United States
Department
of Agriculture

Forest Service

Southwestern Region

April 2021

Tonto National Forest

Green Valley Creek Watershed Restoration Action Plan

Payson Ranger District, Tonto National Forest
Gila County, Arizona

What is the Watershed Condition Framework and Why a Watershed Restoration Action Plan?

The restoration of watershed and forest health is a core management objective of the national forests and grasslands managed by the Forest Service, an agency of the U.S. Department of Agriculture (USDA). To achieve this goal, the Forest Service is directed to restore degraded watersheds by strategically focusing investments in watershed improvement projects and conservation practices at the landscape and watershed scales. The Watershed Condition Framework (WCF) is a comprehensive approach for classifying watershed condition, proactively implementing integrated restoration in priority watersheds on national forests and grasslands, and tracking and monitoring outcome-based program accomplishments for performance accountability (USFS 2011).

The scope of the WCF is broad, and it encompasses multiple resource areas. The Forest Service Watershed Program, as defined by OMB and the Forest Service Strategic Plan, encompasses all Forest Service activities that contribute to improved watershed condition, including soil and water improvements, vegetation management, reforestation, range management, wildlife and fisheries improvements, road decommissioning, and other activities. Watershed restoration refers to activities that improve the conditions of watersheds, restore degraded habitats, and provide long-term protection to soils and aquatic and riparian resources.

The WCF consists of a process involving six steps (Figure 1).

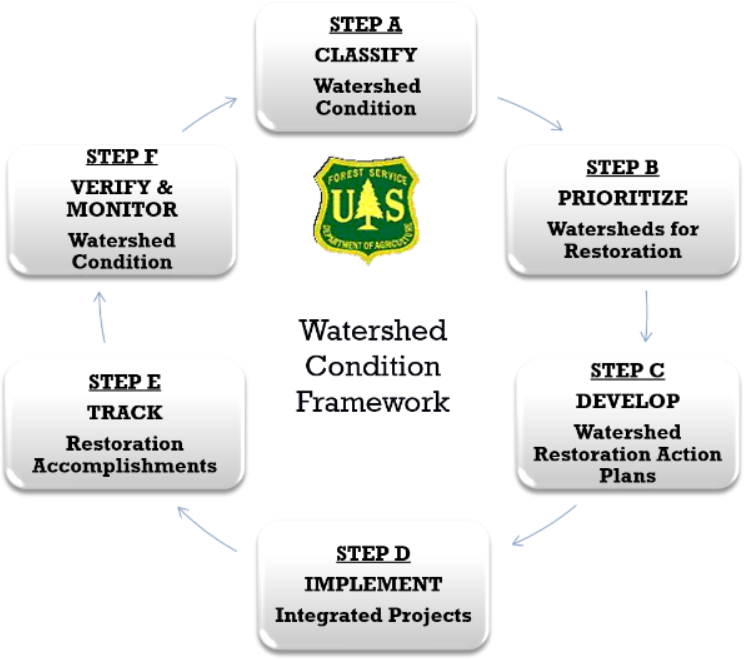


Figure 1 - Watershed Condition Framework Process

Step A, watershed condition classification, is based on 12 core indicators that are rated good (1), fair (2), or poor (3) based on nationally established attributes that can be adjusted to fit local conditions.[1] The 12 core indicators are: water quality, water quantity, aquatic habitat, aquatic biota, riparian vegetation, roads and trails, soils, fire regime, forest cover, rangeland vegetation, terrestrial invasive species, and forest health. The Tonto National Forest completed an initial assessment of its 181 sub-watersheds (6th code hydrologic unit code) watersheds in 2011. Step B is the determination of priority watersheds where restoration and enhancement work will occur. National direction limits each national forest or grassland to no more than five priority watersheds. In 2021 the Tonto National Forest has four priority watersheds: Camp Creek on the Cave Creek District, Lower-Salt Bulldog on the Mesa District, East Verde Headwaters on the Payson District, and this priority watershed –Green Valley Creek – on the Payson District. For each of these priority watersheds, development of a Watershed Restoration Action Plan (WRAP) (Step C in the WCF) is underway and a more detailed assessment, including field assessment for many watershed health attributes, for all four watersheds was completed in 2020.

Watershed Restoration Action Plans (WRAPs) describe the existing condition of the priority watershed and identify specific essential projects designed to improve, or in some cases maintain, the overall condition of the watershed. It can be helpful to think of the WRAP like a treatment plan for an ailing patient – the WRAP provides health history and pre-existing conditions (e.g., highly erosive soils, overgrazing, proliferation of roads or user-created routes): examines the current ailments (e.g., head cuts, erosion, water quality impairment); prescribes treatments to put the patient on the path to recovery (e.g., road decommissioning, stream restoration, fencing of sensitive areas); and a then provides a plan for monitoring the prescribed treatments to determine their effectiveness (e.g., monitoring dissolved oxygen in streams, riparian area extent and composition). A WRAP does not address all that ails a watershed because: it is designed to be completed in five to six years; there are some watershed condition impairments that would be economically impossible to remedy; and in some cases the Forest Service does not have jurisdictional control or the impairment cannot be affected by changes in management. The watershed condition assessment according to the twelve indicators is conducted by Forest Service specialists, however, the development, implementation, improvement, and monitoring of watershed condition is an effort that succeeds only with the participation of the Tonto National Forest's many federal, state, local, and non-profit partners.

[1] The WCF only assesses watershed condition on National Forest System lands – lands owned and managed by other entities within the watershed are not part of the assessment, but through partnerships may be part of a Watershed Restoration Action Plan where appropriate.

Summary

Watershed Name and Hydrologic Unit Code (HUC): Green Valley Creek. HUC #150601050301

General Location: Northern portion of the Tonto National Forest in Gila County. South-Eastern portion of the Payson Ranger district.

Total Watershed Area: 18,142.38 acres (28.34 square miles)

National Forest System area within watershed: 99.3%

Watershed Characterization: The Green Valley Creek (GVC) Watershed is located near the north-eastern border of the Payson Ranger District approximately eight miles east of the Town of Payson. Elevation ranges from about 6,200 feet along Diamond Rim to 3,200 feet at the southern tip of the watershed where Green Valley Creek drains into Tonto Creek. Drainages from Diamond Rim in the north and the Green Valley Hills in the east run into Green Valley Creek. The watershed includes the Hellsgate Wilderness along the southernmost tip and eastern boundary. The northern portion of the GVC Watershed is dominated by Madrean Encinal Woodland and Ponderosa Pine with Evergreen Oak forests and the southern portion is predominately Pinyon Juniper Evergreen Shrub and Juniper Grass.

Dominant land uses within the watershed are grazing, recreation, and timber production. Recreational activities within the watershed include hiking, dispersed camping, hunting, and off highway vehicle (OHV) use. The watershed also includes roughly eight miles of the Highway 260 corridor.

Watershed health concerns addressed in this action plan include road density and condition and degraded soil, riparian vegetation, water quality, and forest health. The primary concern within the area is gullying on and severe degradation of the Little Green Valley Fen (Figure 2). The current watershed condition class for the GVC Watershed is Class 2 (Functioning at Risk) and the target condition class is Class 1 (Functioning Properly). The watershed is functioning at risk because 10 of the 12 watershed condition indicators have attributes that are ranked as poor or fair. The key watershed conditions addressed through the essential projects in this WRAP are summarized in Table 1. All attributes and their ratings are discussed in detail beginning on page 15.

Figure 2: Aerial view of Little Green Valley Fen (2019)

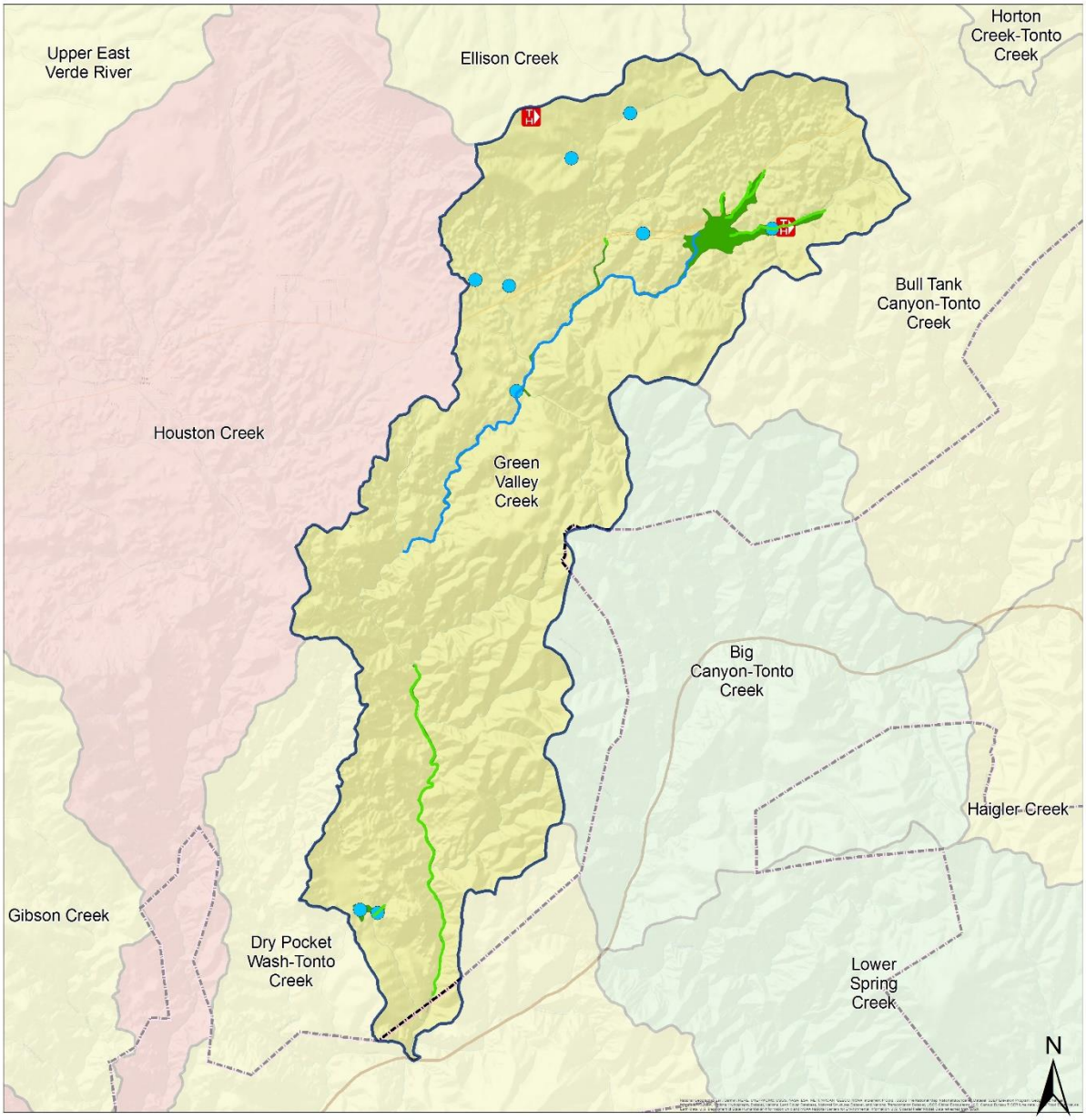


Figure 3: Overview of Green Valley Creek Watershed

Table 1: Summary of key watershed conditions ranked as fair or poor in the Green Valley Creek Watershed that are within Forest Service jurisdictional control and can be affected by changes in management

Attribute	Rating and Brief Reason(s) for Rating
Water Quality	
Water Quality Problems (other)	*Fair* – Green Valley Creek is listed as inconclusive by ADEQ in their 2018 report, however, testing completed in 2016 found dissolved oxygen exceedances. While sedimentation has not been directly measured in Green Valley Creek, road density, domestic and wildlife grazing and erosion from the fen and unstable streambanks also influence Green Valley creek's water quality.
Water Quantity	
Flow Characteristics	*Fair* – Assumed decrease in baseflow from the fen gullies, decreased length of perennial reach of Green Valley Creek.
Aquatic Habitat	
Large Wood Pieces	*Fair* – Large wood pieces are present but are recruited into the system at less than natural rates because of riparian health.
Channel Shape and Function	*Poor* – Size and extent of gullied sections of channels, primarily in the Green Valley Fen area, are extensive and currently increasing. Many stream banks on perennial and intermittent sections of Green Valley Creek show signs of active erosion above that which would be expected naturally.
Riparian / Wetland Vegetation	
Vegetation Condition	*Fair* – Field observations show diversity of riparian obligate species with an adequate abundance of bank stabilizing species. Area is ranked as fair predominately because of eroding banks in some areas, bare ground, and impaired conditions of the fen.
Roads & Trails	
Open Road Density	*Fair* – There is about 58 miles of roads within the watershed boundary making the current open road density 2.07 miles/square mile.
Road Maintenance	*Fair* – Best Management Practices for the maintenance of design drainage features and overall annual maintenance of Class 2 roads occurs on 50-75% of the roads in the watershed.
Proximity to Water	*Fair* – Roughly 2.4 miles of road are within a 300-foot buffer of the perennial portion of Green Valley Creek and roughly 0.4 miles of road are within the 300-foot buffer of the intermittent section of Green Valley Creek.
Soils	
Soil Productivity	*Poor* – Impaired soils at the fen and >25% of soils assessed in the watershed as unsatisfactory or impaired.
Soil Erosion	*Poor* – Gullies on fen and >25% of soils assessed as unsatisfactory or impaired.
Fire Regime	
Fire Regime	*Poor* – All but a few acres of vegetation in the Green Valley Creek Watershed are fire adapted, and most have missed multiple fire cycles. This has resulted in fuels that now support uncharacteristically large and severe fires that threaten the stability and resilience of the watershed.

There are no watershed conditions beyond Forest Service control to affect that will prevent the Forest Service from improving watershed condition on the Green Valley Creek Watershed. There is, however, opportunity to improve riparian vegetation condition and aquatic habitat even further through spring restoration on private land above the Little Green Valley Fen.

Watershed Characteristics

Climate

Climate statistics are available from a weather station in Payson, AZ, located about eight miles east of the GVC watershed.[2]

- Average annual precipitation: 32.44 inches[3]
- Average annual snowfall: 38.1 inches
- Highest average monthly precipitation: 4.31 inches (August)
- Highest average monthly snowfall: 10.8 inches (February)
- Lowest average monthly precipitation: 0.80 inches (June)
- Lowest average monthly snowfall: 0.0 inches (June – September)
- Average annual maximum temperature: 68.3 ° Fahrenheit[4]
- Average annual minimum temperature: 34.3 ° Fahrenheit

Geology/Geomorphology

The western portion of the watershed is comprised of granitic rocks. These rocks are commonly characterized by steep, northeast-striking foliation. The eastern portion of the watershed is characterized as weakly to strongly metamorphosed volcanic rocks. There are multiple fault lines within the watershed with one distinct fault which separates the early Proterozoic granitic rocks from the early Proterozoic metavolcanics rocks. The northernmost portion of the watershed is dominated by Mississippian, Devonian, and Cambrian sedimentary rocks. These rocks record intermittent sea-level rise from the early Paleozoic time.

[2] Monthly average for precipitation and snowfall have a period of 1944-2010 while temperature periods are from 1952-1976.
[3] https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?az8650 period of record 1944 to 2011 (Tonto Creek Fish Hatchery NO. 2)
[4] https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?az6315 period of record 1952 to 1976 (Payson 12NNE)

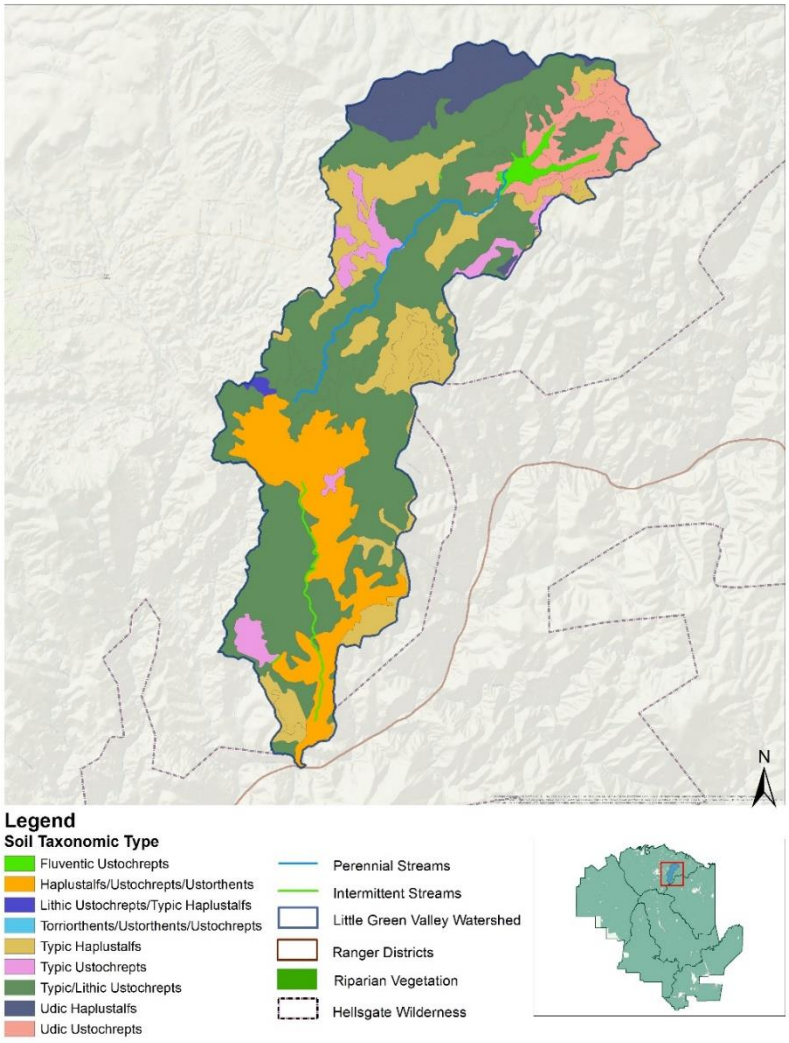


Figure 2: Soil types

Soils

The watershed contains a variety of soil types. The most common are described here. The most common Terrestrial Ecosystem Unit Inventory (TEUI) unit is 4242. TEUI unit 4242 is classified as Lithic Ustochrepts (Figure 2, Forest Green), which are commonly found on mountains with complex slopes with a gradient of 50 percent and dominated by chaparral ecosystems. Another common TEUI unit, 9349 Haplustalfs/ Ustochrepts/Ustothents (Figure 2, Orange), is mostly found in the center of the watershed surrounding the intermittent portion of Green Valley Creek. TEUI unit 9349 has a severe erosion rate and a Pinyon Juniper Oak vegetation type. It occurs in areas containing canyons, scarps and mountains containing widely varied slope characteristics with parent material from mixed sources. 5251, is defined as Udic Haplustalfa (Figure 2, Purple), which is found mostly on hills with complex convex slopes and a gradient of 25 percent and a vegetation type of Ponderosa Pine. Udic Haplustalfa is derived from sandstone and shale allowing it to have a severe erosion rate.

Peat Fen

The focal point of this watershed is one of the largest fens (peat forming wetlands that receive recharge and nutrients almost exclusively from groundwater) in Arizona. The meadow is approximately 80 acres total or 4% of the watershed. In 2008 the lower portion of the fen was acquired by the Tonto National Forest through a land exchange agreement with the Tonto Apache Tribe. The only other known large deposit of organic (peat) soil in Arizona occurs in the Obed Meadow along the Little Colorado River near Joseph City.

Fens are peat-forming wetlands that rely on groundwater input and require thousands of years to develop. Their unique form makes them hotspots of biodiversity and home to rare plants, insects, and small mammals. Fens are important as sites of groundwater discharge and are good indicators of shallow aquifers. Vegetation in all wetlands plays an important role in recycling nutrients, trapping eroding soil, and filtering out polluting chemicals such as nitrates. In addition, fens figure prominently in nearly all scenarios of CO2-induced global change because they are a major sink for atmospheric carbon

(Forest Service, 2009). Nitrogen, phosphorus, and potassium, collectively referred to as 'plant macronutrients', are the most significant agents of enrichment in fens as they are nutrients that typically limit plant growth in a fen. Other chemical elements are also important, most notably oxygen, carbon, calcium, and a range of elements including those collectively termed micronutrients (e.g. magnesium, copper, iron, selenium). Nutrient levels have a significant effect on fen vegetation, biodiversity, and nature conservation value. Understanding how and why nutrient regimes are subject to change, and the problems which can arise as a result, is therefore critical to fen management. Peat soils that dry out on a regular basis, as is likely to have occurred on the Green Valley Fen, undergo a greater degree of mineralization, which releases stored nutrients into the fen system. Even if the drying affects only part of a site, the signs of enrichment may be seen across the entire site as nutrients are 'flushed' across the fen as it re-wets. A constant wetting and drying cycle is considered highly detrimental as it continually releases and flushes nutrients into the fen. Ground and surface water are generally the most important carriers of nutrients to and from fens. Surface water can contain high levels of nitrate in solution, and phosphates, usually attached to silt particles. During high rainfall or floods, large quantities of soil particles containing adsorbed nutrients enter the fen, resulting in nutrient enrichment.

In the Green Valley Fen, the sequence of layers of peat are intermingled with deposits of sand and gravel. Research by Northern Arizona University in 1993 determined that the oldest layers of peat were approximately 2,700 years old. When the Tonto NF acquired the fen in 2008, a 20-foot-deep head cut (an eroding face on the downstream end of the fen) had already been migrating upstream for decades. Comparison of 1946 aerial photos with 1988 photos revealed that the head cut migrated upstream approximately 750 feet between those years. In 2011 the Forest Service, with the cooperation of Arizona Department of Transportation, Ames Construction Inc. (ADOT's contractor for the DRGA portion of the Highway 260 construction project), the private landowner upstream of the head cut, US Army Corps of Engineers (404 Permit), and the Arizona Department of Environmental Quality (401 Certification), arrested the head cut using material left over from the re-construction of Highway 260. Project images can be found in Appendix A.

Hydrology

The Green Valley Creek Subwatershed is within the Rye Creek-Tonto Creek watershed, which is part of the larger Tonto Sub-basin (HUC #15060105). All streams drain to Green Valley Creek, which meets Tonto Creek within the Hellsgate Wilderness at the bottom of the watershed. Green Valley Creek bisects the watershed and is intermittent above the private land around Little Green Valley springs and was historically perennial for 6.2 miles below the spring. The remaining 5.3 miles of the creek is usually intermittent. Wet-dry mapping in June 2020, however, recorded 4.15 miles of perennial stream and 7.35 miles of presumed intermittent stream. It is likely that this decrease in perennial flow is due both to extended drought conditions as well as the impacts from the gulling at the fen. There are 9 springs within the watershed on Forest Service land (Figure 2). Known springs that directly contribute to Green Valley Creek include Little Green Valley Spring, Mud Spring, and Wildcat Spring. One other spring of note is Cabin Spring, located within the Houston Pocket area of this watershed, which based on spring inventory data is significantly altered. According to Arizona Department of Water Resources Wells-55 database, there are 22 groundwater wells within this watershed. Of the 22 wells, 6 have been abandoned (Appendix B). Most of the active wells are privately owned.

Upland & Riparian Vegetation

Vegetation is classified following the Ecological Response Units (ERU) framework[5]. The Madrean Encinal woodland ERU is the dominant ecosystem type within the GVC Watershed. Other ERUs include Pinyon Juniper Evergreen Shrub, Juniper Grass, and Ponderosa Pine – Evergreen Oak. Table 2 identifies the acreage and proportion of ERUs located within the projected watershed and the ERUs are discussed below in more detail the order they appear in the table.

Table 2: Ecologic Response Units (ERU) located within the Green Valley Creek Watershed

Upland		
Ecosystem Type	**Acres**	**Percent of Watershed**
Madrean Encinal Woodland	6,976	38 %
PJ Evergreen Shrub	4914	27 %
Juniper Grass	2,541	14 %
Ponderosa Pine – Evergreen Oak	2490	14 %
PJ Woodland	791	4 %
Interior Chaparral	70	0.4 %
Mojave-Sonoran Desert Scrub	2	0.01 %
Riparian		
Ponderosa Pine / Willow	217	1 %
Sycamore – Freemont Cottonwood	124	0.7 %
Fremont Cottonwood – Conifer	18	0.1 %

The Madrean Encinal Woodland (MEW) ERU is the most abundant in the watershed. MEW is characterized by the dominance of oak trees, with typical tree forms including Arizona white oak (*Quercus arizonica*) and Emory oak (*Quercus emoryi*). Interior chaparral species may be present in some locations but do not co-dominate. Shrub layers are present often containing species such as beargrass (*Nolina microcarpa*), littleleaf sumac (*Rhus microphylla*) and, silktassel (*Garrya sp.*), ceanothus species (*Ceanothus sp.*), and California buckthorn (*Frangula* California).

Pinyon-Juniper (PJC) evergreen shrub is more dominant in the southwestern portion of the watershed. The PJ Evergreen Shrub ERU is typically found on lower slopes in transition zones, often between interior chaparral and montane forest within geographic areas dominated by mild climate gradients and bi-modal precipitation regimes. Pinyon is occasionally absent in this ERU, but one or more juniper species are always present. The understory tends to be dominated by low to moderate density shrubs, with herbaceous plants in the interspaces. Shrub species include Manzanita spp. (*Arctostaphylos spp.*), sumacs (*Rhus spp.*), trubinella oak (*Quercus turbinella*), and mountain mahogany (*Cercocarpus montanus*).

Juniper Grass ERU occurs around the intermittent portion of Green Valley Creek, following the stream down to the southernmost portion of the watershed. Juniper grass is typically restricted to warmer and drier settings that limit pinyon (Wahlberg et al. 2014). This type of ERU classification is found on sites

[5] Ecological response units are mapped ecosystem types based off biophysical themes that represent the range of conditions (e.g., dominant species, vegetation associations, soils, landscape features) that prevail under nature disturbance regimes.

with well-developed, loamy soil characteristics, generally at the drier edge of the woodland climatic zone.

In the northernmost portion of this watershed, ponderosa pine-evergreen oak (PPE) ERU is dominant. PPEs occur in mild climate gradients, particularly below the Mogollon Rim, where warm summer season and bimodal (winter-summer) precipitation regimes are characteristic. Common species include a dominance by ponderosa pine (*Pinus ponderosa* var. *scopulorum*), Arizona white oak (*Quercus arizonica*), alligator juniper (*Juniperus deppeana*), and pinyon pine species (*Pinus spp.*). PPE averages greater fire severity than ponderosa pine forests above the Mogollon Rim, and greater patchiness with less horizontal uniformity and more even-aged conditions.

Characterized with moderate to dense tree canopy and sparse understory or perennial grasses and annual and perennial forbs, the pinyon-juniper woodland is (PJO) ERU is found in the middle edges of this watershed. Typical species for pinyon-juniper woodland include two-needle pinyon (*pinus edulis*), single leaf pinyon (*Pinus monophyla* var. *fallax*), Utah juniper (*Juniperus osteosperma*), one seed juniper (*J. monosperma*), and alligator juniper (*J. deppeana*).

The Interior Chaparral ERU a shrub-dominated system that varies from widely scattered pockets within grasslands and woodlands to more extensive areas on steep slopes. This ERU is found in the southwestern most tip of the watershed. Species composition and dominance varies across the landscape depending on fire history, soils, topography and climate and include, but is not limited to, manzanita spp., crucifixion thorn, desert ceanothus, mountain mahogany, little-leaved mountain mahogany (*Cercocarpus intricatus*), Antelope brush (*Purshia spp.*), shrub live oak (*Quercus turbinella*), and sumacs (*Rhus spp*).

Riparian obligate species within the watershed are characterized by the ERUs of ponderosa pine-willow, sycamore-Freemont cottonwood, and Fremont cottonwood-conifer. There are roughly 358 acres of riparian area, as classified from R3 Regional Riparian Area Mapping Project (RMAP), within the watershed. The riparian systems follow along the intermittent and perennial portions of Green Valley Creek as well as the lower reaches of Preacher Canyon, and around Houston Pocket Spring and Cabin Spring. RMAP defines these riparian areas to consist of Fremont Cottonwood – Conifer, Sycamore – Freemont Cottonwood, and Ponderosa Pine -Willow. The primary drainage in the watershed, Green Valley Creek, is a warm-temperate riparian deciduous forest belonging to the Arizona Sycamore (*Plantanus wrightii),* Velvet Ash (*Fraxinus velutina*)*,* Freemont Cottonwood(*Populus fremontii*) association described by Brown, Lowe, and Pase (1979) and the Sycamore-Fremont Cottonwood Riparian ERU. Arizona Sycamore, velvet ash, and Fremont-cottonwood are the dominant arboreal components along Green Valley Creek with scattered occurrences of red willow (*Salix laevigata*). Herbaceous understories consist of a variety of forbs, grasses, sedges, and rushes. Upland species such as Emory oak, grey oak, ponderosa pine, and alligator juniper commonly integrate within the riparian zone – especially at drier sites, such as abandoned floodplains or terraces.

Threatened, Endangered, and Sensitive Wildlife and Plants

Chiricahua leopard frogs, a species listed as threatened under the U.S. Endangered Species Act, is known to occur at Preacher Canyon in the northern portion of Green Valley Creek Watershed. Recovery actions for the Chiricahua leopard frog are on-going in this area and include habitat assessments and protection, frog releases to augment extant sites, and potential introductions into new sites.

The extreme southern tip of GVC watershed overlaps with the revised proposed critical habitat boundary for narrow-headed gartersnakes. Critical habitat for the northern Mexican gartersnake and the narrow headed gartersnake was proposed along Tonto Creek in 2013. In April 2020, the U.S. Fish and Wildlife Service (USFWS) published a revised proposed critical habitat rule for the northern Mexican gartersnake and Narrow-headed gartersnake. In their revised proposed rule, they recommended a significant reduction in acreage compared to the original proposed critical habitat rule published in 2013. This revised rule removed northern Mexican gartersnakes from the reach of Tonto Creek that intersections with GVC watershed and significantly reduced proposed critical habitat for narrow-headed gartersnakes resulting in an overlap with the extreme southern tip of the watershed.

There are no fisheries within the GVC watershed. Other game and nongame wildlife that can be found within the watershed include bats, small mammals, a variety of birds and herpetofauna, turkey, mountain lions, black bears elk, mule deer, and white tail deer.

The watershed is a contributing drainage system for Tonto Creek which also supports numerous aquatic and terrestrial listed threatened and endangered species such as the southwestern willow flycatcher (*Empidonax trailii extimus*), narrow-headed gartersnake (*Thamnophis rufipuncatus*), and northern Mexican gartersnake (*Thamnophis eques megalops*). Tonto Creek is also designated critical habitat for the flycatcher, both gartersnakes, and spikedace (*Meda fulgida)*, These listed species depend upon riparian areas and springs for their habitat.

A new population of Senator Mine alumroot (*Heuchera eastwoodiae*), regional forester's sensitive and species of conservation concern, was documented along Green Valley Creek by the forest botanist on May 8th, 2020.

Finally, in addition to the species known to occur in the watershed, portions may contain suitable habitat for various life history needs of the following species: hoary bat, silver haired bat, southwestern myotis, Mexican spotted owl, northern goshawk, Arizona toad, Arizona tree frog, northern leopard frog, roundtail chub, long-fin dace, desert sucker, and golden eagle.

Range Management

Historically, allotments there were two allotments in the watershed Green Valley and Star Valley. Since completion of the Diamond Rim Range Grazing Analysis in 2018, the Green Valley and Star Valley allotments have been managed as a single allotment.[6] From the mid-1980s to 2001, the Green Valley allotment was grazed together with the Indian Gardens allotment and there were 95 to 300 adult cattle authorized yearlong. Prior to 1980, 300+ adult cattle were authorized. The Star Valley allotment stocking fluctuated from 186 adult cattle with 70 yearlings from 1968 to 1995. After 1995 to the time of writing this WRAP, permitted numbers for the Green Valley allotment were 255 cow/calf and 30 yearlings while the Star Valley allotment was 114 Cow/calf and 10 yearlings.

[6] The Diamond Rim Grazing Analysis also included the in combination with the Payson and Cross-V allotments.

Table 3: Current Diamond Rim Grazing Allotment within the Green Valley Watershed

Current Allotment Name	Historic Allotment Name	Permitted Numbers	Season of Use	Acres	% of Watershed
Diamond Rim	Green Valley	285	Variable	11,360	63%
	Star Valley	124	Variable	6,790	37%
	Percentage of watershed grazed				99.9%

In 2018, the Green Valley and Star Valley allotments underwent a rangeland analysis as part of the Diamond Rim Range Environmental Assessment. These two allotments make up the entirety of this watershed and key areas were identified to represent rangeland/soil conditions and strategies to achieve desired conditions. Below is a synthesis of conditions and rangeland management activities occurring within the livestock allotments within the watershed.

The Green Valley Allotment is in the northern half of this watershed and consists of the Diamond, Upper Neal, Holding, Ponderosa, Kings Ridge, Winter Division and Lower Neal pastures. Except for an existing proposed project (see Essential Project #2) on the Little Green Valley Fen, all pastures within the allotment are authorized for grazing.

The Star Valley Allotment is in the southern half of this watershed. Pastures included within the watershed are Hole in the Ground, Green Valley Hills, Dry Pocket, Holding, Picket Pen, and a small portion of the Catholic pasture. Key areas affiliated within the allotment for grazing are composed of a mixture of Juniper Grass and Pinyon Juniper Evergreen shrub ERUs.

The Diamond Rim Decision Notice was signed in February 2018, permitted numbers were set at 10,050 animal unit months (AUMs) annually.[7] This permitted stocking rate is equivalent to the combined existing stocking rate on the two term grazing permits associated with the Diamond Rim grazing allotments:

- 619 Cows CYL with 30 yearlings for 10 months = 10,015 AUM's
- 10 yearlings for 5 months = 35 AUM's
- 10,015 + 35 = 10,050 AUMs

Pasture movements within a season are dictated by utilization levels, growing conditions and the need to provide planned rest and to vary the season and intensity of pasture use to eliminate the development of use patterns. Grazing intensity is managed to allow for the physiological needs of plants. Anticipated days within each pasture manage intensity and frequency of defoliation. Distribution of grazing impacts are assessed on an ongoing basis to determine where specific improvements may be useful, based on the need to adaptively manage the development of infrastructure to achieve the desired result.

[7] One cow with calf equals 1.32 Animal Unit (AU); one dry cow equals 1.0 AU; one yearling animal (9-18 months) equals 0.7 AU; weaned calves less than nine months of age equal 0.5 AU; one mature horse or mule equals 1.2 AU

Timber

Approximately 1,300 acres of ponderosa pine is located within the GVC Watershed. The watershed is located at the southern extent of the ponderosa pine belt that runs along the base of the Mogollon Rim. In the northern portion of the watershed, stands of ponderosa pine/evergreen oak are in the vicinity of Little Green Valley and the fen. South of Little Green Valley, the vegetation transitions to pinyon-juniper and oak woodland. Isolated pockets of ponderosa pine may be found in drainages on north-facing slopes throughout the watershed.

Prior to 2004, a larger stand of ponderosa pine was located at the northern boundary of the watershed. In 2004, the Ponderosa Fire burned through this stand, with high severity, stand-replacing fire resulting in a permanent type conversion from ponderosa pine to oak/shrub woodland.

The Bearhide Stewardship Contract was completed in 2013 by TriStar Logging. Of the total 664 acres, approximately 214 acres were located within the watershed. The contract consisted of commercial thinning of ponderosa pine < 18 inches DBH and weed/release treatments of the understory, primarily alligator juniper, Arizona white oak, and Emory oak.

Other thinning treatments that have occurred within the watershed include:

- Approximately 40 acres of thinning from below completed by hand using chainsaws. This treatment near the Diamond Point lookout was completed in 2015.
- Approximately 200 acres of thinning from below completed by hand using chainsaws. This treatment between Little Green Valley and Ponderosa Campground was completed in 2017.
- Approximately 30 acres of thinning from below completed by hand using chainsaws. This treatment on the north and east side of the private property at Little Green Valley was completed in 2013.

Fire Regime

As a part of the Lion and Payson Environmental Assessments (EA), there have been multiple fuel reduction projects within this watershed. The Lion EA, had one mechanical thinning treatment in 2009, and in 2016 completed a prescribed fire and a maintenance thinning project. These three projects totaled over 600 treated acres. The Payson EA implemented two treatments. One maintenance thinning in 2018 and the other was a prescribed burn in 2017, totaling in 83 treated acres. In 2015, there were also two first entry thinning treatments that thinned 41 acres within the watershed. The total combined treated area within this watershed is just under 800 acres.

Air Quality

Air quality for the analysis area is monitored by Arizona Department of Environmental Quality under direction from the *Clean Air Act* and Environmental Protection Agency, who provide National Ambient Air Quality Standards (NAAQS). The analysis area is not in a nonattainment area or maintenance area for regulated air pollution.

Recreation

There is one developed Forest Service recreation site within the Green Valley Creek watershed: the Hells Gate trailhead. Other recreation that occurs within this watershed is dispersed camping, hunting, and OHV.

There are three Recreation Opportunity Spectrum (ROS) classes within the watershed:

- Roaded Natural (RN) (7,349.90 acres)
- Semi-Primitive Motorized (SPM) (6,326.78 acres)
- Semi-Primitive Non-motorized (SPNM) (4,473.01 acres)

Special Area Management

There is one congressionally-designated wilderness within the watershed, the Hellsgate Wilderness. The Hellsgate wilderness roughly covers 180.7 acres within the watershed accounting for a little under 1 % of the total watershed area.

Little Green Valley Fen is a recommended Botanical Area in the revised forest plan. A botanical area is an area that contains plant specimens, plant groups, or plant communities that are significant because of their form, color, occurrence, habitat, location, life history, arrangement, ecology, rarity, or other features. The recommended Little Green Valley Fen botanical area serves as a benchmark example of a rare and sensitive wetland meadow with peat soils that are rare in Arizona. Additionally, the alternating layers of peat and gravel (observed in the head cut) reveal the evolutionary sequence of landform processes which has allowed researchers to reconstruct past climate, vegetation, and disturbances. The boundary was delineated to capture the wetland meadow and portions of Green Valley creek. This area includes the wetland and southern portion of Green Valley Creek where the tributary enters the creek from the southeast. The meadow is about ¼ mile wide but narrows down to a small outlet of less than 100 feet at the southwestern end where Green Valley Creek leaves the meadow. The lower end of the meadow is constantly wet at the lower end and drier at the upper end. The organic layer is about 7 meters thick at the outlet end of the fen. The meadow supports a diversity of grasses, sedges, and wetland herbaceous species. The surrounding vegetation is ponderosa pine oak forest with scattered occurrences of pinyon and juniper.

Watershed Conditions

The current overall condition class of the watershed is Class 2 – Functioning at Risk based on a weighted score of 2.0.[8] This class is based on the scores (good, fair, or poor) for the 23 attributes in 12 indicator categories. The following section provides detail on how each indicator score was determined and Figure 5 summarizes all 12 indicators of watershed condition and their attributes, color coded by their current condition score. The indicator and category scores are the simple average of all attributes. The overall watershed condition class is weighted as follows: aquatic physical, aquatic biological and terrestrial physical scores make up 30% each and terrestrial biological constitutes the remaining 10% of the score. Figures 6 through 12 are recent images (taken in 2019 and 2020) of Green Valley Creek starting above the fen to the bottom of the historically perennial portion of the stream.

[8] Breaks for attribute averages and overall condition class are as follows: 1.0-1.6 is good or class 1, 1.7 to 2.2 is fair or class 2 and 2.3 to 3.0 is poor or class 3.

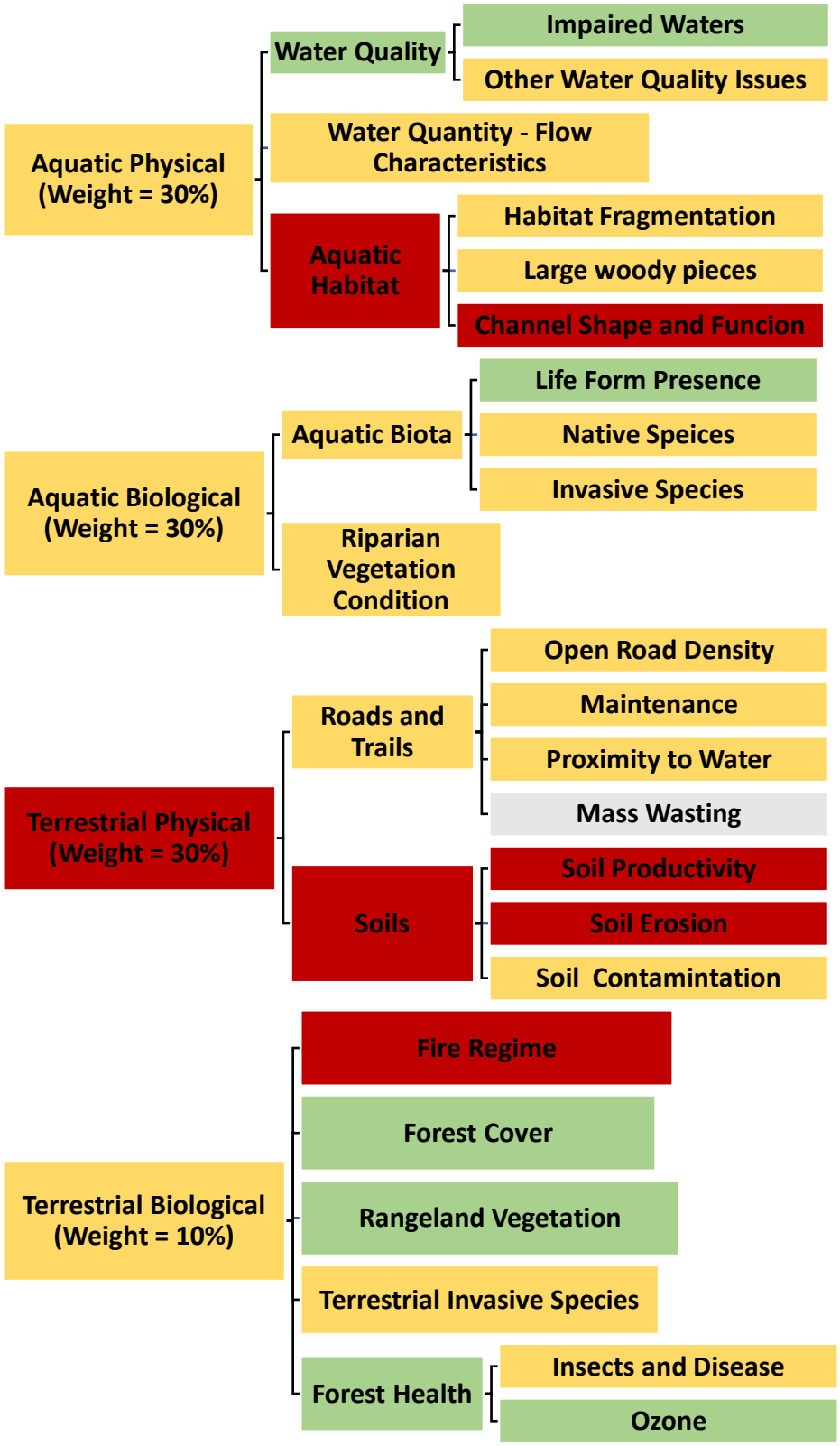


Figure 3: Summary of current condition for all watershed attributes green = good, yellow = fair, and red = poor

Figure 4: Uppermost-portion of Green Valley Creek – above Fen and perennial reach. Looking upstream.

(Personal communication, Jason Jones ADEQ, 4/2/2020). The testing completed in August 2016 showed a dissolved oxygen (DO) exceedance of 3.09 and 5.53 mg/L at two separate sites, however testing in March 2017 showed no DO exceedance. The exceedance of dissolved oxygen is mostly likely due to the impaired state of the fen. Other external factors such as roads, grazing, wildlife grazing, timber harvesting and fuels management may also influence Green Valley creek's water quality. Another stressor is soil erosion and streambank instability due to other large ungulates such as elk and deer. The Green Valley creek is a tributary to Tonto Creek, which is on the ADEQ 303d list as impaired for mercury in fish tissue. Because of the DO exceedance

Figure 8: Middle portion of the Little Green Valley Fen (looking upstream)

Water Quality

Green Valley Creek, the only perennial stream within the watershed, is not currently nor ever has been listed on the 303d list of impaired waters. It was not, however, assessed by the Arizona Department of Environmental Quality (ADEQ) in their 2018 list of impaired waters report. ADEQ monitored the creek in 2016 and 2017 but has listed it as inconclusive for impairment in their 2020 draft assessment because only two samples were taken and at least three samples are needed to make an assessment decision. ADEQ does not plan to further assess Green Valley Creek before the end of the current 2022 assessment window, which closes on 7/1/2021.

Figure7: Deepest portion of gully on Little Green Valley Fen (looking downstream)

and the potential for high total dissolved solids and e-coli from the fen the attribute of other water quality problems was rated as fair. The Tonto NF will monitor DO, temperature, pH, and e-coli as part of the implementation of this WRAP.

Water Quantity

While the watershed is free from diversion structures and impoundments, the baseflow in Green Valley Creek is altered by the gully on the fen. The watershed also contains 16 active wells that have the potential to alter

Figure 9: Location of large head cut (rock placed to arrest head cut can be seen on left and right of the photo)

depth on the fen. Beyond the fen, Green Valley Creek is impacted by vegetation removal for a utility corridor and by two low water crossings on Green Valley Creek. In addition to the fen itself, two other perennial portions of Green Valley Creek have been periodically monitored since the 2000s. Most recently, survey data for these reaches indicate they are F-type (highly erosive) and either fair or poor in Pfankuch stream stability ratings for F-type streams. The overall rating for aquatic habitat is fair because of habitat fragmentation from road crossings and the fen gullies, a less than natural rate of recruitment of large wood pieces because of riparian health, and because of poor stream bank stability.

Figure 11: Green Valley Creek within utility corridor

the hydrology of the area. Because of the changes to the surface water system from the gullies on the fen and the potential impact from the wells, water quantity is rated as fair. There are no other known impacts to the natural flow regime within the watershed.

Aquatic Habitat

Green Valley Creek has experienced ongoing stressors such as cattle and large ungulate species grazing the available vegetation and denuding the bank stabilizing within the fen and the riparian area below the fen. These stressors have eroded the banks of the stream creating an incision in some places more than 10 feet in

Figure 10: Green Valley Creek 0.25 miles below the fen

Riparian Vegetation

Riparian condition was assessed at representative segments of Green Valley Creek and at the Little Green Valley Fen. The assessment uses key indicators for riparian condition that are used in the Proper Functioning Condition protocol. There is a diversity of stabilizing riparian plant species present, however some sections (more confined areas) of the channel are armored from boulders and bedrock where riparian vegetation is less important for channel stability and riparian condition. However, where the potential exists, riparian stabilizing species (sedges and rushes) were present.

Figure 12: Green Valley Creek at bottom of what was historically the perennial reach

Multiple age classes of riparian obligate shrubs and trees were present, however there were few smaller size classes/age groups. Of note was the abundance of large sycamore trees at sections of Green Valley Creek. Similar to other dominant southwest riparian trees, Arizona sycamore provide important wildlife habitat. Others have documented the importance of Sycamore trees for wildlife habitat in mid-elevation oak communities in southern Arizona where oaks bordering these riparian areas to not reach sufficient size or contain the amounts of decayed wood to provide a reliable source of roost/nest sites or possibly food resources.

Some locations along the reach had an adequate abundance of bank stabilizing species, however there were areas that did not – specifically at eroding streambanks. Other areas of the creek had sparse vegetation cover but showed signs of recovery (vegetation establishing). Based on this assessment the riparian vegetation for the watershed was rated as fair.

Roads and Trails

There are 58 miles of open roads within the watershed boundary, for a density of 2.04 miles/square mile and a rating of fair for the open road density attribute.[9] There are seven roads spanning 7.8 miles within the watershed that are within 300 feet of the perennial or intermittent sections of Green Valley Creek and/or Preacher Canyon. Of the 7.8 miles of road, 2.4 miles of them are within 300 feet of streams, making the road to stream proximity attribute rating fair.[10]

The Tonto National Forest does not currently maintain a database of implementation of road best management practices (BMPs). Maintenance interval is, however, an important road BMP and the maintenance schedule for level two roads on the Tonto is every five years. Based on the millage of level two roads and input from engineering staff the road maintenance attribute is ranked as fair for the GVC watershed.

Finally, recreation impacts to watershed are minimal to moderate within this watershed. Dispersed camping does not occur year-round and OHV use and creation of unauthorized routes occurs but is relatively low compared to other areas in the North Zone of the Tonto.

[9] Open road density thresholds are: good = <1 mi/mi^2 ; fair = 1 mi/mi^2 – 2.4 mi/mi^2; and poor = >2,4 mi/mi^2

[10] Road proximity to water thresholds are: good = <10% of road/trail length within buffer; fair = 10% to 25% and poor = >25%

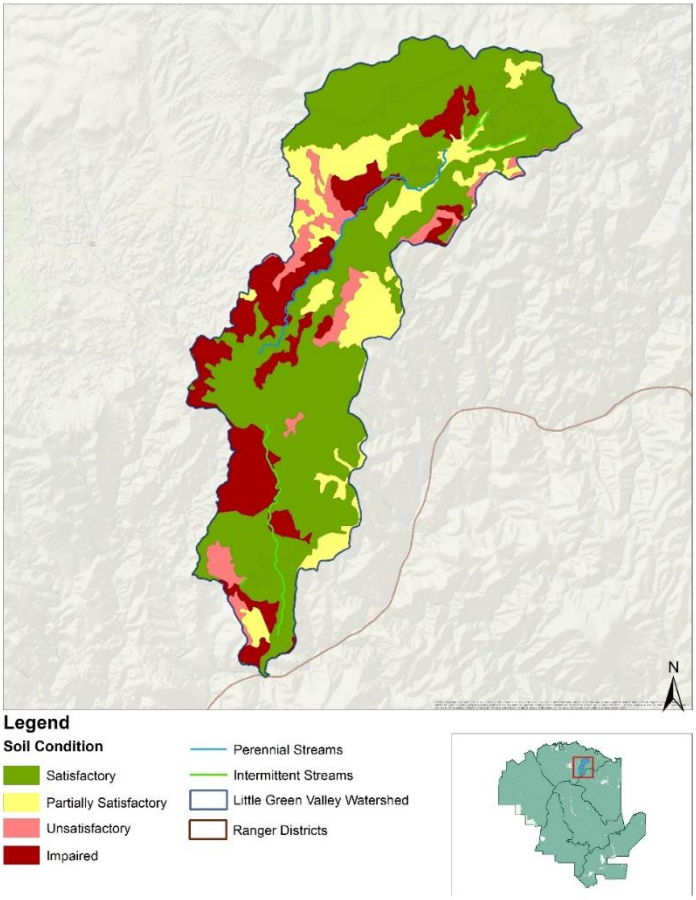


Figure 13: Soil condition in the Little Green Valley Watershed

Soils

From TEUI data, roughly 1,350 acres are characterized with slight erosion potential in Pinyon/Juniper/Oak and Ponderosa Pine vegetation types. A little less than 4,070 acres of the Pinyon/Juniper/Oak and Ponderosa Pine vegetation types are characterized with moderate erosion potential. Finally, roughly 69% of the watershed, a little over the 12,500 acres, have a soil erosion condition characterized as severe in the Interior Chaparral, Pinyon/Juniper – Evergreen oak, Ponderosa Pine – Evergreen oak, Madrean Encinal Woodland, and Semi Desert Grassland vegetation types. Soils in the watershed are subject to natural erosion due to steep slopes and the type of sediment deposits and are therefore rated at unsatisfactory. A soil condition assessment was completed with 2007 data as a part of the Diamond Rim Grazing Allotment EA. Separate datasets are not available to distinguish soil erosion and soil productivity attributes, therefore, the overall soil condition information is used for both of these attributes. Based on the information from the Diamond Rim EA the soils are ranked as poor because >25% of soils in the watershed have been assessed as unsatisfactory or impaired.[11]

There is no historic or current operation, within the watershed boundary, that would potentially contaminate the soil. Previous nutrient (N) condition analysis shows that there is some departure from a properly functioning chemical and nutrient condition in this watershed and therefore the rating for soil contamination is fair.

Fire Regime & Vegetation

There are a variety of fire regimes within the Green Valley Creek Watershed. ERUs with Fire Regime with less than 35 years between mostly low severity fires, make up a little over 2/3 of the watershed and include JUG, PPE, and MEW. There is no documented wildfire history in this watershed going back to at least 1970, and woody vegetation is encroaching into these ERUs changing the potential fire behavior and effects. Modeled fire behavior for current condition shows potential for active or passive crownfire across most of the area mapped as these Fire Regime I ERUs. The rest of the area is covered with fire regimes with lower frequencies and higher severity and, for the most part, they are not highly departed.

[11] Thresholds for soil erosion and soil productivity attributes are - 0-5% = Good, 5-25% = Fair, and > 25 = Poor for the sum of Unsatisfactory and Impaired soils in the watershed.

One exception could be the riparian areas. The frequency of riparian fire regimes relates directly to those of the adjacent areas, with severity being generally lower and patchier. Those riparian areas downslope or adjacent to Fire Regime I ERUs have an elevated threat from the condition of the ERUs that are highly departed.

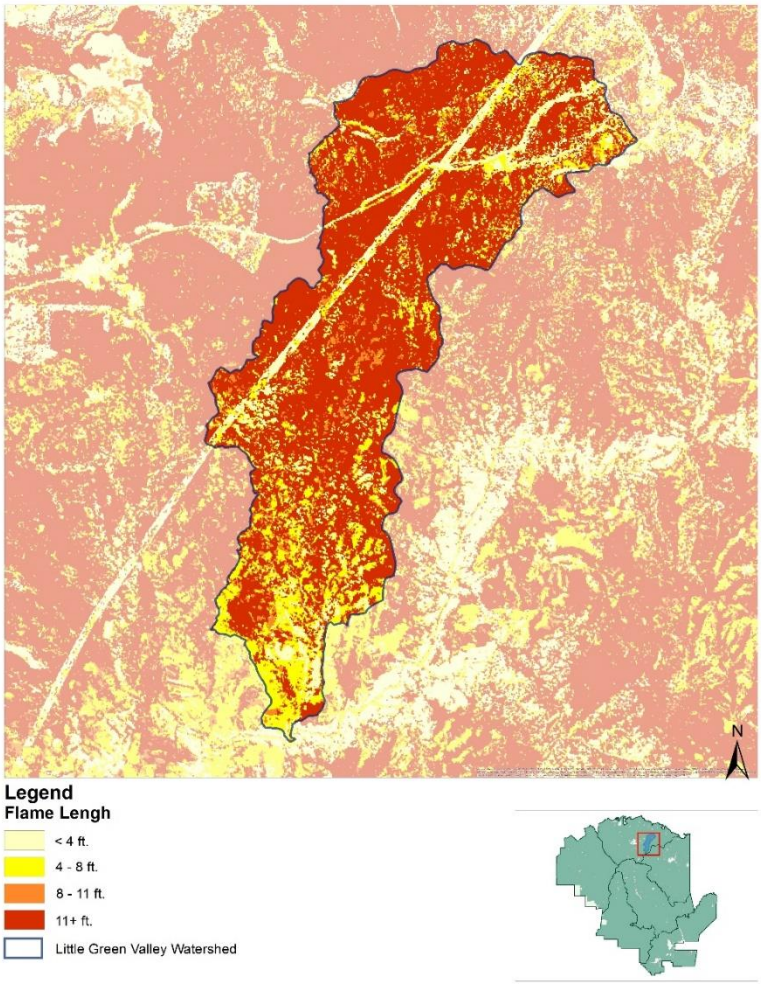


Figure 14: Flame Length

Figure 14 shows the flame length modeled with an average wind speed of 15 mph out of the SW (azimuth = 225°). Fireline intensity is the amount of heat given off by a fire along each foot of the leading edge of the fire each second, usually expressed as Btu per linear foot of fireline per second. This measure is useful for evaluating control objectives because there is almost a 1:1 correlation between fli and Flame Length (FL) (Stratton 2009). This also can give an indication of scorch, or how imminent crown fire might be since flame lengths of about half the canopy base height may ignite the canopy. Thresholds set for the expected fire severity (effects to vegetation) at different fireline intensities are based on fireline intensity levels documented in a case study of a wildfire on the Coconino National Forest (Campbell and others 1977), these levels are:

- Moderate severity at 2,500 – 10,000 BTU/sec/ft. This correlates with Flame Lengths of at least ~35'.
- High severity >=10,000 BTU/sec/ft. This correlated with Flame Lengths of over 90'.

Based on these data the fire regime in this watershed was rated as poor.

Forest Cover and Forest Health

In 2016 and 2017, the level of tree defoliation and mortality identified during aerial detection surveys within the watershed was very low. Although 2018 witnessed a marked increase in tree defoliation and mortality across the forest due to drought, very little was observed within the GVC watershed. In 2019, areas of tree mortality were observed along the east-central portion of the watershed. The largest area of tree mortality was approximately 32 acres in size near Pine Thicket Tank and consisted of light levels (<10%) of ponderosa pine mortality due to bark beetles. The second area of tree mortality was approximately 9 acres in size near Holding Tank and consisted of severe levels (30-50%) of ponderosa pine mortality due to bark beetles. The third area consisted of a single pinyon pine killed by pinyon Ips near Butte Tank. In 2020, a decrease in levels of tree mortality was again observed within the

watershed. Endemic population levels of bark beetles may result in pockets of ponderosa and pinyon pine mortality. However, during favorable environmental conditions, bark beetle populations can build up rapidly and result in landscape-level tree mortality. While endemic levels of tree mortality are beneficial to wildlife by creating snags, tree mortality at the landscape-level may result in loss of forest cover, decreased wildlife habitat, and increased dead and down fuel loading. Based on this information the insect and disease attribute was rated as fair and the forest cover attribute was rated as good. Taken together with an ozone rating of good, because there are no reported ozone issues within this watershed the overall ratings for both Forest Cover and Forest Health are good.

Rangeland Vegetation

Outside of the occasional cattle which find their way into the fen, and based on continued monitoring efforts within this watershed, the current rangeland condition is generally stable with an upward trend overall and is determined to be good. Key areas, which are representative of the of rangeland locations, use, or grazing value allow specialists to make management decisions to meet desired conditions for the allotments. Based on this information the rangeland vegetation attribute was rated as good.

Terrestrial Invasive Species

Some of the invasive species that have been identified within this watershed include; Malta Star Thistle (*Centaurea* melitensis), Common Mullein (*Verbascum thapsus*), Russian thistle (*Salsola*), Spotted Knapweed (*Centaurea stoebe*), Field Bindweed (*Convolvus arvensis*), Yellow bluestem (*Bothriochloa* ischaemum), Lehmann lovegrass (*Eragrostis lehmanniana*), and riparian invasive species of Salt Cedar (*Tamarix*). Four of these identified invasive species are in areas directly beside state highway 260. Another invasive species, which can be found almost anywhere on the Tonto National Forest, is Red Brome (*Bromus rubens*) and is nearly impossible to completely eradicate due to its current land cover and rate of speed it can spread. Based on this information is attribute is rated as fair. Based on these data the invasive species attribute is rated as fair, although it would be desirable to eradicate invasive species within the watershed, this WRAP does not propose treatments because invasive species are so widespread and the cost of treatment would be prohibitive.

Restoration Goals and Objectives

The overall goal of this Watershed Restoration Action Plan is to improve the existing watershed condition from “Functioning at Risk” to “Proper Functioning” within a 6-year timeframe through the implementation of the proposed projects within one to two years of expected timelines described within each essential project.

Objectives

Table provides objectives for project implementation within six years to improve the watershed to a Functioning condition. These objectives align with the Forest Service FY2015-2020 Strategic Objectives 1-A (Foster resilient, adaptive ecosystems to mitigate climate change, all essential projects (EP)); 1-B (Mitigate wildfire risk, EP 1); and 2-D (Provide abundant clean water, all EPs). All essential projects within the WRAP also algin with the following overall goals for watersheds within the 1985 Forest Plan: meeting minimum air and water quality standards, emphasizing improvement of soil productivity, air and water quality, enhancing riparian ecosystems and inventorying and interpreting soil, air, and water resources. It is also keeping with the management direction for the Management Area 4-F (Payson Ranger District General Management Area), which states: “Manage for a variety of renewable natural resources with primary emphasis on wildlife habitat improvement, livestock forage production, and

dispersed recreation. Watersheds will be managed to improve them to a satisfactory or better condition. Improve and manage the included riparian areas (as defined by FSM 2526) to benefit riparian dependent resources."

Table 4: Restoration Objectives for the Green Valley Creek Watershed

***Indicator/* Attributes**	**Current Score**	**Score After Implementation of Essential Projects**	**Essential Project #**
Water Quality (1)			
Impaired Waters (303d listed)	Good	Good	2, 3, 4
Water Quality Problems (other)	Fair	Good	2, 3, 4
Water Quantity (2)			
Flow Characteristics	Fair	Good	2, 3, 4
Aquatic Habitat (3)			
Habitat Fragmentation	Fair	Fair	NA
Large Woody Debris	Fair	Good	2, 3, 4, 5
Channel Shape and Function	Poor	Fair	2, 3, 4, 5
Aquatic Biota (4)			
Life Form Presence	Good	Good	NA
Native Species	Fair	Fair	5
Exotic and/or Invasive Aquatic Species	Fair	Fair	NA
Riparian Vegetation (5)			
Vegetation Condition	Fair	Good	2, 3, 4, 5, 6
Roads & Trails (6)			
Open Road Density	Fair	Good	4
Road Maintenance	Fair	Fair	NA
Proximity to Water	Fair	Good	4
Soils (7)			
Soil Productivity	Poor	Fair	1, 2, 3, 4, 5, 6
Soil Erosion	Poor	Fair	1, 2, 3, 4, 5, 6
Soil Contamination	Fair	Fair	NA

Indicator/ Attributes	Current Score	Score After Implementation of Essential Projects	Essential Project #
Fire Regime (8)			
Fire Condition Class	Poor	Fair	1
Forest Cover (9)			
Loss of Forest Cover	Fair	Good	1
Rangeland Vegetation (10)			
Vegetation Condition	Good	Good	6
Terrestrial Invasive Species (11)			
Extent & Rate of Speed	Fair	Fair	NA
Forest Health (12)			
Insects & Disease	Fair	Good	1
Ozone	Good	Good	NA

Alignment with State or Local Goals

There are no Total Maximum Daily Load (TMDL) reports within this watershed. Green Valley Creek is a tributary to Tonto Creek which is impaired but does not have a TMDL set.

Opportunities for Engagement and Partner Involvement

There are several partners that have expressed interest in assisting the Tonto NF with restoration in the GVC Watershed. These partners include, but are not limited to, Arizona Elk Society, Trout Unlimited, Arizona Game and Fish, National Forest Foundation, and the Northern Arizona Forest Fund. Furthermore, as the restoration work begins, there is the potential to work with the adjacent private landowner and assist them with protection and restoration of springs that feed the fen on their property. Continued photopoint monitoring at nine designated sites within the watershed will be completed through a partnership with the Friends of the Tonto, and it is anticipated that annual wet-dry mapping of Green Valley Creek will be accomplished using Gila County Youth Conservation Corps Crews as was done in June of 2020.

Anticipated Outcomes

Completion of this WRAP will result in accomplishments in the following categories:

- Watershed class improved (WTRSHD-CLS-IMP-NUM)
- Miles of road decommissioned (RD-DECOM-SYS)
- Acres of soil and water improved (S&W-RSRC-IMP)
- Miles of stream habitat restored/enhanced (HBT-ENH-STRM)
- Acres of terrestrial habitat restored/enhanced (HBT-ENH-TERR)
- Timber volume sold (TMBR-VOL-SOLD)
- Acres of timberland treated (TIMBER-SALES-TRT-AC)
- Acres of rangeland improved (RG-VEG-IMP)

Socioeconomic Considerations

The Payson Ranger District, like all districts on the Tonto NF, has a high ecosystem services exposure for surface water supply because all watersheds on the district and forest supply surface water for Maricopa County. Even though Green Valley Creek Watershed is not designated as a municipal watershed it is a headwater watershed for Tonto Creek and thereby contributes to the Salt River and ultimately the water supply for Maricopa County. In terms of employment opportunities generated by this WRAP, within Gila County, these projects will employ contractors for some of the work. Other employment opportunities may occur using stewardship, service, or timber sale contracts. The sale of livestock from Forest Service allotments provides benefits to the permittee, his or her employees, and those businesses that supply materials to local ranching operations. Some seasonal employment is possible to build and maintain range developments and install erosion control measures. Finally, youth conservation crews from Gila County were used in 2020 to complete the initial wet-dry mapping for Little Green Valley and it is anticipated that, as funding allows, we will annually employ these crews to assist in monitoring in this and other watersheds on the Payson Ranger District.

Specific Project Activities (Essential Projects and Complimentary Projects)

Essential Project #1 - Little Nolan Campground Timber Sale
Project description: This project will be a task order on the 4 Forest Restoration Initiative (4FRI) phase 2 contract. Treatment will consist of uneven-aged management (single tree selection) and weed/release of the understory. The task order will be issued in 2022 under the authority of the Rim Country EIS and consists of 200 acres in the vicinity of GVC watershed with approximately 120 acres within the watershed boundary. This project will improve soil conditions, fire regime, and forest health indicators.
NEPA: Rim Country Environmental Impact Statement
Functional Lead: Timber Management
Potential Partners: None identified at this time
Timeline: FY22 – FY23
Estimated Cost: $300-400 per acre for ~200 acres = $60,000 - $80,000

Essential Project #2 – Little Green Valley Fen Fence
Project description: The first step to restoring hydrologic and ecosystem function on the Little Green Valley Fen is to reduce the grazing pressure on it. An elk fence enclosing the approximately 15 acres of the fen on Forest Service property will allow the bank stabilizing species to re-establish and reduce further erosion within the existing gully. This project will improve 15 acres of soil conditions and contribute to the improvement of 6.5 miles of stream improvement through reducing fecal matter in and around the stream and additional erosion/gullying of the stream.
NEPA: Diamond Rim EA
Functional Lead: Watershed and Range
Potential Partners: National Forest Foundation
Timeline: FY21
Estimated Cost: $100,000

Essential Project #3 - Little Green Valley Fen Restoration
Project description: Restore wet meadow function to the portion of the Little Green Valley Fen on USFS land. Specific design plans will be created once the elk fence is in place and the forest is able to observe improvement through natural recovery for at least one year. It is anticipated that this project would include improving and maintaining the riparian vegetation condition on the fen as well as Green Valley Creek's channel shape and function.
NEPA: To be completed
Functional Lead: Watershed
Potential Partners: Northern Arizona Forest Fund, National Forest Foundation, Arizona Elk Society
Timeline: FY23 – FY26
Estimated Cost: TBD

Essential Project #4 – Route Decommissioning
Project description: To reduce sediment delivery to streams within the Green Valley Creek Watershed, work includes, but is not limited to, decreasing road density and proximity to water ratios by decommissioning approximately 10.96 miles of road, as identified in the Draft Travel Management Record of Decision. Road miles to be decommissioned within this watershed will be adjusted to align with the Final Travel Management Record of Decision when it is released.

Decommissioning of roads per Forest Service Manual 7734.1 includes applying various treatments, including one or more of the following:

- reestablishing former drainage patterns, stabilizing slopes, and restoring vegetation
- blocking the entrance to a road or installing water bars
- removing culverts, reestablishing drainages, removing unstable fills, pulling back road shoulders, and scattering slash on the roadbed
- completely eliminating the roadbed by restoring natural contours and slopes

Field coordination throughout the NEPA process will determine actual treatment and final impacted mileage for each segment of road. See Table 5 and Figure 15 for proposed road segments.

Table 5: Routes to Decommission

Route No.	Milage
655	0.83
658	1.43
893	0.81
904	1.29
971	0.26
975	0.83
1259	0.39
1262	1.19
1613	1.52
1614	0.92
3614	0.28
3615	0.53
3618	0.37
3737	0.02

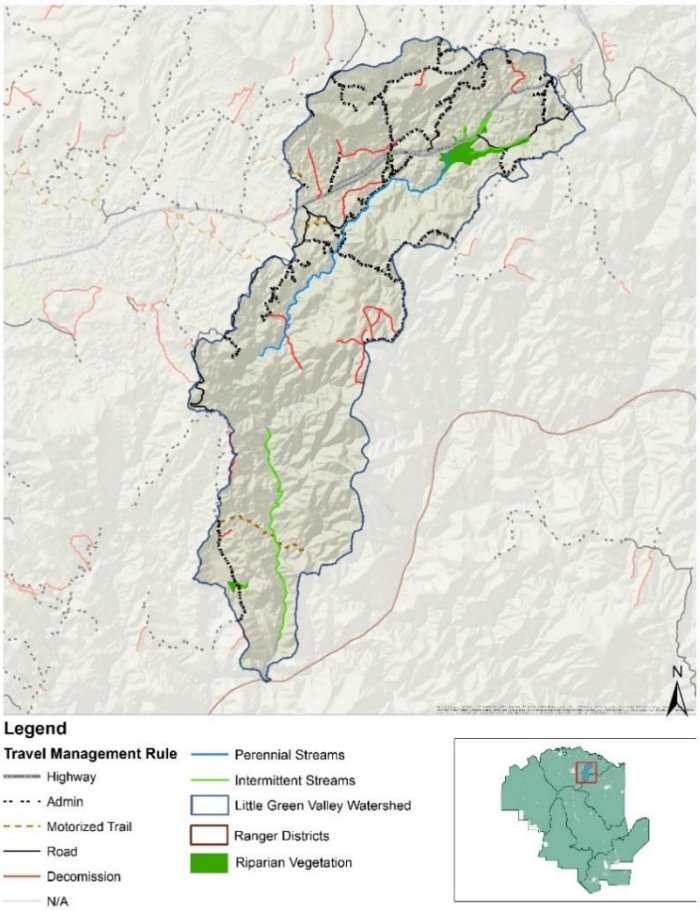


Figure 15: Road status according to the Draft Travel Management ROD – Routes to decommission are shown in red

NEPA: To be completed
Function Lead: Engineering/Watershed
Potential Partners: None identified at this time
Timeline: FY22 – FY26
Estimated Cost: ~$1,000 / mile of road @ 10.96 miles = $10,960

Essential Project # 5 - Preacher Canyon Wildlife Area – Fence Restoration
Project description: The project will install a pipe-rail fence at the Preacher Canyon Wildlife Area, a riparian corridor designated as a wildlife area by Tonto National Forest (TNF), Payson Ranger District. The existing barbed-wire fence has been down for several years causing habitat degradation and sedimentation from the trampling and erosion consistent with heavy livestock use. The creek's perennial stretch is 3-6 ft wide and approximately 1000 ft long. Installation of the pipe-rail fence will protect about 100,000 square feet of riparian area for wildlife; cattle would still have access to water downstream of the fenced wildlife area. Excluding livestock from a small portion of Preacher Canyon will also improve conditions for Chiricahua leopard frogs, which were present at the site historically, as well as other nongame and game species.

NEPA: Diamond Rim EA
Functional Lead: Wildlife
Potential Partners: Arizona Game and Fish Department
Timeline: FY21-FY22
Estimated Cost: $21,000

Essential Project #6 - Little Green Valley Water Development
Project description: Development of an off-stream water source for livestock and wildlife below the Little Green Valley Fen to replace water lost when the elk fence is installed and to potentially ease the grazing pressure on Green Valley Creek below the fen.
NEPA: Diamond Rim EA
Functional Lead: Range
Potential Partners: Northern Arizona Forest Fund, Trout Unlimited, Arizona Game and Fish
Timeline: FY21
Estimated Cost: $15,000

Complimentary Projects
The following project maintains current watershed condition, while it is not an essential project per se it is important for the long-term health of the watershed and is therefore included here.

Kings Ridge Prescribed Fire
Project description: Plan and implement prescribed fire to better the overall health of wildlife habitat, reduce the risk of uncharacteristic wildland fire, restore forest health and structure so that the watershed is healthier and more resistant to climate change. A total of 2,075 acres will be treated, only a portion are in the watershed (See Figure 16).
NEPA: Lion EA
Function Lead: Fuels Management
Timeline: FY23-FY24
Estimated Cost: $100/per acre

Monitoring

The following monitoring activities will help inform management of the GVC watershed during and beyond the life of this WRAP. Monitoring cooperating partners may include: Friends of the Tonto, Arizona Department of Environmental Quality, Arizona Game and Fish, and the Grazing Permittee.

Range condition monitoring and adaptive management: Under the Diamond Rim Grazing Allotment EA, range condition monitoring will be conducted using, but not limited to, pace transects, pace quadrat frequency, dry weight rank, ground cover, Parker 3-step and repeat photography. Monitoring occurs at established permanent monitoring points.

Riparian vegetation monitoring: Riparian vegetation monitoring consists of 9 established photo points within Green Valley Creek that are maintained by Friends of the Tonto, a partner group with the Tonto National Forest. These allow managers to qualitatively monitor riparian areas overtime to see how the system is responding to management objectives. Some photo points date back to 2003 with the most recent photos from 2018. In addition to photo point monitoring, vegetation sampling has been

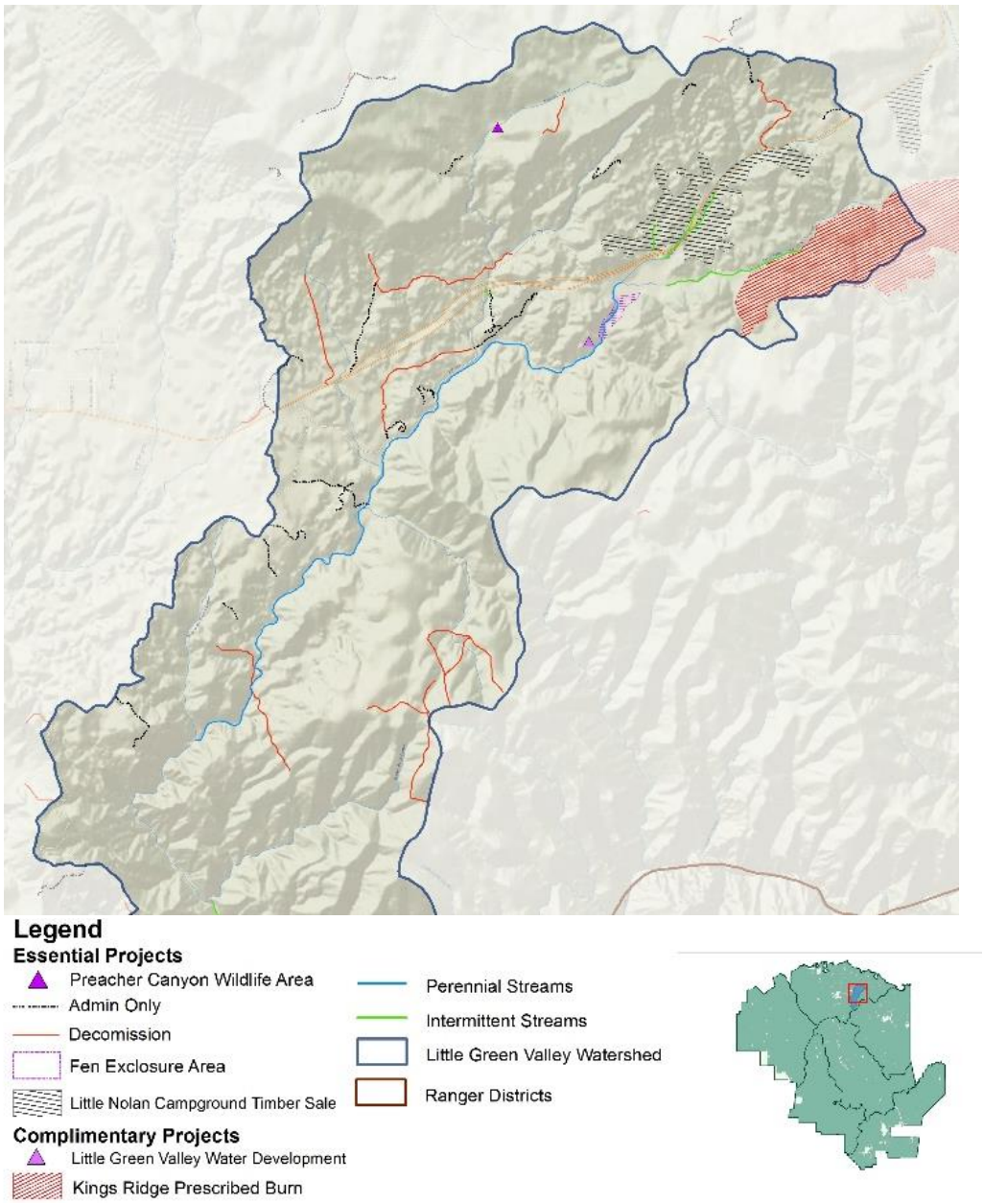


Figure 16: Location of Essential and Complimentary Projects. There is one road listed for decommissioning that is in the southern part of the watershed and not on this map: FSR 971.

established at the fen (7 transects) and at two perennial segments or reaches (10 transects) of Green Valley Creek below the fen using the National Riparian Protocol.

Hydrology/Geomorphology monitoring: Seven monumented cross-sections have been established on the fen and below the fen within the perennial reach of Green Valley Creek to monitor change in channel morphology over time. Three of the four cross-sections within the fen were first recorded in 1998 and provide a valuable resource for charting change on the fen. As part of the legacy cross-section data, there have also been reaches with streambank stability and riparian health assessments conducted. In June 2020 wet-dry mapping was conducted for 10.3 miles of Green Valley Creek and the

forest anticipated conducting this mapping exercise annual to monitor change in stream perennialism. Finally, Monthly median streamflow for Green Valley Creek was collected in 2010-2012 and the forest will install a stream gauge below the fen in early 2021 to continuously monitor streamflow going forward.

Water quality monitoring: Water quality samples were collected by ADEQ in 2016 and 2017. Due to capacity issues, ADEQ does not anticipate monitoring the stream into the future. In partnership with ADEQ, however, over the life of this WRAP and beyond the TNF watershed program will collect water samples and make measurements using equipment provided by ADEQ and submit these to them for analysis. The primary concern in Green Valley Creek is dissolved oxygen.

Other monitoring: Monitoring of sensitive species, e.g., Senor Mine alumroot, will occur as part of routine vegetation and wildlife monitoring that occurs forest wide. As resources allow, a soil nutrient analysis of the fen pre and post restoration activities will be conducted.

Action Plan Date: 4/6/2021

Reviewing Official and Title: Neil Bosworth, Forest Supervisor, Tonto National Forest

Signature:

NEIL BOSWORTH Digitally signed by NEIL BOSWORTH
Date: 2021.04.08 09:59:41 -07'00'

Forest Contact Information:

Kelly Mott Lacroix
Watershed Program Manager
480-601-6218, kelly.mottlacroix@usda.gov

This Watershed Restoration Action Plan is a programmatic document in which the Forest Service describes existing resource conditions and identifies possible management actions that could be taken to move the Agency towards a desired future condition. If the Forest Service determines that it wants to move forward with any of these possible actions, the proposed actions will be subject to National Environmental Policy Act requirements at the time the projects are proposed. NEPA may already be completed on some of these actions.

References

Arizona Geologic Survey. (n.d.). *The Geologic Map of Arizona.* Geologic Map of Arizona. http://data.azgs.az.gov/geologic-map-of-arizona/#

Arizona Department of Environmental Quality. (n.d.) *eMaps*. http://gisweb.azdeq.gov/arcgis/emaps/?topic=impaired2018

Brown, D., Lowe, C., & Pase, C. (1979). A Digitized Classification System for the Biotic Communities of North America, with Community (Series) and Association Examples for the Southwest. Journal of the Arizona-Nevada Academy of Science, 14(1), 1-16.

Triepke, J., Wahlberg, M., Cress, D., Benton, R., (May, 2014). *RMAP Regional Riparian Mapping Project*. https://www.fs.fed.us/r3/gis/gisdata/rmap_project_report_SEPT_2013.pdf

United States Department of Agriculture; Forest Service, Tonto National Forest. (December 2017). *Final Environmental Assessment: Diamond Rim Grazing Analysis*.

United States Department of Agriculture; Forest Service, Tonto National Forest. (November 2019). *Tonto National Forest Draft Land Management Plan*.

United States Department of Agriculture; Forest Service, Tonto National Forest. (October 2019). *Travel Management on the Tonto National Forest Draft Record of Decision.*

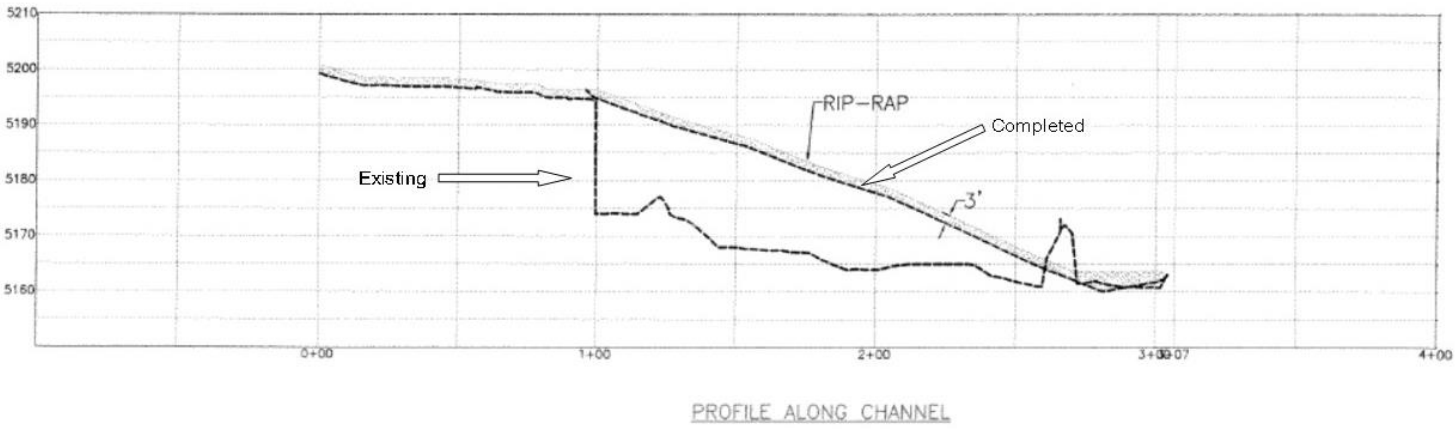
United States Department of Agriculture; Forest Service, Tonto National Forest. Report compiled by John Kelsy. (January 1986). *Terrestrial Ecosystems Survey Report for Tonto National Forest Northern Portion*.

Wahlberg, M.M., F.J. Triepke, W.A. Robbie, S.H. Strenger, D. Vandendriesche, E.H. Muldavin, and J.R Malusa. 2013. Ecological Response Units of the Southwestern United States. USDA Forest Service.

Appendix A – Restoration of the Green Valley Fen Head Cut

View of head cut prior to restoration in 2011 (looking upstream)

View of head cut prior to restoration in 2011 (looking upstream)



Profile view of area filled to restore channel gradient and arrest the head cut

Head cut immediately after restoration in 2011 looking upstream. Cottonwood tree in right-hand corner can also be seen in 2019 photo.

Head cut in 2019 looking downstream.

Appendix B

Well 55 Number	Owner	Well Type	Case Diameter	Pump capacity GPM	Abandoned Y/N
568696	USDA Tonto NF	Non-Exempt	NA	NA	N
610168	Bensch, E	Non-Exempt	10	200	N
809069	Clay Coady	Exempt	NA	2	N
911602	ADOT	Monitor	2	NA	Y
504193	Hal J, Earnhardt III – Family trust	Non-Exempt	8	15	N
605644	Hal J, Earnhardt III – Family trust	Non-Exempt	8	70	N
565621	ADOT	Other	NA	NA	N
553771	Robert C Franek	Exempt	6	10	N
502856	Schnakenberg, B	Exempt	0	0	N
539665	Boulet, Ellyn K	Exempt	6	0	N
539757	Tewana & Robert Bear	Exempt	6	5	N
539663	Stevens, Phillip	Exempt	6	0	N
568681	USDA Tonto NF	Non-Exempt	2	NA	N
577001	USDA Tonto NF	Non-Exempt	6	NA	Y
568684	USDA Tonto NF	Non-Exempt	5	NA	Y
568685	USDA Tonto NF	Non-Exempt	5	NA	Y
568682	USDA Tonto NF	Non-Exempt	2	NA	Y
570585	USDA Tonto NF	Exempt	7	NA	Y
808041	Star Valley Investments, LLC	Exempt			N
217346	Danielle & Jim Earl	Exempt	6	NA	N
644250	Milberger, L	Exempt	8	15	N
613363	Cline, R.	Exempt	30	5	N