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Environmental Assessment

Tusayan Wildlife Waters Project

**Tusayan Ranger District, Kaibab National Forest
Coconino County, Arizona**



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Chapter 1 – Purpose and Need

Document Structure

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This Environmental Assessment discloses the direct, indirect and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four parts:

- **Introduction:** This section includes information on the history of the project proposal, the purpose of and need for the project, and the agency’s proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- **Comparison of Alternatives, including the Proposed Action:** This section provides a more detailed description of the agency’s proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes possible mitigation measures. Finally, this section provides a summary table of the environmental effects associated with each alternative.
- **Environmental Effects:** This section describes the environmental effects of implementing the proposed action alternative. This analysis is organized by resource area. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison to the Proposed Action.
- **Agencies and Persons Consulted:** This section provides a list of preparers and agencies consulted during the development of the Environmental Assessment.

Additional documentation and analyses of project-area resources may be found in the project record located at the Tusayan Ranger District Office in Grand Canyon, Arizona.

Project Area

The Tusayan Ranger District Wildlife Waters project includes specific sites on national forest system lands across the entire district within the Kaibab National Forest. The district contains 331,427 acres. The Tusayan Ranger District is located just south of Grand Canyon National Park’s South Rim, borders the Navajo Nation on the east, and the Havasupai Indian Reservation and Arizona state and private land on the west, and south. The district is not contiguous with other national forest system lands. The district is located in portions of Townships 28, 29, 30, 31, and 32 North, and Ranges 1 West and 1, 2, 3, 4, 5, and 6 East. Figure 1 shows a map of the project area and its proximity within the State of Arizona and national forests within Arizona. The Tusayan District is located within Arizona Game and Fish Department’s Game Management Unit (GMU) 9, and Ecosystem Management Areas (EMAs) 8, 9, 10, 21, and 22 as described in the Kaibab

National Forest Land Management Plan (as amended, and hereafter referred to as the Forest Plan).

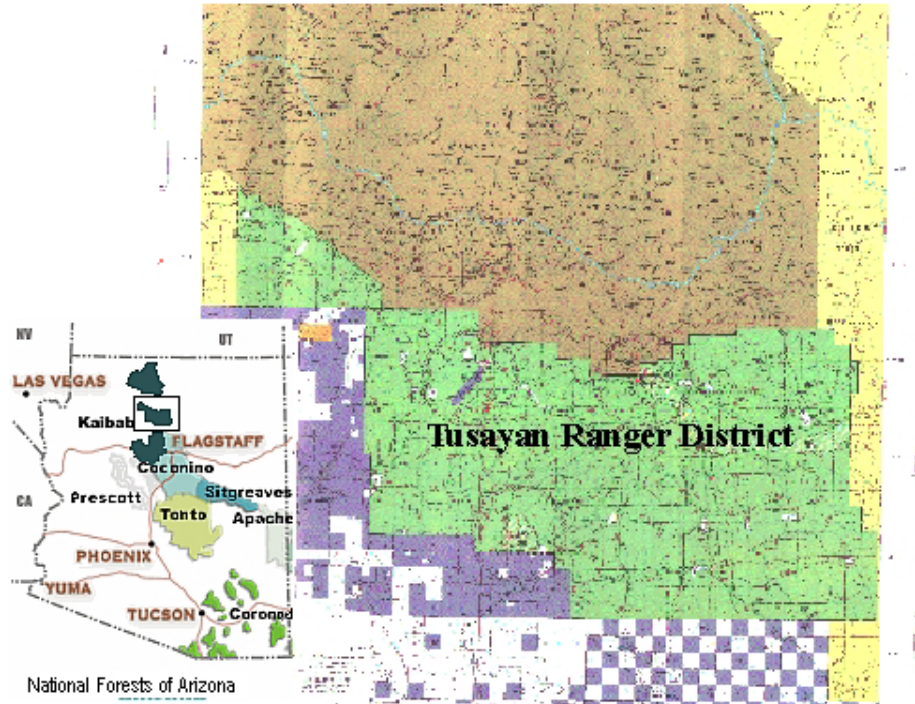


Figure 1. Map of Tusayan Ranger District in relationship to Arizona

The Tusayan Ranger District contains ponderosa pine vegetation, and ponderosa pine mixed in with Gambel oak, primarily in EMA 10 at the higher elevations. The principal elk calving, deer and pronghorn antelope fawning, and turkey nesting habitat in the Tusayan District are located here. Most of the area is grazed by cattle from late spring until fall.

The lower elevation portions (EMAs 8 and 9) of the district contain pinyon-juniper woodland and grassland vegetation types with scattered areas of ponderosa pine. These areas provide winter habitat for mule deer and Rocky Mountain elk. The eastern portion of the area provides most of the winter habitat for pronghorn antelope. Open grasslands are scattered throughout the area and are important forage areas for wildlife as well as livestock. There are no developed recreation sites. The Arizona Trail is the main non-motorized trail through the area, and the Great Western Trail provides a designated motorized route. Areas closed to vehicular travel include Red Butte, a semi-primitive non-motorized area, and the Coconino Rim, a Roadless Area.

EMA 21 includes the developed recreation sites on the district and the Tusayan Ranger District's administrative site. Developed recreation sites include Ten-X Campground, Ten-X Group Campground, and Russell Tank Fishing Area. The Hull Cabin Historic District and Grandview Lookout Tower/Cabin are listed in the National Register of Historic Places and are interpreted to the public. These areas are not affected by the project and will not be considered further in the analysis.

EMA 22 includes planned recreation developments and will not be considered further in this analysis.

The project area includes four Kaibab National Forest livestock grazing allotments: Rain Tank, Anita, Cameron, and Moqui cattle allotments. Cattle have not been grazed on Rain Tank allotment since 1998. Cattle were not grazed on the Anita and Cameron allotments between 2002 and 2006, but were grazed on the allotment in 2007.

Elevation ranges from 6,000 to 7,326 feet at the top of Red Butte in EMA 8, from 6,200 to 6,700 feet in EMA 9, and from 6,700 feet to 7,509 feet in EMA 10. Bedrock across the district is Kaibab Limestone. Common tree species are pinyon pine, Utah and oneseed juniper, and ponderosa pine. Gambel oak is common in some areas. Common shrub species are Wyoming big sagebrush, cliffrose, rubber rabbitbrush, disturbed rabbitbrush, broom snakeweed, fourwing saltbush, winterfat, and wax currant. Common grasses include blue grama, muttongrass, and mountain muhly.

Background

The Tusayan Ranger District has no perennial streams, rivers, lakes, or springs. Natural waters consist of small ephemeral water bodies that develop in low-lying areas where seasonal runoff collects. A variety of water sources have been developed historically on the Tusayan District. The earliest water developments were earthen tanks constructed since the late 1800s primarily to support livestock grazing. Earthen tanks are constructed by bulldozing a small area and creating an earthen dam to capture precipitation runoff, usually in areas downstream from drainages that funnel runoff. Hull Tank is an example of an historic earthen tank. It was constructed in 1888 by the Hull brothers to supply water for their sheep, tourists, and the horse-drawn stage line that ran from Flagstaff to the south rim of Grand Canyon. It still functions today and is part of the Hull Cabin Historic District. Approximately 150 earthen tanks have been constructed on the Tusayan District including those on private property inholdings.

The majority of wildlife water developments (also referred to as trick tanks, catchments, drinkers, or guzzlers) on the Tusayan District were built in the 1960s. Wildlife water developments typically consist of a precipitation collection device (apron) made of concrete or corrugated metal, an aboveground or belowground storage tank, and a drinker tub or basin. Most of these water developments are fenced to exclude livestock access but permit wildlife access. The original wildlife water developments had relatively small water storage tanks. During the time of their construction, there was more precipitation than there has been in recent years. AGFD has installed hard black plastic aboveground storage tanks to many of the older drinkers to increase water storage capacity by 2,600

gallons. This extra storage has been critical to wildlife, especially during drier years when most of the earthen tanks that are scattered throughout the district go dry. There are 37 existing wildlife water developments on the Tusayan District, although many of these are in disrepair.

AGFD personnel have been hauling water to key water developments to provide water for wildlife because of the lack of precipitation during the state-wide drought. Water hauling costs have grown considerably in recent years because of more frequent drought conditions and higher fuel costs. AGFD has been using reclaimed water from the Tusayan municipal wastewater facility for haul water for the past 10 years.

AGFD reconstructed 9 of the older wildlife water developments in 2006 and 2007 (Figures 2 and 3). The new catchment aprons, water storage tanks, pipes, drinkers, and fencing installed at these reconstructed water developments are the same as those proposed for the new water developments under the Proposed Action. Because of the larger water storage tanks and improved components, these reconstructed water developments provide more reliable waters for wildlife.

The district also constructs small earthen roadside tanks during the construction or reconstruction of district roads. These small tanks are easy to build and are designed to collect runoff from forest roads but are generally short-lived as a reliable water source.



Figure 2. Reconstructed Wildlife Water Catchment: Underground Water Storage Tanks, Collection Apron, Field Fence, and Drinker (to the right). Site area still needs to be graded and seeded.

Kaibab Forest Plan Direction

This action responds to the goals and objectives outlined in the Kaibab National Forest Land Management Plan, as amended (2004). The Kaibab Forest Plan contains the following direction relating to the proposed project:

- Cooperate with Arizona Game and Fish Department to achieve management goals and objectives specified in the Arizona Wildlife and Fisheries Comprehensive Plan. Support the AGFD in meeting its objectives for the state.
- Provide for intensive management of wildlife habitats. Make habitat surveys, analyses, and formulate plans in concert with the Arizona Game and Fish Department and ensure high level of habitat diversity and capability.
- Formulate and execute habitat investments to improve habitat components and diversity through vegetative manipulations and the coordinated interaction of other planned resource projects. Plan and execute cooperative habitat projects with conservation groups and volunteers.
- Provide one permanent water source per 640 acres (one square mile) in other coniferous forest timberland and seral grassland (guideline for Ecosystem Management Area 10); provide one permanent water source per 640 acres in other coniferous forest timberland and seral grassland for wildlife.
- Apply best management practices to mitigate adverse effects of activities and maintain site soil productivity.

Applicable Laws and Executive Orders

This environmental analysis meets the requirements of the Federal Land Policy and Management Act of 1976, the National Forest Management Act of 1976, and the National Environmental Policy Act of 1969 (and their amendments). It also complies with the following:

Endangered Species Act of 1973, as amended This action complies with the Endangered Species Act, and specifically with Section 7 of this Act, in that potential effects of the proposed action on listed species have been analyzed and documented.

National Historic Preservation Act of 1966, as amended Section 106 requirements for survey and evaluation have been met for all undertakings listed under this proposed action.

Forest Service Manual 7700 – Transportation System Chapter 7710 – Transportation Atlas, Records, and Analysis (also known as the Roads Analysis Process or RAP)

Other Regulatory or Legal Requirements

- Clean Water Act, Sections 303, 319, 404 Section 303(d) directs states to list water quality impaired water bodies and develop total daily maximum loads to control the non-point source pollutant causing loss of beneficial uses. The designated uses for ephemeral surface waters in the State of Arizona are aquatic, wildlife, and partial body contact.
- Section 319 directs states to develop programs to control non-point source pollution, and includes federal funding of assessment, planning, and

implementation phases. At this time, no known Section 319 projects would be detrimentally affected by project activities.

- Executive Order 11988 – Flood Plain Management: Direction to avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative.
- Executive Order 11990 – Protection of Wetlands: Direction to avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.
- State of Arizona Water Quality Criteria and Designated Beneficial Uses for Water.

Existing Conditions

AGFD has had to increasingly haul water to wildlife water developments on the Tusayan District during the past 10 years to provide for the water needs of wildlife populations. Hauling water is costly, and those costs have increased in recent years due to increased fuel costs. AGFD's water hauling activity has increased due to frequent drought conditions since the mid-1990s and increased wildlife water demand due to increased population abundance of elk. Repeated browsing by elk and deer has impacted various tree and shrub species on the district, especially near existing water developments. These impacts are more pronounced when drought conditions persist.

Desired Conditions

The primary desired condition is a distribution of water developments on the Tusayan Ranger District that provides for the needs of existing wildlife populations while maintaining sustainable ecosystems. Water developments should be sufficiently well distributed to allow AGFD to achieve its wildlife management objectives without resulting in undesirable levels of wildlife impacts to vegetation, soil, and watershed resources on the district.

Purpose and Need for Action

The purpose and need is to increase the availability of reliable water sources on the Tusayan District in order to: 1) provide for the water needs of existing wildlife populations; 2) reduce impacts to vegetation and soil resources around existing water developments by better distributing elk habitat use patterns throughout the Tusayan District; and 3) cooperate with AGFD to help reduce water hauling costs to wildlife water developments.

Proposed Action

The Proposed Action would achieve the purpose and need by constructing 24 new wildlife water developments across the Tusayan District and constructing a water pipeline that would deliver water to 2 existing water developments and 3 proposed water developments. Details of the Proposed Action are described in Chapter 2.

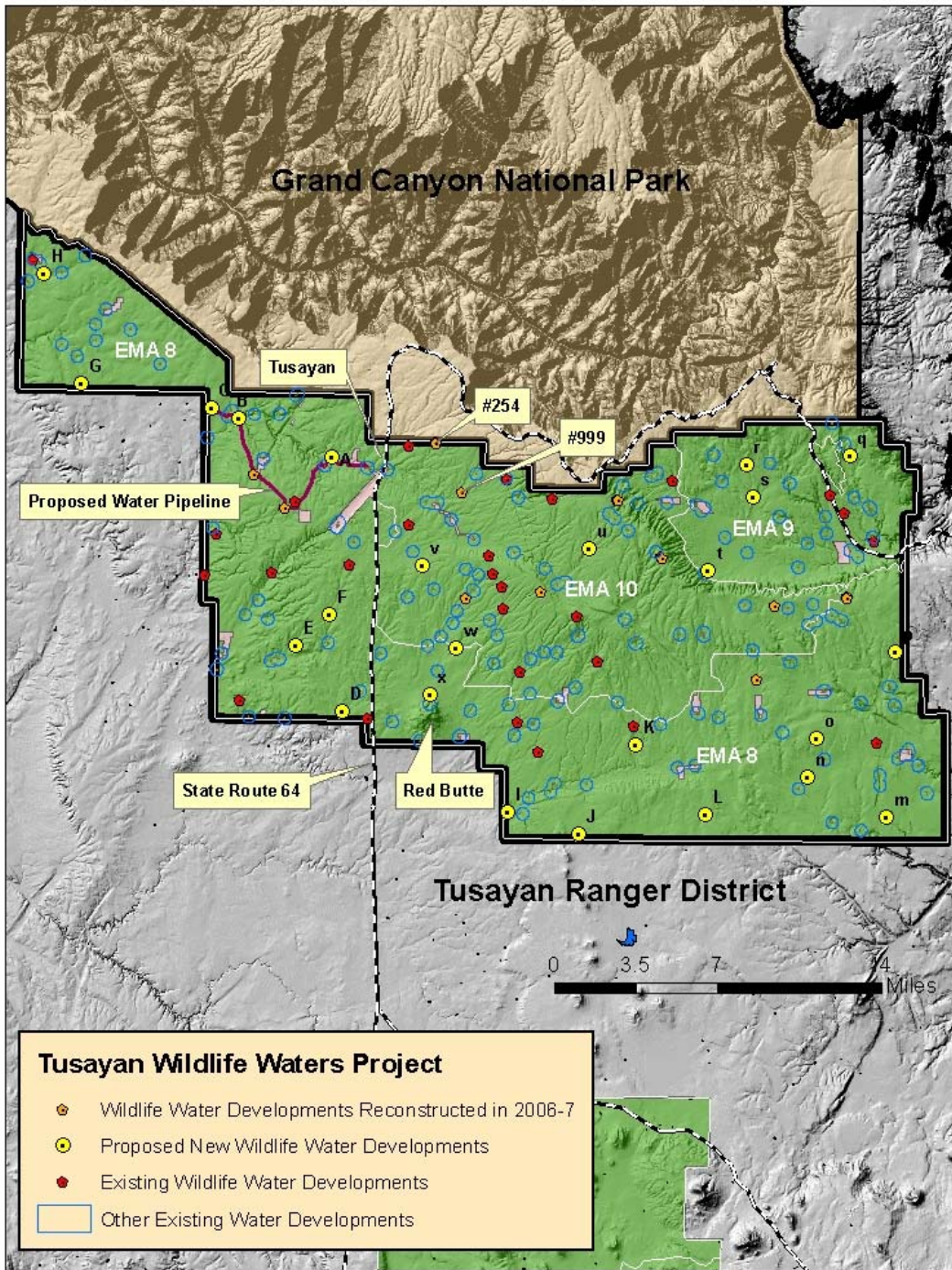


Figure 3. Tusayan Wildlife Waters Project Map (includes Ecosystem Management Areas or EMAs, existing water developments, and the proposed wildlife water developments and pipeline)

Decision Framework

Based on the analysis in this Environmental Assessment, the Tusayan District Ranger will decide how to best meet the purpose and need for the project in accordance with Forest Plan direction and desired conditions. The responsible official will decide whether to implement the Proposed Action, or a modified version of the Proposed Action. The decision will include:

- The approval and scheduling of proposed wildlife water development
- Mitigation measures and monitoring activities

Public Involvement

The proposal was listed in the Schedule of Proposed Actions (SOPA) on July 2005 and has been listed quarterly since that time. The proposal was provided to the public and other agencies for comment during initial public scoping on November 1, 2006 with a comment period extending through November 30, 2006. A Kaibab National Forest press release was sent to various media on November 1, 2006. The *Grand Canyon News* published an article regarding the proposal, "Forest Service seeks input on wildlife watering project" on November 22, 2006. Nine letters of comment were received that included 5 letters of support, one letter requesting more information, and 3 letters with concerns regarding the proposal.

The Forest Supervisor initiated government-to-government consultation (via letter) on August 26, 2005 with the Hopi Tribe, the Havasupai Tribe, the Hualapai Tribe, and initiated public scoping of tribal communities represented by the Bodaway-Gap, Cameron, Coalmine, Coppermine, Lechee, Leupp, and Tuba City Chapter Houses of the Western Agency of the Navajo Nation. The Forest Supervisor initiated government-to-government consultation (via letter) on August 30, 2005 with the Navajo Nation, the Pueblo of Zuni, and the Yavapai-Prescott Indian Tribe.

In addition to the tribal contacts identified above, the following agencies and organizations were also contacted during scoping:

- Apache Stables
- Arizona Antelope Foundation
- Arizona Game and Fish Department
- Arizona Public Service
- Auza & Sons Farms (Anita-Cameron Allotment Permittee)
- Babbitt Ranches (Moqui Allotment Permittee)
- Center for Biological Diversity
- Coconino County Board of Supervisors
- Coconino County Sheriff's Office
- Forest Guardians
- GCNP Airport and FAA Control Tower
- Grand Canyon ATV Adventures Inc.
- Grand Canyon National Park

- Grand Canyon Outback Jeep Tours
- Grand Canyon Trust
- KSGC Radio
- Rocky Mountain Elk Foundation
- Sierra Club, Grand Canyon Chapter
- South Grand Canyon Sanitary District
- Southwest Forest Alliance
- The Wildlife Society, Arizona Chapter
- Tusayan Fire Department
- U.S. West Communications
- Williams-Grand Canyon News

Using the comments from the public, other agencies, and tribal partners, the interdisciplinary team developed a list of issues and concerns to address during analysis.

Issues

An issue is defined as a discussion, debate, or dispute regarding effects. The issues were separated into two groups: significant and non-significant issues. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; 4) conjectural and not supported by scientific or factual evidence, or 5) limited in duration, distribution, and intensity, so that the level of effect is not significant. The Council for Environmental Quality (CEQ) NEPA regulations require this delineation in Sec. 1501.7, "...identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)..."

Important concerns were identified during public scoping, and these concerns were used in development of the Proposed Action or addressed and analyzed in Chapter 3 of the Environmental Assessment. Based on the criteria listed above, none of the concerns identified during public scoping was identified as a significant issue.

The primary concern identified during scoping was the concern that the elk population is currently impacting vegetation and soil resources on the Tusayan District, and that implementation of the Proposed Action would benefit elk and possibly result in increased elk numbers or season of use and additional elk impacts to vegetation and soil resources.

This concern has been addressed in two different parts of this Environmental Assessment. First, it has been addressed in the monitoring section at the end of Chapter 2 (*Monitoring Specific to the Proposed Action Alternative*). This monitoring section describes how AGFD will monitor the elk population in the area, and how Kaibab National Forest range and wildlife staff will monitor vegetation and soil conditions on the Tusayan Ranger District, especially browse utilization levels on key tree and shrub species. Second, potential effects of altered elk distribution and habitat use patterns are fully analyzed in Chapter 3 of this Environmental Assessment.

The Tusayan District is located within AGFD's Game Management Unit (GMU) 9, and AGFD's clearly stated elk population management objective for GMU 9 is to not allow the population size to increase. In their Regional Elk Management Operational Plan for Region II, AGFD states that the primary objective for GMU 9 is "1. Stabilize or slightly reduce this herd in response to continued drought conditions and habitat concerns." (Arizona Game and Fish Department 2006). AGFD has tried to prevent the elk population in the Tusayan District area from increasing since the 1990s as evidenced by significant increases in the number of antlerless elk permits in GMU 9 from 51 in 1991 to 800 in 2005-2008.

Chapter 2 - Alternatives

This chapter describes and compares the alternatives considered for the Tusayan Wildlife Waters Project. This section also presents the alternatives in comparative form, defining the differences between the two alternatives and providing a clear basis for choice between alternatives by the decision maker and the public.

Alternative Development

The District Ranger made the determination to analyze two alternatives in detail in this assessment. Alternative 1, No Action, describes current conditions exclusive of the Proposed Action. Alternative 2, the Proposed Action, describes the construction of 24 new wildlife water catchments, dismantling one existing catchment to be rebuilt at another existing catchment location, and the construction of a 12.2-mile long water pipeline. The two alternatives represent a reasonable range of actions based upon the purpose and need and results from public scoping.

Alternatives Considered in Detail

Alternative 1 – No Action

The 24 new wildlife water developments and 12 miles of water pipeline would not be constructed. Existing wildlife water developments would continue to be maintained and reconstructed when needed. AGFD would continue to haul reclaimed water from the South Grand Canyon Sanitary District's municipal wastewater facility in Tusayan during dry periods when insufficient water is available at existing water developments to meet the needs of wildlife.

Alternative 2 – Proposed Action

The following are features of the proposed action:

Decommission Water Catchment #254: This catchment was constructed in the 1990s and is within one-quarter mile of the Tusayan Ranger District's administrative site and Grand Canyon National Park's South Rim entrance station. Elk and deer are drawn into close proximity of residents and visitors. During big game hunts, hunters are drawn to this catchment and are within earshot to residences when they shoot. Removal of this catchment would lesson wildlife/human conflicts and promote safety. This catchment would be dismantled and rebuilt at site #999 (Figure 3) which is currently non-functional.

Construction of New Water Developments: A total of 24 water developments would be constructed across the Tusayan District (Figure 3). Sites for new water developments are in areas with good access, relatively deep soils, level to gently sloped terrain, and few trees. They would be constructed in areas that currently lack a reliable water source. Each water development would consist of a corrugated metal catchment apron, underground water storage tanks, and a drinker. A large trench would be dug and up to 3 fiberglass storage tanks installed underground and plumbed together with shut-off valves between tanks. If one storage tank starts to leak, it could be shut off while the other 2

tanks stay in operation. Each tank would hold 7,100 gallons of water and would be 20 feet in diameter and 3 feet deep. A steel frame would be constructed above the trench/tank area. On this frame, a water collection apron 24 feet by 96 feet would be constructed using metal siding typically used in metal buildings (called R panels, 26 gauge steel sheeting). The grooved apron would be screwed to the steel frame and would have a fiberglass trough that collects and funnels runoff from rain and snow into the storage tanks below. The entire storage area would be enclosed by a field fence 8 feet high to prevent wildlife, people, or vehicles from entering and damaging the apron. (See Figure 2.)

The actual drinker would be located about 10-15 feet away from the storage tank area and would be installed into the ground but at the same height as the fiberglass storage tanks. This would eliminate the need for a float valve (float valves are used on older catchments and require lots of maintenance and contribute to significant down time). The drinker unit would consist of a fiberglass box over a steel frame and is 5 feet wide, 8 feet long, and 3 feet deep. Plumbing from the storage tank area to the drinker would be buried underground. These drinkers hold about 750 gallons of water. The back side of the drinker is sloped to facilitate escape of small animals. Concrete would be laid around the ends and sides of the drinker. The drinker is designed to overflow onto the concrete entry way. The larger surface area also facilitates water intake by bats that fly over and skim the surface for a drink.

A 3-rung black steel pipe fence would be installed around the water development. The pipe rail fence would be about 150 feet on each side, enclosing a little over a 1/2 acre. The water development would be in the center of the fenced area, and construction would require disturbing about 1/4 acre of land. The fence rails would be 3/4-inch pipe and the fence posts would be 1 1/2-inch pipe set in concrete. There would be an 8-foot long pipe gate to allow vehicle access for maintenance. The fence height would be 42 inches with the bottom rung of the fence 20 inches above ground level to facilitate animal movement under the fence. The top two rungs would be only 6 inches apart to reduce the chance of wildlife catching and breaking their legs while jumping the fence.

Following installation of the new water development, the area would be cleaned up, the soil would be graded and smoothed, mulched and seeded with native grass species, and the site would be signed as a wildlife water development. These water developments are for wildlife use only and livestock would be excluded by the pipe-rail perimeter fence.

Construction of Water Pipeline: The 12.2-mile long water pipeline would connect 2 existing water developments and 3 new water developments. These water development sites would be accessible by vehicle and heavy equipment such as backhoes. Four of the water developments would be smaller systems. Each of these smaller water developments would have one underground 8,000-gallon fiberglass water storage tank, a 24 feet by 24 feet metal water collection apron, an 8-foot high field fence around the water storage and apron area, and a 750-gallon drinker. The new water development at the west end of the pipeline would be in an open area and would be a full-sized water

development (three 7,100-gallon storage tanks plumbed together). This water development would serve wildlife, firefighting needs (filling fire engines, helicopter water buckets), and would also be used to refill other water developments on the west side of the district reducing overall hauling efforts and costs.

The pipeline would be buried in the ground with the exception of a small section that would need to be set overland to avoid adverse effects to a heritage site, or in areas that are too rocky to trench. The pipe would be 1.5-inch diameter high density polyethylene that can withstand freezing without breaking. The water development aprons would also collect and funnel rain and snowmelt from the Coconino Wash area into the underground storage tanks. The pipeline is designed to run downhill for gravity feed, but there would be one water pump installed and used to move water over one small hill along the route.

The water source for the pipeline would be reclaimed water from the South Grand Canyon Sanitary District's municipal wastewater facility, which is located at the pipeline's eastern end. The town of Tusayan uses reclaimed water for various non-drinking water uses such as for toilets and landscaping. The Tusayan wastewater facility treats and delivers this reclaimed water in a separate system from drinking water. The reclaimed water goes through tertiary treatment and has an A+ classification. After tertiary treatment, the reclaimed water undergoes ultraviolet radiation disinfection. Excess reclaimed water is discharged into a pond adjacent to the municipal wastewater facility that typically holds approximately 10,000,000 gallons. Natural runoff from rain and snowmelt also flows into this pond, further diluting the reclaimed water. AGFD estimates an annual use of approximately 200,000 gallons of reclaimed water for the pipeline operation.

Road Access: The existing forest road system provides adequate access for implementation of project activities. Therefore, a site-specific roads analysis process (RAP) will not be undertaken for this project.

Alternatives Considered, but Eliminated from Detailed Analysis

The original proposal included the reconstruction of 11 existing wildlife water catchments. The reconstruction of 9 catchments was completed with administrative approval and focused specialist review and survey in 2006-07. The Tusayan District Ranger made the decision to decommission one of the existing wildlife water catchments (#254) due to its proximity to Grand Canyon National Park and Tusayan Ranger District's administrative housing site. The modified proposed action includes the components of the original proposed action, but no longer includes the 9 reconstructed catchments, and adds the decommissioning of catchment #254 and its reconstruction at catchment #999.

Mitigation Measures Specific to the Proposed Action Alternative

Mitigation measures are measures that are taken to minimize potential negative impacts that may occur from implementing the proposed action. Mitigation measures are also developed to address concerns that might be raised about the proposed action. Additional mitigation measures may be developed as more project input is received. Following are the mitigation measures developed for the proposed action to-date:

Range

1. Coordinate activities with Range Staff and the grazing permittee.
2. Protect, to the degree possible, permanent range transects. Minimize ground disturbance for new construction for sites that are adjacent to any transects. Maintain or replace any witness trees/posts for study sites.
3. Avoid (if possible) construction of new wildlife waters in the vicinity of livestock waters, or in close proximity to fences and corrals. Modify fences with elk jumps where needed.

Soils and Watersheds

4. Berms, silt traps, or other erosion control structures will be used on each construction site in order to re-route water flow to prevent soil erosion when vegetation, litter, and rock cover is removed.
5. Work may only be conducted when soils are dry, in order to prevent soil compaction and puddling.
6. Designate off road driving trails in order to avoid excessive soil and vegetation disturbance by vehicles and heavy equipment.
7. It may be necessary to bury the pipeline deeper in a few areas in order to prevent it from surfacing over time due to the churning action of shrink-swell clays.
8. Grade and smooth the soil after construction is complete. Seed the disturbed sites to native grasses. Use a weed-free mulch to protect the soil from erosion while the new seedlings are becoming established.

Sensitive Plants and Noxious Weeds

9. Survey for sensitive plants and noxious weeds before any ground disturbing activity.
10. Protect, to the degree possible, known populations of disturbed rabbitbrush. Minimize ground disturbance at project sites that are adjacent to these populations.
11. Document new locations of noxious weed populations. Treat existing weed populations at each project site before construction. Minimize ground disturbance at project sites to prevent new populations. To avoid the spread of weeds, vehicles must be cleaned of all plant material when moving from an area of infestation.

Wildlife

12. The Kaibab National Forest South Zone wildlife biologist must be informed at least two weeks prior to project implementation. If planned project implementation is during the goshawk breeding season (March 1 to September 30), the wildlife biologist will determine whether project implementation would likely disturb potential goshawk nesting activity. If there is an active goshawk nest near any of the proposed water development sites, the wildlife biologist will determine how long implementation at that site must be delayed to avoid disturbing goshawk nesting activity.

Recreation and Scenic Resources

13. Any temporary roads created for implementation, particularly inside of the Semi-Primitive Motorized (SPM) and Semi-Primitive Non-Motorized (SPNM) classifications, will be decommissioned when work is completed. Roads will be effectively closed at entrances/exit points, and surface will be scarified, seeded with native species, and mulched to promote re-vegetation.
14. Catchments “t” and “x” will be signed and interpreted to the public since they are located in a Semi-Primitive Non-Motorized classification area.

Heritage

15. All sites will be marked for avoidance prior to project activities. AGFD project leaders must consult with South Zone Archaeologist prior to beginning project to ensure site boundaries (flagging and/or paint) are still marked and visible. For the 12.2 mile pipeline section, close daily coordination is required between AGFD project leaders and Forest archaeologists using handheld GPS units to locate and avoid all heritage sites along the water line. Archaeologists must also be consulted during project work to monitor that the conditions of the heritage survey report are followed.
16. If any unrecorded sites are discovered during project implementation, work in the vicinity of the site must cease and the Forest Archaeologist must be notified immediately.
17. Road Maintenance and Reconstruction: Routine road maintenance activities within existing prisms and features, *where no heritage resource sites are known to exist*, will require no protective or mitigation measures. If ground disturbing activities are proposed in areas of no prior disturbance, project managers must contact the Forest Archaeologist so that protective measures, if warranted, can be devised.

Monitoring Specific to the Proposed Action Alternative

AGFD would continue to monitor the elk population in GMU 9. Two types of monitoring data would continue to be gathered and analyzed by AGFD: 1) ground and/or aerial elk surveys; and 2) elk harvest data from the various GMU 9 hunts. Population survey data include numbers of elk by age class and sex and bull/cow and calf/cow ratios (Arizona Game and Fish Department 2007). Harvest data include numbers of permits

issued, numbers of elk harvested by age class and sex, and hunt success (Arizona Game and Fish Department 2007).

In addition to elk population monitoring that would be conducted by AGFD, the Kaibab National Forest would continue to monitor vegetation and soil conditions on the Tusayan District. Range staff from the Kaibab National Forest already monitor vegetation and soil conditions within the Anita-Cameron and Moqui cattle allotments using the Parker three-step method and pace transects. If the Proposed Action is implemented, Kaibab National Forest range and wildlife staff would establish additional pace transects or other sampling methods to monitor browse levels on key browse species such as ponderosa pine, Gambel oak, cliffrose, sagebrush, and four-wing saltbush. Kaibab National Forest range and wildlife staff would coordinate and share results of vegetation and soil monitoring with AGFD personnel so that the two agencies can effectively address potential habitat concerns.

Comparison of Alternatives

This section provides a comparison and a summary of the effects of implementing each alternative. Information in Table 1 is supported by the environmental analyses featured in Chapter 3 and the resource specialists’ reports contained in the project record.

Table 1. Summary of Direct and Indirect Environmental Effects of No Action and Proposed Action Alternatives on Resources within Tusayan Wildlife Waters Project

Resource	Alternative 1 – No Action	Alternative 2 – Proposed Action
Soils / Watershed / Air Quality		
Soils / Watershed / Water Sources and Water Quality	No effect	Short-term increase in bare soil, possible soil compaction during catchment construction. Long-term stability or improvement due to improved herbaceous cover from seeding, and better dispersal of wildlife as the result of more dependable drinkers scattered throughout the district. During continuous drought years, would likely see increased wildlife use of drinkers with associated impacts such as trampled vegetation and dust.
Vegetation / Rangeland		
Vegetation	No effect	Slight to moderate decrease in tree density/canopy cover and forage in woodland, forest, and grassland within 1/4 to 1 mile of new water developments due to increased ungulate forage utilization and browsing around new water

Resource	Alternative 1 – No Action	Alternative 2 – Proposed Action
		<p>developments; this effect would be intensified during continuous back-to-back drought years when wildlife are more dependent on the new water developments.</p> <p>Management depends upon results of vegetation monitoring at new drinkers. In cases of overuse, use could be managed by strategically filling some wildlife waters while leaving others dry causing animals to disperse across the district; AGFD could also increase antlerless elk permits to manage herd size.</p>
Rangeland	No Effect	Slight decrease to forage and cover such as grasses, forbs, and shrubs due to increased forage utilization by wildlife within a ½ to 1 mile radius of new water developments.
Wildlife		
California Condor (Endangered, Experimental/Non-essential)	No Effect	Small potential increase in habitat quality due to additional water sources for drinking.
Bald Eagle (Sensitive)	No Effect	Small potential increase in habitat quality due to additional water sources for drinking.
Peregrine Falcon (Sensitive)	No Effect	Small increase in habitat quality due to additional water sources for drinking, for both peregrines and their avian prey species.
Merriam's Shrew (Sensitive)	No Effect	Small decrease in amount of suitable habitat (6 acres), but too small of an area to have any population-level effects.
Bat Species (spotted bat, Allen's lappet-browed bat, and Townsend's big-eared bat are Sensitive)	No Effect	Small to moderate increases in habitat quality due to additional water sources for drinking and foraging habitat.

Resource	Alternative 1 – No Action	Alternative 2 – Proposed Action
Mogollon Vole (Sensitive)	No Effect	Small decrease in the amount of suitable habitat (6 acres), but too small to have any population-level effects.
Northern Goshawk (Sensitive and MIS) MIS=Management Indicator Species	No Effect	Small increase in habitat quality due to additional water sources for drinking, both for individual goshawks and certain goshawk prey species.
Wild Turkey (MIS)	No Effect	Small to moderate increase in habitat quality due to increased water sources for drinking.
Hairy Woodpecker (MIS)	No Effect	Small increase in habitat quality due to increased water sources for drinking.
Pygmy Nuthatch (MIS)	No Effect	Small increase in habitat quality due to increased water sources for drinking.
Juniper Titmouse (MIS)	No Effect	Small increase in habitat quality due to increased water sources for drinking.
Abert's Squirrel (MIS)	No Effect	Small increase in habitat quality.
Elk (MIS)	No Effect	Moderate to substantial increase in habitat quality due to increased water sources for drinking.
Mule Deer (MIS)	No Effect	Moderate increase in habitat quality due to increased water sources for drinking. Increase may be offset by some degree due to increased potential for competition from elk and habitat impacts by elk.
American Pronghorn Antelope (MIS)	No Effect	Moderate increase in habitat quality due to increased water sources for drinking. Increase may be offset by some degree due to increased potential for competition from elk and habitat impacts by elk.
Migratory Birds	No Effect	Small increases in habitat quality for various species due to increased water sources for

Resource	Alternative 1 – No Action	Alternative 2 – Proposed Action
		drinking.
Visuals / Scenery Management		
Outdoor Recreation Settings (Recreation Opportunity Spectrum)	No Effect	Short-term negative effect to quality of recreation setting during project implementation; water developments “t” and “x” will be signed to interpret to the public as benefit to wildlife. Quality recreation settings enhanced in the long-term for the public by increased wildlife viewing/hunting opportunities.
Developed Recreation Sites and Facilities	No Effect	No Effect
Scenery Resources		
Desired Landscape Character	No Effect	Changes to landscape character evident but would be within historic ranges.
Scenic Integrity	No Effect	Short-term negative effect to existing scenic integrity during project implementation. Forest Plan Scenic Integrity Objectives achieved shortly after implementation activities and mitigations are completed.
Heritage Resources		
Heritage Resource Sites	No Effect	No adverse effects as mitigation / protection measures will be followed.
Economics / Lifestyle		
Revenue / Jobs	No Effect	No effect to jobs as work is done with volunteers and AGFD supervision; Cost of supplies benefit local economy; approx. \$45,000 per drinker.

CHAPTER 3 – ENVIRONMENTAL EFFECTS

This section summarizes the physical, biological, social, and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for the comparison of alternatives.

Soils and Watershed

Affected Environment

Soils – Description of Entire Project Area (Tusayan Ranger District)

The Tusayan Wildlife Waters Project encompasses the entire Tusayan Ranger District, an area of approximately 331,427 acres. Elevation ranges from 6,000 feet to 7,509 feet with 7,326 feet at the top of Red Butte. The area is dominated by woodland and shrubland soils. The majority of the project area is covered by the Inceptisols soil order (moderately developed soils that formed mostly under woodland or shrub plant communities). The second most common soil type in the area is the Alfisols soil order (well developed soils with more clay that formed mostly under forest cover). Limited areas of Alfisols are mollic subgroups (soils that developed under savannah vegetation with a lot of grass). The Mollisols soil order (soils that developed under grassland vegetation and generally contain more clay and less rock) occurs in very limited areas in narrow strips along some of the drainages. Some are Pachic Argiborolls, the most productive grassland soils in this region. Also present in the project area are Entisols (young soils with very little development) and rock outcrop. Wetland soils are not found anywhere in the project area.

The project area is characterized by plains with a few hills and escarpments. Slopes are mostly less than 15%, but a few hills and escarpments have slopes that range up to 40%, 80%, or even 120%. The soils are formed mostly from limestone (Kaibab Formation), but some areas have soils formed from other sedimentary rocks such as sandstone (Kaibab and Moenkopi Formations) or from basalt, cinders, or ash. Most soils are shallow (i.e. less than 20 inches deep) or moderately deep (20 to 40 inches deep), with a few areas of deeper soils. Surface textures are mostly very fine sandy loam with some areas of loam, fine sandy loam, sandy loam, clay loam, or loamy very fine sand. Most soil surface horizons are gravelly, but a few areas are cobbly or don't have any rock fragments. Subsurface horizons are mostly in the loamy particle size class, but some areas are fine-loamy, fine, or clayey. The majority of subsurface horizons have a significant amount of gravel and/or cobbles. Most of the soils contain a high amount of calcium carbonate due to the fact that they developed mostly from limestone and calcareous sandstone. Calcium carbonate raises the pH of the soil and can make water and nutrients less available to plants. Effects of drought are more severe on calcareous soils.

Moderately to highly erodible soils are dominant in the area due to the predominance of very fine sandy loam, fine sandy loam, and loam surface textures. There are only a few small areas at low risk of soil erosion. Fortunately, the majority of the area is fairly flat, which reduces the erosion hazard significantly.

According to the Terrestrial Ecosystem Survey completed in 1979-86, soils in unsatisfactory condition (i.e. an unacceptable rate of erosion is occurring due to inadequate plant and litter ground cover) may already be found on 8% of the area. Soils in impaired condition (i.e. a moderate rate of erosion is occurring and is approaching an unacceptable rate) may already be found on 3% of the area. More recent data is not available to determine erosion rates today.

Range monitoring data was collected on the Anita, Cameron, and Moqui Allotments in 2004-05. Soil stability/condition averaged Poor to Fair in key areas. Trend ranged from downward to stable to upward with the majority of the area showing a stable trend. Livestock management was changed at that time in order to improve resource conditions. No cattle grazing occurred from 2004 through 2006. The permittee grazed less than 50% of permitted numbers in 2007. Vegetation and litter cover has increased on the allotments due to the limited use by livestock in recent years, so it is assumed that soil stability/condition ratings have improved since 2004.

Range monitoring data was collected on the Rain Tank Allotment in 1991. Soil stability/condition ranged from Very Poor to Good with the majority of the area in Poor to Fair condition. Trend ranged from downward to stable with a majority of the area showing a stable trend. Livestock management was changed in 1996 in order to improve resource conditions. The allotment has not been grazed by permitted cattle since 1998. However, unauthorized cattle from neighboring lands are commonly found on the allotment due to unmaintained fences. Vegetation and litter cover have increased on the allotment due to the non-use by livestock over ten years, so it is assumed that soil stability/condition ratings have improved since 1998.

The majority of the Rain Tank area supports a pinyon-juniper overstory. Some areas have a ponderosa pine forest or savannah and a few very small areas have a Gambel oak – big sagebrush overstory or grassland. Dominant plants include: Utah juniper, oneseed juniper, Colorado pinyon, ponderosa pine, Gambel oak, big sagebrush, Stansbury cliffrose, western wheatgrass, and blue grama. The maximum potential forage that could be produced in the area is 1400 pounds per acre, if most invading trees and shrubs are removed. In 1979-86 when the Terrestrial Ecosystem Survey was conducted, it was estimated that the forage production in the area had been reduced 84% since settlement times by invading trees and shrubs to an average of only 180 pounds per acre.

Description of Proposed Sites for New Wildlife Water Developments: The Proposed Action contains 24 new wildlife water catchments and a 12.2 mile pipeline. Construction of each water catchment will disturb approximately ¼ acre of ground for a total of 6 acres across the project area. Construction of the pipeline will disturb approximately 12 acres

of ground. All sites are located in areas where the slopes do not exceed 15%. Water catchments will be buried approximately 36 inches deep.

All of the proposed wildlife water sites and the pipeline route are located on moderately to highly erodible soils. It is important to maintain as much ground cover as possible during construction and to reseed disturbed areas in order to prevent an unacceptable rate of sheet, rill, and/or gully erosion and sedimentation, leading to a loss in vegetative productivity on and off site. There is also a high risk of compaction and puddling if construction or driving occurs when the soils are moist to wet.

The pipeline route crosses many soils that are shallow to moderately deep. Aboveground pipe segments may be required in these areas. It may also be necessary to bury the pipeline deeper in a few areas in order to prevent it from surfacing over time due to the churning action of shrink-swell clays

Watershed – Description of Entire Project Area (Tusayan Ranger District)

The Tusayan Wildlife Waters Project Area (i.e. Tusayan Ranger District) is distributed across six 5th level watersheds that all drain into the Lower Colorado River 1st level watershed. Sixty-seven percent of the area drains into the Lower Colorado–Lake Mead 2nd and 3rd level watershed through the Havasu Canyon 4th level watershed from these 5th level watersheds: Heather Wash (34%), Red Horse Wash (32%), and Miller Wash (less than 1%). Thirty-three percent of the area drains into the Little Colorado River 2nd and 3rd level watershed through the Lower Little Colorado River 4th level watershed from these 5th level watersheds: Lee Canyon-Lower Little Colorado River (16%), Lower Cedar Wash (16%), and Upper Cedar Wash (1%).

All stream channels within the project area are considered ephemeral. They flow only after substantial precipitation events. Vegetation found along the edges of these channels does not thrive in moist environments and is not considered riparian. Vegetation is primarily grasses, forbs, and shrubs. Major named drainages include: Blue Stem Wash, Bright Angel Wash, Coconino Wash, Deer Tank Wash, Heather Wash, Lee Canyon, Little Red Horse Wash, Lockwood Canyon, Long Jim Canyon, Pasture Wash, Prairie Wash, Rain Tank Wash, Red Horse Wash, Russell Wash, and Tappen Wash. No wetlands or hydric soils exist in the project area.

No large natural lakes exist in the project area. Natural water bodies consist of small basins (e.g. Lockett and Twin Lakes) and very small bedrock potholes. These natural depressions are ephemeral, meaning that they only fill with water periodically when there is significant precipitation and runoff. There are numerous constructed earthen tanks that provide water to livestock and wildlife. The tanks are also ephemeral. In moderate to severe droughts, the tanks may be dry. None of the tanks or ephemeral lakes supports aquatic vegetation, within or around their perimeters, due to the semiarid climate and frequent droughts, low runoff potentials, and lack of stable water levels. The largest earthen tanks are: Rain Tank, XB Tank, Russell Tank, Bucklar Tank, and Peterson East Tank.

Russell Tank is stocked with trout by the Arizona Game and Fish Department when it contains sufficient water. During extended droughts, the tank will go dry. The tank filled up during the wet winter and spring of 2004-5 and was subsequently re-stocked with trout. This is the only fishery on the Tusayan Ranger District.

Perennial waters do not exist on the Tusayan Ranger District due to the characteristics of the climate, geology, and soils. The semiarid climate is characterized by infrequent and erratic precipitation events and high evaporation rates. Fall, winter, and spring precipitation is generally widespread and gentle to moderate. Rain and snowmelt easily infiltrate the shallow, rocky, and loamy soils and enter the aquifer through frequent cracks in the limestone and sandstone. Summer precipitation arrives in localized high-intensity thunderstorms. This precipitation tends to run off site quickly.

Water Sources and Water Quality

The largest potential issues facing water quality, related to range and wildlife habitat management, are exceedances related to turbidity, siltation, and fecal coliform. Overgrazing, construction projects, and off-road driving can result in decreased vegetative cover and increased erosion, thus contributing to siltation and turbidity. Fecal coliform exceedances would most likely be related to animal waste. A review of the 2004 and draft 2006 State of Arizona 303(d) list indicated that no TMDL (Total Maximum Daily Loads) limited segments or water bodies are within or adjacent to the project area.

Russell Tank is the largest impoundment on the ranger district. Protected uses are cold water fishing, fish consumption, full-body contact, and livestock watering.

The Forest Service does not have any recent water quality monitoring data for water bodies on the Tusayan Ranger District. Data were last collected and published in 1993.

The communities of Tusayan and Grand Canyon Village received their water supply from the north rim of Grand Canyon (Roaring Springs) until the early 1990s when deep wells were drilled in the Tusayan area to supplement the supply. Tusayan businesses also trucked in water daily from Bellemont and Flagstaff Ranch. Grand Canyon Village and the Tusayan Ranger District administrative site just north of Tusayan still get their water from the north rim of Grand Canyon. Because of the scarcity of water and the difficulty in developing ground-water supplies at the south rim, Tusayan and Grand Canyon Village have developed state-of-the-art recycling and reuse programs for their effluent (USGS Report 2005-5222).

Tusayan has one wastewater treatment plant with an annual effluent flow of 68 acre feet. In 2003, Tusayan reused 30 to 50 percent of this effluent for irrigation in the community and for secondary gray-water systems. The remaining effluent was discharged to Coconino Wash (wildlife waters pipeline location) where fractures and faults provide pathways for infiltration to water-bearing zones that discharge to the Havasu/Cataract subbasin. It is not known how much of this effluent recharges the water-bearing zones that discharge at springs west of Tusayan along the south rim or at Havasu Spring (USGS Report 2005-5222).

Description of Proposed Sites for New Wildlife Water Developments: The Proposed Action calls for the construction of 24 new wildlife water catchments and a 12.2 mile water pipeline that will fill 3 new catchments and 2 reconstructed catchments with reclaimed water from the community of Tusayan. Also found along the pipeline route are 2 more existing catchments/trick tanks, 1 water point, and 3 water bodies. Each new catchment will hold approximately 20,000 gallons of water. The pipeline will use approximately 200,000 gallons of reclaimed water per year, enough to completely fill each of the five catchments two times. Part of the pipeline route is within Coconino Wash. Another section is within an unnamed wash. The pipeline crosses several unnamed washes.

The catchment aprons are constructed aboveground in order to collect rainfall and snowfall, but not runoff from drainages. Therefore, a water rights determination is not necessary.

All proposed water catchment sites are located within two miles of an existing livestock/wildlife or wildlife water source. Sixty-seven percent of the new sites are located within one mile of an existing water source. It is assumed that most, if not all, of these water sources are unreliable due to the semiarid climate and recent drought.

Environmental Consequences

Direct and Indirect Effects to Soils and Watershed

Alternative 1 – No Action (No new wildlife waters)

Under the No Action Alternative, no new wildlife water developments would be built. The Arizona Game and Fish Department would continue to maintain and reconstruct existing wildlife water catchments. Arizona Game and Fish would continue to haul water to existing wildlife water catchments when they dry up during drought years. Wildlife would continue to use the existing water catchments, natural water sources, and livestock water developments.

Soil stability/condition averaged Poor to Fair with a stable trend on the Anita, Cameron, and Moqui Allotments in 2004-5 and on the Rain Tank Allotment in 1991. The impact of livestock grazing has been reduced on the Anita, Cameron, and Moqui Allotments, due to changes in management that were implemented in 2005 and limited use by the permittee since 2004. The Rain Tank Allotment is not currently grazed by permitted livestock and has not been used since 1998, although small numbers of unauthorized cattle often cross over from neighboring non-Forest Service lands due to un-maintained fences. Vegetation and litter cover has increased on the allotments due to the limited use by livestock in recent years, so it is assumed that soil stability/condition ratings have improved since monitoring was conducted.

Conditions of plant cover and soil stability should continue to improve in the project area as a result of improved livestock management or non-use, but those improvements would

be negated in some areas by continued heavy elk grazing and browsing. If the drought continues and the elk population is not reduced, loss of plant cover and an increased rate of soil erosion and sedimentation of ephemeral stream channels and water bodies would continue within one mile of all dependable livestock or wildlife water sources. Water sources may only be dependable as a result of water hauling by the Arizona Game and Fish Department and the grazing permittees. Wildlife has access to all livestock water developments, but livestock cannot use wildlife water catchments. Elk prefer to use livestock earthen tanks compared to wildlife water catchments because they can immerse themselves in the water to get rid of insect pests (personal communication, John Goodwin, Arizona Game and Fish Department). This situation creates a higher level of forage utilization and trampling around livestock waters compared to wildlife waters.

Earthen tanks built for livestock would not be maintained on the Rain Tank Allotment as long as the allotment is not leased to a grazing permittee. The Kaibab National Forest has no plans to lease this allotment. A certain amount of erosion and sedimentation is natural in this area due to the semiarid climate, lack of continuous soil cover, and high intensity summer thunderstorms. The earthen tanks would eventually fill in with sediment to the point at which many tanks no longer hold a significant amount of water. Much of the area would return to natural conditions where water sources are sparse and unreliable, and elk would no longer be attracted to this area. They would continue to be attracted to this area due to existing and maintained wildlife water developments. Plant and litter cover would increase in areas not served by wildlife water developments, but would decrease in areas within one mile of wildlife waters as the elk further concentrate there. Soil and watershed conditions would improve in areas with little water, while they decline in areas that have water.

Floodplains are the areas next to streams, including ephemeral streams, which accommodate floodwater when flow leaves the active stream channel. Within the Tusayan Wildlife Waters Project Area, floodplains are small in width and lack riparian vegetation. Even though the majority of the floodplains within the project area lack riparian vegetation, they still serve an invaluable purpose. Floodplains hold back floodwater, releasing it into the watershed over time and dissipating floodwater energy. Floodplains capture sediment and debris as floodwaters recede. Average soil condition ratings of Poor to Fair from 2004-5 and 1991 indicate that watershed processes were not functioning properly at that time. Improvements in livestock management and frequent periods of limited livestock use since that time have increased plant cover and litter in many areas, except where large numbers of elk concentrate or where trees have continued to increase and shade out the understory plants. It is assumed that soil condition ratings have also improved in many areas, except where large numbers of elk concentrate. Improved soil conditions would lead to the proper amount of water and sediment being transported to streams within the project area, which in turn, would produce healthy channels and floodplains.

Currently, no water quality issues are present within or downstream of the project area. If the number of elk does not increase greatly compared to the population today, it is expected that water quality would remain in satisfactory condition under the no action alternative.

Effects determination of No Action: Anita-Cameron-Moqui Allotments – Neutral to moderate negative effect on soil condition, bare ground, watershed condition, and water quality, if elk numbers remain stable or increase. Slight positive effect if elk numbers decline.

Rain Tank Allotment – Neutral to moderate negative short-term effect, while elk numbers remain stable or increase; then slight to moderate positive long-term effect on soil condition, bare ground, watershed condition, and water quality, after elk numbers decline across the majority of the allotment.

Alternative 2 – Proposed Action

Effect of Proposed Action on Soils and Hydrology.

Implementation of the Proposed Action would lead to a temporary increase in bare ground exposed to soil erosion. If a heavy rain occurs while the soil is exposed, some soil erosion and sedimentation of stream channels and water bodies would occur. Following the best management practices during construction and reclaiming the area afterward with mulch and native seed will minimize losses of soil and soil productivity. The size of the disturbed areas is minimal, encompassing only about 18 acres total across the district.

The new water catchments would attract elk to new areas. If the elk population remains the same, heavy use of herbaceous forage and shrubby browse, trampling, and soil compaction would occur on about 12,000 new acres (i.e. 1/2 mile radius around 24 new water catchments). The use in these areas would increase during droughts when other sources of water (e.g. livestock earthen tanks) dry up. The increase in bare ground and compaction would increase the rate of soil erosion and sedimentation of water bodies and would reduce soil productivity within 1/2 mile of all the new water catchments. At the same time, the impact of elk at many existing water sources across the 331,427 acre project area would be reduced, leading to reduced rates of soil erosion and sedimentation and increased soil productivity in those areas.

Elk would be attracted to the new water catchments during droughts if they are more dependable than existing water sources in the area. During average to wet years, the elk may spread out over much more of the project area, so their impact may be well distributed. Or they may continue to concentrate around livestock earthen tanks, which they appear to prefer to catchments. The entire elk population might still concentrate at livestock earthen tanks during average to wet years, but then concentrate around the new wildlife water catchments in drought years. This would create a rest-rotation system instead of a uniform distribution of animals. If the annual precipitation pattern alternates frequently between drought and wet years, the rotation would provide effective rest to most of the project area. But if drought years continue to dominate, the elk would concentrate around the most dependable waters and would heavily impact certain parts of the project area. The increase in dependable waters would spread their impact over a larger area, theoretically reducing the negative effects on the soils and watersheds.

There is the possibility that the introduction of more dependable water sources would increase the elk population and the season of use. There could be increased survival, reduced out-migration, and increased immigration to the area. The elk population would almost certainly increase on the Rain Tank Allotment as a result of adding five new waters to an area where elk no longer must compete with cattle for water and forage. An increased season of use would lead to an increase in grazing impact, even if the population does not increase. Either scenario would lead to increased utilization of forage and browse plants, reduced plant and litter cover, increased erosion and sedimentation rates, increased compaction, and reduced soil productivity within ½ to one mile of all dependable water sources in the project area. Instead of a reduction in impacts close to existing waters, there could be an increase in impacts.

Effects determination of Proposed Action: Anita-Cameron-Moqui Allotments – Slight positive effect on soil condition, bare ground, watershed condition, and water quality, if elk numbers remain stable or increase. Moderate positive effect if elk numbers decline.

Rain Tank Allotment – Slight positive short-term effect, while elk numbers remain stable or increase slightly. Then slight to moderate negative long-term effect on soil condition, bare ground, watershed condition, and water quality, after elk numbers increase across the majority of the allotment as a result of not having to compete with cattle.

Cumulative Effects to Soils and Watershed

The cumulative effects analysis area consists of the Tusayan Ranger District surrounded by a one mile buffer. The cumulative effects analysis time period is 1998 to 2018.

Past, ongoing, planned, and foreseeable projects and activities in the cumulative effects analysis area that would have an effect on soils and watersheds include: timber harvesting, forest thinning, grassland restoration tree removal, fuelwood cutting, prescribed burning, livestock grazing, fence construction, water tank construction and maintenance, vehicle driving and horseback riding off-road to herd cattle and maintain fences, noxious weed control, recreational activities (e.g. vehicle and ATV use off-road, dispersed camping, horseback riding, hiking, hunting), road use and maintenance, pipeline and transmission line use and maintenance, travel management (i.e. road closures and elimination of most off-road motorized vehicle use), and residential developments and activities. Natural conditions, events, and activities that have an effect on soils and watersheds include climate and wildfires. (See Table 2 on page 30.)

Timber harvesting, forest thinning, grassland restoration tree removal, and fuelwood cutting projects reduce overstory cover in the short-term and would stimulate an increase in understory cover in two to five years. These projects would also increase litter cover. The long-term increase in herbaceous cover would protect the soil from raindrop impact and overland flow and would lead to a reduction in sheet, rill, and gully erosion, and deposition. It would also prevent excessive runoff and sedimentation of water bodies.

Reduction in tree canopy and heavy fuels would reduce the threat of catastrophic wildfires that could remove most of the plant and litter cover, burn up the seed bank, sterilize the soil, and create erosion and flooding. The long-term net cumulative effect of vegetation management projects on soils and watersheds is positive.

Broadcast prescribed burns remove a portion of overstory, understory, and litter cover. In the ponderosa pine and pinyon-juniper region, these burns are conducted in order to maintain or improve forest health by thinning the trees and increasing the herbaceous understory. The burns temporarily remove cover, but they also increase the growing space, light, water, and nutrients available to understory plants. In two to five years, the understory plants would regenerate and expand in cover compared to the pre-burn conditions. The long-term increase in herbaceous cover would protect the soil from raindrop impact and overland flow and leads to a reduction in sheet, rill, and gully erosion, and deposition. It would also prevent excessive runoff and sedimentation of water bodies. Reduction in tree cover and heavy fuels would reduce the threat of catastrophic wildfires that could remove most of the plant and litter cover, burn up the seed bank, sterilize the soil, and create erosion and flooding. The long-term net cumulative effect on soils and watershed of broadcast prescribed burns is positive.

Piling of tree thinning slash and prescribed burning of piles would remove excess fuels in the area. These projects would reduce the threat of catastrophic wildfires that could remove most of the plant and litter cover, burn up the seed bank, sterilize the soil, and create erosion and flooding. Large piles with heavy fuels can burn at a very high temperature, leading to bare ground and sterilized soil under the piles. Soils would be negatively affected in small (less than 20 foot diameter polygons) scattered locations. Best Management Practices will be followed in order to reduce the temperature of each pile burn. Small areas of soils would be negatively affected in order to reduce the risk of catastrophic wildfires that can negatively affect soils in broad areas. The long-term net cumulative effect on soils and watershed of piling and burning slash is positive.

Livestock grazing will continue in the Anita, Cameron, and Moqui Allotments and in the one mile buffer outside of the project area and outside of Grand Canyon National Park. Utilization on the Kaibab National Forest allotments is maintained at a conservative level that preserves an adequate amount of vegetative and litter cover to protect the soil. Therefore, this activity would not increase erosion and sedimentation within the cumulative effects analysis area. The long-term net cumulative effect of livestock grazing on soils and watershed is neutral.

Fence construction, water tank construction and maintenance (including wildlife catchments), vehicle driving and horseback riding off-road to herd cattle and maintain fences will continue to occur on the Anita, Cameron, and Moqui Allotments. These activities can remove tree cover, remove understory plant cover, and compact the soil in limited areas. Erosion rates may increase in these limited areas, but these negative effects are tolerated in order to facilitate livestock distribution. Improved livestock distribution can reduce grazing intensity, improve plant cover, and protect soil condition and stability.

The long-term net cumulative effect on soils and watershed of these allotment management activities is neutral to positive.

Noxious weed control activities will continue to occur. Small patches of weeds would be controlled by manual, chemical, or biological methods. Removal of noxious weeds can create small patches of bare ground in the short-term. Re-treatments would continue to remove the noxious weeds while allowing native plants to cover the area in the long-term. The long-term net cumulative effect on soils and watershed of noxious weed control activities is positive.

Recreational activities (e.g. vehicle and ATV use off road, dispersed camping, horseback riding, hiking, and hunting), road use and maintenance, and pipeline/transmission line use and maintenance will continue to occur. These activities can have negative effects on soils and watersheds including: removal of tree cover, removal of understory plant cover, channeling of runoff, increased erosion rates, and compaction. The Travel Management Plan will be implemented in a few years. The plan will require the closure of some minor forest roads and will close most areas to off-road motorized vehicle use. This action will greatly reduce the cumulative negative effects on soils and watersheds. After implementation of the Travel Management Plan, the long-term net cumulative effects of recreational, road, and pipeline/transmission line activities on soils and watersheds would be positive.

Exploratory drilling has occurred and may continue to occur on uranium mining claims within the project area. These activities can have negative effects on soils including: removal of understory plant cover, channeling of runoff, increased erosion rates, and compaction. Best management practices will be followed during implementation and the sites will be restored with native plants following disturbance. The long-term net cumulative effect of mining exploration on soils and watersheds is neutral.

Residential developments and activities, government housing, offices, and proposed parking lots, city facilities, and recreational/tourism facilities will be present within the cumulative effects analysis areas. Residents and businesses may remove plant cover, compact the soil, and create water flow channels on their properties. These activities could lead to moderate to high erosion rates on private property and sedimentation on adjoining Forest Service land. The long-term net cumulative effect of residential activities on soils and watersheds would be neutral (no change) to negative.

Climate and wildfires will continue to affect the cumulative effects analysis area. The current year drought is forecast to continue, possibly for many years. Drought reduces plant cover, kills trees, and makes the forest more susceptible to wildfires. Erosion and sedimentation rates would probably increase. The long-term cumulative net effect of climate and wildfires on soils and watersheds would be neutral (no change) to negative.

Alternative 2 – Proposed Action

Within the project area, the Proposed Action calls for construction of 24 new wildlife water catchments and a 12.2 mile pipeline would be constructed. All other activities, except most recreational off-road motorized vehicle use, would continue within the entire cumulative effects analysis area until 2018. Off-road motorized vehicle use will be limited when the Travel Management Plan is implemented.

Cumulative Effects Determination: Slight positive effect on 81% of the project area (Anita, Cameron, and Moqui Allotments) on soil condition, bare ground, watershed condition, and water quality, if elk numbers remain stable or increase. Moderate positive effect if elk numbers decline.

Slight positive short-term effect on 19% of the project area (Rain Tank Allotment), while elk numbers remain stable or increase slightly. Then slight to moderate negative long-term effect on soil condition, bare ground, watershed condition, and water quality, after elk numbers increase across the majority of the allotment as a result of not having to compete with cattle.

Table 2. Past, Present, and Reasonably Foreseeable Projects, Activities, and Events in the Cumulative Effects Analysis Area

Activity	Project Name	Time Frame	Measure
Past Projects/Activities/Events			
* represents past, present and foreseeable activities that are ongoing and will not be repeated in table			
*Hunting / Dispersed Camping/ Recreation			District-wide
*Livestock and Wildlife Water Development	Various	1880s to current for livestock; 1960's to current for wildlife	District-wide
*Uranium Exploration Drilling	Canyon Uranium Mine; Exploratory Drilling	1980's to current	District-wide
*Commercial Fuelwood; Timber Sales	Harbison, Trail, Java; Scott Timber Sale	1980's-early 1990's; 1998 - 2010	3,000 acres; 6,000 acres
*Road Closures/Obliterations	Various	Early 1990's	District-wide 120 miles
*Grassland maintenance (agra-axe)	Harbison; Nameless; No Name; O'Connell; Moqui (includes prescribed burning)	2002 - 2010	4500
*Wildland Fire Use	Mason WFU Mudersbach WFU	7-2004 6-2005 to 7-2005	11 acres 7260 acres
*Prescribed Burning	Various	Ongoing	District/GCNP
*Livestock Grazing; Fence Construction	Anita-Cameron, and Moqui Range Allotment Grazing Authorization EA's; Rain Tank Allotment vacated in 1998	2004	District-wide
Sage Mowing	McRae Sage Mowing; Sage Tank Grassland Mowing Project	2005	145

Activity	Project Name	Time Frame	Measure
*Fuels Reduction (Wildland urban interface)	Lone Tree, Topeka, Long Jim, Tusayan South, Tusayan West, Tusayan East, Boggy Tank	1996 - current	NFS lands adjacent to Tusayan and GCNP
*Non-commercial Thinning	Various	Ongoing	District-wide
*Fence Modification	Pronghorn antelope fence modification	Ongoing	33 miles
*Trail Construction and Reconstruction	Arizona Trail; Greenway Trail; Red Butte Trail; Bike Trails	Ongoing	District-wide
*Fuelwood Harvesting	Personal Use	Ongoing	District-wide
*Christmas Tree Harvesting		Ongoing	Location/acres vary each year
*Drought/Bark Beetle Infestation	Tree mortality	Past 10 years; lessened in 2006; drought continues	Northern AZ; Project Area
*Noxious Weeds (USFS & GCNP)	Noxious Weed Control	Ongoing	District-wide & GCNP
*Special Use Permits	Jeep Tours; ATV Tours; Apache Stables	Past 5 years; Past 30 years	Tusayan – central part of district
Wildlife Water Catchment reconstruction	Reconstructed 9 wildlife water catchments	2006-07	District-wide

Current Projects/Activities

Materials Pit and Extraction	Lower Dillman Pit Expansion Project	Ongoing; began in 2007	
Uranium Exploratory Drilling	VANE Minerals; DIR Exploration; Neutron Energy	2008-12	District-wide
Tusayan District Motorized Travel Management	Tusayan Travel Management Rule Draft Environmental Analysis (EA)	2008-09	District-wide
NFS Land Grant using Educational Land Grant Act	Grand Canyon Unified School District	2008 – Quit Claim Deed Recorded	80 NFS acres sold to school
Fuels Reduction	Airport WUI	2008-2014	3,000 acres
Grand Canyon Transportation Plan	South Rim Entrance Road Improvements	2008-2009	GCNP
Wildfire	X Fire	2008	2048 acres

Foreseeable Projects/Activities

Wildlife Water Development	Tusayan Wildlife Waters Project	2008-2010	District-wide
Uranium Mining	Canyon Mine EIS (Denison Mines)	2008-15 (depends on uranium price)	Re-open Canyon Mine
Cell Tower Construction	Hwy 64/180 Wireless Communication Sites	2008-11	2 sites on Hwy 64 corridor
Energy Corridor Construction	Federal Land in 11 Western States	2008-15	Passes through Tusayan RD
Grand Canyon Transportation Plan	South Rim Visitor Transportation Plan (EA)	2008-2012	10 NFS acres for parking lot
Highway 64 Reconstruction	ADOT - expand Hwy 64 to 4 lanes from Williams to Tusayan	Next 5 years	50 miles; ~ 11 miles through Tusayan RD

Activity	Project Name	Time Frame	Measure
Tusayan Incorporation; may use Townsite Act to acquire land from Forest Service	Coming up for a vote	Next 1-2 years	

Wildlife Resources

Potential effects of the Tusayan Wildlife Waters Project are evaluated for general effects on wildlife habitat, effects related to wildlife predation, effects related to water quality, and effects on the following species groups: animal species listed under the Endangered Species Act, animal species classified as Forest Service Sensitive, Management Indicator Species (MIS), and migratory bird species. Effects on elk, mule deer, and pronghorn antelope are evaluated in the Management Indicator Species section.

Affected Environment and Environmental Consequences

Direct and Indirect Effects of No Action Alternative

The 24 new wildlife water developments and 12 miles of water pipeline would not be constructed. Existing wildlife water developments would continue to be maintained and reconstructed when needed. AGFD would continue to haul water from the South Grand Canyon Sanitary District’s municipal wastewater facility in Tusayan during dry periods when insufficient water is available at existing water developments to meet the needs of wildlife.

Wildlife distribution and habitat use patterns would not be affected by the proposed water developments and water pipeline. Distribution and habitat use patterns of wildlife on the Tusayan District would continue to be determined by an array of factors including the current distribution of water developments (both livestock and wildlife water developments), the amount and timing of annual precipitation, forage and browse production, impacts of livestock on forage and water availability, and the extent to which AGFD is able to haul water during dry periods when water developments have gone dry. Impacts of elk and deer on herbaceous and woody plants would continue to be determined by forage and browse production, current distribution of water developments, and AGFD population management in GMU 9.

Direct and Indirect Effects of the Proposed Action

General Effects on Wildlife Habitat

Direct and indirect effects of the proposed action on wildlife habitat can be broken down into 1) direct effects due to habitat disturbance caused by construction of the water developments and pipeline, 2) direct effects of adding new water sources for wildlife, and 3) indirect effects on wildlife habitat resulting from altered wildlife distribution and habitat use patterns following project implementation.

The area that would be mechanically disturbed during construction of new water developments would be a little less than a 1/4 acre at each water development (see Proposed Action description for details). Thus, wildlife habitat would be impacted on approximately 6 acres as a result of construction of the water developments (24 new developments x 1/4 acre each). The majority of wildlife habitat in these 1/4-acre areas would be lost as a result of putting in these permanent water development structures (i.e., catchment apron, water storage tanks, and drinker). An additional area of approximately 12 acres would be mechanically disturbed as a result of putting in 12.2 miles of new water pipeline (this assumes that a strip approximately 8 feet wide would be disturbed along the 12.2-mile long pipeline). This disturbance would only be short-term because vegetation would grow back over the buried pipeline.

Table 3. Distribution of habitat types surrounding proposed water developments

Habitat Type	Water Development
Grassland	p, q, s, A, I
Sagebrush	m, D, E, F, G, H, K
Pinyon-juniper Woodland	n, o, r, t, x, B, C, J, L
Ponderosa Pine Forest	u, v, w

Different wildlife species have different physiological requirements for surface water for drinking (Rosenstock et al. 1999, Krausman et al. 2006). Species with greater physiological demands for drinking water will benefit most from adding new water sources. Benefits to individual species and species groups are discussed in the following sections.

In addition to direct effects on wildlife habitat resulting from construction of water developments and the pipeline and adding new water sources, there would be indirect effects on soil and vegetation resources and thus wildlife habitat as a result of altered wildlife distribution and habitat use patterns following project implementation.

Field surveys by the Kaibab National Forest South Zone (Williams and Tusayan Districts) wildlife biologist conducted in spring of 2007 indicated that certain shrub and tree species showed sign of repeated ungulate browsing in many areas on the Tusayan District. Common woody plant species that showed sign of repeated browsing were young ponderosa pine trees, young Gambel oak trees, cliffrose, four-wing saltbush, sagebrush, skunkbush, and fernbush. Repeatedly browsed woody plants were common in various places across the district, but were especially common near existing water developments.

Cattle browse on various shrub species, especially when grass forage production is low due to dry conditions. However, woody plants that showed sign of repeated past browsing in spring of 2007 were located in the Anita-Cameron Allotment, which had not been grazed by cattle for the previous 5 years (the allotment had been in non-use status between 2002 and 2006). Much of the browse impacts observed were believed to have been caused by elk and deer. Elk tracks and droppings were abundant throughout the district, especially in areas where browse intensity was heavy. Drought has adversely

affected some of these plants and may be interacting with repeated browsing to adversely affect the growth and survival of certain species.

An effect of the Proposed Action would be increased utilization of various herbaceous and woody plants by elk and deer around the 24 new water developments. Increased utilization of herbaceous and woody plants by elk and deer would result in decreased availability of forage and cover for other wildlife species. Similar to cattle, elk concentrate their activity close to water in the arid Southwest. Elk concentrate their activity within 1/4 to 1 mile of water sources, especially during dry periods or during lactation for females (Rosenstock et al. 1999 (Rosenstock et al. 1999, Arizona Game and Fish Department 2006a:page 51).

Under the assumption that elk density would not increase on the Tusayan District as a result of the Proposed Action, increased elk forage and browse utilization around new water developments would be offset by some degree as a result of decreased elk forage and browse utilization elsewhere on the Tusayan District. The Tusayan District is located in GMU 9, and AGFD elk population management objectives for GMU 9 include "1. Stabilize or slightly reduce this herd in response to continued drought conditions and habitat concerns." (Arizona Game and Fish Department 2006b). The primary method in which AGFD manages elk density is by manipulating the harvest of cow elk through management of antlerless elk hunts.

The addition of 24 new water developments could result in increased season of use by elk in areas near new water developments on the district. If increased season of use by elk results in increased impacts to vegetation and soil resources, AGFD may need to increase antlerless harvest to reduce habitat impacts.

Effects Related to Wildlife Predation

In recent years some critics of wildlife water developments have suggested that artificial water developments may not yield expected benefits to wildlife and may actually result in adverse effects (Broyles 1995, Brown 1998). One of the suggested adverse effects of wildlife water developments is increased predation at water developments. Destafano et al. (2000) documented significantly greater predator sign around wildlife water developments compared to paired non-water sites in southwestern Arizona, but they had no data on actual predation rates. They also concluded that without water developments, predators may be even more concentrated around the fewer natural water sites. O'Brien et al. (2006) recorded >5,000 visits by mammalian predators at water developments in southwestern Arizona but noted only 4 predation events. They concluded that the hypothesized negative impact of increased predation events at water developments appeared to be unfounded in their study area.

Effects Related to Water Quality

Rosenstock and Rabe (2004) recently analyzed water quality at different types of wildlife water developments in southwestern Arizona. They found no significant evidence of water quality problems associated with water chemistry and did not detect toxins produced by blue-green algae. They also found no evidence that the water developments they studied played a significant role in transmission of the protozoan parasite that causes

trichomoniasis or provide larval habitat for biting midges (genus *Culicoides*) that transmit hemorrhagic disease viruses.

Reclaimed water from the Tusayan municipal wastewater facility would be used to supply water to two existing water developments that were recently reconstructed and three new water developments. As described in Chapter 2, Alternative 2 - Proposed Action, the class A+ reclaimed water that would be used to supply the pipeline goes through tertiary treatment and ultraviolet radiation disinfection.

Concern has developed in recent years over potential environmental impacts of certain organic chemicals occurring in pharmaceutical drugs and personal care products (PPCPs) that are found in treated wastewater (Daughton and Ternes 1999, McGovern and McDonald 2003). Research has shown that between 50 and 90 percent of a typical drug dosage can be excreted by the human body and introduced into the environment through the discharge of treated wastewater (McGovern and McDonald 2003). The primary issue is the potentially harmful impact these organic chemicals may have on the normal function of the endocrine system in wildlife and humans (McGovern and McDonald 2003). Endocrine-disrupting compounds can mimic, stimulate, or inhibit the production of natural hormones, thereby disrupting endocrine system function. Municipal wastewater contains a variety of organic chemicals that are pharmaceutically active and known to act on the endocrine system at therapeutic doses (McGovern and McDonald 2003). Chemicals found in both non-prescription and prescription medications have been detected in municipal wastewaters and may act as endocrine disruptors (Daughton and Ternes 1999).

Much of the concern over environmental effects of PPCPs has focused on the effects to fish, amphibians, and other aquatic organisms because the introduction of PPCPs into the environment occurs primarily through aquatic systems (Daughton and Ternes 1999). Because the drinkers that would be used under the proposed action are small (5 x 8 feet) and designed to provide drinking water for terrestrial animals and because of the lack of fish and amphibians on the Tusayan District, there would be no risks to fish or amphibians (or humans) associated with the use of treated wastewater.

Wildlife have been using reclaimed water around Tusayan for many years. Wildlife have been drinking reclaimed water discharged from both the Tusayan municipal wastewater facility and the wastewater facility at Grand Canyon Village in Grand Canyon National Park for years. AGFD has been using reclaimed water from the Tusayan wastewater facility for at least the past 10 years to haul water to wildlife water developments that have gone dry. Thus, use of reclaimed water to supply wildlife water developments under the proposed action would not present any new effects.

Effects on Species Listed Under the Endangered Species Act

All animal species identified for Coconino County, Arizona by the U.S. Fish and Wildlife Service were evaluated (<http://www.fws.gov/arizonaes/>). This list includes species classified as Candidate or Proposed and species with conservation agreements. Critical Habitat has been designated for humpback chub, little Colorado spinedace, razorback sucker, California condor, Mexican spotted owl, and southwestern willow flycatcher, although there is no designated Critical Habitat for any listed species on the Tusayan

District. The Tusayan District is outside of the known range or lacks suitable habitat for most species on the Coconino County list. The Tusayan District is outside of the known range and lacks suitable aquatic habitat for Apache trout, humpback chub, Little Colorado spinedace, razorback sucker, Chiricahua leopard frog, and California brown pelican. The district also lacks suitable riparian habitat for southwestern willow flycatcher and yellow-billed cuckoo. The district lacks suitable wetland habitat and is outside of the limited geographic range of the Kanab ambersnail. There are no known Mexican spotted owl detections on the Tusayan District and no Protected Activity Centers (PACs) or designated spotted owl Critical Habitat. The Tusayan District is located outside of the range of reintroduced black-footed ferrets.

California condor: The Tusayan District is within the experimental nonessential population area designated for the reintroduced California condor. Condors primarily occur within and along the south rim of the Grand Canyon, the Kaibab Plateau on the north side of Grand Canyon, Marble Canyon, the Vermillion Cliffs, and parts of southern Utah (Southwest Condor Review Team 2007). Although condors are common nearby along the south rim of Grand Canyon, they have not been commonly detected on the Tusayan District. There are no known condor nest sites on the district, nor are there sites where condors are known to roost.

Condors are opportunistic scavengers that feed primarily on large dead mammals such as deer, elk, bighorn sheep, and domestic livestock. The amount or distribution of carrion would not be affected by the Proposed Action. Forest Service employees on the Tusayan District report no observations of condors drinking at existing water developments (earthen tanks or wildlife water developments). Suitable foraging habitat on the Tusayan District for condors includes grassland, sagebrush, pinyon-juniper woodland, and ponderosa pine forest. The Proposed Action would affect suitable foraging habitat and may result in a small increase in habitat quality due to additional water sources for drinking.

Effects on Forest Service Sensitive Species

The Forest Service Sensitive species program is designed to assist the Forest Service to maintain biodiversity on national forests and grasslands and help maintain viable populations of existing native and desired non-native species. Of the animal species identified by the Southwestern Region (R3) of the Forest Service for the Kaibab National Forest, the Tusayan District overlaps the range of the following species: northern leopard frog, bald eagle, northern goshawk, burrowing owl, peregrine falcon, Merriam's shrew, spotted bat, Allen's lappet-browed bat, Townsend's big-eared bat, and Mogollon vole.

Northern leopard frog: The Kaibab National Forest has not documented the presence of northern leopard frogs on the Tusayan District, and the distribution map in AGFD's Heritage Data Management System does not show any occurrences on the district (http://www.azgfd.gov/w_c/edits/images/ranapipi.gif). Suitable habitat for this species is defined as perennial water bodies with rooted aquatic vegetation and adjacent wet meadows. The Proposed Action would not affect northern leopard frogs because it would not affect individuals or suitable habitat.

Bald eagle: Bald eagles are winter residents or migrants on the Kaibab National Forest. There are no known bald eagle nests on the Forest. In northern Arizona, bald eagles primarily occur near perennial water (reservoirs, rivers, and streams) with abundant prey, or at sites where carrion occurs. Because of the lack of perennial aquatic habitat on the Tusayan District, bald eagles primarily occur opportunistically where carrion is available. Suitable habitat on the Tusayan District includes grassland, sagebrush, pinyon-juniper woodland, and ponderosa pine habitat types. Various raptor species are known to use wildlife water developments in arid habitats (Rosenstock et al. 1999, Rosenstock and Rabe 2004). It is unknown whether additional water developments would provide much benefit for bald eagles because bald eagles are present on the district during the winter when animal water demands are much less than during the summer. The Proposed Action would affect suitable habitat for this species, however, and may result in a small increase in habitat quality due to additional water sources for drinking.

Northern goshawk: Suitable habitat for northern goshawks on the Tusayan District includes ponderosa pine forest and pinyon-juniper woodland habitat types. There are eight established goshawk management areas located across parts of EMAs 8 and 10 on the district. Goshawks typically nest in large ponderosa pine trees on the Williams and Tusayan Districts. Goshawks prey on a wide variety of species, but most common prey in northern Arizona are American robin, Stellar's jay, hairy woodpecker, northern flicker, red-naped and Williamson's sapsuckers, chipmunks, golden-mantled ground squirrel, cottontail rabbits, black-tailed jackrabbit, Abert's squirrel, and red squirrel (Wiens et al. 2006).

As stated in Chapter 2, Alternative 2 - Proposed Action, the Kaibab National Forest South Zone wildlife biologist must be informed at least two weeks prior to initiation of construction activities at each project site. If planned construction activity is during the goshawk breeding season (March 1 to September 30), the wildlife biologist will determine whether construction activity at the project site would likely disturb potential goshawk nesting activity. If there is an active goshawk nest near any of the proposed water development sites, the wildlife biologist will determine how long implementation at that site must be delayed to avoid disturbing goshawk nesting activity.

Twelve of the 24 proposed new water developments are located in pinyon-juniper woodland or ponderosa pine forest (Table 3). The Proposed Action would affect suitable habitat for goshawks and likely result in a small increase in habitat quality because various species of raptors and certain goshawk prey species are known to use and likely benefit from wildlife water developments (Rosenstock et al. 1999, Rosenstock and Rabe 2004). A potential increase in habitat quality for goshawks would likely be offset by some degree if implementation of the Proposed Action resulted in increased overall habitat impacts by elk. Increased overall utilization levels of herbaceous and woody plants by elk would result in decreased cover and forage for certain goshawk prey species.

Western burrowing owl: In Arizona, burrowing owls are found in flat, open grasslands, sparsely vegetated desertscrub, and edges of human disturbed lands. They use prairie

dog and ground squirrel burrows for nesting. They primarily feed on large insects and small mammals (mice and voles). A small number of Gunnison's prairie dog colonies do occur on the Tusayan District, but burrowing owls are not known to occur on the district. Suitable habitat for burrowing owls on the Tusayan District includes grassland and pinyon-juniper woodland habitat types. Fourteen of the 24 proposed new water developments are located in grassland and pinyon-juniper woodland (Table 3). The Proposed Action would affect suitable habitat and likely result in a small increase in habitat quality due to increased water sources for drinking.

American peregrine falcon: Peregrine falcons nest on cliffs near concentrations of avian prey. Peregrine falcons nest in the Grand Canyon just north of the Tusayan District, but there are no known peregrine falcon nesting records on the district. Suitable foraging habitat on the Tusayan District includes grassland, sagebrush, and pinyon-juniper woodland habitat types. Twenty-one of the 24 proposed new water developments are located in grassland, sagebrush, or pinyon-juniper woodland (Table 3). The Proposed Action would therefore affect suitable foraging habitat and likely result in a small increase in habitat quality due to additional water sources for drinking, both for individual peregrine falcons and their avian prey species.

Merriam's shrew: Merriam's shrews are known to occur on the Tusayan and Williams Districts. Suitable habitat on the Tusayan District includes grassland, sagebrush, pinyon-juniper woodland, and ponderosa pine forest. Construction of the water developments would result in the loss of about 6 acres of suitable habitat (24 water developments x 1/4 acre). Shrews do not rely on free-standing water (they meet their water demands through water content of their insect prey). The Proposed Action would result in a small decrease in the amount of suitable habitat (6 acres) for Merriam's shrew, but this is too small of an area to have any population-level effect. If implementation of the Proposed Action resulted in increased overall habitat impacts by elk, there may be a small decrease in Merriam's shrew habitat quality because increased utilization of herbaceous and woody plants by elk would result in decreased cover and forage for Merriam's shrew.

Spotted bat: This species has been detected in the Grand Canyon just north of the Tusayan District. It has been reported in a variety of habitat types including ponderosa pine forest, and has primarily been detected near rocky areas and cliffs. Suitable foraging habitat on the Tusayan District includes grassland, sagebrush, pinyon-juniper woodland, and ponderosa pine forest. Bats are attracted to surface water for drinking and foraging on flying insects. The Proposed Action would not affect roosting habitat but may affect foraging habitat. Adding 24 new water developments would likely result in an increase in habitat quality for spotted bats on the Tusayan District due to increased water sources for drinking and foraging habitat. The magnitude of the effect would likely not be sufficient to result in a population-level effect at the scale of the Tusayan District or any greater spatial scale.

Allen's lappet-browed bat: This species is known to occur on the Tusayan District. It occurs in ponderosa pine forest and pinyon-juniper woodland, and uses large snags as

roost sites. Suitable foraging habitat on the Tusayan District includes grassland, sagebrush, pinyon-juniper woodland, and ponderosa pine forest. Because bats are attracted to surface water for drinking and foraging on flying insects, the Proposed Action would likely result in an increase in habitat quality for Allen's lappet-browed bat on the Tusayan District. The magnitude of the effect would likely not be sufficient to cause a population-level effect at the scale of the Tusayan District or any greater spatial scale.

Townsend's big-eared bat: This species occurs in a wide variety of habitats including desertscrub, oak woodland, pinyon-juniper woodland, and other conifer forest types. Suitable foraging habitat on the Tusayan District includes grassland, sagebrush, pinyon-juniper woodland, and ponderosa pine forest. Because bats are attracted to surface water for drinking and foraging on flying insects, the Proposed Action would likely result in an increase in habitat quality for Townsend's big-eared bat on the Tusayan District. The magnitude of the effect would likely not be sufficient to cause a population-level effect at the scale of the Tusayan District or any greater spatial scale.

Mogollon vole: In Coconino County, Mogollon voles (formerly referred to as Navajo Mexican voles) have been found in the Grand Canyon, in the Flagstaff area, and the Williams Area, but AGFD's Heritage Data Management System shows no occurrences on the Tusayan District (http://www.azgfd.gov/w_c/edits/images/micrmena_000.gif). Suitable foraging habitat on the Tusayan District includes grassland, sagebrush, pinyon-juniper woodland, and ponderosa pine forest. Construction of the water developments would result in the loss of about 6 acres of suitable habitat (24 water developments x 1/4 acre). Voles do not rely on free-standing water (they meet their water demands through water content of the herbaceous vegetation they eat). The Proposed Action would result in a small decrease in the amount of suitable habitat (6 acres) for Mogollon vole, but this is too small of an area to have any population-level effect. If implementation of the Proposed Action resulted in increased overall habitat impacts by elk, there may be a small decrease in Mogollon vole habitat quality because increased utilization of herbaceous plants by elk would result in decreased cover and forage for Mogollon vole.

Effects on Management Indicator Species

Management Indicator Species and the habitats they represent are listed in the most recent Kaibab National Forest Management Indicator Species report (Forest Service 2008:page 9). Of these, the Tusayan District contains suitable habitat for the following species: northern goshawk, wild turkey, hairy woodpecker, pygmy nuthatch, juniper titmouse, Abert's squirrel, elk, mule deer, and pronghorn antelope. The district lacks suitable aquatic habitat for aquatic macroinvertebrates, suitable wetland habitat for cinnamon teal, low-elevation riparian habitat for Lucy's warbler and yellow-breasted chat, high-elevation riparian habitat for Lincoln's sparrow, suitable pine-oak or mixed conifer forest for Mexican spotted owl, aspen forest for red-naped sapsucker, and mixed conifer or spruce-fir forest for red squirrel.

Northern goshawk: The northern goshawk was selected as an indicator species for late-seral ponderosa pine forest. Life history, potential management impacts, and population

trend data for northern goshawk are summarized in Forest Service (2008:pages 24 to 31). See effects analysis above in Forest Service Sensitive species section. Suitable habitat on the Tusayan District includes ponderosa pine forest and pinyon-juniper woodland. Twelve of the 24 proposed new water developments are located in ponderosa pine forest or pinyon-juniper woodland (Table 1). The primary effect of the Proposed Action would be a small increase in goshawk habitat quality due to additional water sources for drinking, both for individual goshawks and goshawk prey species. The magnitude of this effect would likely not be sufficient to result in a population-level effect at the spatial scale of the Tusayan District or any greater spatial scale.

Wild turkey: Wild turkey was selected as an indicator species for late-seral ponderosa pine forest. Life history, potential management impacts, and population trend data for this species are summarized in Forest Service (2008:pages 60 to 62). Suitable habitat on the Tusayan District includes pinyon-juniper woodland and ponderosa pine forest. In Arizona, surface water is considered an essential habitat component for Merriam's turkey (Rosenstock et al. 1999). Twelve of the 24 proposed new water developments are located in pinyon-juniper woodland or ponderosa pine forest (Table 3). The Proposed Action would likely result in a small to moderate increase in habitat quality for wild turkey due to additional water sources for drinking. This would likely result in no population-level effect or a small increase in population abundance of wild turkey at the spatial scale of the Tusayan District or any greater spatial scale.

Hairy woodpecker: Hairy woodpecker was selected as an indicator species for snags in ponderosa pine, mixed conifer, and spruce-fir forests. Life history, potential management impacts, and population trend data for this species are summarized in Forest Service (2008:pages 31 to 37). Suitable habitat on the Tusayan District includes pinyon-juniper woodland and ponderosa pine forest. Twelve of the 24 proposed new water developments are located in pinyon-juniper woodland or ponderosa pine forest (Table 3). Construction of the water developments and pipeline would not impact numbers of snags. Woodpeckers are known to use wildlife water developments in arid habitats (Rosenstock et al. 1999, Rosenstock and Rabe 2004), so potential effects of the Proposed Action would likely be a small increase in habitat quality for hairy woodpeckers. The magnitude of this potential effect would likely not be sufficient to result in a population-level effect for hairy woodpeckers at the spatial scale of the Tusayan District or any greater spatial scale.

Pygmy nuthatch: The pygmy nuthatch was selected as an indicator for late-seral ponderosa pine forest. Life history, potential management impacts, and population trend data for this species are summarized in Forest Service (2008:pages 50 to 54). This species forages and nests primarily in mature ponderosa pine trees. Only 3 of the 24 proposed new water developments are located in ponderosa pine forest (Table 3). Construction of the water developments and water pipeline would not impact mature ponderosa pine trees. Various species of passerine birds are known to use wildlife water developments in arid habitats (Rosenstock et al. 1999, Rosenstock and Rabe 2004), so potential effects of the Proposed Action would likely be a small increase in habitat

quality for pygmy nuthatches. The magnitude of this potential effect would likely not be sufficient to result in a population-level effect for pygmy nuthatches at the spatial scale of the Tusayan District or any greater spatial scale.

Juniper titmouse: The juniper titmouse was selected as an indicator for late-seral pinyon-juniper woodland and the snag component within this habitat. Life history, potential management impacts, and population trend data for this species are summarized in Forest Service (2008:pages 45 to 50). This species forages and nests primarily in mature juniper trees. Suitable habitat on the Tusayan District includes pinyon-juniper woodland. Nine of the 24 proposed new water developments are located in pinyon-juniper woodland (Table 3). Construction of the water developments and water pipeline would not impact mature juniper trees. Various species of passerine birds are known to use wildlife water developments in arid habitats (Rosenstock et al. 1999, Rosenstock and Rabe 2004), so potential effects of the Proposed Action would likely be a small increase in habitat quality for juniper titmice. The magnitude of this potential effect would likely not be sufficient to cause a population-level effect for juniper titmice at the spatial scale of the Tusayan District or any greater spatial scale.

Abert's squirrel: Abert's squirrel (tassel-eared squirrel) was selected as an indicator for early-seral ponderosa pine forest. Life history, potential management impacts, and population trend data for this species are summarized in Forest Service (2008:pages 85 to 88). This species forages and nests primarily in mature ponderosa pine trees. Only 3 of the 24 proposed new water developments are located in ponderosa pine forest (Table 3). Construction of the water developments and water pipeline would not impact mature ponderosa pine trees. Abert's squirrels may utilize some of the new water developments, so potential effects of the Proposed Action may be a small increase habitat quality. The magnitude of this potential effect would likely not be sufficient to cause a population-level effect for Abert's squirrels at the spatial scale of the Tusayan District or any greater spatial scale.

Elk: Elk was selected as an indicator for early-seral ponderosa pine, mixed conifer, and spruce-fir forest. Life history, potential management impacts, and population trend data for this species are summarized in Forest Service (2008:pages 71 to 74). Elk use a wide variety of habitat types on the Kaibab National Forest. Suitable habitat on the Tusayan District includes grassland, sagebrush, pinyon-juniper woodland, and ponderosa pine forest.

The only native elk in Arizona, Merriam's elk (*Cervus elaphus merriami*), was extirpated by unregulated hunting by the early 1900s (Hoffmeister 1986:page 538). The Arizona range of Merriam's elk was primarily in the White Mountains of eastern Arizona, although low densities of Merriam's elk occurred along the Mogollon Rim west to near the San Francisco Peaks (Arizona Game and Fish Department 2006a:page 51). Between 1913 and 1929, Rocky Mountain elk (*Cervus elaphus nelsoni*) from Yellowstone National Park were introduced into Arizona. Numbers of Rocky Mountain elk have increased significantly statewide since the 1940s, reaching greatest numbers in the 1990s

(Arizona Game and Fish Department 2006a:page 53). In Arizona, elk occur in a wide variety of woodland and forested habitats between 7,000 and 10,500 feet during summer. They tend to stay on the summer range as long as possible, arriving early in the year and remaining until forced down to lower elevations by snow. In Arizona, elk are typically found within 1/2 mile from water (Arizona Game and Fish Department 2006:page 51). Rosenstock et al. (1999) concluded that water developments have played a major role in population expansion of elk in arid regions of West during the last 20 years.

The Proposed Action would likely result in a moderate to substantial increase in habitat quality for elk due to additional water sources for drinking. The magnitude of the effect on habitat quality may be sufficient to result in increased population abundance of elk on the Tusayan District if AGFD does not increase harvest of cow elk in the area. It is assumed that AGFD will manage the elk population in the area to not allow elk density to increase because elk population management objectives for GMU 9 state "1. Stabilize or slightly reduce this herd in response to continued drought conditions and habitat concerns." (Arizona Game and Fish Department 2006b). AGFD has tried to prevent the elk population in the Tusayan District area from increasing since the 1990s as evidenced by large increases in the number of antlerless elk permits in GMU 9 from 51 in 1991 to 800 in 2005-2008.

Mule deer: Mule deer was selected as an indicator for early-seral aspen forest and pinyon-juniper woodland. Life history, potential management impacts, and population trend data for this species are summarized in Forest Service (2008:pages 74 to 78). Mule deer is a habitat generalist and suitable habitat on the Tusayan District includes grassland, sagebrush, pinyon-juniper woodland, and ponderosa pine forest. The Tusayan District is located in GMU 9, and numbers of mule deer surveyed in this unit declined in recent years from 507 total deer in 2001 to 149 total deer in 2005 (Arizona Game and Fish Department 2006a:page 10).

Mule deer in the arid West are dependent upon surface water, and Rosenstock et al. (1999) concluded that wildlife water developments in the West have benefited mule deer populations. The Proposed Action would likely result in a moderate increase in habitat quality for mule deer due to additional water sources for drinking. Increases in mule deer habitat quality may be offset by some degree by increased potential for competition from elk and habitat impacts by elk. Whether mule deer habitat quality would be increased sufficiently to result in a population-level effect on mule deer may depend on the elk population response following project implementation. Increased browse utilization by elk on shrubs such as cliffrose around the new water developments could negatively affect mule deer habitat quality.

American pronghorn: Pronghorn antelope was selected as an indicator for early- and late-seral grasslands. Life history, potential management impacts, and population trend data for this species are summarized in Forest Service (2008:pages 78 to 82). On the Tusayan District, suitable pronghorn habitat includes grassland, sagebrush, pinyon-juniper woodland, and even open ponderosa pine forest. Total number of pronghorn surveyed in

GMU 9 declined from 271 in 2001 to 130 in 2005, but number of fawns/100 does increased from 19 in 2001 to 45 in 2005 (Arizona Game and Fish Department 2006a:page 41). Within the Tusayan District, pronghorn primarily utilize habitat in the Upper Basin in EMA 9, the southeastern portion of EMA 8, and small grasslands in EMA 10. Pronghorns use water developments and research has shown that fawning sites in Arizona are typically within a 1/4 to a 1/2 mile of surface water.

The Proposed Action would likely result in a moderate increase in habitat quality for pronghorn due to additional water sources for drinking. Increases in pronghorn habitat quality may be offset to some degree by increased potential for competition from elk and habitat impacts by elk. Whether pronghorn habitat quality would be increased sufficiently to result in a population-level effect on pronghorn may depend on the elk population response following project implementation. Increased browse utilization by elk on herbaceous forage and browse species such as four-wing saltbush and cliffrose around new water developments could negatively affect pronghorn habitat quality.

Effects on Migratory Birds

Numerous migratory bird species occur on the Tusayan District. Potential effects on northern goshawk, pygmy nuthatch, and juniper titmouse were analyzed above. Effects also were evaluated for Arizona Partners in Flight (PIF) Priority Species. PIF priority species are identified by habitat type. Arizona PIF habitat types that occur on the Tusayan District are pine habitat, pinyon-juniper woodland, cold desertscrub, and high elevation grassland (Latta et al. 1999:page 14). Priority species identified in Arizona PIF for pine habitat are northern goshawk, olive-sided flycatcher, Cordilleran flycatcher, and purple martin. Priority species for pinyon-juniper habitat are gray flycatcher, pinyon jay, gray vireo, black-throated gray warbler, and juniper titmouse. Priority species for cold desertscrub habitat are sage thrasher, sage sparrow, and Brewer's sparrow. Priority species for high elevation grasslands are Swainson's hawk, ferruginous hawk, burrowing owl, and grasshopper sparrow. There are no designated Important Bird Areas within the district.

Birds living in arid environments vary in their dependence on surface water, but research has shown that many bird species use water developments in Arizona, including passerines, shorebirds, upland game birds, waterfowl, and raptors (Rosenstock et al. 1999, Rosenstock and Rabe 2004). Bird species that commonly visited wildlife water developments in southwest Arizona included turkey vultures, great horned owls, other small owls, common ravens, Cooper's hawks, mourning doves, and white-winged doves (Rosenstock and Rabe 2004).

Ground and vegetation disturbance during project implementation (less than 20 acres) and habitat loss (approximately 6 acres) would likely be insufficient to cause any population-level effects on migratory birds. The addition of water sources for drinking would likely result in a small increase in habitat quality for various migratory bird species in the areas around new water developments. The magnitude of potential increases in habitat quality would likely not be sufficient to cause any population-level effects for

migratory bird species at the spatial scale of the Tusayan District or any greater spatial scale.

Cumulative Effects

In an area with no perennial streams and relatively flat topography, watersheds are not clearly delineated on the Tusayan District. Because the proposed water developments are scattered across the entire district, the spatial scale of the cumulative effects analysis area is defined as the Tusayan District, as well as a surrounding 2-mile buffer (total area of 505,330 acres). Cumulative effects were considered for a time period of about 10 years before and after 2008.

Historic activities that have affected environmental baseline conditions on the Tusayan District include:

- Livestock have grazed on the district continuously since the 1880s
- Construction and maintenance of water developments for livestock (primarily earthen tanks) from the 1880s to present
- Introduction of non-native Rocky Mountain elk to northern Arizona between 1913 and 1929 and significant increases in population density of elk on the Tusayan District since the 1940s.
- Establishment of Grand Canyon National Park in 1919 where elk have not been hunted
- Construction and maintenance of wildlife water developments on the Tusayan District since the 1960s
- Fire suppression during the past century that has had substantial effects on vegetation structure and composition

As in the rest of the arid West, livestock grazing has resulted in significant changes in the composition and structure of native plant communities. Many of these changes came about during the late 1800s and early 1900s when unregulated livestock grazing resulted in significant impacts to soil, water, and vegetation resources. Plant species favored by livestock have declined and plant species not favored by livestock have increased since the late 1800s. In addition to direct effects on plant community composition and structure, livestock grazing has resulted in significantly fewer wildfires throughout the West because of the reduction in herbaceous fine fuels caused by grazing. Reduction in wildfire frequencies as a result of livestock grazing and 20th century fire suppression have substantially altered natural disturbance patterns and resulted in significant changes to the composition and structure of plant communities in the West (Covington 2003). On the Tusayan District and elsewhere in northern Arizona, these changes are believed to have resulted in denser ponderosa pine forests. These denser forests have reduced production of herbaceous forage and shrubby browse for wildlife.

Historic logging in ponderosa pine forest and mechanical chainings in pinyon-juniper woodland on the Tusayan district had substantial impacts on both overstory and

understory vegetation composition and structure. In recent years the Kaibab National Forest has been planning and implementing more mechanical thinning and prescribed burning projects in ponderosa pine and pinyon-juniper habitats on the district. These projects generally result in increased understory production of forage and browse species that can be used by wildlife.

Water developments for livestock have allowed livestock grazing to occur on the dry Tusayan District of the Kaibab National Forest. Livestock concentrate around water developments, so livestock impacts to soil and vegetation resources near water developments are pronounced. Areas around livestock water developments on the district have more bare soil and less vegetation compared to areas farther away from water developments.

Following introduction of non-native Rocky Mountain elk to northern Arizona, the elk population on the Tusayan District in GMU 9 has grown substantially since the 1940s. Elk are primarily grazers but also browse on various shrubs and young trees, especially in dry years and fall and winter when green herbaceous forage is less available. Their diet is sufficiently similar to the diets of livestock that elk grazing and browsing impacts on vegetation can be considered additive to livestock impacts on vegetation. Similar to cattle, elk have high water demands and concentrate their activities around water sources. Elk use both livestock water developments and wildlife water developments on the Tusayan District.

Elk distribution and movement patterns on the Tusayan District are likely affected by the presence of Grand Canyon National Park on the northern boundary of the district because elk are not hunted in the park. Discharge from a water treatment facility at Grand Canyon Village also provides water that is widely used by elk and other wildlife species.

AGFD reconstructed 9 of their older wildlife water developments in 2006 and 2007. New catchment aprons, water storage tanks, pipes, drinkers, and fencing put in at these reconstructed water developments are the same as those proposed for the new water developments under the Proposed Action (Figure 2). Because of the larger water storage tanks and improved components, these reconstructed water developments will provide more reliable water sources for wildlife than the older water developments. These reconstructed and more reliable wildlife water developments will likely result in increased season of use by elk, especially during dry years.

Livestock grazing has been suspended on Rain Tank Allotment since 1998. There is no plan to restock this allotment with livestock in the near future. Suspended livestock grazing on the Rain Tank Allotment results in increased availability of forage and water for wildlife on the west side of the Tusayan District. Livestock grazing was suspended on the Anita-Cameron Allotment between 2002 and 2006. Seasonal cattle grazing resumed on the allotment in 2007. Seasonal cattle grazing also occurs on the Moqui Allotment on the southern part of the Tusayan District. Trespass cattle from the

Havasupai Reservation commonly occur on the western side of the Tusayan District. This is an ongoing issue that will likely continue in the foreseeable future.

Conclusions

Primary direct and indirect effects of the Proposed Action on wildlife species evaluated in this report are small to moderate increases in habitat quality due to additional water sources for drinking. Because primary effects would be increases in habitat quality, the Proposed Action would unlikely result in a population decline or threat to population viability for any of the species evaluated.

Because of their high water demands, elk would likely benefit more than any other wildlife species evaluated. It is likely that elk season of use would increase on parts of the district near new water developments as a result of the Proposed Action. Increased season of use would result in increased utilization of herbaceous forage and woody browse plants by elk in these areas and would likely be additive to some level of increased elk season of use around 9 wildlife water developments that were reconstructed on the district in 2006 and 2007. Increased utilization of herbaceous and woody plants in these areas would result in decreased forage and cover for a variety of wildlife species. AGFD may need to increase antlerless elk harvest to achieve their elk population management objective for GMU 9 of "1. Stabilize or slightly reduce this herd in response to continued drought conditions and habitat concerns." (Arizona Game and Fish Department 2006b).

Rangeland Resources

Affected Environment

There are four grazing allotments within the Tusayan Wildlife Waters Project area: Rain Tank, Anita, Cameron, and Moqui.

The Rain Tank Allotment has been vacant since 1998 and the Forest Service has no immediate plans to authorize grazing. There are approximately 50 miles of fence, 25 livestock water sources (8 of them are fenced; waterlots), and 9 Parker 3-Step range clusters within the Rain Tank Allotment. Many of the water sources on the allotments are earthen tanks that were built adjacent to roads, in order to catch run-off.

The Anita and Cameron Allotments are under permit to one grazing permittee and are managed as one allotment. From 1998 thru 2000, the Anita Allotment ran 19%, 41%, and 13% of permitted numbers, respectively. It was in total non-use for resource protection from 2001 through 2006. Permitted use for 2007 was 600 cattle or 46% of upper limits. Permitted use for 2008 is 200 cattle. There are approximately 80 miles of fence on the Anita Allotment, 45 livestock water sources (19 with waterlots), 2 corrals, and 16 Parker 3-Step range clusters.

From 1998 thru 2000, the Cameron Allotment ran 5%, 7%, and 4% of permitted numbers, respectively. It was in total non-use for resource protection from 2001 through 2006, and is not scheduled for use unless fences get repaired. It was in non-use in 2007 and may still be in 2008 pending Forest Service meeting with permittee and review of fences. There are approximately 107 miles of fence, 43 livestock water sources (25 with waterlots), 3 corrals, and 14 Parker 3-Step range clusters.

The Moqui Allotment is under permit to one grazing permittee. From 1998 thru 2001, and from 2004-2007 they ran approximately 80% of permitted numbers. In 2002, they ran approximately 30% and took total non-use in 2003. Permitted use for 2008 is 560 cattle. There are approximately 42 miles of fence, 18 livestock water sources (6 with waterlots), and 17 Parker 3-Step range clusters. Grazing permit information for the allotments is shown in Table 4.

Table 4. Grazing Regime and Season of Use for Allotments affected by Tusayan Wildlife Waters Project

Allotment	Livestock Numbers and Season of Use	AUM's Permitted	Grazing Regime
Rain Tank	Vacant	0	
Anita/Cameron	600-1310 cattle from 5/1 to 10/31	3600-7860	rest - rotation
Moqui	560 yearling cattle from 5/7 to 10/21	2155	rest - rotation

Information from the 2005 Environmental Analysis for the Anita, Cameron, and Moqui Allotments state that range conditions have improved slightly on the Anita Allotment since the last analysis and range trend is considered to be static to slightly upward. On the Cameron Allotment, range condition has also improved since the last analysis and range trend is again considered to be static to slightly up. On the Moqui Allotment, range condition has remained essentially unchanged since the last analysis and range trend is considered static to slightly down.

The Environmental Analysis for the Revision of the Rain Tank Allotment Management Plan (August 1997) indicated an increase in range resource values and trend, as compared to the 1978 inventory. There were higher vegetation scores on all of the Parker 3-Step range clusters indicating a higher frequency of cool season species. Soil condition scores have also increased since the 1978 analysis and the trend is stable or increasing.

Grazing Capacity

An analysis of grazing capability and grazing capacity was conducted on each allotment between 1996 and 2004 (see Table 4).

Grazing capacity is a function of grazing capability, forage production, proper use by livestock, and the level of management that may be applied. Grazing capability of a land area is dependent upon the interrelationship of the soils, topography, plants and animals. Grazing capability is expressed as one of three capacity classes:

Full Capacity (FC) – areas that can be used by grazing animals under proper management without long-term damage to the soil or vegetative resource. They must also produce a minimum of 100 pounds per acre of forage and are on slopes less than 40 percent.

Potential Capacity (PC) – areas that could be used by grazing animals under proper management but where soil stability is impaired, or range improvements are not adequate under existing conditions to obtain necessary grazing animal distribution. Grazing capacity may be assigned to these areas, but conservative allowable use assignments must be made.

No Capacity (NC) – areas that cannot be used by animals without long-term damage to the soil resource or plant community, or are barren or unproductive naturally. In addition, it includes areas that produce less than 100 pounds per acre of forage and/or are on slopes greater than 40 percent. Grazing capacity is not assigned to sites with a “no capacity” classification.

Table 5. Grazing Capacity Estimates

Grazing Capacity Estimates of Tusayan Allotments* (FC and PC Acres)				
Allotment	Estimated AUM's	Livestock AUM's Permitted	Percent (%) Estimated AUM's	Remaining AUM's available for Wildlife
Anita	22,455	3,930	18%	18,525
Cameron	22,170	3,930	18%	18,240
Moqui	9,605	2,155	22%	7,450
Rain Tank	12,675	0	0	12,675
Total	66,905	10,015		56,890

*From 1997 Rain Tank EA and 2005 Anita, Cameron, and Moqui EA

This analysis shows that permitted numbers of livestock are well within the estimated grazing capacities leaving 78-82% of annual forage production available to wildlife. Dietary overlap between cattle and elk is well documented and appears to be more critical in the spring and fall. Since the grazing seasons at Tusayan don't start until May, there shouldn't be any conflicts for spring forage (assuming average winter/spring precipitation). Spring green-up usually starts around mid-March which would favor the elk.

The next 'green-up' period follows the monsoons in July and August. The flush of forage that follows would benefit both cattle and elk resulting in less competition for the forage resources through September in average years.

Cattle are removed from the allotments in late-October which coincides with the next period of critical dietary overlap, fall. Competition for forage resources during October is difficult to predict and would depend on the amount of growth following the

monsoons. In a good monsoon season, it is assumed that forage produced would certainly carry the cattle through the remainder of the grazing season.

Regardless of precipitation, each grazing permit has forage utilization standards that are to be followed to ensure that enough forage is 'left behind' to protect the soil, watershed, and provide for wildlife habitat.

Environmental Consequences

Alternative 1 – No Action

Wildlife will continue to rely on earthen tanks and existing wildlife drinkers. The water level in earthen tanks is almost never constant, since they fill from road runoff following heavy rain and/or snowmelt. Livestock permittees often have to haul water during dry years, but they would only fill tanks in actively used pastures. This may result in temporarily concentrating wildlife around livestock waters during the summer. The increased competition for water may increase stress for both livestock and wildlife. Again, once a permittee moves out of a pasture, they will no longer be hauling water to those tanks.

The resulting competition for forage in these areas may cause (or continue to cause) a decrease in herbaceous and shrub diversity and abundance, which would decrease the amount and quality of forage available for both livestock and wildlife and would likely cause a downward trend in range condition.

Elk movement among and within the allotments could have a negative effect on fences. As elk jump fences to get to water and better feed we may see more breaks that would result in more maintenance for the grazing permittee. Depending on the break, it may result in cattle getting into pastures they shouldn't be in. As fences get maintained, the use of elk jumps will be encouraged.

Alternative 2 – Proposed Action

Implementation of the proposed action will aid in the distribution of reliable sources of water for wildlife. This distribution should have a positive effect on range resources since it should eliminate the concentration of wildlife, primarily elk, from the limited number of reliable waters in the project area. The redistribution of wildlife should reduce competition for water at livestock watering facilities, as well as reducing impacts to forage resources adjacent to water.

Any negative impacts to vegetation that may already be occurring due to the concentration of wildlife around these waters should be reduced, as wildlife move into new areas served by water.

Effects to pasture and allotment boundary fences are expected to be similar to those described in Alternative 1. Elk movements can not be predicted although their movements may be reduced if more permanent water is available.

Cumulative Effects

The cumulative effects analysis area consists of the Tusayan Ranger District. The cumulative effects analysis time period is 1998 to 2018. Past and ongoing uses and actions within or adjacent to the project area that impact livestock grazing include dispersed camping, logging and thinning, prescribed burning, road maintenance, and off-road vehicle travel. Except for off-road vehicle travel, all of these uses are expected to continue indefinitely into the future. Logging and burning generally affect grazing resources negatively in the short term. They tend to decrease available forage, may introduce undesirable species, and temporarily create more bare ground. Campers and off-road vehicle operators may also harass cattle.

On the positive side, tree thinning and broadcast burning provide short to long-term benefits to grazing resources by increasing the amount and distribution of forage. The proposed project may have the cumulative effect of improving range condition. Distributing wildlife across a broader portion of the project area should result in increased herbaceous understory production as competition for forage is reduced. As long as elk numbers don't increase, an increase in understory vegetation density and diversity is also expected.

Vegetation (including Threatened, Endangered, Sensitive Species and Noxious Weeds) _____

Affected Environment

Overstory and Understory Vegetation

Vegetation on the Tusayan Ranger District includes ponderosa pine forest, pine-oak woodland, and pinyon-juniper woodland. Sagebrush flats and open grasslands are also scattered throughout the area.

Within the ponderosa pine bunchgrass community, Arizona fescue, mountain muhly, pine dropseed, blue grama and squirreltail are the major grass species present. Several species of annual and perennial forbs may occur, however, densities are dependant on annual precipitation. Shrubs such as big sagebrush, black sagebrush, rabbitbrush and snakeweed are present, but are not common in heavy densities. Cliffrose is the major browse species present but is not common in heavy densities. It is being heavily impacted by elk use. Throughout most of the area the current ponderosa pine densities have suppressed understory vegetation. This condition has resulted in poor understory vegetation production, reduced density and diversity of understory plants and areas of bare soil.

Although a relatively minor component of the project area, small linear grasslands in drainage bottoms occur within the proposed project area. Within these grasslands, western wheatgrass, blue grama, mountain muhly, spike muhly, and squirreltail are the major grass species present. Numerous species of annual and perennial forbs may occur however, densities are dependant on annual precipitation. Shrub and browse species are uncommon within these grasslands. Ponderosa pine encroachment is occurring within some of these grassland areas. This encroachment is resulting in poor understory vegetation production, reduced density and diversity of understory plants and areas of bare soil.

Threatened, Endangered, and Sensitive Plant Species

The USDI Fish and Wildlife Service have determined that there are no federally threatened or endangered (T&E) plant species that occur on the South Zone of the Kaibab National Forest (letter from the USDI Fish and Wildlife Service to the USDA Forest Service Southwestern Region June 4, 2003; Consultation #2-22-03-F-633). There is also no suitable or critical habitat present for any T&E listed species within the project area.

Sensitive species are defined as "those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by: a) significant current or predicted downward trends in population numbers or density; or b) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution" [FSM 2670.5(19)]. The only sensitive plant species known to occur on the Tusayan Ranger District is Tusayan rabbitbrush (*Chrysothamnus molestus*).

Disturbed Rabbitbrush (*Chrysothamnus molestus*) is a perennial sub-shrub with several to many stems that are frequently found in a low prostrate form and hedged due to grazing. Most colonies are found to range in size from less than 1 to 5 acres with a few colonies found between 25 and 50 acres. It is found exclusively on calcareous soils derived from Kaibab Limestone though some populations are associated with basalt parent materials. However, all the soil types are highly charged with free calcium carbonate. It is generally confined to elevations between 6,000 to 7,000 feet normally associated with the pinyon/juniper terrestrial ecosystems, big sagebrush, or the low elevation grasslands.

Noxious Weeds

Populations of Dalmatian toadflax (*Linaria dalmatica*), leafy spurge (*Euphorbia esula*), Scotch thistle (*Onopordum acanthium*), diffuse knapweed (*Centaurea diffusa*), and cheatgrass (*Bromus tectorum*) occur in the project area. Site-specific noxious weed surveys have not been conducted to date. Most populations occur along main interior forest roads, State Highway 64, and in the Arizona Public Service power line right-of ways.

Environmental Consequences

Alternative 1 – No Action

With the selection of Alternative 1, the 24 new wildlife water developments and 12.2 mile long water pipeline would not be constructed. Understory and overstory vegetation would remain intact. Wildlife use would continue to concentrate around and rely on existing waters which could lead to increased browsing on rabbitbrush causing a decline in frequency of this plant.

Under Alternative 1, there would be no construction-related disturbance to enhance the spread of the existing weeds or to introduce other noxious species to the site. The existing weed populations would continue to be controlled on an annual basis until they are contained, controlled, or eradicated.

Alternative 2 – Proposed Action

Alternative 2 would construct 24 new wildlife water catchments and a 12.2 mile long water pipeline, and decommission one existing catchment (#254) and reconstruct it at another site (#999). The construction sites are in open areas with very few trees. No large overstory trees would need to be cut. Small young trees near the catchments would be browsed and injured by elk. This would cause higher mortality and may prevent them from growing into healthy overstory trees. Understory shrubs, grasses, and forbs would be trampled in the immediate construction area. Following construction, native grasses would be planted and some of the on-site plants would naturally recover and sprout over time. An effect of the Proposed Action would be increased utilization of various herbaceous and woody plants by elk around the 24 new water developments. Under the assumption that elk density would not increase on the Tusayan District as a result of the Proposed Action, the availability of more reliable waters should distribute wildlife across the landscape and reduce impacts to vegetation, including disturbed rabbitbrush populations. Improvements to disturbed rabbitbrush populations would be manifested mostly in the grassland and shrub/grassland ecosystem, where it is found.

Construction-related ground disturbance would create many temporary pockets of noxious weed habitat. Mitigation measures will need to be implemented to prevent introducing new species into the sites, to avoid spreading weeds further within the project area, or transporting weeds to new sites outside the project area.

Cumulative Effects

The cumulative effects analysis area for overstory and understory vegetation, rare plants, and noxious weeds consists of the Tusayan Ranger District surrounded by a one mile buffer. The cumulative effects analysis time period is 1998 to 2018.

When direct and indirect impacts of past, present, and reasonably foreseeable actions are considered, there would be minimal cumulative effects to overstory vegetation from implementing the Proposed Action. Though some smaller trees near the new catchments would be killed or stunted by repeated browsing, antler rubbing, and construction

activities, the scale is small in relation to the forested areas on the district, approximately 284,000 acres, or 86 percent of the Tusayan District. Many of the forested acres are managed with prescribed fire and thinning to promote stand health, diversity, and resilience to wildfire, disease and insects. Understory vegetation would recover following construction and reseeded, but would be more heavily browsed and trampled in the vicinity of the new catchments. These impacts are small in relation to the district's overall understory population and diversity. Drought years also reduce grass, shrub and forb production, and cause mortality in overstory vegetation. All vegetation components of the district are more heavily impacted during drought conditions regardless of active management.

When direct and indirect impacts of past, present, and reasonably foreseeable actions are considered, continual improvement in habitat conditions for disturbed rabbitbrush is anticipated. Present and reasonably foreseeable actions including 6,685 acres of woodland tree removal within disturbed rabbitbrush habitat and 2,000 acres of noxious weed control over the next 10 years would enhance regeneration of this plant. This would be accomplished by providing sites for seed germination and by curtailing the threat of noxious and invasive weeds from becoming established in disturbed rabbitbrush habitat. Because Tusayan rabbitbrush is widespread on the Tusayan Ranger District and very few plants are likely to be destroyed by implementation of the wildlife waters project, there is no cumulative effect on the species.

There are very few known noxious weed locations in the project area. Other projects on the district have not introduced or spread noxious weeds. Because this project and all future projects will be mitigated in order to prevent introduction and spread of noxious weeds, the wildlife waters project has no cumulative effects on noxious weeds.

Recreation and Scenic Resources _____

Recreation and scenic resources are related. High-quality scenery and unique scenic resources are important to recreationists and are an integral part of high-quality recreational settings. Highly attractive and scenic landscapes, and high quality recreational facilities and attractions can be important to quality of life. They also contribute to the success and growth of a vibrant tourism industry, contributing to the local economy.

The Recreation Opportunity Spectrum (ROS) and Scenery Management System (SMS) are recreation management tools used to determine the types and extent of land management practices allowable in a project area. On the Kaibab National Forest, efforts were made to insure the two systems were mapped consistently and complemented one another. The intent is to ensure consistent interpretation and application of the standards and guidelines, and effective and successful implementation of projects on the ground.

Affected Environment

The Tusayan Wildlife Waters Project contains portions of ponderosa pine vegetation (primarily in EMA 10) at the higher elevations. The principal elk calving, deer and pronghorn antelope fawning, and turkey nesting habitat in the Tusayan District are located here. Developed recreation sites include Ten-X Campground, Ten-X Group Campground, and Russell Tank Fishing Area. Hull Cabin Historic District and Grandview Lookout Tower/Cabin are listed in the National Register of Historic Places and are interpreted to the public. Sections of the non-motorized Arizona Trail also pass through this area. Most of the area is grazed by cattle from late spring until fall.

The lower elevation portions (EMAs 8 and 9) of the district contain pinyon-juniper and grasslands vegetation types with scattered areas of ponderosa pine. These areas provide winter habitat for mule deer and wintering elk. The eastern portion of the area provides most of the winter habitat for pronghorn antelope using the area. There are no developed recreation sites. Undeveloped recreation resources include historic Anita Station and Moqui Stage Station. The Arizona Trail is the main non-motorized trail through the area, and the motorized Great Western Trail provides the main motorized route. There is also a hiking trail to Red Butte lookout. Areas closed to travel include Red Butte, a semi-primitive non-motorized area and the Coconino Rim, a Roadless Area. Open grasslands are scattered throughout the area and are important forage areas for livestock.

Visitors pursue a variety of recreational activities in the project area (Tusayan Ranger District) that occur in diverse settings and across all seasons. Uses of the area include camping (both dispersed and developed), pleasure driving, viewing scenery and wildlife, picnicking, taking photographs, hiking, fishing, mountain biking, horseback riding, antler shed collection, pinyon nut collection, permitted fuelwood and Christmas tree cutting, riding ATVs and motorcycles, hunting, and cross-country skiing. The Forest also has special use permits for commercial ATV and jeep tours on established forest roads, and horseback riding on designated horse trails.

National Forest visitors are diverse in their preferences for recreational settings, experiences, and activities. In order to provide a diversity of settings and opportunities the Forest Service uses the Recreation Opportunity Spectrum (ROS) as a management tool to inventory and describe recreation setting objectives for NFS lands. Forest Plan ROS mapping has recently been completed for the Williams and Tusayan Districts, and management guidance provided in the adjunct Kaibab National Forest Recreation Opportunity Spectrum and Scenery Management System Guidebook (Kaibab NF ROS/SMS Guidebook).

Transportation System – Roads. The current road system is adequate for project implementation. Temporary roads may be created due to the movement of trucks and equipment during construction, but measures will be followed to mitigate long term effects. At this time, the Kaibab National Forest is also developing a district-wide travel management analysis to identify the minimum road system needed for safe and efficient travel and for administration, utilization, and protection of National Forest System lands.

Environmental Consequences

Alternative 1 – No Action

Under the No Action alternative, the 24 new wildlife water catchments and 12.2 miles of water pipeline would not be constructed. Existing wildlife water developments would continue to be maintained and reconstructed as needed. AGFD would continue to haul reclaimed water from the South Grand Canyon Sanitary District's municipal wastewater facility in Tusayan to meet the needs of wildlife during dry periods.

Current recreation use would continue, and scenic resources would not be compromised in the short term from project implementation. There would be no immediate direct or indirect effect to the overall recreation opportunities, landscape character, scenic integrity, or other scenic resources.

Alternative 2 – Proposed Action

Under the Proposed Action alternative, there would be no significant effects to developed recreation, and current or reasonably foreseeable recreation activities. Additional wildlife waters would likely encourage the distribution of large game animals such as elk, deer, and antelope across the district, particularly during drought conditions when earthen tanks are dry. This could reduce hunter concentration and spread their impacts during hunt seasons. Jeep and ATV tour participants may have more opportunities to view wildlife due to improved habitat and access from additional waters.

Seven catchment sites are located in areas classified as Roded Natural (RN); 15 are classified as Semi-Primitive Motorized (SPM); and 2 are classified as Semi-Primitive Non-Motorized (SPNM). Scenic Integrity Objectives (SIO's) are Levels 2 and 3 (high and moderate). SIO Level 2 (High) indicates that construction and related impacts are usually completed within one year of implementation. SIO Level 3 (Moderate) indicates that construction and related impacts are usually completed within two years of implementation. All construction activities will be completed within one year. The two catchments classified as SPNM are SIO Level 2 (High) and must be constructed to meet SIO 2 standards. Since these two catchments will be noticeable, they should not be constructed in the foreground of a forest road. They will be interpretively signed so the public is aware of their purpose.

Cumulative Effects

The geographical extent of the cumulative effects analysis area is a 1-mile buffer around the project area (Tusayan Ranger District). This analysis area includes similar recreational pursuits and scenic values that are represented in the project area. Current and recently implemented projects in the analysis area are listed in Table 2 on page 30. For most forest users, the new catchments and pipeline will not be noticeable from major travel corridors (FSR's 302, 328, 320, 306, 307, and 347). Catchment "u" is on the old obliterated FSR 302 right-of-way. Earthen tanks and wildlife catchments are an integral

part of the Tusayan District landscape. These structures have been around for a very long time serving the needs of wildlife and permitted livestock.

There would be no significant cumulative impacts to existing recreational and visual resources on national forest land and adjacent lands when recommendations and mitigation measures are followed.

Heritage Resources

Affected Environment

During the past 30 years, Kaibab National Forest Heritage Resource specialists in compliance with Sections 106 and 110 of the National Historic Preservation Act of 1966, as amended, have intensively inventoried 76,354 of the District's 331,427 acres (23%). Archaeologists have identified 1,770 cultural resources, listed 6 of them on the National Register of Historic Places, declared 300 eligible for the National Register of Historic Places, considered 1365 sites unevaluated, and determined that 95 are not eligible for the National Register. Sixty percent of these sites are artifact scatters (n=1062) associated with the hunting and gathering camps ranging from ca. 9000 BC through the early Euro-American historic contact period ca. AD 1850. Archaeologists have recorded 379 sites with aboveground masonry architecture. Most of these habitation sites date to ancestral Puebloan occupation of the Forest between AD 700 and AD 1200. After AD 1200, many of the prehistoric occupants migrated southeastward (Weintraub et al 2006). Between AD 1200 and the arrival of Euro-American settlers, ancestral Pais and Hopis hunted and gathered leaving scant evidence of their presence (Cleeland et al 1992).

Recent research has challenged traditional theories regarding the prehistory of the area (see Hanson 1999, Sullivan et al 2003, Lyndon 2005, Sorrell 2005, and Weintraub et al 2006). In the late 1800s, Euro-American settlers arrived in the Grand Canyon area with hopes of successfully mining copper. As a result, investors built the Grand Canyon Railway that helped open the area to timber, ranching, mining, and tourism industries as well as to the Forest Service. Researchers have thoroughly documented the history of the Tusayan Ranger District (Putt 1993 and Stein 2006). Archaeologists have documented 259 Historic period sites that include cabins, mines, mining camps, railroad grades and camps, line shacks, water storage features, and even an historic Airport hangar. The Forest has also been an important area for traditional Native American uses (Cleeland et al 1992). As a result, archaeologists have recorded historic period sweat lodges, hogans and pinyon nut gathering camps.

Forest archaeologists intensively surveyed the proposed water development sites on the Tusayan District. In all, 348 acres were surveyed and 18 new heritage resource sites, 2 previously recorded sites, and 11 isolated occurrences were found. Fifteen of these sites were evaluated and considered eligible for the National Register of Historic Places. Five of the sites are considered unevaluated for the National Register of Historic Places, and

the 11 isolated occurrences are not considered significant (Weintraub, KNF Heritage Clearance 2005-75).

Environmental Consequences

Alternative 1 – No Action

Under Alternative 1, there would no measurable direct or indirect effects on any heritage resources.

Alternative 2 – Proposed Action

Under Alternative 2, there will be no effect to heritage resources because known heritage sites will be identified or otherwise marked, and avoided during implementation (Chapter 2 mitigation measures). Following heritage survey and State Historic Preservation Office (SHPO) concurrence, the clearance was approved on December 2, 2005. No tribes or chapter houses submitted concerns or comments to the Forest about this project.

Cumulative Effects

There are no cumulative effects from the no action or proposed action alternatives on heritage resources.

Economics and Lifestyles _____

Affected Environment

The communities closest to the Tusayan Ranger District, or project area, are those in Coconino County: Tusayan; Grand Canyon Village, Woodlands Ranch, South Rim Ranch; Valle; Cameron; Havasupai Village; and Williams. Occupied private land occurs within the project area on private land inholdings. Fuelwood cutters, hunters, and other recreational users use the project area. The communities of Tusayan and Grand Canyon Village numbered 2,022 individuals according to the latest census in 2000 (www.census.gov).

The principal economic activities in this area of Coconino County occur with federal, state, and local governments, retail trade, and the service sector. The trade and service sectors are oriented toward tourism. Commercial timber cutting, livestock grazing, and mineral exploration are enterprises that represent minor components of the economic environment.

General government revenue sources primarily include payroll tax, sales tax, corporate income tax, and property tax. In addition, under the Twenty-five Percent Fund Act of 1908, Coconino County receives 25% of annual national forest receipts for benefits to public schools and roads.

Environmental Consequences

Alternative 1 – No Action

There would be no foreseeable economic changes in the local communities.

Alternative 2 – Proposed Action

AGFD, in partnership with the Rocky Mountain Elk Foundation, is funding this project to improve and increase the number of waters on the district to better manage and benefit wildlife. The new water catchments/developments are strategically placed in areas that don't have a reliable water source close by. This would also improve the distribution of wildlife and their impacts throughout the district. The cost of materials for each catchment is approximately \$45,000.

The water pipeline is designed to free up water hauling efforts (and costs) in that area of the district. The pipeline may concentrate use in that area though it would be spread out over a distance of twelve miles. The new catchment at the west end of the pipeline is in an open area and would be a full-sized catchment (three 7100-gallon storage tanks plumbed together). This catchment would serve wildlife, fire fighting needs (filling fire engines, helicopter water buckets), and would also be used to refill other catchments on the west side of the district reducing overall hauling efforts and costs.

This action would also facilitate water hauling by AGFD employees. By providing more functioning water sources throughout the district, AGFD can select critical waters to haul to and fill during drought cycles or during the seasonally dry months to accommodate limited budgets and resources. The water pipeline would operate on runoff, as well as "excess" treated wastewater provided by the South Grand Canyon Sanitary District, and would alleviate the need for AGFD to haul water to that area. In 2002 alone, AGFD spent approximately \$150,000 hauling water to their catchments on the Tusayan Ranger District (pers. comm., Goodwin, AGFD, 10/13/06). This project is designed to reduce the need for AGFD to haul water and should lower their costs.

There would be some negative short-term effects during catchment and pipeline construction such as noise and human disturbance to wildlife; some noise disturbance to Forest visitors and permittees, primarily during the day; truck traffic on access routes; noticeable dust and equipment exhaust during catchment construction; and potential decrease in the quality of recreational experiences due to noise and the presence of equipment.

The proposed action would be beneficial to the communities and visitors by enhancing wildlife habitat and distribution on the Tusayan Ranger District. Two district jeep tour permittees, one all-terrain vehicle permittee, and one horseback riding permittee, would likely benefit from increased wildlife viewing opportunities for their clients. Big and small game hunters would benefit from improved hunting opportunities throughout the District. Management of the elk herd to reduce vegetative impacts could lead to more permits and revenue to AGFD during hunting seasons.

Cumulative Effects

There would be no measurable cumulative effects on economics or lifestyles from implementation of the proposed action.

Environmental Justice

On February 11, 1994, President Clinton issued Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." This Executive Order was designed to focus the attention of federal agencies on the human health and environmental conditions in minority and low-income communities. It requires federal agencies to adopt strategies to address environmental justice concerns within the context of existing laws, including NEPA.

The goal of Environmental Justice Analysis is not to shift risks among populations, but to identify potential disproportionately high and adverse effects, and to identify alternatives that may mitigate these impacts. One way that this is achieved is by providing an opportunity for minority and low-income populations to participate in planning, analysis, and decision making. Individual tribal members use the project area for the collection of traditional or medicinal plants, ceremonial wood and fuelwood, spiritual reflection, hunting, and private ceremonies. Low-income groups may use the area for the collection of fuelwood, hunting, and recreation. Neither of the alternative would have adverse effects on these uses or to low income and minority populations in the area. No concerns or issues related to Environmental Justice were raised during project scoping. Additionally, the American Indian Tribes listed in Chapter 4 were consulted regarding this proposal, and no concerns were voiced or submitted regarding this project.

CHAPTER 4 – CONSULTATION AND COORDINATION

The Forest Service consulted the following individuals, Federal, state and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

ID Team Members

Barbara McCurry, NEPA Planner
Rick Stahn, Tusayan District Ranger/Silvaculturalist
Jeff Waters, Lead Wildlife Biologist
Karlynn Huling, Soils and Watershed
Neil Weintraub, Archaeologist
Joel McCurry, Recreation Specialist
Clare Hydock, Range; Threatened, Endangered and Sensitive Plants; Noxious Weeds
Tim McGann, Forest GIS Specialist (retired)
Heather McRae, Forester / GIS

Federal and State Officials and Agencies

Mike Lyndon, Forest Tribal Liaison
Mae Franklin, Navajo Tribal Liaison
John Goodwin, Arizona Game & Fish Department
Larry Phoenix, Arizona Game & Fish Department
David Rigo, AGFD, Game Management Unit 9 Manager
Havasupai Tribe
Hualapai Tribe
Pueblo of Zuni
Hopi Tribe
Yavapai-Prescott Tribe
Navajo Nation (NN)
Bodaway Gap Chapter (NN)
Cameron Chapter (NN)
Coalmine Canyon Chapter (NN)
Coppermine Chapter (NN)
LeChee Chapter (NN)
Leupp Chapter (NN)
Tuba City Chapter (NN)

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