18, 2018 10:56 AM
To: Warren Dean
Cc: Steve Mulliken; Kris McGowan gkmccowen@gmail.com; Wally Erickson - DNR; Tony Waldron - DNR; Jeff Fugate; Scott Schultz
Subject: Re: Request for Information

Warren,

Yes, everything we received for the application is available at our website. If you are seeking program data files not included with the application, I would suggest contacting the applicant.

We are currently conducting our preliminary adequacy review of the application, and a copy of our review letter (identifying any adequacy issues) will be available at our website. We're working to get the letter out within the next few weeks.

Thanks,

Amy Eschberger

Environmental Protection Specialist

P 303.866.3567 x8129 | F 303.832.8106 | C 303.945.9014

1313 Sherman Street, Room 215, Denver, CO 80203

Amy.Eschberger@state.co.us | http://www.mining.state.co.us

On Mon, Jan 15, 2018 at 11:23 AM, Warren Dean <warren@rosenbaumdean.com> wrote:

Thanks for the quick response.

Though the Permit Application refers to the model often, I don't see any link on the web site. I presume CDRMS received it and is reviewing it. Yes ? No?

Are you saying that if it is not on the website, you didn't receive it? I guess in that case I would need to go directly to Transit Mix.

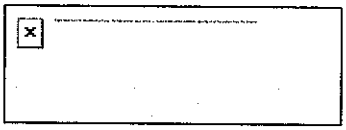
Thanks for you help verifying.

Warren

Sent from my iPad

On Jan 12, 2018, at 9:45 AM, Eschberger - DNR, Amy <amy.eschberger@state.co.us> wrote:

> Hi Warren,
>
> All the information we have received from Transit Mix Concrete Co. for this application (File No. M-2017-049) is available at our website: www.mining.state.co.us. I'm attaching a pdf with instructions on how to access and use our imaged document system, Laserfiche.
>
> Thanks,
>
> **Amy Eschberger**
>
> **Environmental Protection Specialist**



P 303.866.3567 x8129 | F 303.832.8106 | C 303.945.9014

1313 Sherman Street, Room 215, Denver, CO 80203

Amy.Eschberger@state.co.us | http://www.mining.state.co.us

On Thu, Jan 11, 2018 at 1:30 PM, Warren Dean <warren@rosenbaumdean.com> wrote:

Hello Amy, I have attached a request for information so we can understand some of the work Transit Mix submitted with its application.

Thanks for your help with this and let me know if you have any questions.

Have a good weekend.

Warren H. Dean

6 South Tejon Street, Ste 660

Colorado Springs, CO 80903

719-440-1722

warren@rosenbaumdean.com

<LaserficheWeblinkInstructions-New.pdf>

Testimony
Hitch Rack Ranch Quarry
Mining Permit M2017049

Dr. Nancy Reed
President, Eagles Nest Association
Prepared 6 April 2018



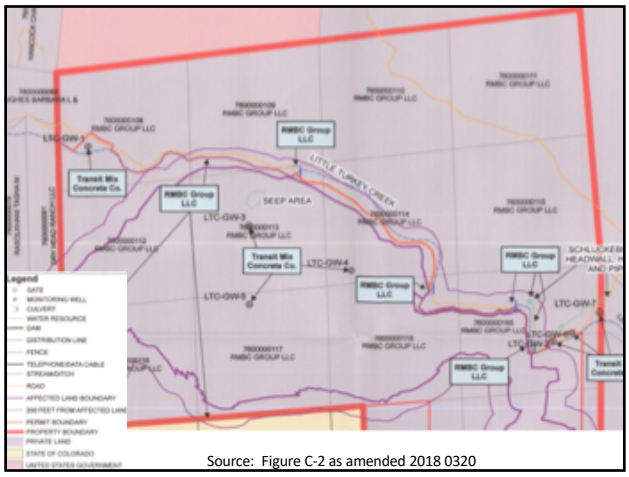
Source: Photo 5 of 2016-06-14_INSPECTION M2016010 (Inspection Report)

Safety

- Risk from flyrock
- Access by emergency services
- Operator allowing people to drive on Little Turkey Creek Road after a misfire, but BEFORE the cause of that misfire has been determined and corrected
- Mine Safety and Health Administration (MSHA) rules that may apply to people driving on Little Turkey Creek Road through the quarry permit area

Damage to Structures OUTSIDE of the Affected Area

- Damage from blasting
  - Flyrock
  - Direct damage to structures caused by blasting vibrations
  - Rockfalls triggered by blasting vibrations
- Damage from flooding
- Pre-blast Survey



Source: Figure C-2 as amended 2018 0320

6.4.19 EXHIBIT S - Permanent Man-made Structures

Where the mining operation will adversely affect the stability of any significant, valuable and permanent man-made structure located within two hundred (200) feet of the affected land, the applicant may either:

(a) provide a notarized agreement between the applicant and the person(s) having an interest in the structure, that the applicant is to provide compensation for any damage to the structure; or

(b) where such an agreement cannot be reached, the applicant shall provide an appropriate engineering evaluation that demonstrates that such structure shall not be damaged by activities occurring at the mining operation; or.

(c) where such structure is a utility, the Applicant may supply a notarized letter, on utility letterhead, from the owner(s) of the utility that the mining and reclamation activities, as proposed, will have "no negative effect" on their utility.

Source: Mineral Rules and Regulations of The Colorado Mined Land Reclamation Board for the Extraction of Construction Materials, Promulgated Oct 1995, Amended April, 199, January 2000, August, 2001, May 2004, June 2005 and August 2006

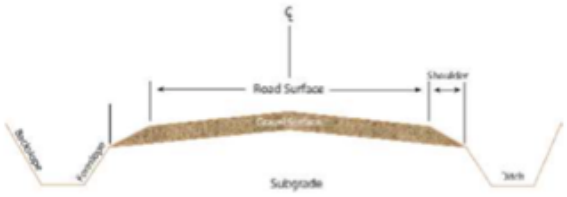


Figure 7: Roadway Cross Section (FHWA, 2015)

Source: Page S-17, Exhibit S of M2017049 application, NORWEST Corporation, "Engineering evaluation of Little Turkey Creek Road"



Source: Photo 5 of 2016-06-14_INSPECTION M2016010 (Inspection Report)



Source: Photo 5 of 2016-06-14_INSPECTION M2016010 (Inspection Report)



Source: Photo 5 of 2016-06-14_INSPECTION M2016010 (Inspection Report)



Source: Photo 5 of 2016-06-14_INSPECTION M2016010 (Inspection Report)

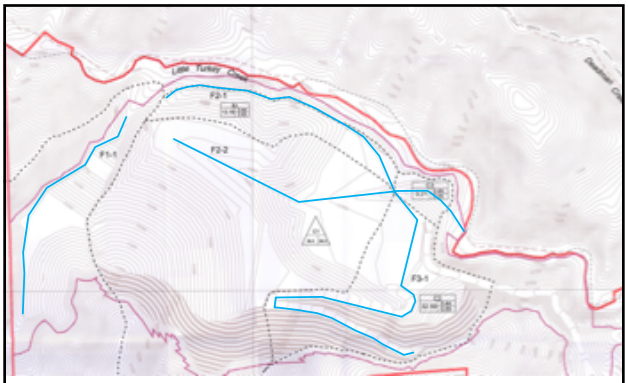
Perhaps the most distinguishing characteristic of the Colorado Springs climate is the frequency and intensity of thunderstorms during summer. Colorado Springs, according to weather records, is the most thunderstorm prone city west of the Mississippi River followed closely by Flagstaff, Arizona and Garden City, Kansas. Although the city itself has never experienced a super-thunderstorm, the Palmer Divide a few miles north of Colorado Springs has experienced some of the most severe thunderstorms on record anywhere in the world.

On May 30, 1935, Elbert, located 35 miles northeast of Colorado Springs, received 24 inches of rain in 24 hours and most of it fell in only 3 hours. Colorado Springs itself received 7 inches of rain in 24 hours on the same date from a related storm to the one that affected Elbert. Monument to the north of Colorado Springs received 14 inches of rain in 24 hours on June 16, 1965. In September 2013, Fort Carson reported received nearly 19 inches of precipitation, and Colorado Springs received 10 inches of rain.

Source: Page K-2, Exhibit K of Application,



Source: Photo 5 of 2016-06-14_INSPECTION M2016010 (Inspection Report)



Source: Figure G-13 of Exhibit G as amended, 2018 0314, NORWEST Corporation

Conclusion

- The applicant has NOT demonstrated that Little Turkey Creek Road WITHIN 200 feet of the affected lands SHALL NOT BE DAMAGED, as required by Rule 6.4.19(b)
- The applicant has NOT demonstrated that Little Turkey Creek Road OUTSIDE of the affected lands SHALL NOT BE ADVERSELY AFFECTED by blasting, as required by Rule 6.4.4 (i) and Rule 6.5 (4)

---------- Forwarded message ----------
From: **Foy - DNR, Caleb** <caleb.foy@state.co.us>
Date: Wed, Jan 10, 2018 at 1:26 PM
Subject: Re: Hitch Rack Ranch M-2017-049
To: Kris and Anita McCowen <gkmccowen@gmail.com>, Amy Eschberger - DNR <amy.eschberger@state.co.us>
Cc: Jeff Deatherage <jeff.deatherage@state.co.us>, Melissa van der Poel <melissa.vanderpoel@state.co.us>

Good Afternoon Kris,

I'm writing in response to your email dated January 5, 2018 that was sent in regard to this office's comments dated January 4, 2018, which were provided to DRMS in response to the reclamation permit application submitted for Hitch Rack Ranch under DRMS file no. M-2017-049. Specifically, you asked the following questions which I have answered in **bold:**

1. What criteria does your office use in assessing a mining application and did your office review documentation other than application M-2017-049 in order to draft its "Conditions for Approval"?

On November 15, 2017, this office received notice from DRMS that Transit Mix Concrete Co. filed an application to conduct a surface mining and reclamation operation known as Hitch Rack Ranch Quarry. This office reviewed the application and associated documents in DRMS file no. M-2017-049 for compliance with applicable statutes, rules, and regulations concerning the diversion, use, and administration of surface and ground water in Colorado, and responded with comments to DRMS dated January 4, 2018. As stated in the January 4, 2018 comments, "According to the application, the proposed operation does not anticipate exposing groundwater, but does anticipate small amounts of water will be incidentally encountered during the mining process. Therefore, the Office of the State Engineer has determined that a well permit to expose ground water issued pursuant to Section 37-90-137(2), C.R.S., and an associated substitute water supply plan/plan for augmentation is unnecessary for the operation as proposed. Based on the above, exposure of ground water must not occur during or after mining operations and any water that is incidentally encountering during the proposed operation must be returned to Little Turkey Creek, or the ground water system within the permit area, immediately without consumption."

2. Did your office conduct a site survey of the proposed quarry?

No, this office did not conduct a site survey of the proposed quarry prior to providing the comments dated January 4, 2018. The standard procedure in responding to notices from DRMS (such as that concerning the application for the Hitch Rack Ranch Quarry) is to review the application materials and provide any applicable comments/conditions for approval related to compliance with statutes, rules, and regulations concerning the diversion, use, and administration of surface and ground water in Colorado. A site survey is not performed by staff of this office prior to providing comments to DRMS in response to a proposed application.

I understand from your email that you have concerns regarding the quarry's potential impact to the hydrologic balance, specifically to existing wells in the area; therefore, you may consider participating in the mining permit application review

process with DRMS. Based on my understanding, there will be an informal public meeting with DRMS concerning the application sometime around the end of February, and DRMS will send out formal notice of said meeting once scheduled. Should you have any additional questions concerning the pending application from DRMS, please feel free to contact DRMS Environmental Protection Specialist Amy Eschberger, who I've also copied on this email.

Sincerely,

Caleb Foy, P.E.
Water Resource Engineer
COLORADO
Division of Water Resources
Department of Natural Resources
P 303.866.3581 x8272
1313 Sherman St., Suite 818, Denver, CO 80203
Caleb.Foy@state.co.us | www.water.state.co.us

On Fri, Jan 5, 2018 at 10:07 PM, Kris and Anita McCowen <gkmccowen@gmail.com> wrote:
Dear Mr. Foy,
My name is Kris McCowen. I am a property owner residing near the Hitch Rack Ranch south of Colorado Springs where Transit Mix Concrete Co. (TM) is proposing to open and operate a quarry. I believe my well (and several wells belonging to my neighbors) will be adversely impacted should TM's application be approved. Despite TM's repeated assertions in the application that the hydrological balance will be "minimized" and that TM doesn't "anticipate" exposing ground water, research and testimony by other subject matter experts indicates otherwise.

The removal of massive amounts of granite is most likely to disrupt the recharge of the fractured rock wells and damage the hydrologic system that property owners depend upon for water. Even minimal disturbance of the hydrological balance could prove catastrophic, and permanent, for well owners both upstream and downstream. There is no alternative source of water. Ultimately, the burden and expense to prove that TM's actions damaged a well will be borne by the well owner.

In December 2016, the Mined Land Reclamation Board denied TM's application M-2016-010. That application proposed a quarry in the same location as the new application. I've attached the transcript of the Board's hearing on October 26th and 27th, 2016 and invite you to review the testimony provided by Mr. Jerry Moore, a geologist (pages 233-249 on 26 Oct.), Mr. Chuck Norris, a hydrogeologist (pages 12-29, 27 Oct.) and Mr. Paul Anderson, a water attorney (pages 31-34, 27 Oct.). Their testimony contradicts that of TM's water consultant and proved to be one of three reasons why the Board denied the application, declaring in its *Finding of Fact, Conclusions of Law and Order* (attached) that Transit Mix failed to demonstrate that the hydrological balance and the quantity and quality of ground water will be minimized.

In regards to your letter dated Jan. 4th, 2018 that you submitted to Ms. Amy Eschberger at CDRMS:
1. What criteria does your office use in assessing a mining application and did your office review documentation other than application M-2017-049 in order to draft its "Conditions for Approval"?
2. Did your office conduct a site survey of the proposed quarry?

Thank you for your time and consideration of this serious issue. If your office has not conducted a site survey, I would like to offer you a tour of the area along with a more detailed discussion about the impacts to our wells and water supply.

Respectfully,
Kris McCowen
3070 Little Turkey Creek Road
Colorado Springs, CO 80926

COLORADO
Division of Water Resources
Department of Natural Resources

Response to Reclamation Permit Application Consideration

DATE: January 4, 2018

TO: Amy Eschberger, Environmental Protection Specialist

CC: Division 2 Office; District 10 Water Commissioner

FROM: Caleb Foy, P.E.

RE: Hitch Rack Ranch Quarry, File No. M-2017-049
Operator: Transit Mix Concrete Co.
Contact: Andre LaRoche, (719) 475-0700
Secs. 16, 21- 23, Twp. 16S, Rng. 67W, 6th P.M., El Paso County

CONDITIONS FOR APPROVAL

☒ According to the application, the proposed operation does not anticipate exposing groundwater, but does anticipate small amounts of water will be incidentally encountered during the mining process. Therefore, the Office of the State Engineer has determined that a well permit to expose ground water issued pursuant to Section 37-90-137(2), C.R.S., and an associated substitute water supply plan/plan for augmentation is unnecessary for the operation as proposed. Based on the above, exposure of ground water must not occur during or after mining operations and any water that is incidentally encountering during the proposed operation must be returned to Little Turkey Creek, or the ground water system within the permit area, immediately without consumption.

☒ The proposed operation will consume water by: ☐ evaporation, ☒ dust control, ☐ reclamation, ☐ water removed in the mined product, ☒ processing, ☐ other:.

☒ All water used on-site for mining needs shall be a legal supply of water provided by an appropriate supplier. According to the application, the primary source of water for use in mining operations on the site will likely be via purchase from Colorado Springs Utilities and hauled to the site. The applicant shall confirm the legality of any proposed source of water supply with the Division of Water Resources prior to use in the operation.

☒ The application materials indicate that the storm water management plan will include construction of ditches, sediment ponds, and culverts as a part of this project. The applicant should be aware that, unless the storm water detention structures can meet the requirements of a "storm water detention and infiltration facility" as defined in section 37-92-602(8), Colorado Revised Statutes, the structure may be subject to administration by this office. The applicant should review DWR's *Administrative Statement Regarding the Management of Storm Water Detention Facilities and Post-Wildland Fire Facilities in Colorado*, attached, to ensure that the notification, construction and operation of the proposed structure meets statutory and administrative requirements. The applicant is encouraged to use *Colorado Stormwater Detention and Infiltration Facility Notification*

Portal, located at https://maperture.digitaldataservices.com/gvh/?viewer=cswdif, to meet the notification requirements.

☒ To assist in avoiding adverse impacts to water resources or vested water rights, the applicant shall consult with the local Water Commissioner (Doug Hollister, Doug.Hollister@state.co.us) regarding any activity that might affect the flow of water to any stream system and/or ditch.

COMMENTS: The local Water Commissioner, Doug Hollister, may be contacted at (719) 227-5291 or Doug.Hollister@state.co.us regarding legal supplies of water in the area.

COLORADO
Division of Reclamation, Mining and Safety
Department of Natural Resources

1313 Sherman Street, Room 215
Denver, CO 80203

DATE: December 22, 2016

TO: Transit Mix Concrete Co.
ATTN: Andre LaRoche
444 E. Costilla St.
Colorado Springs, CO 80903

RE: Findings of Fact, Conclusions of Law and Order
Transit Mix Concrete Company
File No. M-2016--010

On December 20, 2016 the Mined Land Reclamation Board signed the enclosed Board Order for the above captioned operation. We strongly advise that you read this document carefully. The Board orders that applicant file no. M-2016-010 be DENIED.

Sincerely,

Camille Mojar
Board Secretary

Enclosure(s)

Certified Mail
7014-2120-0001-7869-7827

Cc's

Amy Eschberger
Wally Erickson
John Roberts
Scott Scultz

BEFORE THE MINED LAND RECLAMATION BOARD
STATE OF COLORADO

FINDINGS OF FACT, CONCLUSIONS OF LAW, AND ORDER

IN THE MATTER OF THE APPLICATION OF TRANSIT MIX CONCRETE COMPANY FOR A 112 CONSTRUCTION MATERIALS RECLAMATION PERMIT, File No. M-2016-010

THIS MATTER came before the Mined Land Reclamation Board ("Board") on October 26 and 27, 2016 in Colorado Springs for a hearing to consider the application for a 112c construction materials reclamation permit filed by Transit Mix Concrete Company ("Applicant"), file number M-2016-010.

Amy Eschberger, Wally Erickson, Peter Hays, Tim Cazier, and Assistant Attorney General Scott Schultz appeared on behalf of the Division of Reclamation, Mining and Safety ("Division"). Norton Cutler, Esq. appeared on behalf of Applicant. Carrie Bernstein, Esq. and Amanda Bradley, Esq. appeared on behalf of Objector Cheryl Kimble. Steven Mulliken, Esq. appeared on behalf of Objector Ingersoll Trust. Fire Chief Hartmut Wright appeared on behalf of Objector Southwestern Highway 115 Fire Protection District. Objectors Nancy Reed, Gary K. (Kris) McCowen, Warren Dean, and Weldon Flaharty each appeared on his or her own behalf.

The Board, having considered the presentations, testimony, and evidence of the Division;[1] Applicant; and the objectors, and being otherwise fully informed of the facts in the matter, enters the following:

FINDINGS OF FACT

1. On March 8, 2016, the Applicant filed an application with the Division for a 112c reclamation permit under section 34-32.5-112, C.R.S. for a site known as the Hitch Rack Ranch Quarry in El Paso County, Colorado, file number M-2016-010 ("Application"). The Application proposed an operation to be located in section 16, Township 16 South, Range 67 West, 6th Principal Meridian on property known as Hitch Rack Ranch.

2. On March 9, 2016, the Division deemed the Application "complex" and extended the standard ninety-day decision deadline by sixty days, from June 6, 2016 to August 5, 2016, pursuant to Rule 1.4.1(7) of the Mineral Rules and

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[1] The Division was advisory staff to the Board, not a party, in this proceeding.

Regulations of the Colorado Mined Land Reclamation Board for the Extraction of Construction Materials, 2 CCR 407-4 ("Rules").

3. During the public comment period, as mandated by Rule 1.7.1, the Division received one hundred eight comment and objection letters from individuals, organizations, and agencies. The public comment period closed on April 19, 2016.

4. On June 14, 2016, pursuant to Rule 1.6.2(1)(f), the Division required the Applicant to provide additional notice to the property owners at the Eagles Nest and Bauer Ranch subdivisions. During this second public comment period, which closed on July 8, 2016, the Division received nine written objection letters.

5. On June 30, 2016, the Division hosted an informal public meeting in Colorado Springs for the purpose of explaining the application review process, issues within the Board's jurisdiction, the prehearing conference, and formal Board hearing processes. Parties and interested persons were informed of the informal public meeting by written notice, provided on June 9, 2016.

6. The Division extended the Application recommendation deadline from August 5, 2016 to October 4, 2016 on the Applicant's request. The prehearing conference and Board hearing were rescheduled and properly noticed accordingly.

7. During the review period, the Division generated six adequacy letters between May 27, 2016 and September 23, 2016. The Applicant addressed all adequacy issues to the Division's satisfaction.

8. On September 29, 2016, the Division issued and served on all parties both a written recommendation to approve the Application over objections and a written rationale for that recommendation.

9. On October 5, 2016, the Board, through a prehearing officer, conducted a prehearing conference in Colorado Springs. The prehearing officer issued a draft prehearing order. Among other things, the draft prehearing order identified five categories of issues for the parties to present to the Board for consideration. At the hearing, the Board considered the draft prehearing order and invited amendments or adjustments to be proposed by the parties. No party objected to, or proposed amendments or adjustments to, the draft prehearing order. The Board adopted the draft prehearing order as the final prehearing order.

10. The Application described a proposed construction materials (granite) mining operation and on-site processing of mined materials, including crushing, screening, washing, and production of aggregate products. The proposed operation would be the fourth quarry in the foothills west of Colorado Highway 115 near

Colorado Springs (the others being the Menzer Quarry, the Red Canyon Quarry, and Table Mountain Quarry).

11. The permit boundary described in the Application included three large excavation areas with highwalls maintained in a benched configuration on 392.75 acres of affected lands. As described in the Application, the proposed operation would advance through six mining phases with reclamation occurring concurrently as the operation progresses. The Application proposed to reclaim the affected lands for wildlife habitat. The Division calculated the financial warranty for the operation through phase three to be $3,857,842.00.

12. The proposed permit boundary included segments of Little Turkey Creek and Deadman Creek.

13. As proposed, the permit boundary included part of Little Turkey Creek Road, a private dirt road. Little Turkey Creek Road branches at a point east of the proposed permit boundary and both branches proceed through the proposed mining operation. One branch of Little Turkey Creek Road parallels Little Turkey Creek through the proposed mining area, while the other branch of Little Turkey Creek Road parallels Deadman Creek through the proposed mining area. Little Turkey Creek Road is the sole means of access for residents of the Eagles Nest subdivision.

14. The mining plan in the Application proposed to construct an access road for the mining operation, which road was proposed to cross Little Turkey Creek Road, Little Turkey Creek, and Deadman Creek. In response to the Division's third adequacy review letter, dated August 8, 2016, Applicant submitted an "Engineering Evaluation of Little Turkey Creek Road," signed and sealed by Paul Kos, PE of Norwest Corporation. The engineering evaluation stated that "the quarry design includes plans to build a separate access road so that no heavy equipment associated with the quarry will travel Little Turkey Creek Road." The engineering evaluation further stated, at pages 8-9:

> Potential Problem: The quarry access roads will require an intersection on both the Little Turkey Creek and Deadman Creek segments of Little Turkey Creek Road. These intersections could impact the safety and ease of use of the road.
>
> Solution: The intersection and crossing of Little Turkey Creek Road will be established during the initial quarry development and last through the life of the quarry. The intersection and crossing of Deadman Creek will be established once mining commences in the North Pit Extension area, and the intersection will be removed and reclaimed when mining and reclamation is finished in this area. ...

Both intersections will be at-grade crossings equipped with stop signs for mine traffic. Traffic on Little Turkey Creek Road will not be required to stop. Establishing the intersection requires realigning Little Turkey Creek Road for approximately 400 feet to remove unnecessary curves.

15. At the hearing, Robert Stabo ("Mr. Stabo") testified on behalf of the Applicant. Mr. Stabo stated that, under the proposed blasting plan in the Application, traffic will not be permitted through the quarry on Little Turkey Creek Road for a period of time. Amy Eschberger testified for the Division that the Applicant's blasting plan provided that: blasts may occur up to three times per week; prior to a blast, "access corridors will be secured for the length of time needed to successfully complete the blast;" a typical length of time for a blast is approximately thirty minutes, but that access corridors may be secured for a longer, unspecified, period in the event of a misfire. Segments of one or both branches of Little Turkey Creek Road into and through the mining operation constitute "access corridors."

16. At the hearing, Fire Chief Hartmut Wright ("Chief Wright") testified about the dangers of fly rock related to blasting, that approximately ninety percent of the residents near the proposed operation are more than fifty years of age, and about the importance of emergency vehicles having access through the quarry on Little Turkey Creek Road. Chief Wright further testified that the Front Range is an area of extreme fire danger, and that the area of the proposed operation presents a high potential that a fire would spread because it is in a box canyon.

17. RMBC Group, LLC is the owner of the Hitch Rack Ranch. At the hearing, the Applicant offered into evidence an "Owner's Acknowledgement," signed by RMBC Group, LLC on September 15, 2016, stating that pursuant to a royalty agreement between RMBC Group, LLC and the Applicant, that the Applicant "has the legal right to enter upon [Hitch Rack Ranch] for the purpose of mining operations and the extraction of construction aggregates." The Division testified that it has received the Owner's Acknowledgment. The Board admitted the Owner's Acknowledgement into evidence over objection by counsel for Objector Cheryl Kimble.

18. One or more residents of the Eagles Nest subdivision possess a non-exclusive easement on Little Turkey Creek Road. The residents of the Eagles Nest subdivision who possess the easement are the dominant estate owners of the Little Turkey Creek Road easement. Counsel for Objector Kimble testified that the dominant easement was in the records of the El Paso County Assessor's Office at the time that the Application was filed with the Division.

19. On October 5, 2016, Objector Cheryl Kimble submitted, through counsel, her DRMS Rule 2.6 Pre-Hearing Motion to Deny Application for Mining Permit ("Prehearing Motion"). On October 20, 2016, the Division submitted its response to the Prehearing Motion. In its response, the Division stated, in paragraph 18:

> The Division has not received the source of the Applicant's legal right to utilize Little Turkey Creek Road as proposed in the Application, i.e., initiate a mining operation on the affected land, specifically Little Turkey Creek Road.

20. At the hearing, the Applicant testified that crossings of Little Turkey Creek Road, its planned improvements to the road, and closures of the road for blasting do not constitute an impermissible or unreasonable interference with the use of the easement.

21. As proposed in the Application, the Applicant's responses to adequacy letters from the Division, and based on evidence and testimony presented at the hearing, the Applicant planned to affect Little Turkey Creek Road through modification of the road (*e.g.*, straightening the road and adding crossings) and temporary closures of the road for blasting.

22. The Applicant has not demonstrated that it has received, or is not legally required to receive, the conveyance of a legal right to enter and initiate a mining operation on Little Turkey Creek Road from the owners of the dominant easement on Little Turkey Creek Road. The Division testified that the adjudication of private property rights are outside the authority of the Division and the Board.

23. At the hearing, Timothy Crawford ("Mr. Crawford") of Bishop-Brogden Associates, Inc., testified on behalf of the Applicant. Mr. Crawford testified that three primary aquifers exist at or near the proposed mining site, including a fractured rock aquifer associated with Little Turkey Creek, perched on shallow hard rock systems, and sedimentary bedrock aquifers. Mr. Crawford opined that the proposed mining operation will not intercept groundwater, and have no impact on neighboring wells or nearby surface water or groundwater users. Mr. Crawford testified that Little Turkey Creek will buffer potential impacts to wells west of the proposed quarry. Mr. Crawford also testified that if impacts on surface water or groundwater are identified, then the Applicant will remedy such impacts. Mr. Crawford testified that evaluating groundwater resources is not an exact science, and that the magnitude of changes and consideration of available data is important.

24. At the hearing, Objector Ingersoll Trust presented testimony from various witnesses about groundwater concerns and potential impacts on

groundwater from the proposed mining operation, including Steve Mulliken, Jerry Moore, Ted Kerr, and Charles Norris.

DATE FILED: August 1, 2017 2:02 PM
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25. Steve Mulliken ("Mr. Mulliken") testified that water to individual wells in the area originates from water held in fractured granite, not a large aquifer and that monitoring wells would be ineffective. Mr. Mulliken testified that the granite deposit that would be removed by the proposed mining operation is the water storage vessel and delivery system for small water deposits.

26. Jerry Moore ("Mr. Moore"), a retired exploration hydrologist, testified on behalf of Objector Ingersoll Trust that the fractured granite aquifer in the area of the proposed mining operation has a relatively small volume of water and is very sensitive to being recharged. Mr. Moore also testified that it is very difficult to accurately model fractured aquifers. Mr. Moore stated that surface water and groundwater flows are directed to the proposed affected area, and that the mining operation's removal of the granite will destroy the "pipeline" for the water and damage the current water recharge flow system.

27. At the hearing, Ted Kerr ("Mr. Kerr"), President of Red Rock Valley Estates Water District, testified on behalf of Objector Ingersoll Trust. Mr. Kerr testified that the District has never had a reliable water source; that any water, and particularly good water, is difficult to find; and that District residences have xeric landscaping, not lawns.

28. Charles Norris, Ph.D. ("Dr. Norris") with Geo-Hydro, Inc. testified at the hearing on behalf of Objector Ingersoll Trust. Dr. Norris testified that there is no indication of perched water in the area. Dr. Norris disputed the testimony on behalf of the Applicant regarding how the granite fracture system drains. Specifically, Dr. Norris testified that the Applicant modeled the area drainage on a sand pile, which drains much differently than a fractured granite system, such as the system located in the area of the proposed mining operation. Dr. Norris testified that the mining operation will drain water from the flanks of Little Turkey Creek, reduce the base flow (and possibly the perennial flow) of the creek, and reduce availability of water to wells in the valley. Dr. Norris opined that removing granite from the proposed mining area will destroy the pathways for water movement. Dr. Norris testified that the proposed quarry will absolutely impact water levels and that it is impossible to tell the impact on groundwater until after the groundwater system is already affected.

29. At the hearing, Steve Boyle ("Mr. Boyle") of BIO-Logic, Inc. testified on behalf of the Applicant. Mr. Boyle testified that BIO-Logic, Inc. mapped vegetation communities on the proposed mining site, performed a biological evaluation of the site, conducted a Mexican Spotted Owl Habitat Assessment (indicated by the

Division to have occurred on October 13, 2015), performed a Mexican Spotted Owl Survey Report (indicated by the Division to have occurred on June 24, 2016), and completed a Nesting Raptor Survey Report. Mr. Boyle testified that the evaluations at the site found no Mexican Spotted Owls, found no nesting raptors, found no Ute Ladies' Tresses habitat, and identified approximately one hundred fifty species likely to occur at the site.

30. Mr. Boyle testified at the hearing that the Mexican Spotted Owl is on the federal list of "threatened" species. Mr. Boyle further testified that the Mexican Spotted Owl is a small bird that is selective about where it nests, preferring old-growth conifer forests, rock cliffs, and canyons.

31. Mr. Boyle testified that the age of the conifers in the area make it a poor quality nesting habitat for Mexican Spotted Owl, but that one area at the site could constitute nesting habitat. Mr. Boyle testified that approximately 325 acres of suitable Mexican Spotted Owl foraging habitat would be impacted by the proposed mining operation. Mr. Boyle testified that foraging by Mexican Spotted Owl in the area of the proposed mining operation will not be possible until after completion of reclamation.

32. Mr. Boyle testified that the proposed mining operation would displace wildlife in the area, but that such impacts will be local and not regional.

33. John Sanderson, Ph.D. ("Dr. Sanderson") of The Nature Conservancy testified on behalf of Objector Ingersoll Trust. Dr. Sanderson testified that the proposed mining operation, as proposed in the Application, is in the heart of an area of very high biodiversity significance and that it abuts an established nature preserve that is more than one thousand six hundred acres in size. Dr. Sanderson testified and showed exhibits demonstrating that Hitch Rack Ranch is within a migratory corridor for animals including elk and mule deer between the Beaver Creek Wilderness Study Area to the west and Fort Carson to the east. Dr. Sanderson further testified that Hitch Rack Ranch is a critical connection point in a four-hundred-square-mile conservation landscape.

34. Dr. Sanderson testified that the proposed mining operation would be northeast of the Aiken Canyon Preserve. Dr. Sanderson testified that the Aiken Canyon Conservation Area includes habitat for wildlife such as black bear, mule deer, elk, mountain lions, bobcats, gray foxes, badgers, tuft-eared pine squirrels, and more than one hundred species of birds. Dr. Sanderson testified that while six hundred species of plants are located in the area, the reclamation plan of the proposed mining operation identifies only twenty-two plant species. Dr. Sanderson testified and presented an exhibit showing that wild turkeys inhabit the area, including an area within Hitch Rack Ranch near Little Turkey Creek.

35. Dr. Sanderson testified that the Mexican Spotted Owl has been listed as threatened since 1993 and that it requires old-growth conifer forests or rocky cliffs for nesting. Dr. Sanderson testified and presented an exhibit from the Mexican Spotted Owl Assessment performed by BIO-Logic, Inc. showing that Hitch Rack Ranch is entirely located in one of three Mexican Spotted Owl "Critical Habitats" west of Castle Rock, Colorado Springs, and Pueblo. Dr. Sanderson testified that "critical habitat" may include "areas that are not currently occupied by the species but will be needed for its recovery." Dr. Sanderson testified that the area from Cañon City to Colorado Springs is the best place in Colorado for Mexican Spotted Owl. Dr. Sanderson presented Figure 4 from the Mexican Spotted Owl Assessment performed by BIO-Logic, Inc., showing that the proposed mining site includes "fair" nesting habitat. Dr. Sanderson testified that the site of the proposed mining operation contains good quality foraging habitat, and possibly roosting habitat, for the Mexican Spotted Owl.

CONCLUSIONS OF LAW

36. The Board has jurisdiction over this matter pursuant to the Colorado Land Reclamation Act for the Extraction of Construction Materials, Article 32.5 of Title 34, C.R.S. (2016) ("Act").

37. Under section 34-32.5-115(4), C.R.S., "the applicant must comply with the requirements of this article and section 24-4-105(7), C.R.S."

38. Under Rule 1.4.1(10), the Applicant "has the burden of demonstrating that the application meets the minimum requirements of the Act, Rules, and Regulations."

39. Under Rule 2.8.1(1) and section 24-4-105(7), C.R.S., "the proponent of an order shall have the burden of proof." As the party initiating this matter by filing the Application, Applicant was the "proponent of an order" at the hearing and, therefore, has the burden to prove that the Application was consistent with applicable laws and rules, and should be approved by the Board.

40. In considering whether to grant a permit to an applicant, the Board "shall not deny a permit except on one or more of the following grounds," as relevant:

> (a) The application is incomplete and the performance and financial warranties have not been provided.
>
> . . . .

(c) Any part of the proposed mining operation, the reclamation program, or the proposed future use is contrary to the laws or regulations of this article.

. . . .

(g) The proposed reclamation plan does not conform to the requirements of section 34-32.5-116.

C.R.S. § 34-32.5-115(4) (2016).

41. The Applicant failed to meet its burden to show that the Application meets the minimum requirements of the Act, specifically, the requirement to show the source of the legal right to enter and initiate a mining operation on affected land set forth in section 34-32.5-112(1)(b)(IV), C.R.S. The Application proposed to realign a portion of Little Turkey Creek Road, close the road temporarily during mining operations, and to install crossings of the road. The Applicant's proposed impact on Little Turkey Road may affect the legal rights of the dominant estate owners of the easement on the road. Determination of the legal rights of the easement owners is outside the Board's jurisdiction. However, the Board is required to determine whether the Application shows that the Applicant has obtained from all owners of record a legal right to enter and initiate a mining operation. The Application failed to demonstrate to the satisfaction of members of the Board that the Applicant has obtained from all property owners, including dominant estate owners of the private road easement, a legal right to enter and initiate a mining operation on Little Turkey Creek Road.

42. "Affected land" means "the surface of an area within the state where a mining operation is being or will be conducted, which surface is disturbed as a result of an operation," specifically including private ways and roads. C.R.S. § 34-32.5-103(1) (2016). Little Turkey Creek Road constituted "affected land" because of the manner of use, and intended modification, of the road as proposed in the Application.

43. Applicant has not demonstrated that it does not need to obtain a legal right of entry from the dominant estate holders. There exists a dispute regarding whether the servient estate holder has authority to grant the Applicant permission to alter Little Turkey Creek Road over the objection of the dominant estate holders. This dispute exists regardless of whether Applicant's proposed modifications and use of the road constitutes an impermissible or unreasonable interference with the dominant estate holders' use of the easement. This is a legal dispute regarding the respective property interests of the dominant and servient estate holders as granted by the easement. The Board does not have jurisdiction to resolve this legal dispute. Without resolution of this issue, however, Applicant cannot meet its burden to

demonstrate that it has obtained the legal right of entry to initiate a mining operation on Little Turkey Creek Road.

44. To the extent that the Applicant may be required by the Act and Rules to obtain and show a legal right to enter and initiate a mining operation on Little Turkey Creek Road from all property owners, including dominant estate holders, the Application is incomplete.

45. Section 34-32.5-116(4)(h), C.R.S. provides:

> Reclamation plans and their implementation are required on all affected lands and shall conform to the following requirements:
>
> (h) Disturbances to the prevailing hydrologic balance of the affected land and of the surrounding area and to the quality and quantity of water in surface and groundwater systems, both during and after the mining operation and during reclamation, shall be minimized. Nothing in this paragraph (h) shall be construed to allow the operator to avoid compliance with other statutory provisions governing well permits and augmentation requirements and replacement plans when applicable.

46. The Application failed to demonstrate to the satisfaction of the Board that the impact of the proposed mining operation on the prevailing hydrologic balance of the proposed affected land and the surrounding area and on the quality and quantity of groundwater systems will be minimized.

47. By failing to demonstrate that the impact of the proposed mining operation on the prevailing hydrologic balance of the proposed affected land and the surrounding area, and on the quality and quantity of groundwater systems will be minimized, the reclamation plan in the Application fails to conform to the requirement of section 34-32.5-116(4)(h), C.R.S.

48. Because the reclamation plan in the Application fails to conform to the requirement of section 34-32.5-116(4)(h), C.R.S., the Board may deny the Application in accordance with section 34-32.5-115(4)(g), C.R.S.

49. Rule 3.1.8(1) requires:

> All aspects of the mining and reclamation plan shall take into account the safety and protection of wildlife on the mine site, at processing sites, and along all access roads to the mine site with special attention given to critical periods in the life cycle of those species which require special consideration (e.g., elk calving,

migration routes, peregrine falcon nesting, grouse strutting grounds).

50. Rule 6.4.8 requires an application for a 112 reclamation permit to provide, in Exhibit H, information about the wildlife in and around the proposed mining area, and states:

> (1) In developing the wildlife information, the Operator/Applicant may wish to contact the local wildlife conservation officer. The Operator/Applicant shall include in this Exhibit, a description of the game and non-game resources on and in the vicinity of the application area, including:
>
> (a) a description of the significant wildlife resources on the affected land;
>
> (b) seasonal use of the area;
>
> (c) the presence and estimated population of threatened or endangered species from either federal or state lists; and
>
> (d) a description of the general effect during and after the proposed operation on the existing wildlife of the area, including but not limited to temporary and permanent loss of food and habitat, interference with migratory routes, and the general effect on the wildlife from increased human activity, including noise.
>
> (2) The application may be reviewed and commented upon by the State of Colorado Division of Wildlife (DOW). If the DOW has comments, they must be provided prior to the end of the public comment period specified in Subsection 1.7.1(2)(a) to be considered by the Board and Office.

51. The Application failed to take into account, to the satisfaction of the Board, the safety and protection of wildlife at the proposed site, including without limitation, failing to take into account conservation of Mexican Spotted Owl foraging habitats and potential nesting habitats, and turkey production areas.

52. Because the Application failed to take into account the safety and protection of wildlife at the proposed site, the proposed mining operation failed to comply with Rule 3.1.8.

53. By failing to comply with Rule 3.1.8, the Application may be denied by the Board pursuant to section 34-32.5-115(4)(c), C.R.S.

ORDER

Based on the foregoing findings of fact and conclusions of law, the Board hereby orders the Application DENIED.

DONE AND ORDERED this 20th day of December 2016.

FOR THE COLORADO MINED LAND RECLAMATION BOARD

Jill Van Noord

Jill Van Noord, Vice Chair

NOTICE OF JUDICIAL REVIEW RIGHTS

This order becomes effective and final upon mailing. Any party adversely affected or aggrieved by agency action may commence an action for judicial review by filing a complaint with the district court within thirty-five (35) days after the effective date of this order, pursuant to section 24-4-106, C.R.S. (2016) and the Colorado Rules of Civil Procedure. In the event that a complaint for judicial review is filed, designations of record made in accordance with section 24-4-106(6), C.R.S. should be served on the Board at: 1313 Sherman Street, Room 215, Denver, CO 80203, Attention: Johnie Abad.

CERTIFICATE OF SERVICE

This is to certify that I have duly served the within FINDINGS OF FACT, CONCLUSIONS OF LAW, AND ORDER upon all parties herein by depositing copies of same in the United States mail, first-class postage prepaid, at Denver, Colorado, this 22 day of December 2016 addressed as follows:

By Certified Mail to:
7014-2120-0001-7869-7827

Transit Mix Concrete Co.
ATTN: Andre LaRoche
444 E. Costilla St.
Colorado Springs, CO 80903

By United States Postal Mail to:

Mark McClurg
Highlands of Turkey Cañon Ranch
Homeowners Association
15795 Phantom Canyon View
Colorado Springs, CO 80926

William & Marion Baker
3375 Turkey Cañon Ranch Road
Colorado Springs, CO 80926

Chelsea Luttrall
2453 Gold Rush Drive, #4
Colorado Springs, CO 80906

Lisa Pecoraro
16230 Cala Rojo Drive
Colorado Springs, CO 80926

By inter-office or electronic mail to:

Amy Eschberger
Division of Reclamation, Mining & Safety
1313 Sherman Street, Room 215
Denver, CO 80203

Wally Erickson
Division of Reclamation, Mining & Safety
1313 Sherman Street, Room 215
Denver, CO 80203

By intra-office or electronic mail to:

John J. Roberts
First Assistant Attorney General
Department of Law
Business and Licensing Section
Ralph L. Carr Colorado Judicial Center
1300 Broadway, 10th floor
Denver, CO 80203

Scott Schultz
Assistant Attorney General
Department of Law
Natural Resources and Environment Section
Ralph L. Carr Colorado Judicial Center
1300 Broadway, 10th floor
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By United States Postal Mail (Continued):

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15575 Henry Ride Heights
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Colorado Springs, CO 80926

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Colorado Springs, CO 80926

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6980 Granite Peak Drive
Colorado Springs, CO 80923

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3070 Little Turkey Creek Road
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Doug Lee Wekamp
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L.D. and D.L. Decker Trust
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Colorado Springs, CO 80903

Turkey Creek Conservation District
200 S. Santa Fe Ave., 4th Floor
Pueblo, CO 81003

Troy L. Day
2320 Paseo Corto
Colorado Springs, CO 80926

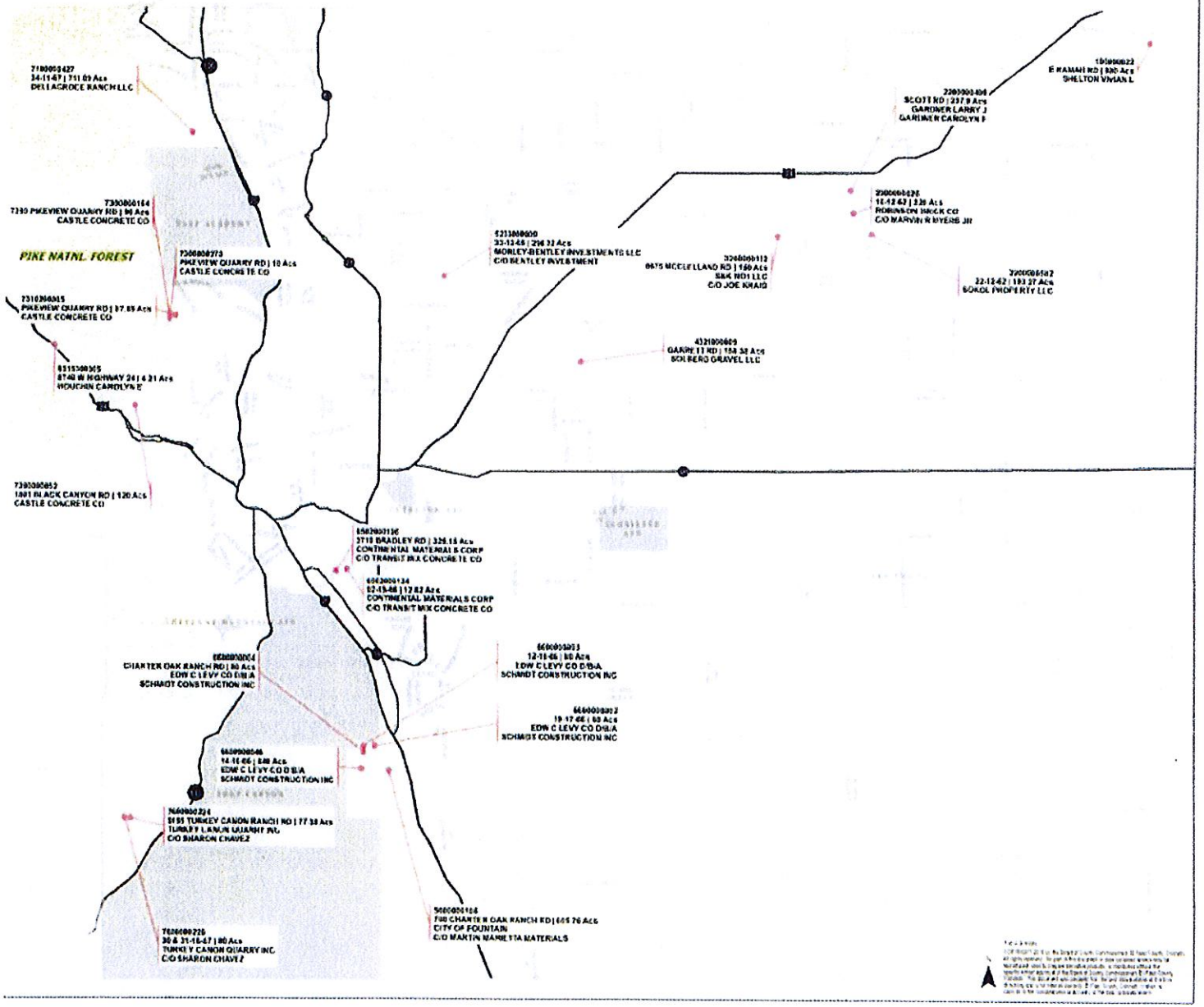
Ted D. Kerr
Board of Directors
Red Rock Valley Estates Water District
11145 Calle Corvo
Colorado Springs, CO 80911

Camille Mojar, Board Secretary

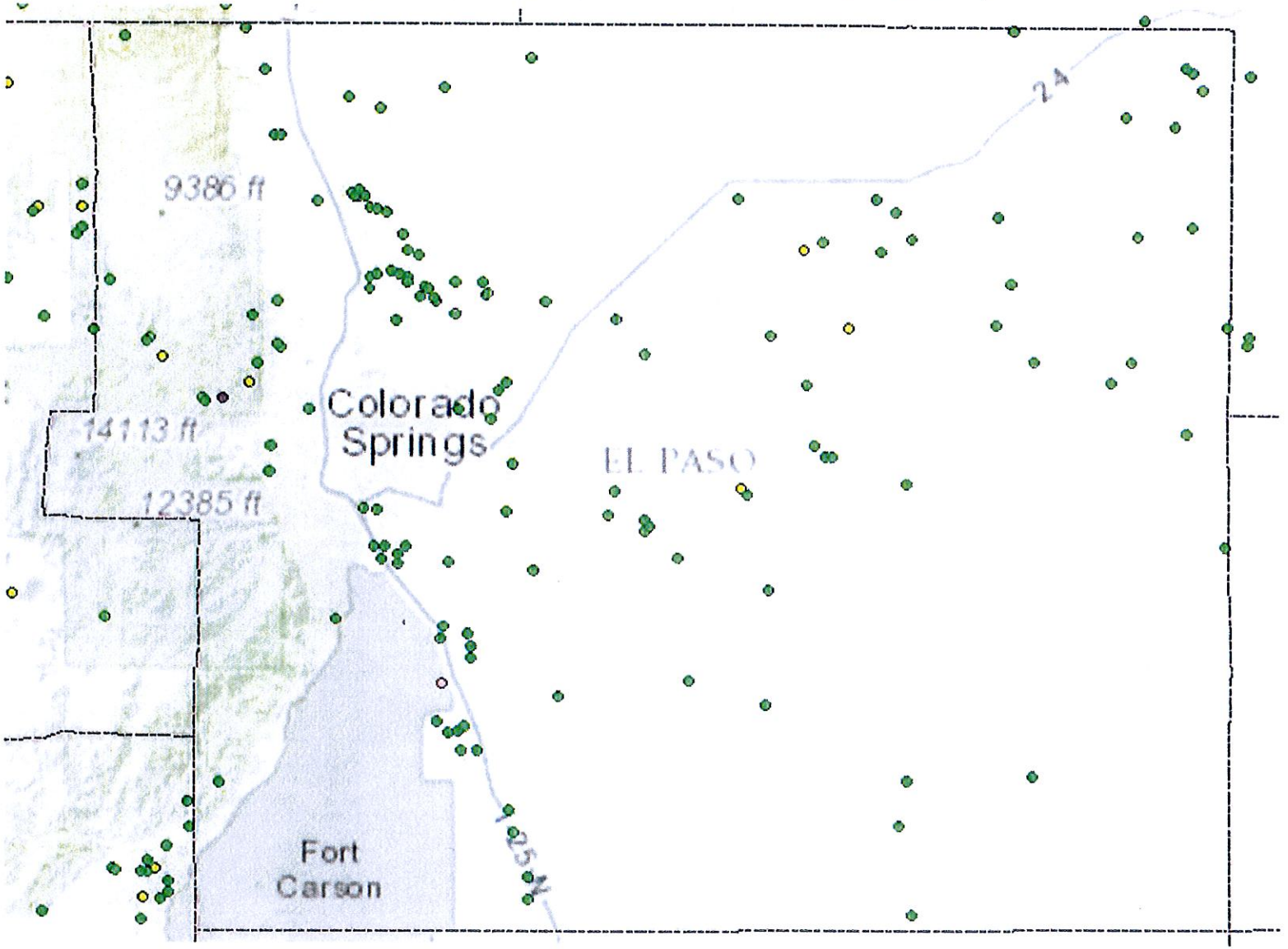
Mining in El Paso County

Source: El Paso County map;
CDRMS mining map and
CDRMS Mining Data

EL PASO COUNTY
5120 EARTH AND STONE LAND USES



CDRMS Map of Mining Operations in El Paso County



Active Mine Permits In El Paso County

County	Site Name	Operator	Permit #	Permit Date	Permit Type	Permit Acres	Mine Type	Commodities
El Paso	Agnus Dei Lode Claim	Jean Marie Cowman	M2013052	4/29/2014	110(2)	9.9	SR	GEM QTZ
El Paso	Apache 9	General Shale Brick, Inc.	M1978009	8/14/1978	112c	1,691.00	SR	CLY SDG
El Paso	Calhan Clay Pit	The Summit Pressed Brick and Tile Company	M1993080	4/26/1994	112c	320	SR	CLY
El Paso	Clear Spring Ranch Pit	City of Colorado Springs	M1992074	3/12/1993	112c	50.7	SR	GRAV
El Paso	Daniels Sand Pit 2	Continental Materials Corporation	M19730075G	1/7/1981	112c	352.3	SR	SDG
El Paso	Dellacroce Pit	Raymond F. & Robert W. Dellacroce	M1993050	2/22/1994	112c	130.99	SR	GRAV
El Paso	Fountain Colony Pit	Kiewit Western Company	M1987171	5/9/1995	112c	313.9	SR	SDG
El Paso	Fountain Pit	Martin Marietta Materials, Inc.	M1981307	12/3/1982	112c	605	SR	SDG
El Paso	Goss Sand & Gravel	David Goss	M1985140	1/24/1986	110c	9.9	BL	SDG
El Paso	Hale Pit aka Earl's Pit	S & K No. 1, LLC	M1981121	7/23/1981	110c	9.9	SR	SDG
El Paso	Houchin Gravel Pit	Charles W Houchin	M1980249	2/4/1981	110c	3	SR	SDG
El Paso	Kunau Site	Tim Kunau	M2006025	2/17/2010	110c	9.18	SR	GRAV
El Paso	Menzer Quarry	Schmidt Construction Company	M1976009HR	6/23/1977	112c	172.5	SR	GRT
El Paso	Midway Pit	Midway Aggregates, RLLP	M1988018	8/12/1988	112c	25.35	SR	SDG
El Paso	Mitchell Mine No 1	R E Monks Construction Co.	M1986025	3/19/1986	110c	9.5	SR	SDG
El Paso	Pikeview Quarry	Continental Materials Corporation	M1977211	5/27/1980	112c	246.46	SR	LST GRT DOL
El Paso	Schuler Construction Pit # 1	Schuler Construction	M2005002	6/24/2005	110c	9.9	SR	GRAV
El Paso	Simla Highway Pit	Schuler Terracing	M1995095	7/8/1996	110c	8.72	SR	GRAV
El Paso	Snyder Quarry	Continental Materials Corporation	M1977210	5/27/1980	112c	110	CO	LST
El Paso	Sokol Pit	Rocky Mountain Materials and Asphalt, Inc.	M1980193	10/23/1980	112c	295	SR	SDG
El Paso	Solberg Pit	Solberg Gravel LLC	M1981044	4/7/1981	112c	234.56	SR	SDG
El Paso	South Asphalt Plant	Rocky Mountain Materials and Asphalt, Inc.	M2009004	9/3/2009	110c	9.9	SR	GRAV SAND
El Paso	Sundance Sand and Gravel Resource	Sundance Investments LLP	M2006073	3/27/2008	112c	745	SR	SAND GRAV
El Paso	The Rise Above	Amanda Adkins Anderson & Travis Anderson	M2014054	2/19/2015	110(2)	9.9	SR	GEM
El Paso	Vollmer Road Pit	Pioneer Sand Company, Inc.	M1977174	5/23/1979	112c	149.7	SR	SDG
El Paso	Yoder	Rocky Mountain Materials and Asphalt, Inc.	M1980189	10/23/1980	110c	7	SR	SDG

Permit Type

Permit types are divided into two major types, construction materials and hard rock permits. Construction permits are 110c, 111, and 112c. The 111 permit is exclusively for Government entities. Permits 110(1), 110(2), 110d, 112, 112d1, 112d2 and 112d3 are hard rock related permits. The d designation is related to extraction methods used in hard rock operations.

110(1)	Hard Rock Limited Impact
110(2)	Hard Rock Limited Impact
110c	Construction Limited Impact
110d	Designated Limited Impact
111	Construction by Government Agency
112	Hard Rock Regular Operation
112c	Construction Regular Operation
112d-1	Designated Mining Operation
112d-2	Designated Mining Operation
112d-3	Designated Mining Operation
COAL	Coal Permit
COEX	Coal Exploration Permit
ILL	Illegal
NM	Not Mining

Mine Type

BL	blank - future update
CO	combined surface and underground
CX	coal exploration
HL	heap leach
IS	In-situ
OR	other
SR	surface
UG	underground
UN	unknown mine type

Commodities

AG	Silver
AGGR	Aggregate
AU	Gold
BOR	Borrow Material
CLY	Clay (General)
COA	Coal
DOL	Dolomite
EVA	Evaporities
GEM	Gemstones
GRAV	Gravel
GRT	Granite, granite gneiss
GYP	Anhydrite, gypsum
LST	Limestone (General)
MIC	Mica
MPG	mineral pigments
PEA	peat
QTZ	Quartz (quartzite/quzrtzose sandstone)
SAND	sand
SDG	sand and gravel
SIL	silica (quartz, quartzite)
SST	sandstone (silica, stone, quartzite)
STN	stone
STN1	crushed stone material
UN	unknown commodity

Colorado Division of Minerals & Geology Report Sorted By Operator 3/29/2018

You requested a report sorted by Operator / Permit Number and based on:	
County:	Fremont
Operator:	All Operators
Permit Number:	All Permit Numbers
Mine Name:	All Mine Names
Permit Status:	AC
Commodity:	GRAV

Resort by County / Operator / Permit Number

Operator / Site Name / Permit No. / Permit Type	Permit Issued / Permit Status	Section	Township	Range	Prime Meridian	Contact / Address Line 1 / Address Line 2 / City State Zip Code / Telephone	Commodities Mined (USGS Codes)			County / Permit Acreage / Mine Type / Annual Fee / Required Surety
Fremont County Quagmire Creek M1990047 110c	6/8/1990 AC					Sterling Rife 1170 Red Canyon Road Canon City CO 81212-0000				Fremont 6.40 SR $323.00
/NE/NE		2	49N	11E	10	(719) 275-7430	GRAV			$0.00
Fremont County Stirrup Pit M1990138 110c	12/3/1990 AC					Sterling Rife 1170 Red Canyon Road Canon City CO 81212-0000				Fremont 9.60 SR $323.00
/NW/NE		21	51N	12E	10	(719) 276-7430	GRAV			$0.00
Fremont County Howard Creek Pit #1 & #2 M1999033 110c	5/26/1999 AC					Sterling Rife 1170 Red Canyon Road Cañon City CO 81212-0000				Fremont 8.94 SR $323.00
/SE/SE		6	48N	10E	10	(719) 276-7430	GRAV			$0.00
Fremont County Union Hill Gravel Pit M2000056 112c	10/19/2000 AC					Sterling Rife 1170 Red Canyon Road Canon City CO 81212-0000				Fremont 79.70 SR $791.00
/NW		15	19S	69W	06	(719) 276-7430	GRAV			$0.00
Fremont County Indian Springs Park Pit M2001087 112c	2/11/2002 AC					Sterling Rife 1170 Red Canyon Road Canon City CO 81212-0000				Fremont 20.00 OR $791.00
/SE		36	19S	73W	06	(719) 276-7430	GRAV			$0.00
Front Range Aggregates, LLC Parkdale Project M1997054 112c	1/11/1999 AC					David Bieber c/o Martin Marietta Materials, Inc. 1627 Cole Boulelvard, Suite 200 Lakewood CO 80401-0000				Fremont 513.20 SR $791.00
/SE		12	18S	72W	06	(720) 245-6423	SST	GRAV	GRT	$1,145,736.00
Ranch Land LLC dba Pioneer Sand Co Inc Ranch Land Rock Pit #2 M2003021 112c	3/22/2004 AC					Julie Sevier 5000 Northpark Drive Colorado Springs CO 80918-0000				Fremont 920.00 SR $791.00
/NW/NE		4	20S	68W	06	(719) 599-8100	GRAV			$83,750.00
Rockbottom, LLC Oak Creek Gravel Pit M1989084 112c	9/8/1989 AC					Andrew Kagan 555 Ernest Avenue Westcliffe CO 81252-0000				Fremont 25.50 SR $791.00
//		23	20S	71W	06	(719) 783-9636	GRAV			$59,732.00
Rocky Mountain Excavating, LLC Iron Mountain Road Gravel Pit M1994092 110c	6/27/1995 AC					Bennie Koch, Jr. 2976 L Path Cotopaxi CO 81223-0000				Fremont 9.90 SR $323.00
/SE/NW		32	19S	72W	06	(719) 942-4311	GRAV			$18,220.00
Tezak Stone & Aggregate Supply, Inc. Tezak No 2 Pit M2017016 111	5/19/2017 AC					Mike Tezak 5200 County Road 37 Cotopaxi CO 81223-0000				Fremont 5.00 SR $504.00
/NE/SE		22	48N	12E	10	(719) 275-1146	GRAV	AGGR		$12,500.00

Return

Colorado Division of Minerals & Geology Report Sorted By Operator 3/29/2018

You requested a report sorted by Operator / Permit Number and based on:	
County:	Fremont
Operator:	All Operators
Permit Number:	All Permit Numbers
Mine Name:	All Mine Names
Permit Status:	AC
Commodity:	All Commodities

Resort by County / Operator / Permit Number

Operator / Site Name / Permit No. / Permit Type	Permit Issued / Permit Status	Section	Township	Range	Prime Meridian	Contact / Address Line 1 / Address Line 2 / City State Zip Code / Telephone	Commodities Mined (USGS Codes)			County / Permit Acreage / Mine Type / Annual Fee / Required Surety
AZCO Construction, Inc. AZCO Pit M2004029 110c	9/24/2004 AC					Ronald E Walker 112 Top Rail Trail Penrose CO 81240-0000				Fremont 9.90 SR $323.00
/SE/SE		17	17S	73W	06	(719) 372-6872	SDG			$17,500.00
Byzantine Quarry LLC Byzantine Quarry M2007014 112c	12/6/2007 AC					Daniel Tezak 1087 East Holiday Drive Pueblo West CO 81007-0000				Fremont 175.31 SR $791.00
/NW/NW		7	18S	71W	06	(719) 547-0363	LST	GRT	SST	$90,052.00
Colorado Quarries Inc Mica Lode M1977144 112c	11/30/1977 AC					Bill Tezak 270 S 15th St Canon City CO 81212-0000				Fremont 46.00 SR $791.00
/SW/SE		14	18S	71W	06	(719) 275-6894	QTZ			$38,002.00
Colorado Quarries Inc Marrs Memorials M1977168 110c	11/30/1981 AC					Bill Tezak 270 S 15th St Canon City CO 81212-0000				Fremont 2.00 SR $323.00
NW/NE/NW		3	47N	12E	10	(719) 275-6894	AGGR			$3,040.00
Colorado Quarries Inc Mica White M1992058 112c	8/5/1992 AC					Bill Tezak 270 S 15th St Cañon City CO 81212-0000				Fremont 38.10 SR $791.00
/NE/NE		6	48N	11E	10	(719) 275-6894	MIC	SIL		$184,720.00
Continental Materials Corporation Cañon Dolomite Quarry M1977376 112c	9/22/1978 AC					Andre Laroche 444 E. Costilla St. Colorado Springs CO 80803-0000				Fremont 481.00 SR $791.00
/NW/SW		30	18S	70W	06	(719) 475-0700	DOL			$232,000.00
Continental Materials Corporation Grisenti Farms Gravel Pit M2001005 112c	5/23/2001 AC					Andre Laroche 444 E. Costilla St. Colorado Springs CO 80903-0000				Fremont 115.30 SR $791.00
/SW/NE		13	19S	69W	06	(719) 227-2035	SDG			$115,000.00
First Bentonite Company Colorado LBC Bentonite Pit M1977231 110c	8/23/1984 AC					Pamela Wedige 215 Teller St. Salida CO 81201-0000				Fremont 8.00 SR $323.00
/SE/SW		18	48N	11E	10	(719) 539-4693	CLY			$11,020.00
Fremont County Dist No 2 Gravel Pit M1979216 110c	12/18/1980 AC					Sterling Rife 1170 Red Canyon Road Canon City CO 81212-0000				Fremont 9.90 SR $323.00
//NE		16	19S	69W	06	(719) 276-7430	SDG			$0.00
Fremont County Fremont Gravel Pit M1984117 110c	7/26/1984 AC					Sterling Rife 1170 Red Canyon Road Canon City CO 81212-0000				Fremont 9.90 SR $323.00
//		20	48N	11E	10	(719) 276-7430	SDG			$0.00
Fremont County Cottonwood Pit M1986010 112c	2/26/1986 AC					Sterling Rife 1170 Red Canyon Road Cañon City CO 81212-0000				Fremont 48.40 SR $791.00
//SE		36	16S	73W	06	(719) 276-7430	SDG			$0.00
Fremont County Quagmire Creek M1990047 110c	6/8/1990 AC					Sterling Rife 1170 Red Canyon Road Canon City CO 81212-0000				Fremont 6.40 SR $323.00
/NE/NE		2	49N	11E	10	(719) 275-7430	GRAV			$0.00
Fremont County Stirrup Pit M1990138 110c	12/3/1990 AC					Sterling Rife 1170 Red Canyon Road Canon City CO 81212-0000				Fremont 9.60 SR $323.00
/NW/NE		21	51N	12E	10	(719) 276-7430	GRAV			$0.00
Fremont County Howard Creek Pit #1 & #2 M1999033 110c	5/26/1999 AC					Sterling Rife 1170 Red Canyon Road Cañon City CO 81212-0000				Fremont 8.94 SR $323.00
/SE/SE		6	48N	10E	10	(719) 276-7430	GRAV			$0.00
Fremont County Union Hill Gravel Pit M2000056 112c	10/19/2000 AC					Sterling Rife 1170 Red Canyon Road Canon City CO 81212-0000				Fremont 79.70 SR $791.00
//NW		15	19S	69W	06	(719) 276-7430	GRAV			$0.00
Fremont County Indian Springs Park Pit M2001087 112c	2/11/2002 AC					Sterling Rife 1170 Red Canyon Road Canon City CO 81212-0000				Fremont 20.00 OR $791.00
//SE		36	19S	73W	06	(719) 276-7430	GRAV			$0.00
Fremont Paving & Redi-Mix, Inc. McKenzie Pit M1980224 112c	10/27/1983 AC					John P Ary P.O. Box 841 Canon City CO 81215-0000				Fremont 32.78 SR $791.00
/SE/SE		2	19S	70W	06	(719) 275-3264	SDG			$10,460.00
Fremont Paving & Redi-Mix, Inc. Penrose Pit						John P Ary 839 MacKenzie Avenue				Fremont 821.00

M1987131 112c /SW/SW	6/6/1988 AC 11	19S	69W	06	Canon City CO 81212-0000 (719) 275-3264	SDG			SR $791.00 $320,000.00
Fremont Paving & Redi-Mix, Inc. Florence South Pit M1988093 112c /SW/NW	3/3/1989 AC 17	19S	69W	06	John P Ary P.O. Box 841 Canon City CO 81215-0000 (719) 275-3264	SDG			Fremont 22.50 SR $791.00 $45,100.00
Front Range Aggregates, LLC Parkdale Project M1997054 112c //SE	1/11/1999 AC 12	18S	72W	06	David Bieber c/o Martin Marietta Materials, Inc. 1627 Cole Boulelvard, Suite 200 Lakewood CO 80401-0000 (720) 245-6423	SST	GRAV	GRT	Fremont 513.20 SR $791.00 $1,145,736.00
GCC Rio Grande, Inc. Salt Canyon Project M1997064 112c /NE/SW	7/9/1998 AC 26	17S	68W	06	Gina Nance 3372 Lime Road Pueblo CO 81004-0000 (719) 647-6800	GYP			Fremont 559.22 SR $791.00 $69,832.00
High Plains Stone Company South 40 Quarry M1990016 110c /NW/NE	7/11/1990 AC 14	17S	68W	06	Debbie Wagner P.O. Box 100 Castle Rock CO 80104-0000 (303) 791-1862	STN			Fremont 9.80 SR $323.00 $2,000.00
Holcim (US) Inc. Coaldale Quarry M1977247 112c //	4/28/1981 AC 5	47N	11E	10	Dominic Bellino 3500 Highway 120 Florence CO 81226-0000 (719) 288-1418	GYP			Fremont 100.00 SR $791.00 $707,000.00
Holcim (US) Inc. Portland Limestone Quarry M1977344 112c //	10/10/1978 AC 17	19S	68W	06	Dominic Bellino 3500 Highway 120 Florence CO 81226-0000 (719) 288-1420	LST			Fremont 1,600.00 SR $791.00 $5,268,550.00
Holcim (US) Inc. Ranch Land Rock Pit #1 M2002096 112c //	10/15/2003 AC 24	20S	68W	06	Nick Bellino 3500 Highway 120 Florence CO 81226-0000 (719) 288-1418	SST	LST	SDG	Fremont 640.00 SR $791.00 $43,500.00
Indian Springs Ranch, LLP Thorson Mine M1981020 110c //SW	5/6/1981 AC 8	18S	69W	06	Ina Finch P.O. Box 405 Canon City CO 81212-0000 (719) 275-5003	GYP			Fremont 9.80 SR $323.00 $2,500.00
KrauthCo Inc J&J Stone Pit #1 M2011004 112c /SW/SW	5/23/2011 AC 2	18S	70W	06	Michael D Krauth 1068 Red Canyon Road Canon City CO 81212-0000 (719) 275-5727	SST			Fremont 115.00 SR $791.00 $8,490.00
Langston Concrete, Inc. Florence Sand & Gravel Pit M1992051 112c /NW/NW	8/11/1992 AC 21	19S	69W	06	Mike Langston 902 South Union Street P.O. Box 279 Florence CO 81226-0000 (719) 784-3878	SDG			Fremont 77.40 SR $791.00 $38,100.00
Las Rocas, LLC Ary Airport Pit M1991118 112c /SE/SE	11/15/1991 AC 34	18S	69W	06	Robert Hamilton P.O. Box 38429 Colorado Springs CO 80937-0000 (719) 784-6942	SDG	BOR		Fremont 100.00 SR $791.00 $46,520.00
Northfield Partners, LLC Northfield Project X200522600 COEX //	3/11/2005 AC 13	19S	70W	06	Scott Leonhart P.O. Box 630678 Littleton CO 80163-0678 (303) 267-0667	COA			Fremont 0.00 CX $0.00 $14,117.00
Pioneer Sand Company, Inc. Phillips Ranch Property Gravel Pit #2 M2000046 112c /NE/NW	6/16/2000 AC 1	20S	69W	06	Julie Sevier 630 Plaza Drive, Suite 150 Highlands Ranch CO 80129-0000 (719) 599-8100	SDG			Fremont 175.00 SR $791.00 $117,123.00
Pioneer Sand Company, Inc. Hardscrabble Pit M2000138 112c /SW/NE	2/20/2001 AC 19	19S	68W	06	Julie Sevier 630 Plaza Drive, Suite 150 Highlands Ranch CO 80129-0000 (719) 599-8100	SDG			Fremont 146.19 SR $791.00 $81,517.00
Ranch Land LLC dba Pioneer Sand Co Inc Ranch Land Rock Pit #2 M2003021 112c /NW/NE	3/22/2004 AC 4	20S	68W	06	Julie Sevier 5000 Northpark Drive Colorado Springs CO 80918-0000 (719) 599-8100	GRAV			Fremont 920.00 SR $791.00 $83,750.00
Rockbottom, LLC Spotted Burro Pit M1979192 112c //NW	10/14/1980 AC 27	18S	69W	06	Andy Kagan 555 Ernest Avenue Westcliffe CO 81252-0000 (719) 783-9636	SDG			Fremont 53.91 SR $791.00 $45,478.00
Rockbottom, LLC Oak Creek Gravel Pit M1989084 112c //	9/8/1989 AC 23	20S	71W	06	Andrew Kagan 555 Ernest Avenue Westcliffe CO 81252-0000 (719) 783-9636	GRAV			Fremont 25.50 SR $791.00 $59,732.00
Rocky Mountain Excavating, LLC Iron Mountain Road Gravel Pit M1994092 110c /SE/NW	6/27/1995 AC 32	19S	72W	06	Bennie Koch, Jr. 2976 L Path Cotopaxi CO 81223-0000 (719) 942-4311	GRAV			Fremont 9.90 SR $323.00 $18,220.00
Rocky Mountain Materials and Asphalt, Inc. Red Canyon Quarry M1985043 112c //NE	5/6/1985 AC 1	17S	68W	06	David Bieber c/o Martin Marietta Materials, Inc. 1627 Cole Boulevard, Suite 200 Lakewood CO 80401-0000 (720) 245-6423	AGGR	SDG		Fremont 675.00 SR $791.00 $334,000.00
Rocky Mountain Materials and Asphalt, Inc. Penrose Ranch's M1992016 112c /NW/NE	6/24/1992 AC 19	19S	68W	06	David Bieber Martin Marietta Materils Inc. 1627 Cole Boulevard, Suite 200 Lakewood CO 80401-0000 (720) 245-6423	SDG			Fremont 2,496.00 SR $791.00 $281,283.09

Rocky Mountain Materials and Asphalt, Inc. Coyote Ridge M2000052 112c	9/11/2000 AC				David Bieber c/o Martin Marietta Materials, Inc. 1627 Cole Boulevard, Suite 200 Lakewood CO 80401-0000				Fremont 193.28 SR $791.00
//	2	20S	69W	06	(719) 473-3100	SDG			$32,400.00
Seifert Construction dba Seifert Enterprises, LLC Tallahassee Pit M1999003 110c	4/8/1999 AC				Trenton Stafford 198 Range View Loop Westcliffe CO 81252-0000				Fremont 9.90 SR $323.00
//NW	30	16S	72W	06	(719) 783-2757	SDG			$34,185.00
South Forty Recreation, LLC Canon City East Pit M1977559 112c	2/22/1978 AC				Steve Lindner 759 Apache Drive Canon City CO 81212-0000				Fremont 30.84 SR $791.00
//SW	1	19S	70W	06	(719) 371-3104	SDG			$46,910.00
Summit Brick & Tile Co. 8-Mile Clay Mine M1977320 112c	6/29/1978 AC				Matt Welte P.O. Box 533 Pueblo CO 81002-0533				Fremont 120.00 SR $791.00
/SW/SW	4	18S	71W	06	(719) 542-8278	CLY			$49,166.00
Summit Brick & Tile Co. Beaver Crk Clay Mine M1977322 110c	2/17/1978 AC				Matt Welte P.O. Box 533 Pueblo CO 81002-0533				Fremont 8.20 SR $323.00
/NE/NE	35	17S	69W	06	(719) 542-8278	CLY			$11,300.00
Summit Brick & Tile Co. Stocks Clay Mine M1977324 112c	2/17/1978 AC				Matt Welte P.O. Box 533 Pueblo CO 81002-0533				Fremont 280.00 SR $791.00
SE/NW/SE	4	18S	70W	06	(719) 542-8278	CLY			$38,500.00
Summit Brick & Tile Co. Patton Clay Mine M1998067 112c	1/13/1999 AC				Steve Obrian 7985 Vance Dr. Suite 205A Arvada CO 80003-0000				Fremont 280.00 SR $791.00
//	25	17S	71W	06	(303) 423-7297	CLY			$29,500.00
Tezak Heavy Equipment Co. Inc. T.H.E. Aggregate Source M1977193 112c	11/22/1977 AC				Randy DiLuzio 205 Tunnel Dr. Cañon City CO 81212-0000				Fremont 231.00 SR $791.00
/NW/SE	31	18S	70W	06	(719) 269-1173	GRT	SDG		$540,215.00
Tezak Heavy Equipment Co. Inc. Table Mountain Quarry M1999004 112c	6/25/1999 AC				Randy DiLuzio 205 Tunnel Dr. Canon City CO 81212-0000				Fremont 561.40 SR $791.00
/NW/NE	22	17S	68W	06	(719) 269-1173	SIL			$202,793.00
Tezak Stone & Aggregate Supply, Inc. Tezak No 2 Pit M1981080 110c	5/27/1981 AC				Mike A Tezak 6200 CR 37 Texas Creek CO 81223-0000				Fremont 19.80 SR $323.00
SW/SE/SW	22	48N	12E	10	(719) 275-1146	SDG			$55,535.00
Tezak Stone & Aggregate Supply, Inc. Tezak No 2 Pit M2017016 111	5/19/2017 AC				Mike Tezak 6200 County Road 37 Cotopaxi CO 81223-0000				Fremont 5.00 SR $504.00
/NE/SE	22	48N	12E	10	(719) 275-1146	GRAV	AGGR		$12,500.00
The Summit Pressed Brick and Tile Company Cherokee Clay Mine M1977325 110c	11/23/1977 AC				Matthew Welte P.O. Box 533 Pueblo CO 81002-0533				Fremont 9.00 SR $323.00
/SE/SW	1	20S	70W	06	(719) 542-8278	CLY			$18,500.00
U S Soil Conditioning Company Maverick Placer M1979206 112c	6/16/1980 AC				Joseph E Lionelle P.O. Box 926 Salida CO 81201-0000				Fremont 37.00 SR $791.00
/SE/SE	7	49N	10E	10	(719) 539-3535	GYP	EVA		$32,500.00
Vallie Gravel, Inc. Vallie Gravel Co. M1978331 110c	3/1/1979 AC				Ed Zabrisky 365 Heather Ln Howard CO 81233-0000				Fremont 9.40 SR $323.00
//NE	20	48N	11E	10	(719) 942-3570	SDG			$5,550.00
Yevoli Cobblestone Inc Yevoli Cobblestone Pit M2007003 110c	9/6/2007 AC				Mark Yevoli 8347 S. Carr St. Littleton CO 80128-0000				Fremont 9.98 SR $323.00
/NE/SE	2	20S	69W	06	(303) 683-0200	SDG			$34,925.00

Return

Colorado Division of Minerals & Geology Report Sorted By Operator 3/29/2018

You requested a report sorted by Operator / Permit Number and based on:	
County:	El Paso
Operator:	All Operators
Permit Number:	All Permit Numbers
Mine Name:	All Mine Names
Permit Status:	AC
Commodity:	All Commodities

Resort by County / Operator / Permit Number

Operator / Site Name / Permit No. / Permit Type	Permit Issued / Permit Status				Contact / Address Line 1 / Address Line 2 / City State Zip Code				County / Permit Acreage / Mine Type / Annual Fee
QT/QT/QT	Section	Township	Range	Prime Meridian	Telephone	Commodities Mined (USGS Codes)			Required Surety
Amanda Adkins Anderson & Travis Anderson					Amanda A Adkins				El Paso
The Rise Above					P.O. Box 130				9.90
M2014054	2/19/2015								SR
110(2)	AC				Rye CO 81069-0000				$259.00
/NE/SE	12	14S	68W	06	(719) 568-0373	GEM			$5,900.00
Charles W Houchin					Curt Houchin				El Paso
Houchin Gravel Pit					P.O. Box 85				3.00
M1980249	2/4/1981								SR
110c	AC				Green Mountain Falls CO 80819-0000				$323.00
//	15	13S	68W	06	(719) 684-9766	SDG			$3,500.00
City of Colorado Springs					Michael Brady				El Paso
Clear Spring Ranch Pit					PO Box 1103				50.70
M1992074	3/12/1993				Mail Code 940				SR
112c	AC				Colorado Springs CO 80947-0000				$791.00
/NW/SW	20	16S	65W	06	(719) 668-4068	GRAV			$0.00
Continental Materials Corporation					Andre Laroche				El Paso
Daniels Sand Pit 2					444 E. Costilla St.				352.30
M1973007SG	1/7/1981								SR
112c	AC				Colorado Springs CO 80903-0000				$791.00
//	3	15S	66W	06	(719) 475-0700	SDG			$1,038,500.00
Continental Materials Corporation					Andre Laroche				El Paso
Snyder Quarry					444 E. Costilla St.				110.00
M1977210	5/27/1980								CO
112c	AC				Colorado Springs CO 80903-0000				$791.00
//NW	32	13S	67W	06	(719) 227-2035	LST			$340,000.00
Continental Materials Corporation					Andre LaRoche				El Paso
Pikeview Quarry					444 E. Costilla				246.46
M1977211	5/27/1980								SR
112c	AC				Colorado Springs CO 80903-0000				$791.00
/SE/NE	9	13S	67W	06	(719) 491-0288	LST	GRT	DOL	$4,226,000.00
David Goss					Dean Goss				El Paso
Goss Sand & Gravel					24040 Falcon Hwy				9.90
M1985140	1/24/1986								BL
110c	AC				Calhan CO 80808-9156				$323.00
/SE/SW	7	13S	62W	06	(719) 683-4295	SDG			$5,000.00
General Shale Brick, Inc.					Harold Stickler				El Paso
Apache 9					1845 W. Dartmouth Ave.				1,691.00
M1978009	8/14/1978								SR
112c	AC				Denver CO 80110-1308				$791.00
//	16	12S	62W	06	(303) 783-3071	CLY	SDG		$181,161.00
Jean Marie Cowman					Jean M Cowman				El Paso
Agnus Dei Lode Claim					1065 S. Woodland Ave. #1				9.90
M2013052	4/29/2014								SR
110(2)	AC				Woodland Park CO 80863-0000				$259.00
/NE/SW	12	14S	68W	06	(719) 314-8945	GEM	QTZ		$6,553.53
Kiewit Western Company					Daniel Leone				El Paso
Fountain Colony Pit					3527 Wabash Street				313.90
M1987171	5/9/1995								SR
112c	AC				Colorado Springs CO 80906-0000				$791.00
//	18	16S	65W	06	(719) 393-0026	SDG			$200,000.00
Martin Marietta Materials, Inc.					Julie Mikulas				El Paso
Fountain Pit					1800 N. Taft Hill Road				605.00
M1981307	12/3/1982								SR
112c	AC				Fort Collins CO 80521-0000				$791.00
//SW	18	16S	65W	06	(970) 227-4041	SDG			$1,369,462.00
Midway Aggregates, RLLP					Joe C Baxter				El Paso
Midway Pit					P.O. Box 580				25.35
M1988018	8/12/1988								SR
112c	AC				Rye CO 81069-0000				$791.00
//	22	17S	65W	06	(719) 489-3385	SDG			$62,260.00
Pioneer Sand Company, Inc.					Julie Sevier				El Paso
Vollmer Road Pit					630 Plaza Drive				42.37
M1977174	5/23/1979				Suite 150				SR
112c	AC				Highlands Ranch CO 80129-0000				$791.00
//	5	13S	65W	06	(303) 944-3913	SDG			$86,867.00
Raymond F. & Robert W. Dellacroce					Julie Sevier				El Paso
Dellacroce Pit					Pioneer Sand Co., Inc.				130.99
M1993050	2/22/1994				5000 Northpark Dr.				SR
112c	AC				Colorado Springs CO 80918-0000				$791.00
/NE/NE	34	11S	67W	06	(719) 599-8100	GRAV			$37,949.00
Rocky Mountain Materials and Asphalt, Inc.					David Bieber				El Paso
Yoder					c/o Martin Marietta Materials, Inc.				7.00
M1980189	10/23/1980				1627 Cole Boulevard, Suite 200				SR
110c	AC				Lakewood CO 80401-0000				$323.00
/NW/SW	28	15S	61W	06	(720) 245-6423	SDG			$28,820.00
Rocky Mountain Materials and Asphalt, Inc.					David Bieber				El Paso
Sokol Pit					c/o Martin Marietta Materials, Inc				295.00
M1980193	10/23/1980				1627 Cole Boulevard, Suite 200				SR
112c	AC				Lakewood CO 80401-0000				$791.00
//SW	22	12S	62W	06	(720) 245-6423	SDG			$113,757.00
Rocky Mountain Materials and Asphalt, Inc.					David Bieber				El Paso
South Asphalt Plant					c/o Martin Marietta Materials, Inc.				9.90
M2009004	9/3/2009				1627 Cole Boulevard, Suite 200				SR
110c	AC				Lakewood CO 80401-0000				$323.00
//SW	3	15S	66W	06	(719) 275-6423	GRAV	SAND		$59,055.00
S & K No. 1, LLC					Joe Kraig				El Paso
Hale Pit aka Earl's Pit					P.O. Box 49681				9.90

M1981121	7/23/1981								SR
110c	AC				Colorado Springs CO 80949-0000				$323.00
/SW/SW	24	12S	63W	06	(719) 491-2287	SDG			$17,570.00
Schmidt Construction Company					Scott Davis				El Paso
Menzer Quarry					2635 Delta Dr.				172.50
M1976009HR	6/23/1977								SR
112c	AC				Colorado Springs CO 80910-0000				$791.00
/NW/NW	32	16S	67W	06	(719) 392-4207	GRT			$456,000.00
Schmidt Construction Company					Scott Davis				El Paso
Fountain Pit					2635 Delta Dr.				643.80
M1982155	2/22/1978								SR
112c	AC				Colorado Springs CO 80910-0000				$791.00
/NW	13	16S	66W	06	(719) 392-4207	SDG			$457,188.00
Schuler Construction					Dave Schuler				El Paso
Schuler Construction Pit # 1					4520 Ramah Highway				9.90
M2005002	6/24/2005								SR
110c	AC				Yoder CO 80864-0000				$323.00
/NE/SW	20	13S	60W	06	(719) 478-2455	GRAV			$10,000.00
Schuler Terracing					Henry A Schuler				El Paso
Simla Highway Pit					35389 CR 197				8.72
M1995095	7/8/1996								SR
110c	AC				Limon CO 80828-0000				$323.00
/SE/SE	10	11S	60W	06	(719) 541-2396	GRAV			$28,540.00
Solberg Gravel LLC					Julie Sevier				El Paso
Solberg Pit					13745 Garrett Rd				234.56
M1981044	4/7/1981								SR
112c	AC				Peyton CO 80831-0000				$791.00
/NE/NE	21	13S	64W	06	(719) 683-3198	SDG			$175,100.00
Sundance Investments LLP					Mike Drabing				El Paso
Sundance Sand and Gravel Resource					900 Castleton Rd Suite 115				745.00
M2006073	3/27/2008								SR
112c	AC				Castle Rock CO 80109-0000				$791.00
/NE/NE	15	17S	65 W	06	(303) 814-3863	SAND	GRAV		$1,000.00
The Summit Pressed Brick and Tile Company					Matt Welte				El Paso
Calhan Clay Pit					PO Box 533				320.00
M1993080	4/26/1994								SR
112c	AC				Pueblo CO 81002-0533				$791.00
/SW/SE	8	12S	62W	06	(719) 542-8278	CLY			$19,200.00
Tim Kunau					Tim Kunau				El Paso
Kunau Site					23945 Lucky Ln				9.18
M2008025	2/17/2010								SR
110c	AC				Calhan CO 80808-0000				$323.00
/SW/NW	22	13S	61W	06	(719) 683-3720	GRAV			$11,218.00

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Colorado Division of Minerals & Geology Report Sorted By Operator 3/29/2018

You requested a report sorted by Operator / Permit Number and based on:	
County:	El Paso
Operator:	All Operators
Permit Number:	All Permit Numbers
Mine Name:	All Mine Names
Permit Status:	AC
Commodity:	All Commodities

Resort by County / Operator / Permit Number

Operator / Site Name / Permit No. / Permit Type	Permit Issued / Permit Status	Section	Township	Range	Prime Meridian	Contact / Address Line 1 / Address Line 2 / City State Zip Code / Telephone	Commodities Mined (USGS Codes)			County / Permit Acreage / Mine Type / Annual Fee / Required Surety
Amanda Adkins Anderson & Travis Anderson						Amanda A Adkins				El Paso
The Rise Above						P.O. Box 130				9.90
M2014054	2/19/2015									SR
110(2)	AC					Rye CO 81069-0000				$259.00
/NE/SE		12	14S	68W	06	(719) 568-0373	GEM			$5,900.00
Charles W Houchin						Curt Houchin				El Paso
Houchin Gravel Pit						P.O. Box 85				3.00
M1980249	2/4/1981									SR
110c	AC					Green Mountain Falls CO 80819-0000				$323.00
//		15	13S	68W	06	(719) 684-9766	SDG			$3,500.00
City of Colorado Springs						Michael Brady				El Paso
Clear Spring Ranch Pit						PO Box 1103				50.70
M1992074	3/12/1993					Mail Code 940				SR
112c	AC					Colorado Springs CO 80947-0000				$791.00
/NW/SW		20	16S	65W	06	(719) 668-4068	GRAV			$0.00
Continental Materials Corporation						Andre Laroche				El Paso
Daniels Sand Pit 2						444 E. Costilla St.				352.30
M1973007SG	1/7/1981									SR
112c	AC					Colorado Springs CO 80903-0000				$791.00
//		3	15S	66W	06	(719) 475-0700	SDG			$1,038,500.00
Continental Materials Corporation						Andre Laroche				El Paso
Snyder Quarry						444 E. Costilla St.				110.00
M1977210	5/27/1980									CO
112c	AC					Colorado Springs CO 80903-0000				$791.00
//NW		32	13S	67W	06	(719) 227-2035	LST			$340,000.00
Continental Materials Corporation						Andre LaRoche				El Paso
Pikeview Quarry						444 E. Costilla				246.46
M1977211	5/27/1980									SR
112c	AC					Colorado Springs CO 80903-0000				$791.00
/SE/NE		9	13S	67W	06	(719) 491-0288	LST	GRT	DOL	$4,226,000.00
David Goss						Dean Goss				El Paso
Goss Sand & Gravel						24040 Falcon Hwy				9.90
M1985140	1/24/1986									BL
110c	AC					Calhan CO 80808-9156				$323.00
/SE/SW		7	13S	62W	06	(719) 683-4295	SDG			$5,000.00
General Shale Brick, Inc.						Harold Stickler				El Paso
Apache 9						1845 W. Dartmouth Ave.				1,691.00
M1978009	8/14/1978									SR
112c	AC					Denver CO 80110-1308				$791.00
//		16	12S	62W	06	(303) 783-3071	CLY	SDG		$181,161.00
Jean Marie Cowman						Jean M Cowman				El Paso
Agnus Dei Lode Claim						1065 S. Woodland Ave. #1				9.90
M2013052	4/29/2014									SR
110(2)	AC					Woodland Park CO 80863-0000				$259.00
/NE/SW		12	14S	68W	06	(719) 314-8945	GEM	QTZ		$6,553.53
Kiewit Western Company						Daniel Leone				El Paso
Fountain Colony Pit						3527 Wabash Street				313.90
M1987171	5/9/1995									SR
112c	AC					Colorado Springs CO 80906-0000				$791.00
//		18	16S	65W	06	(719) 393-0026	SDG			$200,000.00
Martin Marietta Materials, Inc.						Julie Mikulas				El Paso
Fountain Pit						1800 N. Taft Hill Road				605.00
M1981307	12/3/1982									SR
112c	AC					Fort Collins CO 80521-0000				$791.00
//SW		18	16S	65W	06	(970) 227-4041	SDG			$1,369,462.00
Midway Aggregates, RLLP						Joe C Baxter				El Paso
Midway Pit						P.O. Box 580				25.35
M1988018	8/12/1988									SR
112c	AC					Rye CO 81069-0000				$791.00
//		22	17S	65W	06	(719) 489-3385	SDG			$62,260.00
Pioneer Sand Company, Inc.						Julie Sevier				El Paso
Vollmer Road Pit						630 Plaza Drive				42.37
M1977174	5/23/1979					Suite 150				SR
112c	AC					Highlands Ranch CO 80129-0000				$791.00
//		5	13S	65W	06	(303) 944-3913	SDG			$86,867.00
Raymond F. & Robert W. Dellacroce						Julie Sevier				El Paso
Dellacroce Pit						Pioneer Sand Co., Inc.				130.99
M1993050	2/22/1994					5000 Northpark Dr.				SR
112c	AC					Colorado Springs CO 80918-0000				$791.00
/NE/NE		34	11S	67W	06	(719) 599-8100	GRAV			$37,949.00
Rocky Mountain Materials and Asphalt, Inc.						David Bieber				El Paso
Yoder						c/o Martin Marietta Materials, Inc.				7.00
M1980189	10/23/1980					1627 Cole Boulevard, Suite 200				SR
110c	AC					Lakewood CO 80401-0000				$323.00
/NW/SW		28	15S	61W	06	(720) 245-6423	SDG			$28,820.00
Rocky Mountain Materials and Asphalt, Inc.						David Bieber				El Paso
Sokol Pit						c/o Martin Marietta Materials, Inc				295.00
M1980193	10/23/1980					1627 Cole Boulevard, Suite 200				SR
112c	AC					Lakewood CO 80401-0000				$791.00
//SW		22	12S	62W	06	(720) 245-6423	SDG			$113,757.00
Rocky Mountain Materials and Asphalt, Inc.						David Bieber				El Paso
South Asphalt Plant						c/o Martin Marietta Materials, Inc.				9.90
M2009004	9/3/2009					1627 Cole Boulevard, Suite 200				SR
110c	AC					Lakewood CO 80401-0000				$323.00
//SW		3	15S	66W	06	(719) 275-6423	GRAV	SAND		$59,055.00
S & K No. 1, LLC						Joe Kraig				El Paso
Hale Pit aka Earl's Pit						P.O. Box 49681				9.90

M1981121	7/23/1981								SR
110c	AC				Colorado Springs CO 80949-0000				$323.00
/SW/SW	24	12S	63W	06	(719) 491-2287	SDG			$17,570.00
Schmidt Construction Company					Scott Davis				El Paso
Menzer Quarry					2635 Delta Dr.				172.50
M1976009HR	6/23/1977								SR
112c	AC				Colorado Springs CO 80910-0000				$791.00
/NW/NW	32	16S	67W	06	(719) 392-4207	GRT			$456,000.00
Schmidt Construction Company					Scott Davis				El Paso
Fountain Pit					2635 Delta Dr.				643.80
M1982155	2/22/1978								SR
112c	AC				Colorado Springs CO 80910-0000				$791.00
/NW	13	16S	66W	06	(719) 392-4207	SDG			$457,188.00
Schuler Construction					Dave Schuler				El Paso
Schuler Construction Pit # 1					4520 Ramah Highway				9.90
M2005002	6/24/2005								SR
110c	AC				Yoder CO 80864-0000				$323.00
/NE/SW	20	13S	60W	06	(719) 478-2455	GRAV			$10,000.00
Schuler Terracing					Henry A Schuler				El Paso
Simla Highway Pit					35389 CR 197				8.72
M1995095	7/8/1996								SR
110c	AC				Limon CO 80828-0000				$323.00
/SE/SE	10	11S	60W	06	(719) 541-2396	GRAV			$28,540.00
Solberg Gravel LLC					Julie Sevier				El Paso
Solberg Pit					13745 Garrett Rd				234.56
M1981044	4/7/1981								SR
112c	AC				Peyton CO 80831-0000				$791.00
/NE/NE	21	13S	64W	06	(719) 683-3198	SDG			$175,100.00
Sundance Investments LLP					Mike Drabing				El Paso
Sundance Sand and Gravel Resource					900 Castleton Rd Suite 115				745.00
M2006073	3/27/2008								SR
112c	AC				Castle Rock CO 80109-0000				$791.00
/NE/NE	15	17S	65 W	06	(303) 814-3863	SAND	GRAV		$1,000.00
The Summit Pressed Brick and Tile Company					Matt Welte				El Paso
Calhan Clay Pit					PO Box 533				320.00
M1993080	4/26/1994								SR
112c	AC				Pueblo CO 81002-0533				$791.00
/SW/SE	8	12S	62W	06	(719) 542-8278	CLY			$19,200.00
Tim Kunau					Tim Kunau				El Paso
Kunau Site					23945 Lucky Ln				9.18
M2008025	2/17/2010								SR
110c	AC				Calhan CO 80808-0000				$323.00
/SW/NW	22	13S	61W	06	(719) 683-3720	GRAV			$11,218.00

Return

Colorado Division of Minerals & Geology Report Sorted By Operator 3/29/2018

You requested a report sorted by Operator / Permit Number and based on:	
County:	El Paso
Operator:	All Operators
Permit Number:	All Permit Numbers
Mine Name:	All Mine Names
Permit Status:	Any Permit Status
Commodity:	GRT

Resort by County / Operator / Permit Number

Operator / Site Name / Permit No. / Permit Type	Permit Issued / Permit Status	Section	Township	Range	Prime Meridian	Contact / Address Line 1 / Address Line 2 / City State Zip Code / Telephone	Commodities Mined (USGS Codes)			County / Permit Acreage / Mine Type / Annual Fee / Required Surety
City of Colorado Springs Manitou Incline Trail. M2014048 IM //	 TR 	 6	 14S	 67W	 06	Sarah Braun 1315 E. Pikes Peak Colorado Springs CO 80909-0000 (719) 385-6855	 GRT	 	 	El Paso 0.00 $0.00 $0.00
Colorado Division of Highways Green Mt Falls Pit M1974083 112c /SW/SE	 DN 	 32	 12S	 68W	 06	Ilyess Ksouri 4340 E Louisiana Ave Denver CO 80222-0000 (303) 757-9432	 GRT	 	 	El Paso 20.00 SR $0.00 $0.00
Continental Materials Corporation Pikeview Quarry M1977211 112c /SE/NE	 5/27/1980 AC 	 9	 13S	 67W	 06	Andre LaRoche 444 E. Costilla Colorado Springs CO 80903-0000 (719) 491-0288	 LST	 GRT	 DOL	El Paso 246.46 SR $791.00 $4,226,000.00
Joe Morin Joe Morin Casenda Co. M2002022 NM /SW/NW	 TR 	 23	 13S	 68W	 06	Joe Morin P.O. Box 362 Lake George CO 80827-0827 (719) 748-2252	 GRT	 	 	El Paso 0.00 $0.00 $0.00
Schmidt Construction Company Menzer Quarry M1976009HR 112c /NW/NW	 6/23/1977 AC 	 32	 16S	 67W	 06	Scott Davis 2635 Delta Dr. Colorado Springs CO 80910-0000 (719) 392-4207	 GRT	 	 	El Paso 172.50 SR $791.00 $456,000.00
Transit Mix Concrete Co. Hitch Rack Ranch Quarry M2016010 112c /SW/NE	 DN 	 16	 16S	 67W	 	Andre LaRoche 444 E Costilla St. Colorado Springs CO 80903-0000 (719) 475-0700	 GRT	 	 	El Paso 392.75 SR $0.00 $0.00

Return

Colorado Division of Minerals & Geology Report Sorted By Operator 3/29/2018

You requested a report sorted by Operator / Permit Number and based on:	
County:	El Paso
Operator:	All Operators
Permit Number:	All Permit Numbers
Mine Name:	All Mine Names
Permit Status:	Any Permit Status
Commodity:	GRAV

Resort by County / Operator / Permit Number

Operator / Site Name / Permit No. / Permit Type	Permit Issued / Permit Status	Section	Township	Range	Prime Meridian	Contact / Address Line 1 / Address Line 2 / City State Zip Code / Telephone	Commodities Mined (USGS Codes)		County / Permit Acreage / Mine Type / Annual Fee / Required Surety
Cedar Heights Community Assn.						Fred D Smith			El Paso
Cedar Heights						2250 Black Canyon Rd.			0.00
M2002075									
NM	TR					Colorado Springs CO 80904-0904			$0.00
//	28	13S	67W	06		0 -	GRAV		$0.00
Cheyenne Mtn.Develop/Rampart Contracting						Bob Irwin			El Paso
Cheyenne Mountain Development Pit						1765 S. 8th St. Suite T-1			0.00
M2000114									SR
ILL	WD					Colorado Springs CO 80928-0928			$0.00
/NW/NE	9	17S	62W	06		(719) 321-7609	GRAV	SAND	$0.00
Christine Dellacroce									El Paso
Dellacroce Pit						2210 West Baptist Road			8.00
M1981188									SR
110c	WD					Colorado Springs CO 80921-0000			$0.00
SE/NW/NE	34	11S	67W	06		(303) 481-2452	GRAV		$0.00
City of Colorado Springs						Michael Brady			El Paso
Clear Spring Ranch Pit						PO Box 1103			50.70
M1992074	3/12/1993					Mail Code 940			SR
112c	AC					Colorado Springs CO 80947-0000			$791.00
/NW/SW	20	16S	65W	06		(719) 668-4068	GRAV		$0.00
Dave Schuler						Dave Schuler			El Paso
Schuler Pit						4520 Ramah Highway			0.00
M2004068									SR
ILL	TR					Yoder CO 80864-0864			$0.00
//	30	13S	60W	06		(719) 478-2442	GRAV		$0.00
Dave Schuler						Dave Schuler			El Paso
Cook Pit						4520 Ramah Highway			0.00
M2004069									SR
ILL	TR					Yoder CO 80864-0864			$0.00
//	20	13S	60W	06		(719) 478-2442	GRAV		$0.00
HLBE Inc						Joe Pieper			El Paso
Moonlight Hills						10 Boulder Crescent, Suite 101			56.50
M1988016									SR
112c	TR					Colorado Springs CO 80903-0000			$0.00
//SE	3	13S	67W	06		(719) 111-1111	GRAV		$301,500.00
Park & Associates, Inc.						W. D Park			El Paso
Unknown						4575 Hilton Parkway, Suite 102			0.00
M2010067									
NM	TR					Colorado Springs CO 80907-0000			$0.00
//	16					(719) 534-9497	GRAV		$0.00
Raymond F. & Robert W. Dellacroce						Julie Sevier			El Paso
Dellacroce Pit						Pioneer Sand Co., Inc.			130.99
M1993050	2/22/1994					5000 Northpark Dr.			SR
112c	AC					Colorado Springs CO 80918-0000			$791.00
/NE/NE	34	11S	67W	06		(719) 599-8100	GRAV		$37,949.00
Rice & Rice, Inc.						Buddy Rice,			El Paso
Hanna Ranches						8150 Rice Lane			9.00
M1989050	5/11/1989								SR
111	TR					Fountain CO 80817-0000			$350.00
/SW/NE	4	17S	65W	06		(719) 392-5311	GRAV	BOR	$40,500.00
Rocky Mountain Materials and Asphalt, Inc.						David Bieber			El Paso
South Asphalt Plant						c/o Martin Marietta Materials, Inc.			9.90
M2009004	9/3/2009					1627 Cole Boulevard, Suite 200			SR
110c	AC					Lakewood CO 80401-0000			$323.00
//SW	3	15S	66W	06		(719) 275-6423	GRAV	SAND	$59,055.00
Schuler Construction						Dave Schuler			El Paso
Schuler Construction Pit # 1						4520 Ramah Highway			9.90
M2005002	6/24/2005								SR
110c	AC					Yoder CO 80864-0000			$323.00
/NE/SW	20	13S	60W	06		(719) 478-2455	GRAV		$10,000.00
Schuler Terracing						Henry A Schuler			El Paso
Simla Highway Pit						35389 CR 197			8.72
M1995095	7/8/1996								SR
110c	AC					Limon CO 80828-0000			$323.00
/SE/SE	10	11S	60W	06		(719) 541-2396	GRAV		$28,540.00
Sundance Investments LLP						Mike Drabing			El Paso
Sundance Sand and Gravel Resource						900 Castleton Rd Suite 115			745.00
M2006073	3/27/2008								SR
112c	AC					Castle Rock CO 80109-0000			$791.00
/NE/NE	15	17S	65 W	06		(303) 814-3863	SAND	GRAV	$1,000.00
Tim Kunau						Tim Kunau			El Paso
Kunau Site						23945 Lucky Ln			9.18
M2008025	2/17/2010								SR
110c	AC					Calhan CO 80808-0000			$323.00
/SW/NW	22	13S	61W	06		(719) 683-3720	GRAV		$11,218.00

Return

Water Telluric LLC

April 7, 2018

Mr. Steve Mulliken
Mulliken Weiner Berg & Jolivent, P.C.
102 South Tejon Streeet, Ste., 900
Colorado Springs, Co. 80903

RE: Hitch Rack Ranch Quarry Permit Application – Opinions of William E. Sanford Ph.D. Regarding Groundwater Concerns

Mr. Mulliken

I am submitting this report which summarizes my opinions concerning the application for the Hitch Rack Ranch (HRR) quarry permit application (File NO. M-2017-049) submitted by Transit Mix Concrete Company to the Colorado Division of Reclamation Mining and Safety. My opinions are based on my review of Exhibit G – Water Information, with my focus being on groundwater.

After review of the material, I have a number of concerns that lead me to the conclusions that:

1. The aquifer was not properly characterized;
2. The conceptual model of the groundwater system was not developed using all the available data;
3. The groundwater model developed is simplified, not properly tested, and not adequate for predicting future groundwater level declines which may permanently damage the water supply of surrounding households;
4. There are numerous water supply wells located downgradient and outside the area modeled. With there being a great deal of geologic and hydrologic uncertainty, it is highly likely there will be a negative impact to the water supply of some of these households.

Water Telluric LLC

Below is a detailed list of my concerns:

General

- Fractured rock systems are known to have zones of more intense fracturing – core logs show this. The localized porosity can be much greater than the bulk porosity
- Water in the fractures can flow much faster than in a bulk porous medium
- If water is concentrated in the fracture zones, drawdown can occur farther away and be greater than if assume a uniform porous medium at that distance
- Heads used to contour a water level map are from only one day
- Concerned that the potentiometric water levels are contoured at 100 ft blow Little Turkey Creek (LTC) elevation. How can the details around the creek be drawn with such limited data?
- There is no evidence that the fault zone at the east is impermeable. It just makes it convenient
- No pumping from monitoring wells to estimate permeability and vertical connections between wells
- Groundwater discharge into LTC is based on limited data
- Streamflow differences between gaging stations of just 0.04 CFS are used. This appears to be smaller than measurement error.
- Potentiometric heads measured in the wells are not necessarily the same as the water table

Modeling Concerns

- No groundwater flow into modeled system from outside watershed boundaries
- The number of layers used in the model is not given
- What is the upper boundary of the model – does it include topography?
- River package used for all tributaries to LTC. What flow data were used for those?
- What head gradients were used for the River nodes? At what depth was the permeability contrast?
- Baseflow used is from minimal data and is assumed the steady-state condition
- Heads calibrated to are only in a limited area compared to area of watershed modeled
- What was the potentiometric surface of the entire watershed after calibration?
- What was the starting head distribution around the watershed?
- Use of bulk parameters over a thickness of 400-800 ft in a system with known fracture zones and heterogeneities simplified the modeling but is not realistic.
- In steady-state, using bulk parameters over a large area is fine to determine flow rates and heads at the watershed scale. At a scale much smaller than the watershed (such as

the size of the quarry), the smaller-scale heterogeneities will play a much more important role in modeling changes in head

- The assumption of the no-flow fault zone is suspect as the water level contouring shows that there is a continuous groundwater system to the east
- No testing of potentially different subsurface models.
- Effects of drawdown are based on the steady-state model by including drains during various stages of quarry operation
- How was ET estimated?
- A cross-section of pre-and post-mining water levels of nearly 150 feet. This has the potential of reducing flow into the creek by removing water during mining.

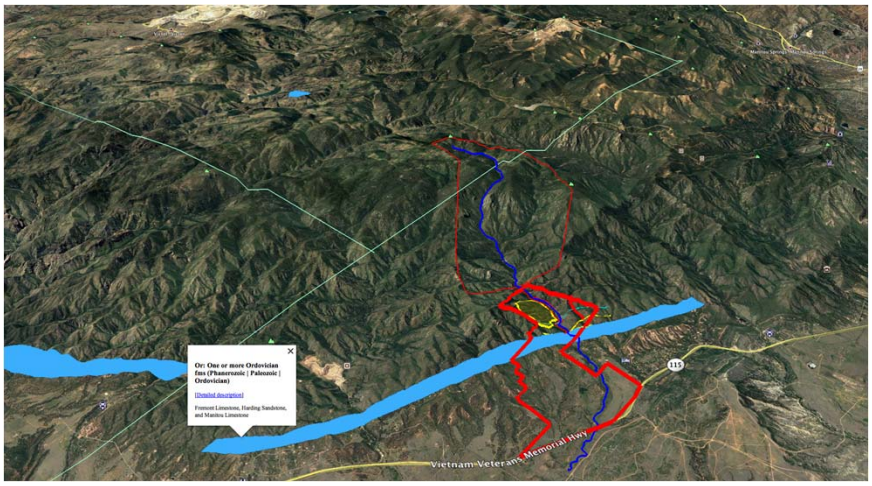
Concerns

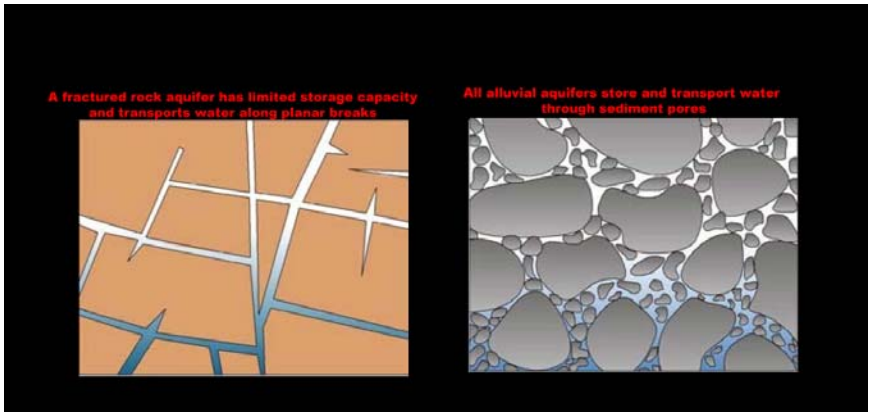
- An over-simplified model that ignores a more realistic system. No sensitivity testing was done
- Little information on the model so it would be difficult to reproduce
- The assumption of the fault being permeable is a convenience and ignores all the available data.
- Draining a fracture zone will have a greater distal effect on water levels, especially for water wells in the same zone.

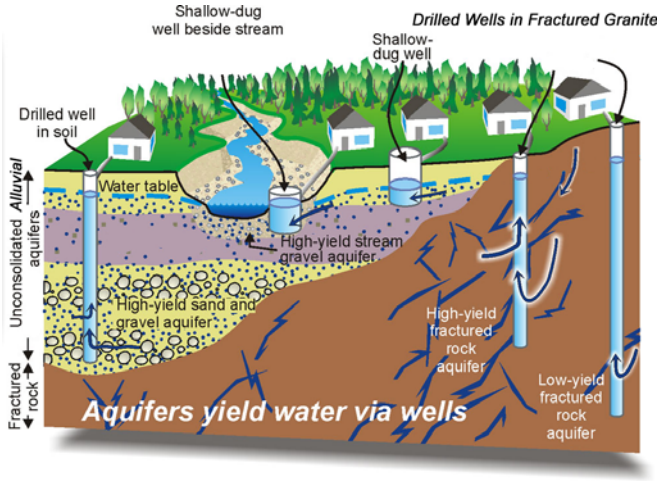
Based on my experience in reviewing numerous groundwater models, I find this one incomplete and, if it was from a student, I would have them re-do the model taking the above points into account. It is very important to have a proper groundwater model when the potential for permanently damaging a household's water supply is at stake.

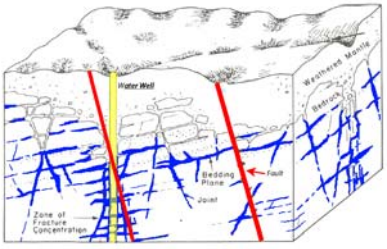
Sincerely,

William E. Sanford Ph.D.
Water Telluric LLC
!967 Sandalwood Lane
Fort Collins, Colorado 80526
970-988-7256


Or: One or more Ordovician fms (Phanerozoic | Paleozoic | Ordovician)
[Detailed description]
Fremont Limestone, Harding Sandstone, and Manitou Limestone
115
Vietnam Veterans Memorial Hwy

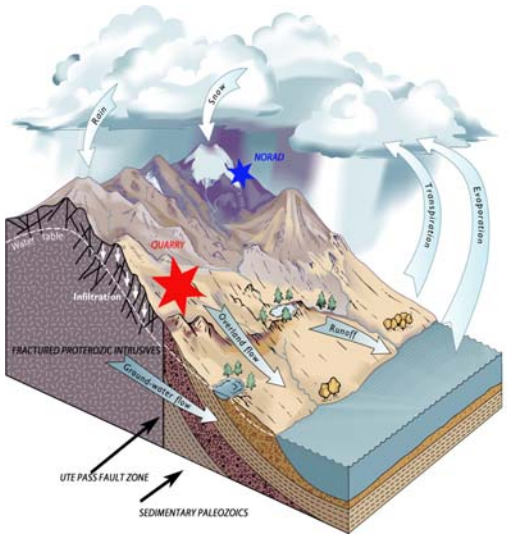

A fractured rock aquifer has limited storage capacity and transports water along planar breaks
All alluvial aquifers store and transport water through sediment pores

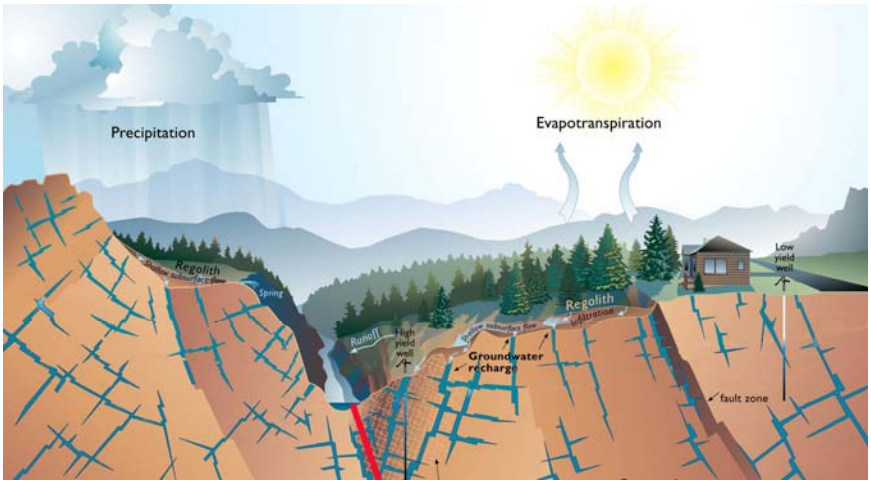

Shallow-dug
well beside stream
Drilled Wells in Fractured Granite
Shallow-
dug well
Drilled well
in soil
Water table
Unconsolidated Alluvial
aquifers
High-yield stream
gravel aquifer
High-yield sand and
gravel aquifer
Fractured
rock
High-yield
fractured
rock
aquifer
Low-yield
fractured
rock
aquifer
Aquifers yield water via wells

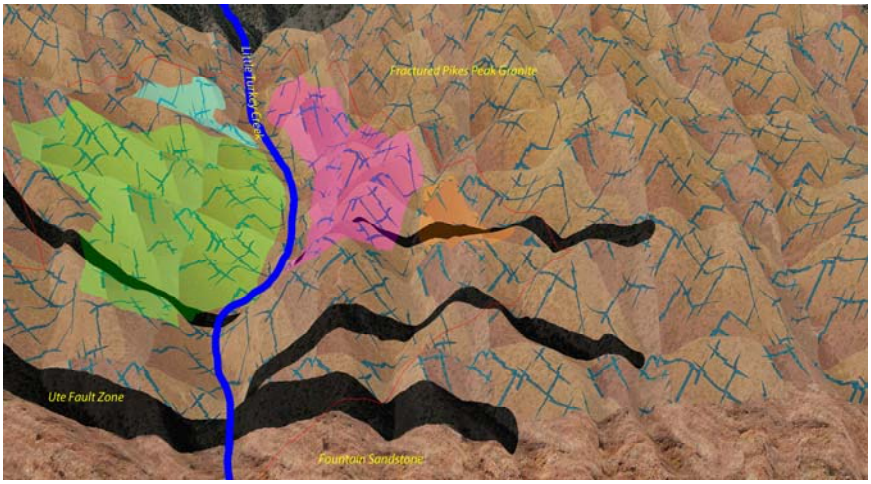

Water Well
Weathered Mantle
Bedrock
Bedding
Plane
Fault
Joint
Zone of
Fracture
Concentration





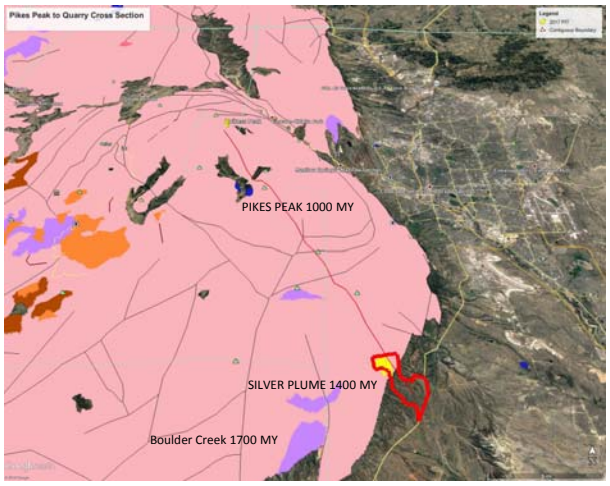

Rain
Snow
NORAD
Transpiration
Evaporation
Water table
QUARRY
Infiltration
Overland flow
Runoff
FRACTURED PROTEROZOIC INTRUSIVES
Ground-water flow
UTE PASS FAULT ZONE
SEDIMENTARY PALEOZOICS

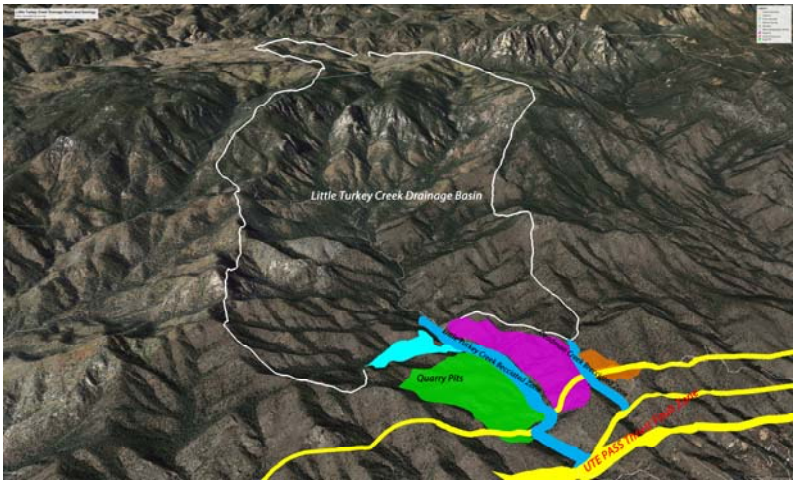

Precipitation
Evapotranspiration
Regolith
Spring
Runoff
High yield well
Groundwater recharge
Regolith
Low yield well
fault zone

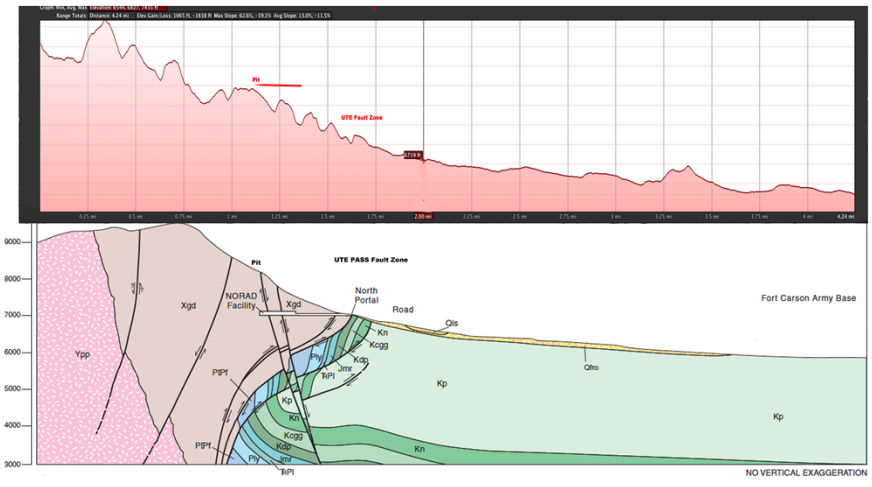

Fractured Pikes Peak Granite
Ute Fault Zone
Fountain Sandstone

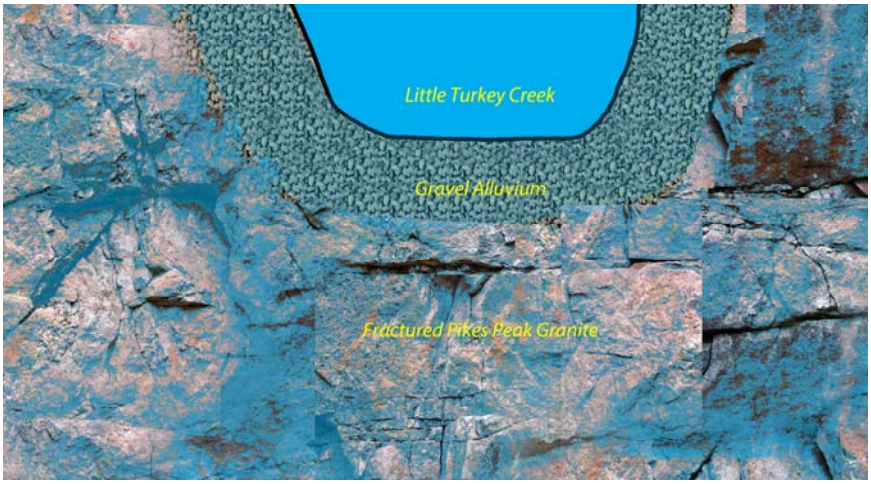





Pikes Peak to Quarry Cross Section
PIKES PEAK 1000 MY
SILVER PLUME 1400 MY
Boulder Creek 1700 MY

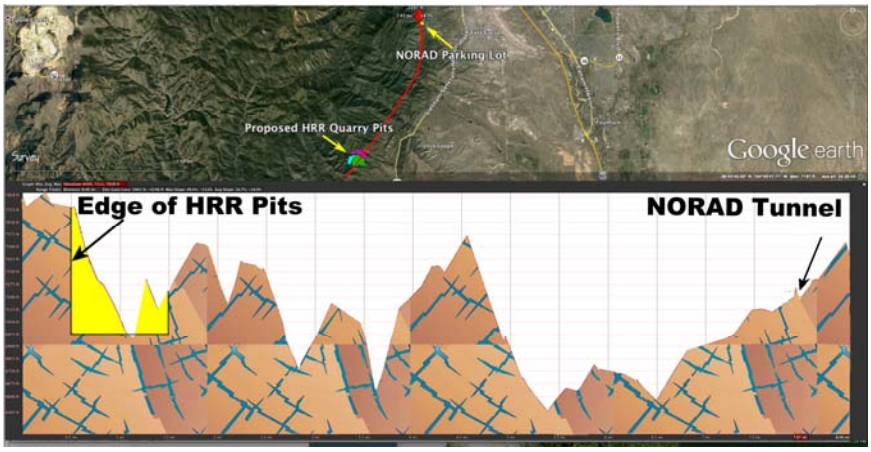

Little Turkey Creek Drainage Basin
Quarry Pits

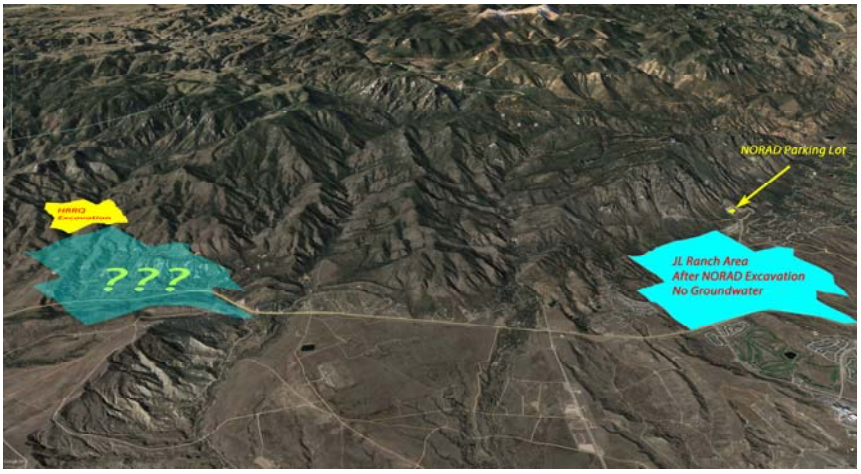

Pit
UTE Fault Zone
UTE PASS Fault Zone
North Portal
Road
NORAD Facility
Xgd
Ypp
PlPl
TrPl
Jmr
Kdp
Kcgg
Kn
Kp
Qls
Qfro
Fort Carson Army Base
NO VERTICAL EXAGGERATION


Little Turkey Creek
Gravel Alluvium
Fractured Pikes Peak Granite

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Proposed HRR Quarry Pits
NORAD Parking Lot

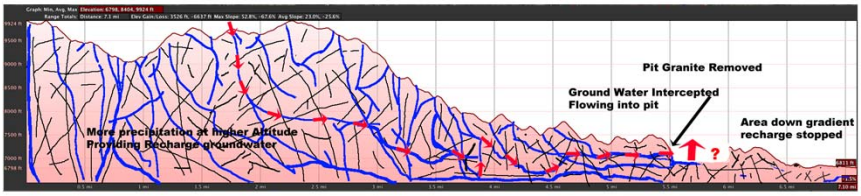

NORAD Parking Lot
Proposed HRR Quarry Pits
Google earth
Edge of HRR Pits
NORAD Tunnel


NORAD Parking Lot
???
JL Ranch Area
After NORAD Excavation
No Groundwater

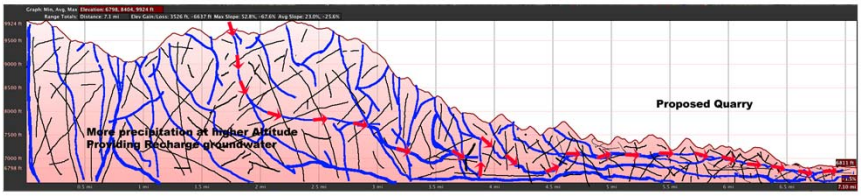


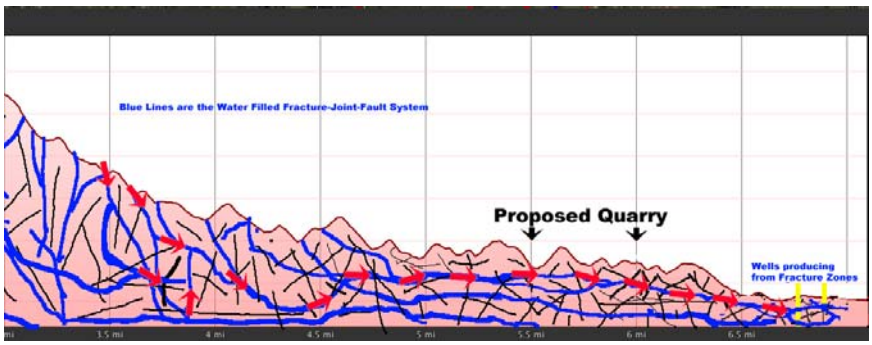

lewis water Well
1
Lewis water well

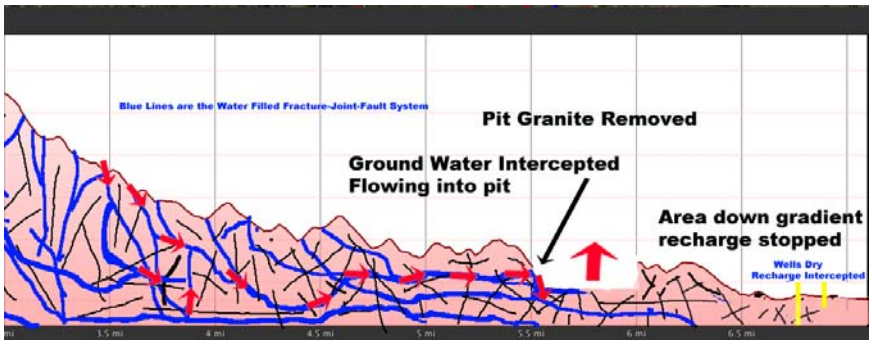
Water Drop After Granite Removal



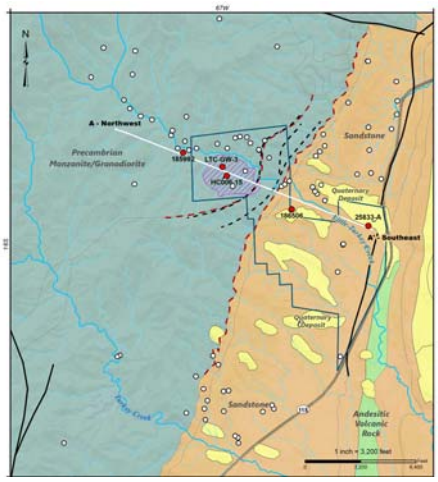
Water Drop Flow




Blue Lines are the Water Filled Fracture-Joint-Fault System
Proposed Quarry
Wells producing from Fracture Zones
3.5 mi
4 mi
4.5 mi
5 mi
5.5 mi
6 mi
6.5 mi


Blue Lines are the Water Filled Fracture-Joint-Fault System
Pit Granite Removed
Ground Water Intercepted
Flowing into pit
Area down gradient
recharge stopped
Wells Dry
Recharge Intercepted
3.5 mi
4 mi
4.5 mi
5 mi
5.5 mi
6 mi
6.5 mi

Local Water Wells







Alluvial Fan Facies Model

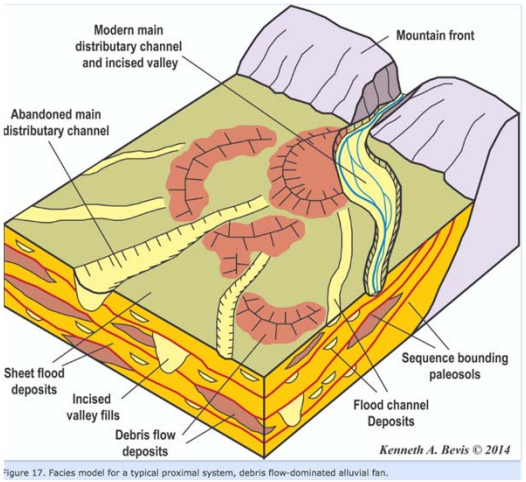
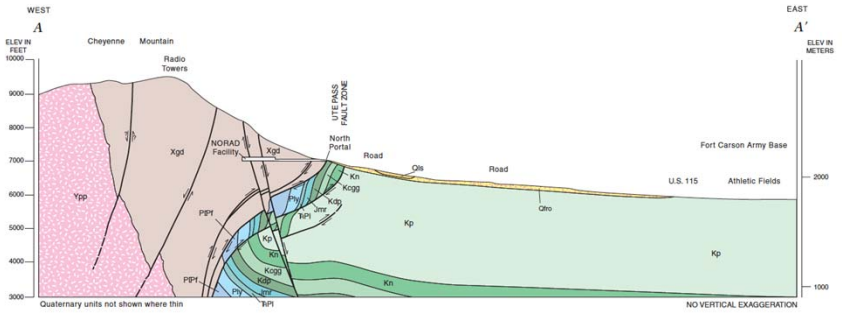
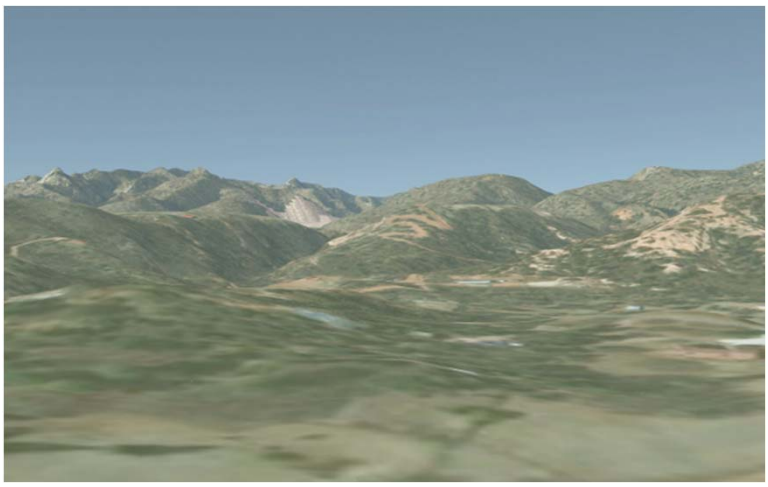


Figure 17. Facies model for a typical proximal system, debris flow-dominated alluvial fan.

Cross Section NORAD





Groundwater Conduit in Fractured Fault Core

"Fault zones have the capacity to be hydraulic conduits"

Fault zone hydrogeology

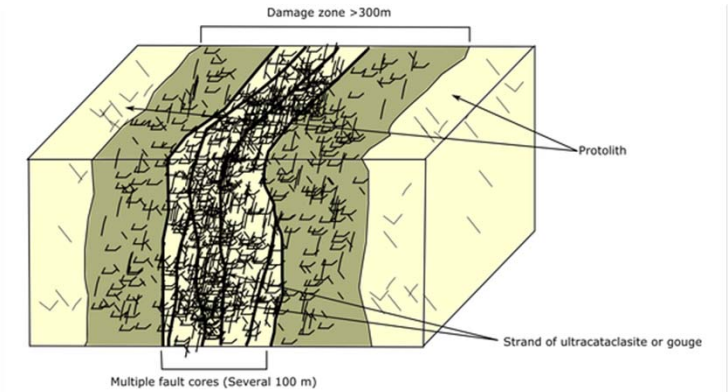
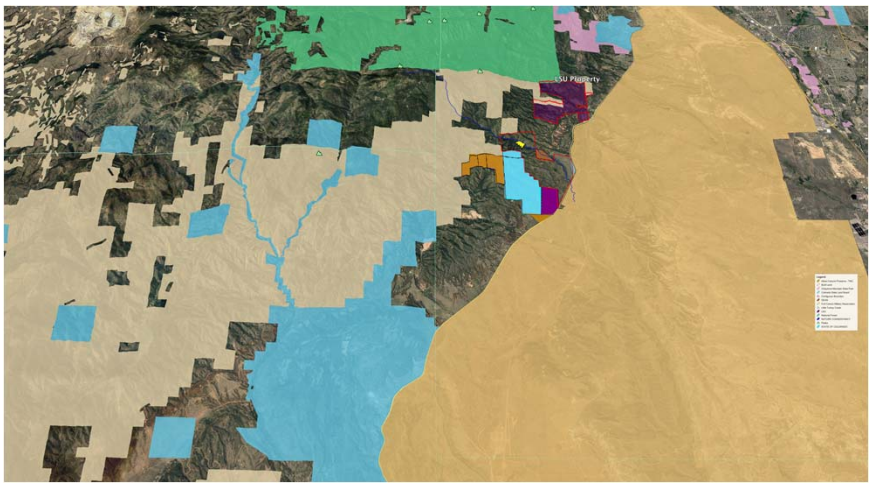
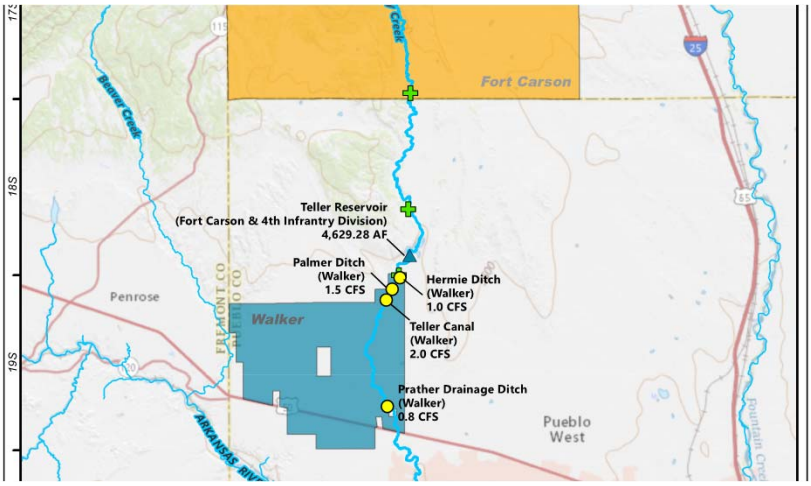


Figure 2. Multiple fault core damage zone model adapted from Mitchell and Faulkner (2009). The block diagram makes it easy to see that the greatest fracture density lies in the zone surrounding the fault cores. The damage zone is also significantly wider than in the single core model. There is also some diffuse fracturing in the protolith

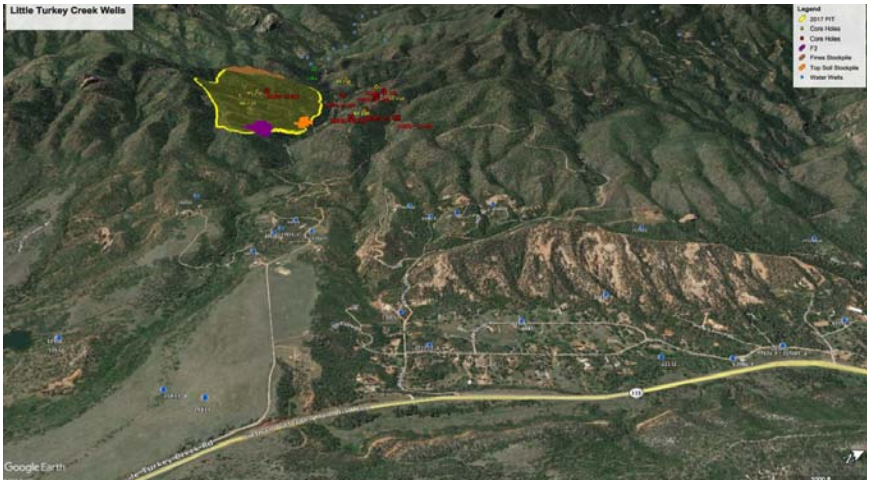



Fort Carson
Teller Reservoir
(Fort Carson & 4th Infrantry Division)
4,629.28 AF
Palmer Ditch
(Walker)
1.5 CFS
Hermie Ditch
(Walker)
1.0 CFS
Teller Canal
(Walker)
2.0 CFS
Prather Drainage Ditch
(Walker)
0.8 CFS
Walker
Penrose
Pueblo
West
Beaver Creek
18S
19S
25
65




Little Turkey Creek Wells
Legend
2017 PIT
Core Holes
Core Holes
F3
Fines Stockpile
Top Soil Stockpile
Water Wells
Google Earth
2000 ft


Little Turkey Creek Wells
Google Earth


Little Turkey Creek Wells
Legend
Google Earth

Neighbors gird for another round of battle over proposed quarry near Colorado Springs

By: **Rachel Riley (/author/Rachel+Riley)** • April 2, 2017 • *Updated: April 3, 2017 at 11:22 am*



In a cluster of subdivisions just west of U.S. 115, dozens of residents have been served almost identical court summons - the consequence of speaking out against a proposed quarry that they believe could put their water supply at risk and harm wildlife.

The 90 individuals and organizations, now defendants, believe the legal complaint is an attempt to bully residents into silence just as the company behind the plan reapplies for the state's permission to build the mine.

"The message to us is pretty clear: If you're objecting, we're going to sue you," said Kristan Rigdon, who lives near the proposed quarry site. "We just think that's outright infuriating."

Their attorneys, as well as third-party legal experts, called the legal filing a "Strategic Lawsuit Against Public Participation," or SLAPP.

The development is the latest chapter in the saga of the proposed Hitch Rack Quarry, a 400-acre mine that Transit Mix Concrete wants to build off Little Turkey Creek Road in the rugged hills of southeastern El Paso County.

In late January, roughly three months after Colorado's Mined Land Reclamation Board denied Transit Mix Concrete's application for a mining permit, the Colorado Springs-based company asked a county judge to review the board's decision. Meanwhile, Transit Mix also plans to reapply for a permit from the board in the next few months, said company spokesman Daniel Cole.

Transit Mix disputes the notion that the complaint for judicial review, which also requests the court "grant its reasonable costs and attorneys' fees" in the prayer for relief, is an effort to intimidate opponents of the project.

"It's normal practice in situations like these for an applicant to reserve rights to pursue every possible recourse, and judicial review is one of them," Cole said.

A lawyer for the company said the request for attorney's fees included in the complaint is a standard practice that appears in most legal complaints.

Unexpectedly defendants

Those served have 21 days to file an answer, or the court could issue a decision in Transit Mix's favor without further notice. Simply responding to the claim will cost defendants a $158 filing fee, amounting to a sum of more than $14,000 for all of the defendants to reply.

Collectively, opponents of the project have spent thousands of dollars and countless hours researching, organizing and seeking out experts to testify against the project, area resident Rigdon said.

About 140 people submitted letters of objection to the project, said Tony Waldron, minerals program supervisor for the state's Division of Reclamation, Mining and Safety, which recommended the Mined Land Reclamation Board approve Transit Mix's application. The number of public comments submitted in response to such applications can vary, but many projects receive only a few objections, 10 to 15, Waldron said.

After two days of public hearings in October, the board denied Transit Mix's application on a 3-2 vote, later citing several of the same concerns that opponents raised when speaking out against the project. State law requires that the board, as well as those who objected in the public hearing process, be named as defendants in the complaint for judicial review.

The board has not yet filed a response to the complaint, said Todd Hartman, a spokesman for the state's Division of Reclamation, Mining and Safety.

In addition to other arguments made, those who testified against Transit Mix at the hearings said the proposed quarry could endanger a valuable wildlife corridor, including "critical habitat" for the threatened Mexican spotted owl, and disturb the fragile system of underground cracks and fractures that holds the area's water supply. In its decision, the board also stated that the company did not demonstrate that it has legal rights to enter into a tract of private land that was part of the proposed site.

Getting SLAPPed

Lawyers for objecting groups are pushing back against the so-called SLAPP.

SLAPPs are "frivolous or meritless lawsuits" that are designed not to be won, but to silence critics, said Evan Mascagni, policy director for the Public Participation Project, a California-based organization that advocates for legislation that protects citizens from the lawsuits.

"A SLAPP filer doesn't go to court to seek justice," Mascagni said. "Lawsuits are expensive. So they're going to try and drown their opponents in legal fees."

Attorneys for The Barbara Ingersoll Marital Trust, which owns land near the proposed site, argued in a motion filed Friday in El Paso County District Court that the attorneys' fees request is a SLAPP "brought to intimidate and silence the objectors."

In the motion, the attorneys cite the Colorado Supreme Court's 1986 decision in a landmark SLAPP case.

The case arose after an environmental activism group that opposed a proposed real estate development filed a lawsuit against the developer and the Jefferson County board that had approved the project. The environmental organization lost the case in trial court, a ruling that was subsequently upheld in an appellate court. The developer then brought a case against the environmental group, asserting the organization had taken advantage of the legal process by objecting to the project. The state's highest court ruled that the First Amendment right to petition protected the group from the developer's lawsuit.

Third-party lawyers, including one who specializes in free-speech issues, also said the request for attorneys' fees resembled a SLAPP.

"To the extent that Transit Mix's complaint seeks an award of attorneys fees and costs from those citizens who filed objections before the Colorado Mined Land Reclamation Board regarding Transit Mix's permit application, in my opinion, it is a classic example of a SLAPP," said Steve Zansberg, a Denver-based First Amendment attorney who has represented The Gazette in legal

matters.

Colorado Springs attorney Greg Walta, who previously served as a state public defender, echoed Zansberg's opinion.

"For the concrete company to sue these people, seek attorney's fees and put average citizens in a position to have to hire lawyers to protect their free speech right is really outrageous," Walta said. "It's a clear infringement on people's free speech and their right to petition their government for relief."

The price of speaking out

A lawyer for the company said in an email that the request for legal fees does not mean that Transit Mix is asking that any of the defendants named in the complaint foot the company's legal bill.

"Transit Mix would only be entitled to collect attorneys' fees if one of the parties engaged in bad behavior, and if the relevant statute or rule allowed such a recovery as a result," John Cook, a partner at international law firm Hogan Lovells' office in Colorado Springs, said in an email.

"Simply put, and as opposing counsel is well aware, the attorneys' fees language in the prayer for relief is only intended to put all parties on notice that Transit Mix may seek attorneys' fees if any such bad behavior were to occur to such an extent as to give rise to a right to recover such fees. Transit Mix does not expect that this will happen," Cook added.

But, in addition to paying the filing fee, those served who don't know how to file a response to the complaint may have to seek legal help to do so, said Bruce Wright, an attorney for the Turkey Cañon Ranch Homeowner's Association. Lawyers in the region charge a range of prices for their services, typically from $200 to $500 an hour, Wright said.

And if the judge sides with Transit Mix and the company decides to recover legal expenses, the bill for those named as defendants in the complaint could amount to "megabucks," Wright said.

"That's money and that has a real chilling effect on whether those people are going to show up the next time Transit Mix applies," Wright said.

In a motion filed in El Paso County District Court on March 22, he argues that Transit Mix has "no legal basis" for asking the homeowners association to pay the company's legal bill "merely because it exercised its constitutional and statutory right" to testify before the board in opposition to the proposed quarry. The motion, in turn, asks Transit Mix to pay the legal expenses accrued by the homeowners association.

Transit Mix's evolving plan

In Transit Mix's second application, the company will likely propose a change to the original plan for the quarry that company spokesman Cole said would address concerns about wildlife and land rights: reducing the area of land that would be mined.

The original application included a plan to mine 400 acres north and south of Little Turkey Creek, which runs nearby the road of the same name. In the revised plan, the mining site likely will be only south of the creek and cover fewer than 200 acres.

"We won't know definitively what the changes will be until after we've reapplied, but that's what we're envisioning," Cole said.

The company also plans to reduce the expected lifetime of the quarry from 55 to 30 years in its second application, Cole said. When the site was spent, Transit Mix would then assess if it was interested in mining the area north of the creek and, if so, would have to reapply for a permit from the board.

During the initial application process, Transit Mix tweaked its plan at least six times, implementing some of the changes in response to residents' concerns, Cole said.

More than 100 other sites were considered for the quarry, but decided Hitch Rack Ranch was "the best for the community," Cole said. One main reason, he added, is that the site's rugged landscape would hide the quarry - a claim that residents in the area have disputed.

The mine would provide local governments with a reliable source of aggregate, for roads and other infrastructure needs, that would otherwise have to be hauled into the region at a higher price, Cole said.

Transit Mix hopes the new quarry will allow officials to phase out operations at the Pikeview Quarry within a few years, Cole said.

The company expects it will be able to save time and money spent on its second application by using some of the research generated in its first try. Some opponents of the project, who fear another expensive and time-consuming crusade against the project could be in their future, are thinking similarly.

"We're way more well-prepared this time than we were last time. We've been through it once," said area resident Rigdon.

"We will systematically and methodically approach it like we did last time. No one's quitting here."

-

Contact Rachel Riley: 636-0108

EXHIBIT 1

COLORADO MINED LAND RECLAMATION BOARD
Pre-Hearing Conference of Permit Application of Transit Mix Concrete Co.
DRMS File No. M-2017-049

INGERSOLL'S PRELIMINARY EXHIBIT LIST

No.	Description	Date	Bates Label	Witness	Stipulated	Admitted	Refused	Notes
1	Excerpt – Report of Joe Beidieman RE: Aiken Canyon/Potato Mountain Area Bird Population	1984-1985						
2	El Paso County Planning Department – Southwestern Highway 115 Area Plan	7/24/1990						
3	Mexican Spotted Owl Recovery Plan, First Revison (Strix Occidentalis Lucida), US Fish and Wildlife Service	10/16/1995						
4	Survey of Critical Biological Resources, El Paso County, Colorado Natural Heritage Program	December 2001						
5	Biological Assessment & Management Plant for the Mexican Spotted Owl on Fort Carson - Directorate of Environmental Compliance & Management	April 2002						
6	Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for the Mexican Spotted Owl; Final Rule, US Fish and Wildlife Service	8/31/2004						
7	El Paso County Parks Master Plan	6/12/2013						
8	Cheyenne Mountain State Park Management Plan (Excerpt) *Complete report can be obtained at https://cpw.state.co.us/placestogo/parks/CheyenneMountain/Documents/CheyenneMountainStateParkManagementPlan.pdf	2013						
9	Extract from Integrated Natural Resources Management Plant for Fort Carson and the Pinon Canyon Maneuver Site	2013-2017						
10	Land Ownership & Area Maps	Undated						
11	Google Earth Images of Quary Locations Along Highway 115 (with Mark Ups)	12/29/2017						
12	That Nature Conservancy's Management Plan for Aiken Canyon Preserve	December 2013						
13	Memo from the Nature Conservancy RE: Science Evaluation of Impacts at Aiken Canyon of the Proposed Transit Mix Quarry	7/19/2016						

EXHIBIT 1

No.	Description	Date	Bates Label	Witness	Stipulated	Admitted	Refused	Notes
14	Adverse Impacts to Habitat & Wildlife from the Proposed Quarry at Hitch Rack Ranch - Power Point Report of John Sanderson, Ph.D	4/9/2018						
14A	Pg 228 from Wisdom et al. 2018 Elk responses to trail-based recreation on public forests	2018						
14B	Pages 51 & 73 from Noon et al. 2009 Multispecies Conservation Planning on U.S. Federal Lands	2009						
14C	Abstract and Conclusions from Cushman et al. 2010 Use of abundance of one species as a surrogate for abundance of others	8/6/2009						
15	Curriculum Vitae of John Sanderson, Ph.D., Director of Science at The Nature Conservancy of Colorado							
16	Report of Charles Norris, PG / Geo-Hydro, Inc.	9/30/2016						
17	Curriculum Vitae of Charles Norris, P.G., Geo-Hydro, Inc.	9/29/2016						
18	Hitch Rack Ranch Quarry Assessment - Power Point Report of Jerald S. Fifield, Ph.D., Hydrodynamics, Inc.	2018						
19	Curriculum Vitae of Jerald S. Fifield, Ph.D., Hydrodynamics, Inc.	2016						
20	Reclamation Plan Review - Power Point Report of Richard Alward, Ph.D.	4/25/2018						
21	Curriculum Vitae of Richard Alward, PhD	Undated						
22	Colorado Natural Heritge Program's Review of Hitch Rack Ranch Proposal - Power Point Report of Renee Rondeau	April 2018						
23	Curriculum Vitae of Renee Rondeau	2018						
24	Effects of Blasting on Water Wells - Power Point Report of Brett A. Lewis PE, Ph.D.	4/16/2018						
25	Curriculum Vitae of Brett A. Lewis, PE, PhD	Undated						
26	Report of Dennis McGrane / McGrane Water Engineering, LLC	4/9/2018						
27	Cirriculum Vitae of Dennis McGrane							
28	Cirriculum Vitae of William E. Sanford, Ph.D.							

EXHIBIT 1

No.	Description	Date	Bates Label	Witness	Stipulated	Admitted	Refused	Notes
29	Cirriculum Vitae of Nancy J. Fishbein	Undated						
30	Gazette Article "Quarry dispute far from resolved"	2/23/2017						
31	Newspaper Articles RE: Account of Impact of Construction of NORAD (to be supplemented upon availability)							
32	Information regarding other sources of aggregate	1/11/2018 - 1/19/2018						
33	Power Point Report Nancy Reed	7/10/1905						
34	Email from Kris McCowen to Caleb Foy dated January 5, 2018 and response from Foy to McCowen dated January 10, 2018	1/5/2018 - 1/10/2018						
35	Colorado Division of Water Resources Response to Reclamation Permit Application Consideration dated January 4, 2018	1/4/2018						
36	Findings of Fact, Conclusions of Law and Order of Permit Application M-2016-10	12/22/2016						
37	Information regarding other sources of aggregate	Various						
38	Report of William E. Sanford, PhD	4/7/2018						
39	Power Point Presentation of Jerry P Moore	4/9/2018						
40	Gazette Article "Neighbors gird for another round of battle over proposed quarry near Colorado Springs"	4/3/2017						
	Documents and exhibits submitted by other Objecting Parties							
	Any document or exhibit from first Application Hearing or in DRMS files for this mining site or the applicant							

EXHIBIT 1

No.	Description	Date	Bates Label	Witness	Stipulated	Admitted	Refused	Notes