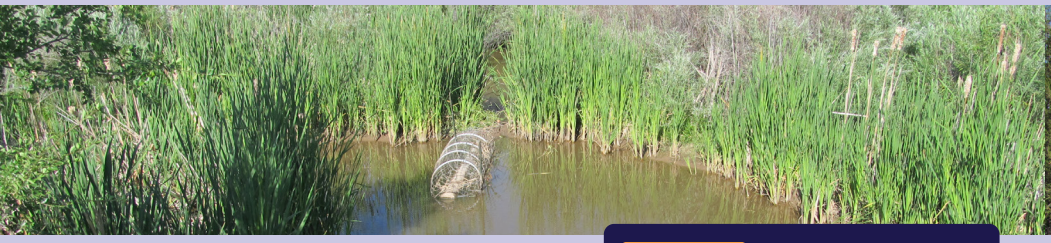
SANTA FE COUNTY OPEN SPACE AND TRAILS PROGRAM

LA CIENEGUILLA OPEN SPACE MANAGEMENT PLAN

APPENDICIES

FINAL DRAFT

SEPTEMBER 13, 2016



SANTA FE COUNTY
OPEN SPACE & TRAILS

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LA CIENEGUILLA OPEN SPACE APPENDICES

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LCOS	# (Term and Priority)	Project or Management Activity	Objective or Purpose	Location Code	Actor	Timeline	Recurring (R) or Not Recurring (NR)	Labor and Cost Estimates	Funding Source
Maintenance	1.1	Communication & outreach with neighbors and stakeholders; integrate feedback in planning	Holistic & Inclusive Management	Entire property	SFC-M (Crew) and Planning staff	ST-MT-LT	R	Annually (or more often)	GF
	1.2	Inspection and repair of fences, gates, stiles, and signs	Public Safety / Access Management	Entire property: approx. 20,900 lf	SFC-M (Crew)	ST-MT-LT	R	Annually, up to 4 days for 2 people (32 h/y) + supplies TBD	GF
	1.3	Inspection and cleanout of culverts, stream crossings	Public Safety / Ecological Health	LC-RIP: culvert, bridge, crossing locations	SFC-M (Crew)	ST-MT-LT	R	Monthly: (approx. 64 h/y)	GF
	1.4	Inspection and repair of drainage and erosion on road sides, bridges, and trail on terrace on river left	Public Safety / Access Management	LC-RIP, LC-WOO: Select areas	SFC-M (Crew) or contractor	ST -MT-LT	R	Annually: 1 day for 2 people (16 h/y)	GF
	1.5	Field inspection of riparian conditions	Public Safety / Ecological Health	LC-RIP: Entire riparian area; approx. 19 acres	SFC-M (Crew)	ST-MT-LT	R	35 times/y: 4 h for one person (140 h/y)	GF
	1.6	Dead willow and woody debris removal	Public Safety / Ecological Health	LC-RIP: Select areas; 4 ac/y	Contractor or volunteers	ST-MT-LT	R	Annually or every 3 yr; based on bid (rough estimate: $14,175-$22,680/y)	GF, CIP, VOL
	1.7	Channel cleaning, removal of woody debris	Ecological Health	LC-RIP	SFC-M (Crew) or volunteers	ST-MT-LT	R	Twice annually: 2 days for 2 people	GF, VOL
	1.8	Invasive tree species removal	Ecological Health	LC-RIP: Select areas	Contractor or volunteers	ST-MT-LT	R	Annually: based on bid	CIP, VOL
	1.9	Pond leveler maintenance or relocation; removal of unwanted beaver dams	Ecological Health	LC-RIP: Select locations	SFC-M (Crew)	ST-MT-LT	R	Several times annually; perhaps 4-6 crew member days/y (48 h/y)	GF
	1.10	Tree protection (caging with wire mesh)	Ecological Health	LC-RIP: Select trees	SFC-M (Crew), Volunteers	ST-MT-LT	R	Annually: approx. 1 day/y for 2 people (16 h/y)	GF, VOL
	1.11	Piling and burning	Public Safety / Ecological Health	LC-RIP (probably best in southern area near BLM land)	Contractor; with SFC Fire Dep and BLM	ST-MT-LT	R	Occasionally (once in 4 or 5 yr, when needed): based on bid	CIP, grant
	1.12	Grassland inspection and removal of invasive plant species	Ecological Health / Grazing / Grassland Management	LC-GRA-P, LC-GRA-F, LC-GRA-G, LC-GRA-J, LC-GRA-D, LC-ARR, LC-WOO	SFC-M (Crew), Volunteers or Contractor	ST-MT-LT	R	Annually: 1 day for 2 people	GF, VOL
	1.13	Managed grazing (select acreage yearly; a few wks/yr)	Ecological Health / Grazing / Grassland Management	LC-GRA-P, LC-GRA-F, LC-GRA-G, LC-GRA-J: Rotations in pastures	Contractor	ST (yr 4) MT-LT	R	based on bid	CIP, FFS
	2.1	Juniper removal and reseeding of grass	Grassland Management	LC-GRA-J: (1-2 acres/yr out of approx. 25 acres)	Contractor or SFC Fire Dep	MT-LT	R	2 full days for two people (16 h/); based on bid	CIP, grant
	2.2	Prescribed burn	Public Safety / Ecological Health	LC-RIP (probably best in southern area near BLM land)	Contractor; with SFC Fire Dep and BLM	MT-LT	R	When need arises; TBD, based on plan and bid	CIP, Grant

LCOS	# (Term and Priority)	Project or Management Activity	Objective or Purpose	Location Code	Actor	Timeline	Recurring (R) or Not Recurring (NR)	Labor and Cost Estimates	Funding Source
Improvements	1.1	Improve drainage from trail on terrace	Public Safety / Access Management / Ecological Health	LC-WOO: along trail on terrace on river left	SFC-M (Crew) or contractor	ST	R	Every 3-5 years: Based on assessment and bid	CIP
	1.2	Stabilize eroding stream banks	Public Safety / Access Management / Ecological Health	LC-RIP, LC-WOO: along trail on terrace ; LC-RIP: along CR56 and Calle Debra	Contractor	ST	R	Every 3-5 years: Based on assessment and bid	CIP
	1.3	Install signs and bulletin boards	Natural Appearance / Education	LC-GRA-F, LC-GRA-P, LC-RIP: Selected locations on property	SFC-M (Crew) or contractor	ST	NR	TBD, based on plan and bid	CIP, grant
	1.4	Fence off Arroyo de las Calabasas	Public Safety	LC-ARR	SFC-M (Crew) or contractor	ST	NR	TBD, based on plan and bid	CIP
	1.5	Emergency cleanup of Arroyo Calabasas; prepare long-term cleanup	Public Safety / Ecological Health	LC-ARR	Contractor	ST	NR	TBD, based on plan and bid	CIP, grant
	1.6	Repair priority fence problems	Public Safety / Access Management / Ecological Health / Grazing	Entire property: select locations	SFC-M (Crew) or contractor	ST	NR	TBD, based on plan and bid	CIP
	2.1	Boundary fence upgrades and gates (and wildlife-friendly fencing)	Public Safety / Access Management / Ecological Health / Grazing	Entire property: along roads and around perimeter	SFC-M (Crew) or contractor	MT	NR	TBD, based on plan and bid	CIP
	2.2	Grassland improvement: soil improvement, weed removal, managed grazing, partial juniper removal	Ecological Health / Grazing / Grassland Management	LC-GRA-P, LC-GRA-F, LC-GRA-G, LC-GRA-J, LC-GRA-D	Contractor + community group	MT	R (phased over several years)	TBD, based on plan and bid	CIP
	2.3	Arroyo de las Calabasas cleanup and rehabilitation	Public Safety / Natural Appearance / Ecological Health	LC-ARR	Contractor	MT	NR	TBD, based on plan and bid	CIP, State grant
	2.4	Calle Debra bridge reconstruction	Public Safety / Access Management	LC-RIP	Contractor	MT-LT	NR	TBD, based on plan and bid	CIP
	2.5	Trail development (phase-1)	Access Management / Infrastructure / Natural Appearance	LC-RIP, LC-GRA-P, LC-GRA-F, LC-GRA-G, LC-GRA-J	Contractor (+ community group?)	MT	NR	TBD, based on plan and bid	CIP, grant
	3.1	Trail development and implementation of other recreational facilities	Access Management / Infrastructure / Natural Appearance	LC-RIP, LC-GRA-P, LC-GRA-F, LC-GRA-G, LC-GRA-J	Contractor	LT	NR	TBD, based on plan and bid	CIP, grant
	3.2	Installation of interpretive education signs	Natural Appearance / Education / Infrastructure	Selected locations on property	SFC-M (Crew) or Contractor	LT	NR	TBD, based on plan and bid	CIP, grant
	3.3	Dryland agricultural development and facilities	Education / Ecological Health	Selected locations on property	Contractor and community group	LT	R (phased over several years)	TBD, based on plan and bid	CIP, grant

LCOS	# (Term and Priority)	Project or Management Activity	Objective or Purpose	Location Code	Actor	Timeline	Recurring (R) or Not Recurring (NR)	Labor and Cost Estimates	Funding Source
Planning	1.1	Develop and implement protocols for maintenance work, team coordination, and ongoing fund identification and acquisition	All management goals (effective management)	Entire property	Planning staff	ST-MT	R	TBD (20 h/y)	GF
	1.2	Develop a monitoring plan and gathering base-line data	All management goals (effective management)	Entire property	Planning staff	ST	NR	TBD (60 h/y)	GF
	1.3	Develop a basic signage plan; Develop signs and bulletin board for selected locations and establish a fund for signs and bulletin board maintenance and replacements	Holistic & Inclusive / Public Safety / Education	Entire property	Planning & Projects staff	ST	NR	TBD (25 h/y)	GF
	1.4	Ongoing community outreach and coordination of riparian area management	Holistic & Inclusive / Public Safety / Education / Ecological Health	LC-RIP	Planning & Community Services staff	ST-MT-LT	R	TBD (30 h/y)	GF
	1.5	Plan erosion and drainage improvement along the trail on the terrace on river left and along Paseo Real	Public Safety / Ecological Health	LC-WOO, LC-RIP	Planning & Projects staff	ST	NR	TBD (30 h/y)	GF
	1.6	Plan and implement community stewardship structure and events	Holistic & Inclusive / Education / Ecological Health	Entire property	Planning & Community Services staff	ST-MT-LT	R	TBD (100 h/y)	GF
	1.7	Plan and design coordination for the Calle Debra bridge/crossing re-engineering project	Public Safety / Access Management / Ecological Health	LC-RIP	Planning & Projects staff	ST	NR	TBD (20 h/y)	GF
	1.8	Plan coordination for the Arroyo Calabasas cleanup and rehab work	Public Safety / Ecological Health	LC-ARR	Planning & Projects staff	ST	NR	TBD (60 h/y)	GF
	1.9	Develop a grazing and grassland management plan (including fencing, revegetation, and juniper management)	Ecological Health / Grazing / Grassland Management	LC-GRA-P, LC-GRA-J, LC-GRA-F, LC-GRA-G, LC-GRA-D	Planning & Projects staff	ST	NR	TBD (60 h/y)	GF
	1.10	Prepare a managed grazing pilot program (and contract)	Ecological Health / Grazing / Grassland Management	LC-GRA-P, LC-GRA-J, LC-GRA-F, LC-GRA-G, LC-GRA-D	Planning & Projects staff	ST	NR	TBD (40 h/ year-1 or -2)	GF
	1.11	Launch, oversee, and evaluate the managed grazing program	Ecological Health / Grazing / Grassland Management	LC-GRA-P, LC-GRA-J, LC-GRA-F, LC-GRA-G, LC-GRA-D	Planning & Projects staff	ST	NR	TBD (40 h/ year-1 or -2)	GF
	1.12	Develop Recreation Master Plan	Natural Appearance / Infrastructure	Entire property	Planning & Projects staff	ST-MT	NR	TBD (80 h/y)	GF

LCOS	# (Term and Priority)	Project or Management Activity	Objective or Purpose	Location Code	Actor	Timeline	Recurring (R) or Not Recurring (NR)	Labor and Cost Estimates	Funding Source
Planning	2.1	Update and manage the grazing program	Ecological Health / Grazing / Grassland Management	LC-GRA-P, LC-GRA-J, LC-GRA-F, LC-GRA-G, LC-GRA-D	Planning & Projects staff	MT-LT	R (phased implementation)	TBD (20 h/y)	GF
	2.2	Update and manage the riparian area program	Holistic & Inclusive / Public Safety / Education / Ecological Health	LC-RIP	Planning & Projects staff + Community	MT-LT	R (phased implementation)	TBD (20 h/y)	GF
	2.3	Guide the Arroyo Calabasas cleanup process	Public Safety / Ecological Health	LC-ARR	Planning & Projects staff	MT	R (phased implementation)	TBD (20 h/y)	GF
	2.4	Plan and coordinate implementation of gradual juniper removal and revegetation work	Ecological Health / Grazing / Grassland Management	LC-GRA-J	Planning & Projects staff	MT-LT	R (phased implementation)	TBD (20 h/y)	GF
	2.5	Plan and coordinate detailed plans and designs for trails and other recreational uses	Natural Appearance / Infrastructure	Entire property	Planning & Projects staff	MT	NR	TBD (40 h/y)	GF
	2.6	Plan development of an interpretive education program	Natural Appearance / Education / Infrastructure	Entire property	Planning staff	MT	NR	TBD (40 h/y)	GF
	2.7	Secure funding for recreation plan implementation	Natural Appearance / Infrastructure	Entire property	Planning staff	MT	NR	TBD (20 h/y)	GF
	2.8	Plan a feasibility study for dryland agriculture development	Ecological Health / Education	LC-GRA-P, LC-GRA-J, LC-GRA-F, LC-GRA-G, LC-GRA-D	Planning & Projects staff	MT	R (phased implementation)	TBD (40 h/y)	GF
	3.1	Update and manage the upland vegetation management program	Natural Appearance / Education / Ecological Health / Grazing / Grassland Management	LC-GRA-P, LC-GRA-J, LC-GRA-F, LC-GRA-G, LC-GRA-D	Planning staff	LT	R (phased implementation)	TBD (20 h/y)	GF
	3.2	Implement the recreation plan	Natural Appearance / Infrastructure	Entire property	Planning & Projects staff	LT	R (phased implementation)	TBD (40 h/y)	GF
	3.3	Implement an interpretive education program	Natural Appearance / Education / Infrastructure	Entire property	Planning staff	LT	R (phased implementation)	TBD (40 h/y)	GF
	3.4	Plan and design a dryland agriculture program	Ecological Health / Education	LC-GRA-P, LC-GRA-J, LC-GRA-F, LC-GRA-G, LC-GRA-D, LC-ARR	Planning & Projects staff	LT	R (phased implementation)	TBD (40 h/y)	GF
	3.5	Identify and prepare funding for dryland agriculture plan implementation and guide implementation	Ecological Health / Education	LC-GRA-P, LC-GRA-J, LC-GRA-F, LC-GRA-G, LC-GRA-D, LC-ARR	Planning staff	LT	R (phased implementation)	TBD (40 h/y)	GF

Santa Fe County Open Space Management Planning Initiative

A Field Characterization for the La Cieneguilla Open Space Property
Santa Fe County, New Mexico
An Existing Conditions and Inventory Report

February 19, 2016

Ecotone

Conservation Planning for Landscapes in Transition

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Photographs Page 1. Top left: view across grasslands from northern gravelly grasslands to the southwest; top right: view across grasslands from southern loamy grasslands to the southwest; bottom left: view across grassland with junipers to the northwest; bottom right: view along Santa Fe River riparian zone to the west-southwest. (Photographs by Jan-Willem Jansens)

INTRODUCTION

This report provides an overview of field characterizations, including existing conditions, and a list of key assessment (research) projects to be addressed at a later date for the La Cieneguilla Open Space (LCOS) property in La Cieneguilla, in Santa Fe County, NM. The report describes the findings of the second phase – Inventory and Assessment – of the 2015 Santa Fe County Open Space Management Planning Initiative.

The purpose of the (Phase-2) Inventory and Assessment research is to collect more in-depth data on selected issues to have the minimally needed information to proceed with Master Planning, to develop Maintenance Plans and to complete Management Plans for the LCOS property. Findings of the Inventory and Assessment phase will also play a directing role in structuring community input for Master Planning for the community of LCOS stakeholders.

Research Topics and Methods

The Ecotone project team conducted the research for this project phase from October through December 2015. The research scope focused on selected issues identified in phase-1. A summary of the selected research issues during the Inventory and Assessment phase is listed at the top of the Findings section.

Research activities included two terrain visits, supported by web- and literature research, and fact-checking and interviews with experts. The project team collected detailed terrain data along a series of grassland and wetland vegetation transects and documented specific observations through photography and GPS documentation of the locations of the issues observed. Terrain assessments included specific assessments of fuel loads on the ground to quantify fire hazard in wooded areas. Project team members also conducted formal and informal meetings and fact-checking using e-mail communication with a State hydro-geologist regarding stream and groundwater flows

While this report focuses on findings, it also includes a few conceptual conclusions and recommendations. Detailed maintenance and ecological restoration recommendations will be formulated in Phase 3 of the Open Space Management Planning initiative and included in the final Management Plan.

FINDINGS OF EXISTING CONDITIONS: LA CIENEGUILLA OPEN SPACE – LA CIENEGUILLA

Scope of Research

Table 1: Listing of Phase-2 Research Topics

#	Research Topics
1a	Land health assessment of grasslands
1b	Water rights information
1c	Land suitability study of grassland for various uses/mixed use
1d	Id needs and opportunities for improvements
2a	Id flood risks, log jams, and bosque wildfire hazards
2b	Id stream flow and evapotranspiration processes regarding irrigation needs downstream and in La Cieneguilla
2c	Id stream and floodplain restoration needs
3	Id needs and costs for stormwater management and erosion control on the trail on the terrace on river left

Summary of Findings, Conclusions and Recommendations

Land Health and Suitability of the Grasslands

1a: Land Health Assessments of Grasslands

The grasslands at LCOS include six different terrain management units based on topography, soils, and vegetation, across four ecological sites (Figure 1 and Table 2). In summary, the grassland conditions range from very poor to somewhat good. Most grassland sites appear to be recovering from past impacts of drought and terrain disturbances. The grassland data, the terrain management units and ecological sites and their conditions are summarized in Table LCOS-2, and illustrated on a map in Figure LCOS-A-1, in Appendix A.

The grasslands appear not to have been grazed for many years. However, managed grazing practices aimed at grassland restoration (i.e., restorative grazing) have the potential to increase grassland health by removing undesirable weeds and increase nutrient cycling.

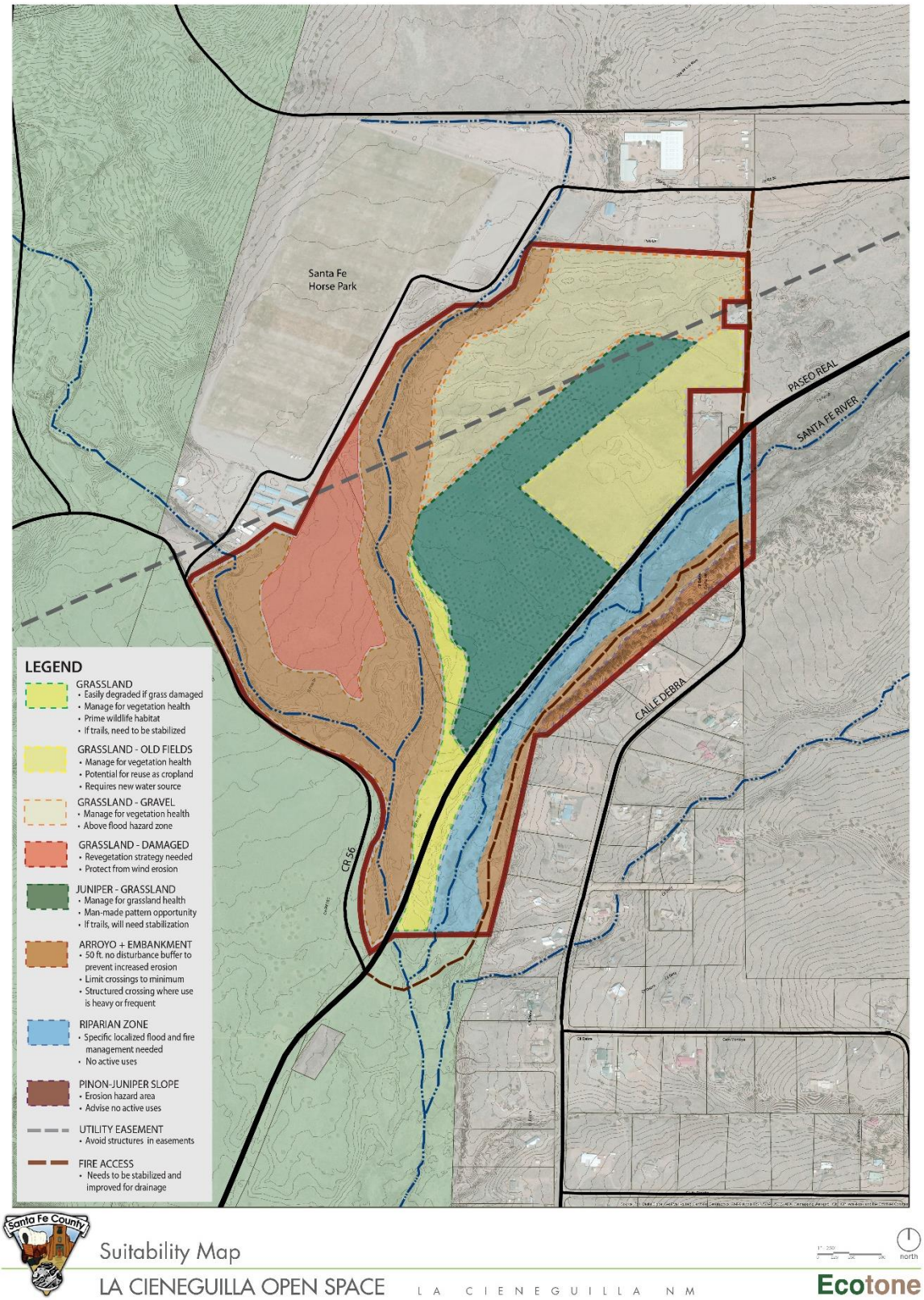

Figure 1. La Cieneguilla Open Space – Land Suitability Map

Table 2. Overview of LCOS Terrain Management Units and their ecological sites, land health conditions and suitability opinions.

Terrain Management Unit	Ecological Site	Land Health Conditions	Suitability Options
1. Grassland – Gravel: upland gravel terrace	"The Pits", a sandy-gravelly, disturbed soil; well-drained, uneven topography; possible former site of dumping of cut and fill dirt; outside flood zone; Sand dropseed is the dominant grass (23%)	Dry terrain with 21%-41% soil cover of a mosaic of grass, forb, and shrub vegetation; and 10% litter and 14%-15% stone cover; very little erosion risk; some weed proliferation; rodent holes	(1) Park and trail uses (2) Very limited managed grazing (3) Specialized dryland farm crops
2. Piñon-Juniper area	"Delvalle-Urban Land Complex", loamy sand and sandy loam complex of alluvial soils; Flood zone AE (0.1-0.02%); Sand dropseed is the dominant grass (12%)	Dry terrain with nearly 50% bare ground, 12% litter and 2% gravel; some signs of sheet wash; juniper seem to dry out soils; significant weed proliferation; many rodent holes and nests	(1) Limited park use (2) Trail uses (3) Very limited, managed grazing (4) Ecological restoration opportunities to reduce juniper cover and increase grass cover
3. Grassland – Old Fields: former pastures	"Delvalle-Urban Land Complex", loamy sand and sandy loam complex of alluvial soils; Flood zone AE (0.1-0.02%); Sand dropseed is the dominant grass (39%-47%)	Dry, locally disturbed terrain (ridges and depressions) with variable (15%-34%) bare ground, 12%-14% litter and 1%-2% gravel in a mosaic of dense grass and shrubs	(1) Limited park use (2) Trail uses (3) Managed grazing (4) Ecological restoration opportunities
4. Grassland: lower grassland strips	"Delvalle-Urban Land Complex", loamy sand and sandy loam complex of alluvial soils; Flood zone AE (0.1-0.02%)	Strip of fair-quality grassland along arroyo and riparian area with good grass and forb cover and some shrubs and trees (elm)	(1) Trail uses (2) Managed grazing (3) Ecological restoration opportunities
5. Grassland – Damaged: loamy rangeland	"Zepol Siltloam", loamy and fine sandy soil, mostly flat terrain with poor drainage; Flood	Very poor, weed-covered rangeland with 29% bare ground, 15%-16%	(1) Limited park use (2) Very limited trail uses (3) Restorative grazing

	zone A (undetermined); Kochia, a non-native plant, is dominant (21% cover)	plant litter and 2%-3% gravel; poorly draining soils, and signs of past soil disturbance; wind erosion risks	(4) Ecological restoration opportunities to increase native grass cover in place of Kochia
6. Arroyo Embankment: arroyos with buffer zone	"Walkibout-Innacutt Complex", sandy drainage strips following incised arroyos with steep banks; Flood zone A (undetermined)	Partly grass-covered, sandy arroyo bottom with steep sandy-loamy banks and many large piles of construction debris; including a 100-ft buffer zone with waste piles and holes (tunnel erosion through subsoil)	Not suitable for use except for a carefully-constructed trail crossing unless reclaimed (safety hazards due to flood risks and waste dumps)

1b: Water Rights for Grassland Irrigation

No water rights are available for irrigation on the grasslands of LCOS. Water rights associated with the Hagerman well are reportedly leased to HIPICO Santa Fe (a.k.a. The Horse Park) in a gentlemen's agreement. It is unclear when the agreement will end.

Santa Fe County also has no rights to the effluent water piped from the Municipal WWTP. However, Santa Fe County could consider benefiting from the nearby pipeline infrastructure (to HIPICO Santa Fe) and investigate the opportunity of purchasing effluent from the City of Santa Fe for irrigation purposes on LCOS.

1c: Land Suitability of Grassland for Various Uses/Mixed Use

The suitability of various forms of land use (grazing, agriculture, trails, fishing pond, community park, and mixed uses) are determined by suitability goals and criteria described in Appendix C.

Grazing

Suitability for grazing is low. The NRCS WebSoil Survey indicates that in favorable years forage production is around 633 lbs/acre. In normal years, forage production is only 433 lbs/acre. We estimate based on visual observations that the forage biomass volume in the late fall of 2015 was probably above the value of 633 lbs/acre for the sandy grassland outside the juniper-dominated area. The relatively favorable forage production in 2015 is probably related to the record precipitation of the year.

Figure 2. Grassland at the Upland Gravel Terrace with a large proportion of poor quality forage species; view to the east-southeast. (Photo by Jan-Willem Jansens)

Plant diversity is relatively high with 21 species recorded. However, most plants are unpalatable forbs (Figure 2). Only 5 plant species are palatable grass species of moderate forage quality, with Sand dropseed as the dominant grass species throughout the area. The five grass species constitute less than 30% of all the vegetation cover. Grass covers no more than 15% of the soil and bare ground, litter and rock covers 47% of the soil.

Grass cover and forage quality are patchy and highest on the fringes of the juniper area (unit 2), the former pastures (unit 3), and the strips of grass along the arroyos (unit 4). The loamy rangeland and the arroyos are currently unsuitable for grazing because of relatively high potential soil loss from sheet wash and wind erosion and due to sparse forage cover.

The fencing for the property is in moderate to good condition with only a few areas with broken wires. Stray livestock in the area have not been observed and don't present a concern for trespass entry at this time. Land suitability for grazing can most likely be improved after a regime of prescribed, restoration grazing. Such a managed grazing regime is probably best

achieved with initial goat grazing to remove invasive plants and plants with low forage qualities. Selective and gradual juniper removal is also advisable to increase grass cover while minimizing soil loss due to wind and water, especially in dry years.

Figure 3. Arroyo with construction debris in foreground and eroding slopes. (Photo by Rich Schrader)

Orchard, Farm, or Garden

Suitability for the development of an orchard, farm or garden on LCOS is very low due to the absence of water for irrigation and relatively poor soil conditions. Only dryland farming would be possible if a local water harvesting system could be established based on roof-collection systems and an infrastructure of cisterns and drip irrigation, combined with soil preparation and rigorous mulching. A dryland farming or garden system might benefit from Keyline contour plowing to optimize water distribution and infiltration across the variegated topography of the landscape. This land use option would require considerable investments in further research, organizational development of the farming operation, and terrain improvements.

Trails

The upland area is moderately suitable for trail development. The best suitable area is the Upland Gravel Terrace because of its well-drained, stony-gravelly surface. The loamy soil

components of the grasslands and juniper area below the Upland Gravel Terrace unit limit trail development or will increase trail maintenance because of the potential of sheet wash (erosion) and dustiness. These problems can be mitigated with appropriate design but will require a greater upfront investment in trail surfacing and drainage features.

The upland area on LCOS has many subtle assets and points of interest, which offer opportunities for discovery and research. The wide views and many different view lines offer a sense of spaciousness (Figure 4). Most of the area is relatively quiet and peaceful. However, the Upland Gravel Terrace and Loamy Rangeland areas are very exposed to sun, wind, and ambient noise. Some people may experience the powerline crossing the Upland Gravel Terrace and Juniper Area as an eyesore or discomforting feature. Additionally, the smells, noise, and visual impacts of HIPICO Santa Fe may also be uncomfortable for some (Figure 5).

Figure 4. View from Upper Gravel Terrace grassland to the southwest. (Photo by Jan-Willem Jansens).

The arroyo system and the slopes crossing the western side of the upland area are seriously degraded and impacted by construction debris and other waste piles. The area is potentially

hazardous in some locations due to tunnel erosion (piping) and sharp debris objects, and susceptible to further ecological degradation (dumping, wind/water erosion, and invasive plants). This area should be considered not accessible for trail development, except perhaps for a carefully constructed trail crossing, if trails were to be built across the upland terrain units.

Trail development is probably best geared toward low-key recreational use, and take the form of a natural surface foot trail. If there is community interest, the trail could potentially be combined in certain spots with a series of workout stations. The trails could potentially also be lined with an array of interpretive signs related to historical land use and ecology. Over time, it is conceivable that a trail connection could be established to the southern end of the property across Paseo Real (County Road 56) and the Santa Fe River, connecting to the lower trail end of the trail on the terrace on river left at the southeastern side of the riparian area (Figure 6).

Figure 5. View of HIPICO Santa Fe at the northwestern corner of the LCOS property. Drainage from the facility enters the LCOS property in the center of the picture at the location of the willows and the pile of manure. Visual impacts, noise, odors, runoff, and waste from HIPICO Santa Fe impact people's experience of the LCOS property. (Photo by Jan-Willem Jansens)

Figure 6. Location of a possible future trail connection from the southern end of the trail on the terrace on river left across the Santa Fe River and Paseo Real (County Road 56) to potential future trails on the western upland area. (Photo by Jan-Willem Jansens).

Fishing Pond

The suitability of the grassland area for the construction of a fishing pond is low due to the absence of water rights associated with the land. Additionally, besides the costly investment to obtain water rights, investments in engineering and construction of a fishing facility will be costly as well, because soils are highly permeable and will need to be lined to prevent infiltration losses. Water losses from evaporation will also be considerable. The suitability of water from the wastewater treatment plant for a fishing pond is low given high phosphorus concentrations and other pharmaceutical elements that are typically found in the water. A fishing pond will also compete with the interest of the downstream traditional communities to use water for agricultural uses

Community Park

The upland area is moderately suitable for the development of a community park. The Upland Gravel Terrace unit is most suitable from a soils and drainage perspective. However, its exposed location, proximity to the impacts from HIPICO Santa Fe, and uncertainties about access are limiting factors. The Former Pastures and Loamy Rangeland units are also moderately suitability, but have limitations related to uncertain flood hazards and soil erosion risks, while the Loamy Rangeland also has access limitation related to the need to cross an arroyo.

A community park will most likely serve as the trailhead for the trail system mentioned above and may further include a parking area, a shelter canopy, dog run, and/or playground. The need for these uses will need to be corroborated with the community.

Mixed Uses

The various suitable uses described above could be combined next to each other across the land or developed in conjunction with each other over much of the same area. For example, restorative or periodic grazing may be combined with a trail system. A trail system could be logically combined with park facilities; particularly any workout stations or interpretive education facilities would combine well with a community park. Uses could be sequenced in time, and developed in different phases of the development of the open space property.

1d: Needs and Opportunities for Improvements

Maintenance and restoration

There are no immediate needs for maintenance or ecological restoration work in the upland (grassland and juniper) area. However, there are numerous aspects to the grasslands that would require maintenance and restoration over time. These include:

- Grassland improvement: (as discussed above)
    - soil conservation for the protection from wind erosion
    - removal of weeds and invasive species (mostly Kochia, snakeweed, and Russian thistle/tumbleweed)
    - improvement of grass cover
    - juniper removal
    - reclamation of the southwestern loamy rangeland area

- Waste and pollution management:
    - removal and reclamation of construction debris/waste dumps
    - protection from pollutants escaping from HIPICO Santa Fe

- Fencing:
    - fencing improvements would prevent dumping and make the grassland better suitable for grazing
    - fencing along the Paseo Real (County Road 56) could be altered to benefit wildlife crossing between grassland and riparian area (shelter and drinking area).

Restorative, managed grazing could benefit the ecological health of the grasslands, offer some community benefits, and reduce long-term maintenance cost for weed and erosion control. Grassland health conditions are probably best achieved with a combination of managed grazing and gradual juniper removal. After a period of several years of restorative grazing (e.g., with goats), the grassland could from time to time be used as a grazing area for local ranchers.

It will be important to define grassland health goals and annually monitor grassland health conditions. Consequently, grazing will have to be managed well to prevent overgrazing and degradation of vegetation and soils. In absence of water rights, stock tanks refilled by water delivered by the grazing lessee and cross-fencing will need to be brought in to facilitate rotational grazing. Gradually, the juniper area could be converted to grassland as well, but care must be given to evaluate the current ecological benefits of the juniper (esp. wind protection for erosion control), and conversion to grass may require irrigation. Details about how to establish a grazing program in Santa Fe County are outlined in an assessment for Los Potreros Open Space in Appendix B. More detailed land maintenance and restoration recommendations will be worked out in the final Management Plan for LCOS.

Needs for infrastructure improvements

Any construction work or improvement of infrastructure will be related to the preferred land use alternative that the County chooses to implement on the LCOS upland area. Besides some fence repairs (listed above), there are no immediate needs for construction or infrastructure improvements in the upland area of LCOS.

Land Health of Riparian Area

Stream conditions in the riparian zone of the Santa Fe River change seasonally due to rapid plant growth and annual die off, beaver activity, flood events, debris jams, and subsequent changes in channel patterns. In addition, significant daily and seasonal variations in discharge of water from the municipal wastewater treatment plant (WWTP) causes fluctuations from 1.5 cfs in the morning to 9 cfs in the afternoon (see Figure 7).

The revegetation of the riparian area with willows and cottonwoods started in the late 1990s, and was finished in 2004 by the Wild Earth Guardians. The plantings plus the exclusion of cattle, which had overgrazed the area, resulted in a dense riparian area where there once was a riverbed with very few riparian plants. The fast-growing willows and cottonwoods caught the attention of the USEPA which recognized the revegetation as a “success story” in 2015 (see Figures 8 and 9).

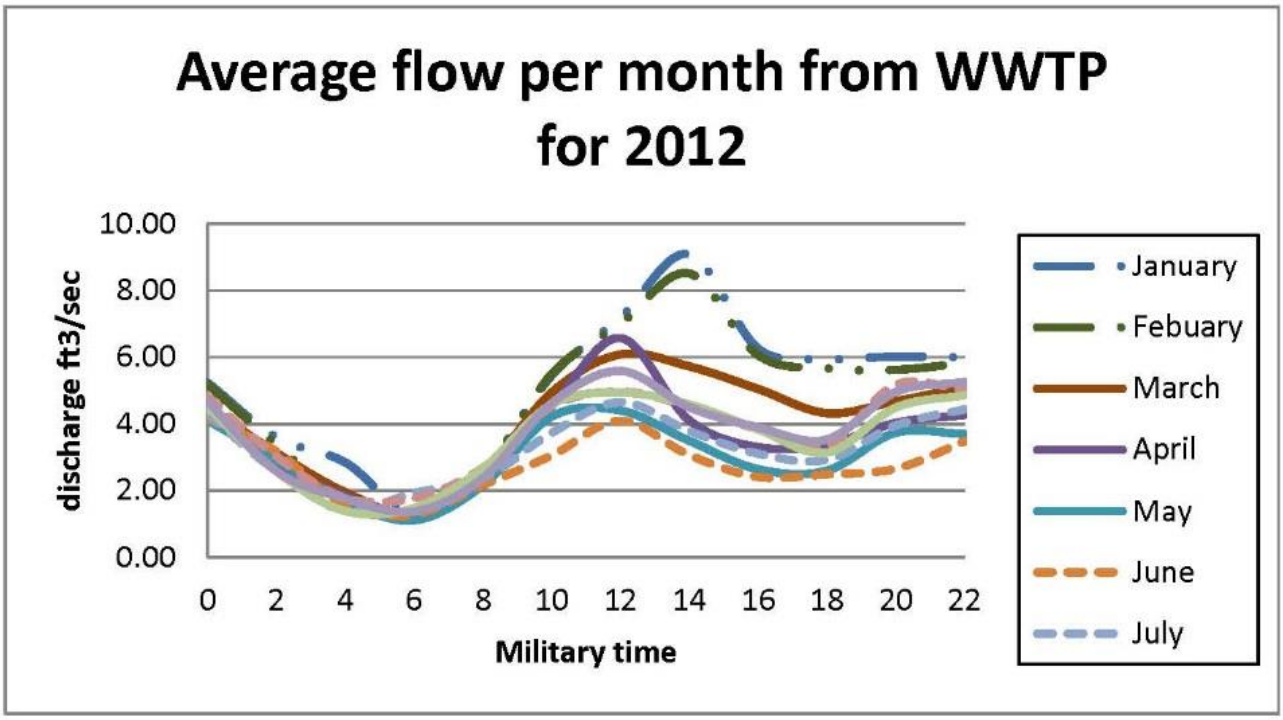

Figure 7. Average recorded flow volumes released by the Municipal Waste Water Treatment Plant upstream from LCOS. (Source: City of Santa Fe WWTP, data for 2012).

The quality of the riparian vegetation with a dominance by native coyote willows, cottonwoods, and Gooding willows is considered to be a "reference" condition, or a model, for good wildlife habitat. The current steady source of water from the WWTP and relatively infrequent large floods creates the conditions for a healthy riparian community that attenuates floods, prevents soil erosion, and supports diverse wildlife.

Beaver, which have migrated up and down the stream corridor, arrived around 2008 and benefited from the newly developed riparian habitat. The riparian plants offer the foundation of the economy for beavers that need the soft wood of willows and cottonwoods to create dams that provide the ponds they need as safe havens from predators

The dense vegetation and saturated soils caused by the beaver ponds create a rich wetland that provides important wildlife habitat. At the same time, the accumulation of woody biomass, both live and dead and rising water table present management concerns for human infrastructure such as the Calle Debra Road crossing which was not designed for year-round wet floodplain conditions. The highly variable WWTP flows, increased water infiltration and evapotranspiration and drought in recent years has led nearby farmers to claim that the beavers have taken the water from them. The County responded by installing several pond leveling devices to suppress the problem of flooding around Calle Debra and allow water to flow downstream more readily.

Figure 8. View of Santa Fe River downstream, April 1997. (Photo by Jim Matison)

The most important maintenance concerns for the riparian zone include debris and log jams and associated flood risks, stream bank stability (including stability of road sides and the Calle Debra bridge), fire hazard, and stormwater and erosion management along the trail on the terrace on river left. Many of these concerns are related to each other and linked to a combination of dense vegetation growth and dead wood accumulation, periodic high flows, and the close proximity and structural qualities of sensitive infrastructure directly surrounding the riparian zone. Below, these concerns will be analyzed in more detail.

Managing the vegetation component, maintaining the pond leveling devices and improving the Calle Debra road crossing will probably be most effective in addressing the majority of management concerns. However, because of its natural, living quality, the riparian vegetation requires recurring management attention. Additionally, roadsides, culverts, and the Calle Debra bridge and roadbed could possibly be improved to increase their sustained stability and resilience and to reduce annual maintenance on these infrastructure facilities.

Figure 9. View of Santa Fe River downstream, repeat photo from August 2004. (Photo by Jim Matison)

2a: Flood Risks, Log Jams, and Bosque Wildfire Hazard

Flooding, bank failure below infrastructure, and wildfire are posing the greatest emergency risks on this open space property. Proper terrain management with frequent inspections and annual maintenance activities can reduce the need for emergency interventions. Table 3 lists specific concerns regarding flooding, bank failure and wildfire which were identified during a field assessment in November 2015.

2b: Stream Flow and Evapotranspiration Processes regarding Downstream Irrigation Needs

The conditions related to flooding and ponding of river water described above contribute to the high quality wetland ecosystem of the riparian area of the LCOS. Yet, downstream water users have voiced concerns that river water used for plant growth and wetland conditions on the LCOS reduces water availability for irrigation downstream.

Santa Fe County has passed resolutions that direct staff to address the concerns from downstream water users. In addition to and outside the context of the Management Plan for LCOS, County staff will continue to work to the best of their ability and jurisdiction with the affected communities to address downstream water needs.

Table 3. Specific Concerns regarding Flooding, Bank Failure and Wildfire.

Location	Concerns	Proposed Solution
Calle Debra bridge	Periodic blockage of culverts. Sink holes beneath pavement.	Periodically remove debris on grates and in culvert. Repair road when needed. Mid-long term: reengineer the bridge support substrate to become more resilient to fluctuating flows and moisture levels
Entire riparian area, esp. northern 1,400 ft of east side and entire west side along Paseo Real	Nearly 16 t/ac of dry wood fuel, mostly in the form of coarse fuel, such as logs and branches. Many stands of willow in which an approx. average of 40%-50% of dead wood.	Maintenance cleanup in a series of phases to remove specific stands of dead standing biomass (dead willow, invasive spp.), non-native trees and junipers. Periodic maintenance thereafter.
Entire area	Beaver impacts on native trees, stream channels, and flow regimes	Large-scale maintenance cleanup (as above), caging of large trees that should be preserved, and maintaining the pond leveling devices on the property
East side of the riparian area, from Calle Debra about 1,300 ft downstream	Overgrown conditions, including dead willow stands, some invasive species (Siberian elm, Russian olive, tamarisk) and juniper	Maintenance cleanup in a series of phases to remove specific stands of dead standing biomass (dead willow, invasive spp.), non-native trees and junipers. Periodic maintenance thereafter.
Over entire west side along stream banks in grass & shrubland between Paseo Real and SF River	Various piles of bucked up elm and other wood: high fuel loads; source of possible debris jam downstream.	Remove or pile and burn.
On various places along Paseo Real	Signs of flooding of road sides, and bank erosion due to ponding in side channel with beaver dam; elm trees fallen on fence in two other locations.	Install flow devices or remove beaver dam, elms, and willows to prevent future beaver dams along the road; stabilize road sides; repair fence.
Southern, dry shrub- and forb-dominated area (3.5-4 acres)	Locally overgrown conditions, invasive plants, and piles of dead and down woody material	One-time thinning and prescribed burn; potentially in collaboration with BLM

A detailed hydrological and hydro-geological study will be needed to arrive at an authoritative conclusion about the wetland conditions. Such a study should specifically address what aspects of the wetland plant and animal activity lead to reduced actual water delivery downstream

compared to any alternative riparian conditions, for example, such as those present at the site prior to 2004 when the stream-side plantings were completed.

A review of existing research and an e-mail exchange with Ms. Peggy Johnson, a hydro-geologist and expert in stream and groundwater flows for the downstream La Cieneguilla and La Cienega area (Appendix F) revealed the following relevant findings and conclusions:

- The river reach on LCOS is a water-losing reach due to the geology of the area. This means that the volume of water flowing in the stream bed at the upstream end of the reach is greater than the volume of water flowing out in the streambed at the downstream end. The reason for this phenomenon is that the net infiltration of river water in the banks and river bed is greater than the amount of groundwater that discharges into the surface flow from the banks and streambed.
- Part of the water that infiltrates at LCOS flows downstream under the surface and resurfaces again as springs at certain points downstream in the Santa Fe River where the net inflow of groundwater is higher than the net outflow. Another part of the water that infiltrates is believed to flow underground in a west-ward direction out of the river's alluvial aquifer. Where and how this happens, how much water is involved in this process, and to what extent the wetland conditions contribute to it is still unclear.
- There are indications, from various studies and field observations, that the wetland ecosystem– with its wet soils and ponding features – leads to an increase of the extent and duration of saturation of the alluvial soils (and alluvial aquifer) beneath the LCOS wetlands. The wetlands likely increase, at least periodically, the volume and duration of surface flows during high flow events, compared with conditions of no significant wetland ecosystem.
- It is reasonable to assume (but not certain) that the volume of water that flows out of the LCOS riparian area is less than what flows in due to evapotranspiration with the current wetland conditions. The evapotranspiration of water is greater now than during the prior drier (non-wetland) stream conditions. The amount of water that is lost to evaporation has not been estimated nor is that amount known to be significant.
- There are no data that indicate whether the conditions described above lead to any annual increases or decreases in outflow volumes in the river channel and in the alluvial aquifer at the downstream end of the river at LCOS compared to conditions without the wetland ecosystem.
- If evapotranspiration and infiltration have in fact increased, it is possible that there has been a slight net reduction of stream channel outflow volumes. It is equally possible that this reduction is (largely or entirely) compensated by increases in sub-surface aquifer recharge and downstream discharges in springs and streambanks in the water-gaining parts of the river as it enters La Bajada canyon.
- It is not clear how seasonal variations and year-to-year differences influence the volumes of downstream discharges of surface and sub-surface flows from the LCOS.

Even if there is no net loss of average annual discharge volume due to the LCOS wetlands, it is most likely that a larger volume of such discharges is happening more often during the winter or during wet years. As a result, water volumes reaching lower La Cieneguilla and the la Bajada box will be relatively low in the spring and summer seasons. Downstream irrigators may experience a seasonally lower amount of available water in the spring and summer months when they most need the water.

- Ms. Johnson affirms that the greatest causes for water losses for agricultural water users downstream are related to upstream water diversions for urban water uses in Santa Fe and to the drier climate conditions we have been experiencing in the past 20 years. Thirdly, she has a sense that evapotranspiration losses along the stream and in general cause some reduction in available water for irrigation. The latter is obviously related to the increases in average annual temperatures over the last half century and to the local increase of riparian vegetation.

In conclusion, it is not clear to what extent, if any, the wetland ecosystem at LCOS leads to any water gains or water losses for agricultural water users downstream. The magnitude of other influences on reduced water availability, such as drought and water input by the waste wastewater treatment plant, indicates that the impact of the LCOS wetlands is rather limited in comparison. Yet, it is understandable that in the context of the already considerably reduced water availability, downstream beneficiaries are concerned about any reductions, however small, that may be caused by the LCOS's wetland conditions. More research will be needed to identify whether the total water delivery from the LCOS to downstream water users is more or less than in non-wetland conditions.

2c: Stream and Floodplain Restoration and Maintenance Needs

A field assessment in November 2015 found that the stream channel and floodplain were in many places covered with dense vegetation, parts of fallen dead trees, material from broken beaver dams, and miscellaneous flotsam. The amount of human debris and trash was surprisingly low. The plant debris has created several log and woody debris jams. About 700-1000 ft downstream from Calle Debra, the debris has split the flows in several places and caused bank erosion and channel bottom scour. The channel erosion seems to have played a role in local channel incision of 2 to 2.5 ft deep. While the erosion is probably only temporary, it indicates that the channel is not efficient enough to move high flows, which leads to flooding. The dense vegetation, combined with the presence of beaver dams, scattered woody debris, and log and debris jams add up to a high level of "roughness", which is an engineering factor in calculating the capacity of a river system to pass a flood flows. High roughness increases the incidence (i.e., risk) of elevated flow levels and related flooding of terrain and adjacent infrastructure.

The Federal Emergency Management Agency (FEMA), the agency mapping anticipated flooding areas, has indicated on its June 2008 map for the region that covers the LCOS property that the Santa Fe River and its immediate banks are in FEMA Zone-AE with a chance of flooding assessed at 1% (Figure 10). Flood zone AE includes the area of the trail on the terrace on river left as well as the pastures and juniper area to the west of the river. A narrow strip on either side of the Zone-AE area is in a 0.2% flood zone, called Zone-X. FEMA maps and regulations offer guidelines to local government agencies and landowners about limitations to construction in flood-prone areas. Santa Fe County's Sustainable Land Development Code (SLDC) includes specific regulations to prescribe the process for studying flood impacts and permitting of land uses in the flood-prone area to reduce the chance of elevated flood levels and increased flood risks in adjacent areas.

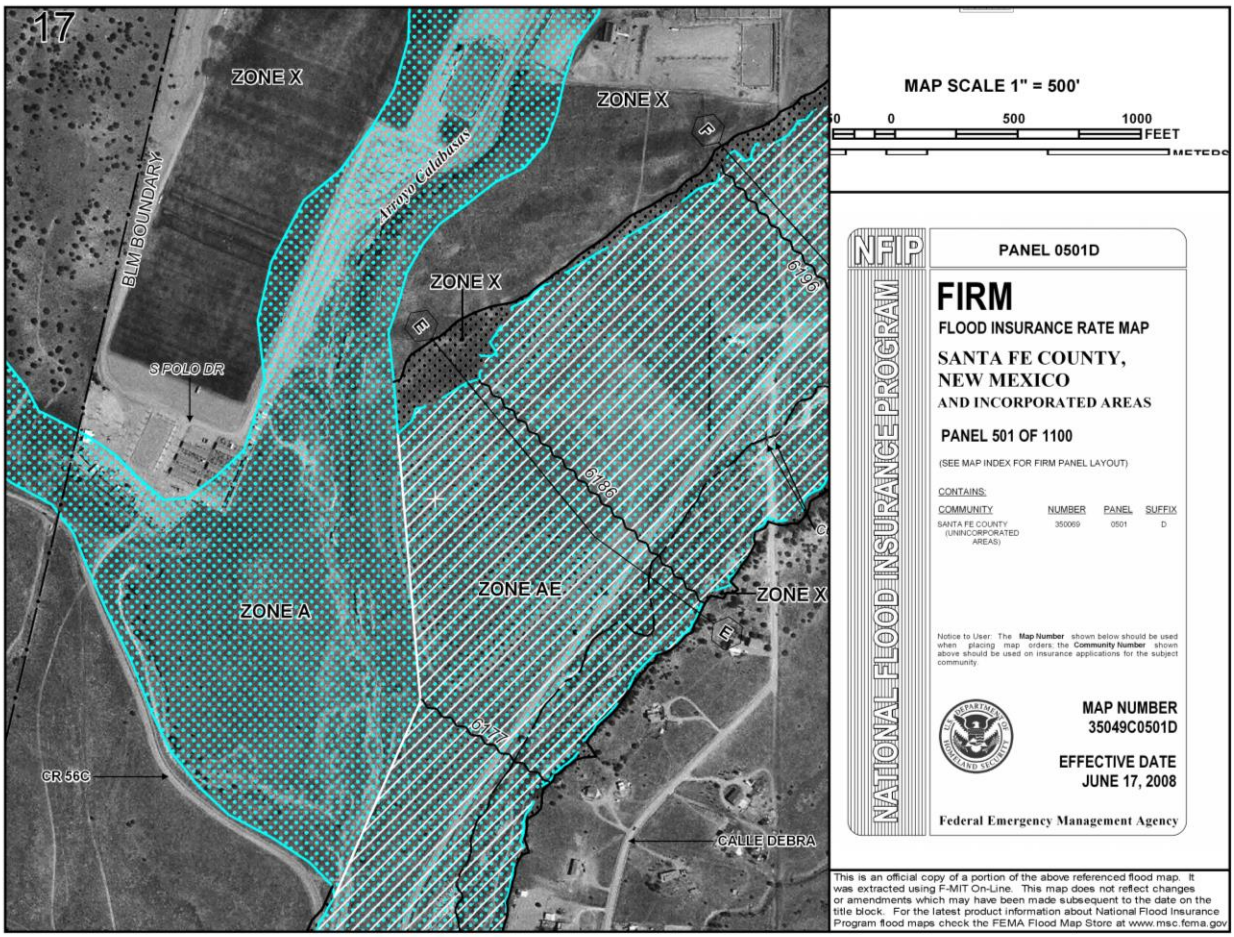

Figure 10. A Firmette map of the LCOS area based on the FEMA FIRM map for the Santa Fe County Area.

While no flood management permitting requirements are directly associated with annual maintenance of the riparian area or even master planning for the LCOS, the FEMA map and the

Flood Prevention and Flood Control section of the SLDC (Section 7.18) offer useful indications for the need for riparian area management. Particularly when in the future Santa Fe County would implement any improvements on the pastures and juniper area west of Paseo Real, maintenance of the riparian area becomes more important in order to reduce the risk of flood damage of infrastructure during unusually large flow events.

As a result of the flood hazard in the riparian zone and the need for frequent maintenance, this area is best suitable for ecological conservation purposes and flood management. The trail on the terrace on river left could officially be made publicly accessible as a multi-purpose trail. Over time, this trail could be connected at the southern end with a simple crossing (stepping stones or a simple bridge) to river right and further to the grassland area.

Final solutions about water management need to be balance with a need to maintain healthy riparian habitat along the Santa Fe River on LCOS, while also meeting goals regarding the protection of critical infrastructure around the area. Practical solutions will likely include maintenance work aimed at keeping the main stream channels clear of plants and debris to optimize channel flows during peak events, particularly during the agricultural growing season. Beaver dams will most likely not need to be removed unless they are threatening to erode or damage critical infrastructure during peak flow events.

KEY ASSESSMENT PROJECTS

Certain topics could not be addressed in the (Phase-2) Inventory and Assessment research due to limitations in project scope and budget. The field inventory work and community meetings in Phase-1 helped identify a list of research and planning projects that need further attention after completion of the Management Plan for the La Cieneguilla Open Space. These projects include, more or less in order of priority over time:

1. Site specific study and planning for improved drainage and erosion control along Paseo Real and along the trail on the terrace on river left, leading to an internal work order or an RFP to implement the improvements.
2. Site specific study and planning for site cleanup and safety measures for the Arroyo de los Calabasas area and its banks, including the dump sites, leading to a phased cleanup and site rehabilitation plan.
3. Specific study and planning for the mechanics and procedures of a restorative grazing program and an ongoing managed grazing program, including fencing, contracting, and monitoring.
4. Study of hydrogeological conditions and processes regarding water discharge from the LCOS to downstream irrigation area under current wetland conditions in comparison with (previous) non-wetland conditions. Seasonal and multi-year influences on water delivery regimes downstream.
5. Identification of access rights on the dirt road extending north from Calle Debra along the northeastern boundary of LCOS and the dirt road approaching from the east to the northeastern corner of the LCOS. Questions include: what rights does the County have and what level of neighbor cooperation would need to be required to use existing dirt roads to access the property?
6. Specific study and planning for the development of a detailed Master Plan for the development of trail and park facilities, leading to a possible phased implementation of trails and park facilities, signage, parking, etc.
7. Specific study and planning for the feasibility and community capacity to engage in small-scale, rain-fed agricultural or gardening activities (perhaps in conjunction with a community park facility).
8. Specific study and planning for the implementation of an interpretive education component at LCOS, possible in conjunction with trail connections to BLM lands.

APPENDIX A – LAND SUITABILITY AND LAND HEALTH OF GRASSLANDS

Detailed field research at LCOS focused on grassland and riparian health conditions to anticipate present land suitability for alternative uses and for restoration and maintenance needs. The field research component was based on the NRCS WebSoil Survey and Ecological Site Descriptions (ESD) for the various types of grasslands at LCOS. Field research consisted of visual field observations during a day-long walk through the grassland area, combined with six 100-ft transects with a total of 60 vegetation sample plots (ten per transect) (Figure LCOS-1).

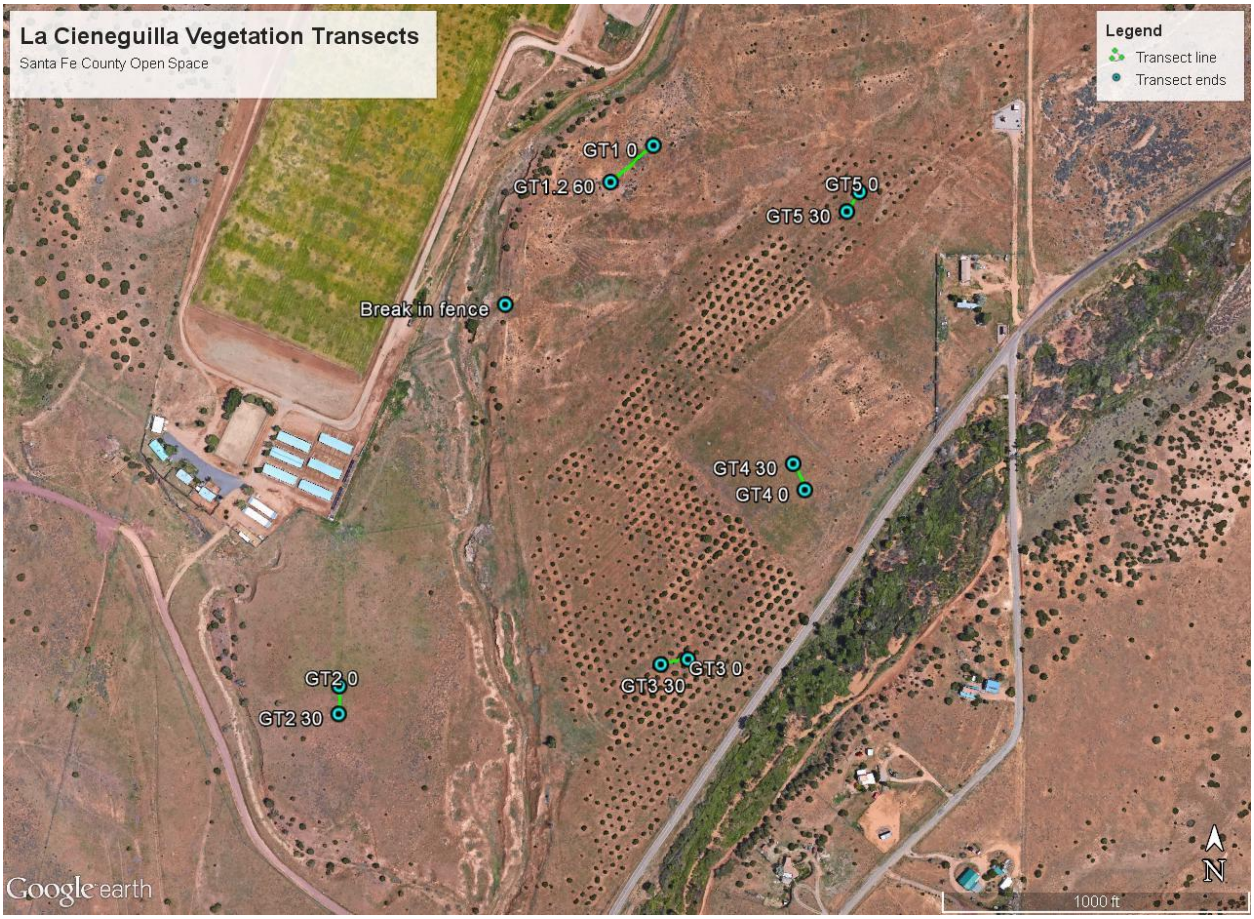

Figure LCOS-1. Google Earth map of La Cieneguilla Open Space with locations of transects used for grassland vegetation sampling.

A summary of findings for the different terrain types includes the following observations and is summarized in Tables LCOS-A-1 and LCOS-A2.

1. Terrain types (soil classes) determine the general grassland conditions. The NRCS WebSoil Survey distinguishes four terrain types:
    a. Pits: a sandy-gravelly soil (mostly graded fill on old river terrace), mostly flat terrain with distinct ridges and closed depressions, draining in westerly direction; located in the most northern and northwestern part of the property along the boundary with the HIPICO Santa Fe

   b. Delvalle-Urban Land Complex: a loamy sand and sandy loam complex of alluvial soils that constitute most of the grassland and terrain with juniper plantings, flat or with a grade of 1%-2%, and draining gently in southwesterly direction, located in the central and southeastern part of the property along Paseo Real (County Road 56)
   c. Walkibout-Innacutt Complex: sandy drainage strips of incised arroyos with steep slopes of the arroyo banks (Arroyo de los Calabasas) located in the southwestern part of the property
   d. Zepol Siltloam: a loamy and fine sandy soil between the two arroyo branches, mostly flat terrain with poor drainage, located in the southern part of the property
2. Soils are mostly sandy – varying between alluvial loamy sand deposits and coarse sand and gravel, which is mostly fill material. Soils are fine to coarse in structure and moderately to well-draining. Estimated soil loss is low due to the relatively flat terrain and the permeable soil quality. Soil loss is highest on loamy soils in the southern part of the property and on the slopes of the Arroyo de los Calabasas. Additionally, wind erosion potential is high on exposed soils with a silt and clay component, which occur mostly in the southern and western parts of the property and in the riparian zone.
3. Vegetation cover on the sandy grassland was consistently more than 50% this year, which is surprisingly high, and dominated by sanddrop seed. However, on the more silty and loamy soil on the southern part of the property, between the two tributaries of Arroyo de los Calabasas, vegetation cover was low and dominated by Kochia.
4. The NRCS WebSoil Survey and Ecological Site Description for the area indicates that the currently dominant vegetation may be a result of grazing impacts that have removed the blue grama and Western wheat grass that would form the climax plants for this landscape type. Past grazing and ongoing heavy browse by wildlife (ungulates and rodents) may in fact be the causes of the current grassland conditions. These conditions seem to be further degraded in the juniper dominated area due to the water absorption by the juniper vegetation. Grassland disturbance and ecological stress has led to a co-dominant – and locally dominant – presence of Kochia and snakeweed throughout the property. Locally, especially in the juniper dominated area and the loamy Zepol terrain unit, bare soil patches occur. The bare patches are crusted, which is probably a result of raindrop splash impacts on the silt component of the soil. Crusting stagnates natural land regeneration; it prevents evaporative losses but also reduces infiltration of precipitation and germination of plants.

The dominant grass species on the LCOS grasslands is sand dropseed (Sporobulus cryptandrus), a warm season grass with good to fair palatability for livestock and wildlife when it is green. The palatability of the grass drops with maturity. Sand dropseed was the dominant grass on all transects except GT2 which was dominated by Kochia (Kochia scoparia), a non-native tumbleweed-like plant that covered 21% of the transect quadrats. Tables LCOS-A2 and LCOS-A3 show summary results from the grassland transect data.

Table LCOS-A1. Summary of findings for bare ground, litter, and rock cover percentages for each transect.

Transect/Site	Bare Ground (%)	Litter (%)	Rock (%)
Transect 1.1 & 1.2 Pits area	31.1	9.7	14.4
Transect 2 -Kochia area	28.9	15.5	2.5
Transect 3-Juniper	49.1	11.9	2.2
Transect 4 - grassland	23.7	11.7	1.1
Transect 5 - grassland	15.4	14.1	1.6
Transect 1.1- Pits (0-30m)	21.2	12.3	11.5
Transect 1.2- Pits (30-60m)	40.9	7	17.3

Table LCOS-A2. Detailed findings of percent cover of species of grass, forbs and woody plants for each transect.

Transect/Site: 1	Pits area	AVG (%)	Total Cover (%)
Sporobolus cryptandrus	Sand dropseed	23.0	46.7
Gutierrezia sarotherae	Broom snakeweed	12.3	
Aristida spp	Threeawn species	4.0	
Ericameria nauseosa	Chamisa	3.3	
Bouteloua gracilis	Blue grama	0.8	
AF-1	Annual forb 1	0.7	
Bidens	Bidens SPP.	0.5	
Heterotheca villosa	Hairy golden aster	0.4	
Chenopodium album	Lambsquarters	0.3	
Elymus elmoides	Bottlebrush squirrel tail grass	0.3	
Eriogonium Spp	Buckwheat SPP.	0.3	
Kochia scoparia	Kochia	0.1	
Muhlenbergia porteri	Ring muhly	0.1	

Transect/Site: 2	Kochia area	AVG (%)	Total Cover (%)
Kochia scoparia	Kochia	21.3	41.7
Sporobolus cryptandrus	Sand dropseed	8.7	
Bouteloua gracilis	Blue grama	5.5	
Gutierrezia sarotherae	Broom snakeweed	4.0	
AF-1	Annual forb 1	1.0	
Muhlenbergia porteri	Ring muhly	1.2	
Transect/Site: 3	**Juniper rows area**	**AVG (%)**	**Total Cover (%)**
Sporobolus cryptandrus	Sand dropseed	12.4	30.2
Kochia scoparia	Kochia	6.6	
Machaernthera canesces	Purple aster var. glabra	4.7	
Gutierrezia sarotherae	Broom snakeweed	3.5	
Heterotheca villosa	Hairy golden aster	1.0	
Ratibida tagetes	Prairie conflower	0.6	
Aristida spp	Threeawn species	0.5	
Juniperus monosperma	One seed juniper	0.4	
Verbesina encelioides	Cowpens daisy	0.3	
Muhlenbergia porteri	Ring muhly	0.2	

Transect/Site: 4	East Grassland area	AVG (%)	Total Cover (%)
Sporobolus cryptandrus	Sand dropseed	39.2	56.0
Machaernthera canesces	Purple aster var. glabra	11.0	
Ratibida tagetes	Prairie conflower	1.6	
Aristida spp	Threeawn species	1.2	
Kochia scoparia	Kochia	1.0	
Panicum obtusum	Vine mesquite	0.8	
Salsola tragus	Tumbleweed	0.5	
Elymus elmoides	Bottlebrush squirrel tail grass	0.4	
Gutierrezia sarotherae	Broom snakeweed	0.1	
Pf-2	Perrenial forb 2	0.1	
Pf-3	Perrenial forb 3	0.1	

Transect/Site: 5	East Grassland area	AVG (%)	Total Cover (%)
Sporobolus cryptandrus	Sand dropseed	46.6	59.4
Kochia scoparia	Kochia	10.5	
Ratibida tagetes	Prairie conflower	2.3	

APPENDIX B – GEO-HYDROLOGY CONDITIONS IN LA CIENEGUILLA

La Cienega Wetlands Study NMBGMR OFR-569
Response to Inquiry from Jan-Willem Jansens re La Cieneguilla Open Space (LCOS) Groundwater Hydrology
November 9, 2015

Jan-Willem,

Thanks for your email and inquiries regarding the recent La Cienega wetlands study (NMBG OFR-569). You present some very good questions (*italic* font) and my responses are found below. First, I'd like to make the following clarification. Field studies for this report were largely confined to the La Cienega area and the springs and wetlands along Cienega Creek and its tributaries. Data from the LCOS are entirely from a 2003-2005 regional study (NMBGMR OFR-511). In 2011, we visited one well downstream in Cieneguilla for a water-level measurement and a groundwater sample and these data are reported in OFR-569. In general, the LCOS area lacks sufficient data for a robust characterization of the shallow groundwater system, its interconnection with the Santa Fe River, temporal variability in water levels and surface discharges, and seepage losses along the Santa Fe River in the LCOS. Many of your questions can be addressed conceptually, but existing groundwater and surface water data are inadequate to support the level of interpretation you are hoping for.

1. *Is our understanding correct that:*

    a. *Groundwater flows in the area of **La Cieneguilla Open Space (LCOS)** are predominantly originating from the northeast (north of Agua Fria area) and not so much from the east (Arroyo Hondo/Chamisos/Cienega complex)?*

Yes, GW flow in the area of LCOS does originate from the northeast, but **from a mixture of 2 sources**: (1) recent recharge from channel infiltration of runoff (precipitation and snow melt) along the length of the Santa Fe River corridor, not just north of Agua Fria; and (2) up welling of deep groundwater from the regional Tesuque aquifer as flows approach the edge of the basin at the Rancho Viejo hinge zone, which intersects the Santa Fe River valley about 1 mile downstream from the southern boundary of the LCOS. Groundwater flow from the east discharges from the Ancha Formation primarily or entirely into the La Cienega streams, springs and wetlands and does not contribute to groundwater flows in the LCOS. In the LCOS, the Ancha Formation is only saturated along the Santa Fe River corridor. The Santa Fe River in the LCOS is a losing stream that locally recharges the shallow groundwater system.

    b. *Groundwater flows in the area of La Cieneguilla Open Space (LCOS) are predominantly flowing to the west/southwest away from the Santa Fe River rather than toward La Cieneguilla and La Cienega?*

Groundwater outflow from the LCOS area is a little more complicated than you are depicting. Focused recharge along the Santa Fe River corridor locally saturates the underlying Ancha Formation and is superposed onto the regional Tesuque aquifer. Conceptually, two things likely occur: (1) some groundwater in the shallow Ancha aquifer flows south-southwest beneath the Santa Fe River channel, within the area of the active floodplain, and down the Santa Fe River canyon; and (2) some groundwater

in the shallow Ancha aquifer is entrained into regional westward flow toward the Rio Grande. As mentioned above, existing data are inadequate to robustly characterize the surface water and shallow groundwater flow systems and the magnitudes and proportions of south-southwestward sub-channel flow and westward regional flow are unknown.

> *c. Surface water flows in the Santa Fe River in the area of the LCOS are infiltrating rapidly into the water losing reach of the Santa Fe River at LCOS and then flowing underground to the west rather than toward La Cieneguilla?*

See response to question 1.b above. The amount and rate of surface infiltration from the Santa Fe River to the underlying alluvium and Ancha Formation is unknown. Historic seepage data are inadequate to quantify infiltration rates or to precisely define where the river channel transitions from losing to gaining conditions. The NMOSE seepage studies noted significant uncertainties in the precise location of this surface-water transition zone (see OFR-569, Fig. 18, page 44), which is estimated to occur near the southern boundary of the LCOS.

Ethan Mamer, a hydrogeologist at the Bureau of Geology, is interested in testing a new method of locating and quantifying surface water infiltration. The method requires digging a shallow trench along a streambed, and burying a pair of fiber-optic cables. An instrument (a Distributed Temperature Sensor) is attached to these cables that can determine the temperature of the cable, every meter, along its entire length. Using the thermal profile of the stream bed collected from the trenched fiber-optic cable we can quantify the rate at which groundwater is infiltrating, and locate where it is occurring. It may be possible to install these paired cables upstream of the WWTP while the stream bed is dry this winter, and prior to spring snow melt. From this record we may be able to infer what the infiltration rate downstream of the WWTP is with better certainty.

> *d. The role of water flows from the WWTP in surface- and ground water volumes reaching La Cieneguilla and the SF River near La Cienega is insignificant, even in the winter. (If I understand this correctly, what is your explanation for this? Is there hardly any surface water from the WWTP flowing down the SF River to La Cienega?)*

This statement is **incorrect** (the SF River does not flow to La Cienega). You are applying to Cieneguilla my statement regarding no contribution of WWTP outflow to discharge at La Cienega. We see no chemical or physical evidence that treated waste discharge contributes to groundwater discharge at springs and wetlands **along Cienega Creek**. However, there is both chemical and physical evidence that WWTP outflow to the Santa Fe River channel provides focused recharge to shallow groundwater beneath the river; and that some shallow sub-channel groundwater flow contributes to downstream discharge along the gaining reach of the river south of LCOS. The physical evidence that WWTP discharge contributes to shallow groundwater beneath the Santa Fe River at Cieneguilla includes the recharge mound along the river corridor and channel-parallel groundwater flow (see OFR-569, Fig. 22, page 52). The chemical evidence includes: (1) elevated chloride, elevated chloride-bromide ratios, and a relatively young groundwater age from ^{14}C and tritium content in Cieneguilla well water (OFR-569, Figs. 33, 35 on pages 72, 75); and (2) a strong evaporation indicator in the stable isotope composition of Cieneguilla spring discharge (OFR-569, Fig. 34, page 73). These chemical data are notably unique from those observed at La Cienega sites and indicate that WWTP discharge contributes significantly to both shallow groundwater and spring discharge at Cieneguilla.

2. From the point of view of hydrogeology does it make sense to harvest water locally at the LCOS for downstream irrigation uses by:

I'm not sure I totally understand your vision to "harvest water locally" in light of the complex surface water-groundwater interaction, the influence of regional groundwater flow at the LCOS, and the need for downstream irrigation deliveries (what's "downstream": Cieneguilla? Cañon?). I don't understand the management priorities for surface water and groundwater in the Santa Fe River downstream of the WWTP or locally in the LCOS. A few thoughts on the local hydrology and water balance that may help the discussion are included below.

a. Establishing systems for water harvesting, infiltration and aquifer recharge (perhaps even reinjection) at LCOS?

This scenario maximizes aquifer storage and minimizes surface flow. What do you want to achieve in your management plan?

b. Encouraging and preserving the establishment of beaver ponds on the LCOS?

This scenario might balance contributions to aquifer storage and surface flows by temporarily holding water in the "waste-watershed" to encourage more infiltration while allowing some (likely less) surface flow to move downstream in the short-term, or maybe more downstream flows in the long-term as groundwater storage is slowly increased below the LCOS. From my limited observations, this scenario seems politically more difficult and hydrologically more uncertain, particularly since beaver are rather independent minded creatures that work outside of management plan objectives.

c. Maximizing Santa Fe River flows and alluvial infiltration across the flood plain?

This scenario would also balance contributions to aquifer storage and surface flows. Sounds great! How would you achieve "maximizing Santa Fe River flows" (?), with the options listed in #3 below?

3. What options might Santa Fe County consider in order to ensure increased surface and subsurface flows in the Santa Fe River to downstream users? For this purpose (in #3), would it make sense to:

These scenarios require in-depth analyses, which are best done by a private sector hydrologic consultant. I am not comfortable formulating a response to questions 3 and 4.

a. Reduce evapotranspiration (remove bosque vegetation)? Th

b. Eliminate or, instead, increase beaver ponds?

c. Capture and pipe rainwater down to the water gaining reach of Santa Fe River in La Cieneguilla?

4. Would it make sense to invest in runoff management on the higher grassland ridge to the west and in the Arroyo de Calabasas in an attempt to increase flow volumes downstream in the Santa Fe River, either by

I will venture a comment here in light of the hydrologic effect of climate change to increase precipitation well beyond the 100-year event. Considering the area of the lower Santa Fe River watershed and the potential for large (100s of cfs or more) flows, the Cieneguilla community would be well served if future management plans were to include ways of accommodating very large, short-term events. Engineering methods that slow down and spread out water, and maximize infiltration, can better manage large flow events while enhancing aquifer storage and moderating downstream flows. Just a thought.

a. Slowing down water and forcing it to infiltrate?

b. Speeding up water to flow downstream to the water-gaining part of the river?

5. What is the influence (in decreasing order of importance) of the following factors on surface water and groundwater flows through the LCOS?

All of these scenarios, except perhaps beaver ponds, exist/occur now and always will. These comments are directed only by my sense of how significant each factor may be in the local/regional water budget (groundwater and surface water). Ultimately these factors, and the surface water and groundwater water budgets, need in-depth analysis from consulting or government hydrologists.

a. Climate (change)

CC is the wild card. We don't know what will happen when, but can depend on more extreme wet-dry cycles marked by long-term, severe drought and intense flooding. Precipitation, runoff, recharge potential all increase, but (we anticipate) will be separated by longer periods with minimal to no moisture. Rivers, streams, wetlands, ecosystems and communities will have to accommodate reversals between positive (too much) and negative (too little) water budgets.

b. Upstream diversions (city, county, and domestic wells)

First on the water budget list. This factor encompasses both surface water diversions, past/present groundwater diversions and the transient effects of long-term loss of aquifer storage. This is the primary, long-term negative water-budget impact and requires a regional management strategy.

c. The SF WWTP

Third on water-budget list. WWTP discharge will continue to provide a hydrologic opportunity. For the LCOS and lower Santa Fe River it can provide a steady base-flow supply to help attenuate shifts between extremes.

d. Beaver ponds in the SF River on the LCOS

Natural (beaver ponds) and engineered means of temporarily holding surface water in the lower Santa Fe River above the lower canyon provide long-term management options for local groundwater recharge and for promoting a reduced, but more persistent, long-term downstream surface supply.

e. Riparian vegetation (evapotranspiration) in the SF River on the LCOS

Second on water-budget list. OFR-569 demonstrated that riparian ET is a significant water-budget component in the Leonora Curtin wetlands. However, how effectively ET "losses" can be positively influenced by vegetation management, while maintaining the desired ecological habitats, is still uncertain. Managing riparian ET for a positive hydrologic and ecologic response must be possible, but how to accomplish that and predict the outcomes is outside of my field of expertise.

APPENDIX C – ALL OPEN SPACE PROPERTIES: LAND SUITABLITY GOALS

Primary Goals for Land Suitability Assessment and Master Planning include:

a. Minimization of Upfront Development Costs and Complexities
   - Length and area of disturbance: costs of road development, paving, fencing
   - Engineering and earth moving requirements: topography, cut&fill, bridges
   - Soil suitability, drainage, vegetation disturbance/removal

b. Minimization of Mitigation and Restoration Costs due to Resource Disturbance
   - Disturbance of cultural and historical sites
   - In appropriate use (waste) of, disturbance of or cumulative negative effects on natural resources
   - Susceptibility to erosion after disturbance
   - Scenic quality impacts (viewshed disturbance; e.g., views on/over parked cars)

c. Public Safety Optimization
   - Safe line of sight at road intersections
   - Public visibility of public areas (avoidance of illicit activities; social surveillance and control of nuisance behavior: dumping, shooting, theft, harassment, etc.)
   - Safety regarding terrain features (flood hazard, wildfire hazard, steep or unstable slopes, gullies, dump sites, hazardous mine pits, proximity to shooting areas, etc.)

d. Experiential Quality Optimization
   - Richness of experiences (e.g., diversity of view shed, and micro-texture of the land, such as vegetation types and specific things to see/experience)
   - Options for different (trail) users (e.g., trail extensions; distance variations, destinations, trail connectivity)
   - Diversity of user groups for which the land use scenario is appealing

Santa Fe County Open Space Management Planning Initiative

A Maintenance Plan for the La Cieneguilla Open Space Property
Santa Fe County, New Mexico

FINAL DRAFT
June 30, 2016

La Cieneguilla Open Space maintenance needs are highest in the riparian area

Ecotone

Conservation Planning for Landscapes in Transition

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INTRODUCTION

This Maintenance Plan documents recommended maintenance activities for the La Cieneguilla Open Space (LCOS) property in La Cieneguilla, in Santa Fe County, NM, based on the analysis of findings and community feedback during a general inventory phase and a more detailed field characterization phase. The purpose of this document is to provide a detailed maintenance plan, which includes projected needs for labor and equipment, as part of the Management Plan for LCOS. This Maintenance Plan also makes strategic recommendations for the frequency, timing, and human capacity options Santa Fe County may want to consider to implement the maintenance activities.

VISION STATEMENT, GOALS AND OBJECTIVES

The following vision statement for the LCOS Management Plan is based on the La Cienega and La Cieneguilla Community Plan (2015), feedback from community meetings, and other input from stakeholders.

> *In 2025, the La Cieneguilla Open Space is a healthy ecosystem with native grasslands, a flowing river, clean water, irrigation water, and high-quality native wildlife habitats. Wildlife pathways connect to the larger landscape. The open space is managed holistically so that the land and water resources are protected, monitored, and maintained; the cultural resources are protected; and there are educational opportunities for the public to learn about the land, water, ecology, human history, and past and current uses of the place.*
>
> *It is possible that the LCOS includes one or more trails, including a trail to improve the safety of walkers and bikers. The area may also include family-friendly, safe outdoor recreation opportunities for neighborhood residents and their children. It may also include agricultural activities that protect and regenerate the grasslands.*
>
> *Local residents, especially youth, are actively involved in the maintenance and stewardship of LCOS.*

Based on this vision description, the central management goal for LCOS would be:

> *Santa Fe County and the community of the Santa Fe River valley around La Cieneguilla collaboratively maintain and enhance the land and water resources of LCOS for wildlife, recreation, education, and other low-impact uses. LCOS is managed in such a way that gradually opportunities are developed for interpretive education, research and public education, and low-impact recreational uses by neighborhood families and the public, at a scale that requires little maintenance, encourages local community stewardship, and protects the land and water.*

Specific management objectives in support of this vision and central goal would be:

1. Manage the property in a way that the different values and objectives are balanced as a whole – holistically – (and not one despite another), and that improvements and changes are introduced in a gradual way, and seek and maintain optimal working relationships with neighbors and other local stakeholders
2. Enhance public safety, for example by cleaning up old waste dumps, maintaining appropriate fencing of flood zones and steep slopes, developing a trail along Paseo Real, and installing non-obtrusive lighting when park facilities are developed
3. Control access by maintaining roads, trails, fences, gates, stiles, fords, and other river crossings, and signage
4. Maintain the area's natural appearance, sweeping scenic views, and cultural-historical qualities, keep maintenance limited, and maintain a rural, natural visual quality by using natural design principles and natural materials, and by choosing deliberately when to let nature run its course
5. Provide and maintain interpretive education, and explore and use educational and research opportunities
6. Develop basic infrastructure such as community gathering areas and play areas that are as natural and low-maintenance as possible
7. Maintain the ecological health, resilience, and productivity of the LCOS uplands and riparian area, and maintain wildlife habitat qualities and connectivity across the landscape
8. Explore and use – when appropriate – managed, restorative grazing practices (and rest periods) as a way to improve grassland health and respond to the need to develop an agricultural use for County Open Space properties
9. Evaluate the removal of some junipers to improve the regeneration of the grasslands while maintaining visual benefits

Management decisions, including maintenance activities, should be made in the spirit of the vision, aimed at meeting the central management goal, and in adherence to the specific objectives for the LCOS.

TERRAIN MANAGEMENT UNITS

Maintenance activities are often strongly related to specific terrain characteristics. The Land Suitability Map developed in Phase-2 for identifying appropriate uses for the different types of terrain was based on the identification of Terrain Management Units, and the Suitability Map describes the Terrain Management Units. The same map will be used in this plan to identify the Terrain Management Units as a basis for identifying maintenance activities (Figure 1). Table 1 lists the Terrain Management Units and their regular maintenance activities.

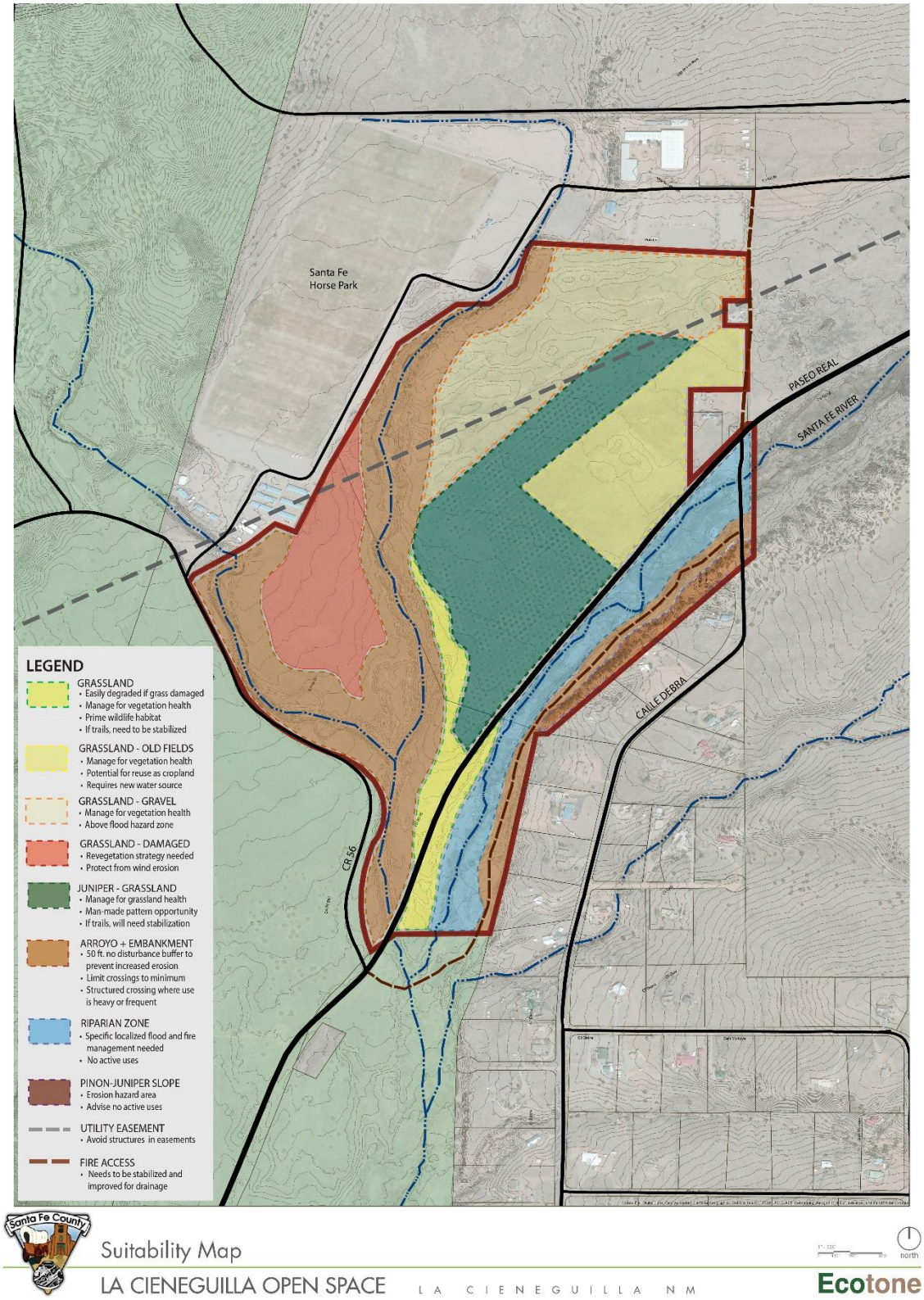

Figure 1. La Cieneguilla Open Space – Terrain Management Units Map

Table 1. Overview of Terrain Management Units and anticipated regular maintenance activities.

Mgmt Goals	Terrain Management Unit	Anticipated Regular Maintenance Activities	Maintenance Frequency
1	All Terrain Management Units	Communication and outreach with neighbors and stakeholders and integrate feedback in planning	Quarterly
2, 3, 5, 6	All Terrain Management Units	Inspection and repairs of: a. Fences, gates, and stiles b. Culverts, stream crossing c. Roads, trails d. Signage	a. Annually b. Monthly c. Quarterly d. Annually
7, 8	Grassland – Gravel Unit: upland gravel terrace (LC-GRA-G)	a. Invasive species inspection b. Managed grazing	a. Annually b. Annually after yr 3
7, 8, 9	Grassland-Juniper Unit: Juniper area (LC-GRA-J)	a. Invasive species inspection b. Managed grazing c. Gradual juniper removal and reseeding	a. Annually b. Annually after yr 3 c. Periodically, after careful planning
7, 8	Grassland – Old Fields Unit: former pastures (LC-GRA-F)	a. Invasive species inspection b. Managed grazing	a. Annually b. Annually after yr 3
7, 8	Grassland-Pasture Unit: lower grassland strips (LC-GRA-P)	a. Invasive species inspection b. Managed grazing	a. Annually b. Annually after yr 3
7, 8	Grassland-Dry/Damaged Unit: loamy rangeland (LC-GRA-D)	a. Invasive species inspection b. Restorative and after that managed grazing and reseeding where necessary	a. Annually b. Annually after yr 3
2	Arroyos Unit: arroyos with buffer zone (LC-ARR)	a. Invasive species inspection b. Cleanup and grading c. Restorative and after that managed grazing and reseeding where necessary	a. Annually b. One-time, and inspect annually c. Annually after yr 3
7	Riparian Unit (LC-RIP)	a. Removal of dead wood b. Removal of invasive plant species c. Channel cleaning; removal of debris d. Culvert cleaning e. Moving / maintenance of	a. Annually for 2-3 years and then as needed by volunteers b. Annually c. Twice annually d. When needed /

		pond levelers f. Tree protection g. Fence repair and inspection	at least twice annually e. When needed f. Annually g. Annually
7	Woodland Unit: Piñon-Juniper Slope (LC-WOO)	a. Trail on terrace on river left inspection and drainage maintenance b. Thinning/pruning of junipers c. Erosion control (e.g., using slash from thinned and pruned trees)	a. Annually b. Once in 3-5 years c. Once in 3-5 years

UPLAND MAINTENANCE ACTIVITIES

There are no immediate needs for maintenance or ecological restoration work in the upland (grassland and juniper) area. However, there are numerous aspects to the grasslands that would require maintenance and restoration over time. These include:

- Grassland improvement:
  - soil conservation for the protection from wind erosion
  - removal of weeds and invasive species (mostly Kochia, snakeweed, and Russian thistle/tumbleweed)
  - improvement of grass cover
  - juniper removal (gradual)
  - reclamation of the southwestern loamy rangeland area

- Waste and pollution management:
  - removal and reclamation of construction debris/waste dumps (see Figure 2)
  - protection from pollutants escaping from HIPICO Santa Fe (a.k.a. The Horse Park)

- Fencing:
  - fencing improvements would prevent dumping and make the grassland better suitable for grazing
  - fencing along the Paseo Real (County Road 56) could be altered to benefit wildlife crossing between grassland and riparian area

Grassland Improvement

Restorative, managed grazing could benefit the ecological health of the grasslands, offer some community benefits, and reduce long-term maintenance cost for weed and erosion control. Grassland health conditions are probably best achieved with a combination of managed grazing and gradual juniper removal. After a period of several years of restorative grazing (e.g., with goats), the grassland could from time to time be used as a grazing area for local ranchers.

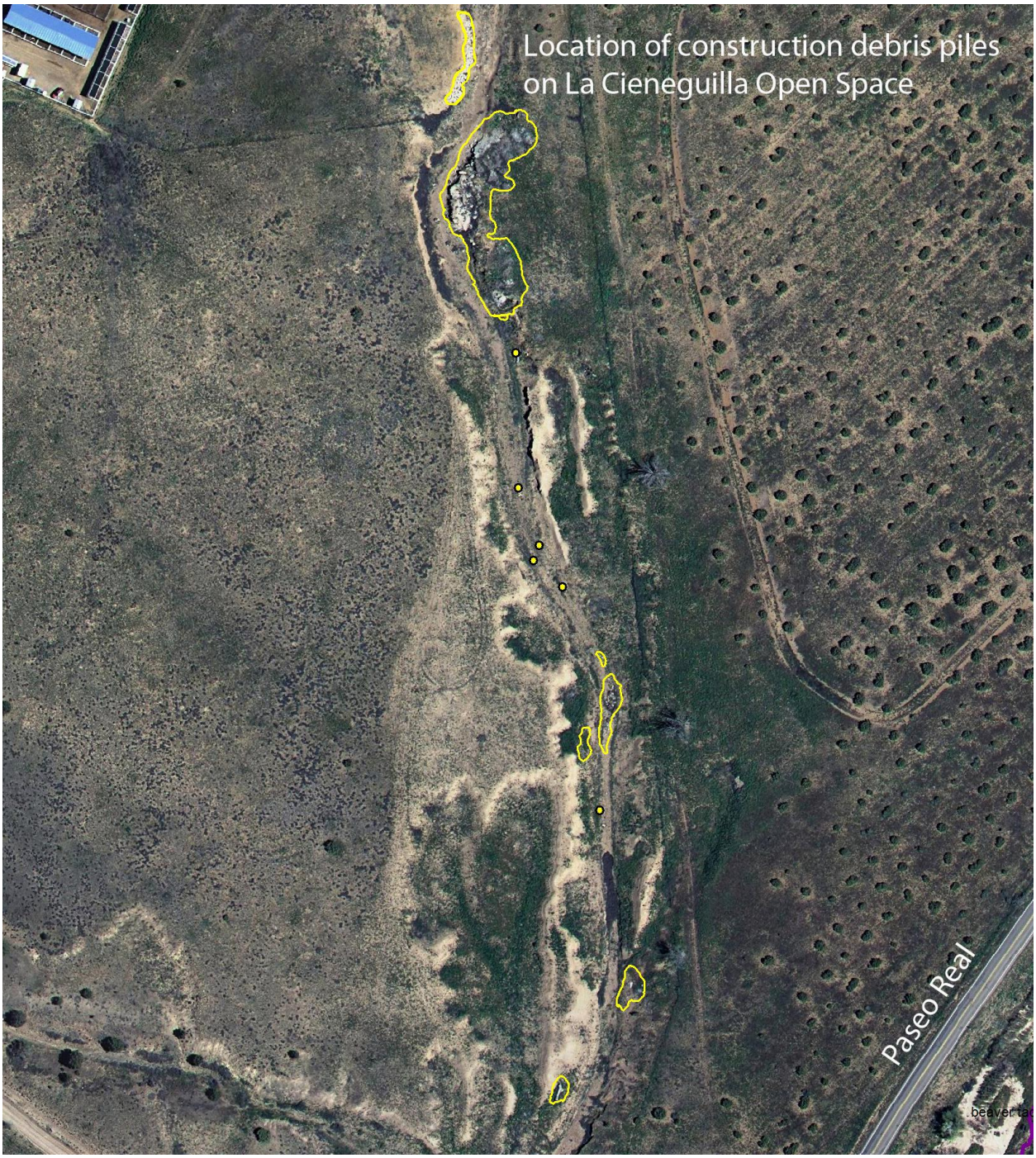

Figure 2. Location indications for the most important waste dump piles along Arroyo de las Calabasas.

It will be important to define grassland health goals and annually monitor grassland health conditions. Consequently, grazing will have to be managed well to prevent overgrazing and degradation of vegetation and soils. In absence of water rights, stock tanks will need to be

refilled with water delivered by the grazing lessee and cross-fencing will need to be brought in to facilitate rotational grazing.

Gradually, the juniper area could be converted to grassland as well, but care must be given to evaluate the current ecological benefits of the juniper (esp. wind protection for erosion control), and conversion to grass may require irrigation. Some stakeholders also appreciate the juniper area for visual quality and as a visual buffer concealing the HIPICO Santa Fe facilities.

A detailed overview of suggested maintenance activities is included in Tables 5 and 6. These tables will be available in spreadsheet format for convenient adjustments and tracking of maintenance and repair activities.

Waste Dump Removal

Numerous large waste dump piles line the Arroyo de las Calabasas and its embankments (see Figure 2). The Ecotone team estimated the total volume of the waste dump material to be at least 1,500 cubic yards. The waste material consists mostly of discarded construction debris, including mixed debris (30% or 453 cubic yards) and concrete debris (70% or 1,055 cubic yards).

The Ecotone team recommends that Santa Fe County focuses debris removal efforts on the four largest piles. Removal work will require heavy equipment, notably a backhoe and dump truck. The area is best accessed with this equipment from the west (County Road 56C). We assume that the waste material would be hauled to the Santa Fe County landfill. In our cost assessment, we assume that there would be no tipping fees to the hauler because this would involve a County activity.

RIPARIAN AREA MAINTENANCE ACTIVITIES

The primary maintenance concern for the riparian zone involves reducing the risks of flooding of Paseo Real and Calle Debra while at the same time preserving the wildlife habitat functions of the river forest. The flow of water from the City of Santa Fe Wastewater Treatment Plant that tends to have high nutrient levels and the relative absence of high velocity flows promotes a riparian forest that becomes overly dense. The maintenance recommendations suggest periodic removal of dead woody debris and thinning of non-native and selected native plants to keep the stream channel open and able to transport larger floods without compromising the nearby roads or the health of the wildlife habitat.

Woody Debris

Woody debris can clog culverts and channels and get caught in the stems of patches of willows near the river channel. When woody debris builds up in specific areas the result can clog up the channels and culverts and cause flooding in nearby areas. Flooding can cause the roads and bridges to be damaged or become unusable.

The culverts under Calle Debra already have grates placed over them to prevent beaver from clogging them and stopping flow. The culverts need periodic visual inspections (1 time per month) and for the grates to be cleared when necessary.

Periodic floods will mobilize woody debris and cause the material to get lodged in the thickets of willows near the river channel in a process called "racking" (see Figure 3). When this material builds up on one side of the flow, the river may concentrate on the opposite bank and / or cause flooding, bank erosion and damage to road infrastructure. Large piles of racked woody debris need to be removed periodically to enable larger floods to pass through the river channel without causing damage to nearby roads. The woody materials can be put in small piles and burned (approximately 6 feet wide and 6 feet tall) or hauled off site. Cutting and burning is best done in the late fall or early winter after the first snowfall.

Figure 3. A 4-foot tall pile of woody debris cause in a stand of willows on the left back of the Santa Fe River. (photo by R. Schrader)

Tree Thinning & Protection Prescriptions

The purpose of thinning the trees is to reduce flooding risk of nearby roads, improve the health of the river forest by removing non-native trees or upland native trees in wetland areas, and help maintain efficient transport of water through the area to downstream water users. The vegetation types and conditions that call for thinning or protective treatment are:

A. Removal: Non-native Russian olive, tamarisk (saltcedar) and Siberian elm
B. Removal: Large stands of mostly dead willows (*Salix exigua* or Coyote willow)
C. Removal: Native upland trees such junipers that have encroached in the riparian area should be removed because they lead to drying of the wetland ecosystem.
D. Protection: Cottonwoods and Goodding's willow are two tree types that are very important to keep and protect as they are relatively uncommon and are native to the area. Protection should include caging to protect them from beaver.

The Ecotone team suggests that the thinning areas be identified and flagged by a contractor due to the challenge of identifying different tree species, particularly when there are few or no leaves on the trees. In addition, the team suggests a gradual approach for thinning that can happen in several phases rather than a large-scale, one-time thinning project. A phased approach enables Santa Fe County to monitor and adapt the thinning work as it proceeds to make sure visual quality, habitat, and flood control objectives are met.

A. Remove Non-native trees (Russian olive, tamarisk and Siberian elm)
The non-native deciduous trees put out seeds prolifically and have rooting strategies that make them more successful at germinating and growing than some native trees. We suggest the following prescription to remove these trees:

- Cut the trees close to the ground during the fall or winter and lop the branches and stems into 3-4 foot long pieces and create small piles for hauling off site or burning.
- Use a very targeted method to apply herbicide to the cut stump of the tree. This can be done using a paint brush or a squeeze bottle. A non-toxic herbicide is preferred in aquatic areas, such as Santa Fe River floodplain – please see below.
- If conventional herbicides are used, the ideal ones are Roundup (Glyphosate with a half-life of 90 days depending on temperature) or Garlon 4 (Triclopyr with a half-life of 60 days). No or very little herbicide contact occurs with soil, water or non-target plants and organisms may occur when handled carefully.
- Recut and treat resprouts for up to 5 years. Conventional herbicide treatments range from 50 to 90% effective in the first year so retreatment is very important.
- If using herbicides in the floodplain it is suggested to use "aquatic approved" versions, which are considered by the EPA to be safe to apply near or in water without damaging fish or other aquatic species. Aquatic approved herbicides usually cost more than non-aquatic versions.
- The preferred herbicide in areas near streams is a 20% vinegar solution that can be sprayed or brushed on cut stumps. The strong vinegar can be purchased for $13-$25 per gallon from a variety of sources including San Jacinto Environmental Supplies, Maestro-Gro or Factory Direct Chemicals. This method's success rate is roughly 50% and will have to be repeated or combined with repeated trimming of sprouts or covering of the stump with 60-mil tarp for lasting success.

- Stumps can be covered with 60-mil black tarp to starve them from sun light and prevent resprouting. This method is not common in New Mexico, but has been used in Europe, and preliminary tests in New Mexico show that it is very effective, though labor intensive.

B. Thin large stands of dead willows and selected stands of live willow (Salix exigua or Coyote willow are the most common)

Willows have grown thick in many places and during drier periods large stands have died off (see Figure 4). Willows have roots that can grow underneath and underlying the river, the benefit of which keeps the bed of the river from eroding but also has a negative effect during drier periods as the channel may become clogged with the plant. Thinning is needed in dense, large stands of willows in two different areas, in the dead or mostly dead thickets and in carefully selected stands of plants on edge of the river.

Figure 4. The dark grey pile consists of mostly dead willows. (Photo by Rich Schrader)

Prescription for removing willows in dead thickets

- Remove stems fairly aggressively with 90% to 100% of the stems cut in 30 – 50 foot diameter areas.
- Focus on removing all dead stems. If any stems of willow are left leave the very small diameter willows that have a more reddish color than the darker, grey, larger diameter stems (greater than 1 inch).
- Pile the materials 6 feet wide by 5 feet tall next to or on the trail on the terrace on river left for burning or for hauling away.

Prescription for thinning the willow patches on the edge of the river

- Remove willow patches that encroach into the channel and narrow the channel and/or tend to cause "racking" (i.e., catch woody debris). In places where the channel is heavily overgrown, remove no more than 50% of stems in alternating lengths of 40 feet along the length of the river. The purpose is to create a patchiness of the thinning and to prevent long lengths of the river from becoming exposed to sunlight which can cause water temperatures to rise excessively and harm fish and aquatic insects.
- Focus on removing the larger diameter (over 0.75 inch diameter stems) and leave more of the small diameter stems.
- Pile the materials 6 feet wide and 5 feet tall for burning or for hauling away.
- The Santa Fe County fire crew has said that they cannot use chainsaws within 6 feet of the river. So, the willows by the channel will need to be cut by hand or with chainsaws by an approved contractor or Open Space staff.

C. Keep and protect Cottonwoods and Goodding's willow trees

The cottonwood and Goodding's willow trees are relatively uncommon and are native to the area. The Goodding's willow is easy to mistake for a Siberian elm in the wintertime. So, it is important to identify the tree and mark them to prevent them from being cut. The cottonwood with its soft bark is the preferred food and building material for beaver. The trunks of some cottonwoods have been surrounded be wire fencing to prevent beavers from cutting down the trees. More fencing needs to be installed. The trees that have already been protected with wire need inspection every 2 years to see if the wire needs to be expanded as the tree grows.

Figure 5. Bark of a Goodding's willow tree.

D. Native upland trees (primarily junipers but possibly chamisa shrubs also)

Juniper and chamisa are plants that generally occur in drier upland areas. Removing them from the riparian area can be appropriate when they are found to be crowding out native riparian trees. When they are not growing densely or are found far away from the river channel removing them is not necessary.

Disposal of Wood Waste Material

Woody material cut and removed from the riparian area could be disposed of in a variety of ways. It is conceivable that fresh or dried wood material could be (1) offered to the wood cutters as part of the compensation for their work; (2) distributed among local residents in the community; or (3) pile burned once every 3 years. Dead wood from species that are not suitable for firewood should be (1) pile burned every 3 years or (2) hauled to a landfill. The latter option is recommended in particular for root material of invasive species, such as Russian olive, tamarisk, and Siberian elm. Brush and slash from shrubs and branches cut from trees could be (1) chipped for use on trails or (2) piled and burned every 2 to 3 years.

Table 2. Inspection and Maintenance Recommendations for the LCOS Uplands Area (Terrain Management Units LC-GRA-G/J/F/P/D and LC-ARR).

MAINTENANCE ACTIVITY	AREA & LOCATIONS	FREQUENCY	LABOR & COST ESTIMATE
Fence inspection and repair	Exterior fence of upland area (approx. 10,500 ft)	Annually	Annually, 1-2 days for two people
Managed (rotational) grazing	LC-GRA-G/J/F/P	Annually (for a few weeks) after year 5	TBD: based on bid
Juniper removal	LC-GRA-J	Annually (a few acres/yr) after year 5	2 full days for a sawyer and one swamper
Waste dump removal	LC-ARR	Once or in several entries spread over time	115 dump trucks (1,377 cu yards and 12 cu yards per dump truck); @$150/load > $17,200

Table 3. Inspection and Maintenance Recommendations for the LCOS Riparian Area (Terrain Management Unit 7).

MAINTENANCE ACTIVITY*	AREA & LOCATIONS	FREQUENCY	LABOR & COST ESTIMATE**
Removal of clumps of dead willow and dead wood and woody debris along channel	Selected areas: approx. 20% (4 acres) yearly	Yearly, starting Yr-1	$750-$1,200/ac = $14,175-$22,680 (for total area)
Removal of invasive species	Selected sites: where necessary	When need arises	TBD
Piling and burning	Entire riparian area (approx. 18.9 acres)	One time	TBD
Inspections on foot (one person)	Entire riparian area (approx. 18.9 acres)	Weekly x 30; monthly x 5	4 hours for one person each time: 140 hours/year
Annual vegetation management, including pile burning in fall; 4-5 yr rotations	Selected spots across the entire riparian area (approx. 4 ac/yr)	Twice yearly; late winter (Feb-Mar) and fall (Nov)	$250-$450/ac = $4,725-$8,505 for a contractor; or 5 days for 2 crew members (80 h)
Calle Debra culvert cleanout and repairs	Calle Debra: all culverts	Annually (perhaps 4 times/y)	Based on bid and scope & scale OR approx. 64 h/y for County crew
Calle Debra road repair	Calle Debra road bed and berms	Annually and when needed	Based on bid and scope & scale
Calle Debra road bed redesign and reconstruction	Calle Debra road bed and berms	One time: TBD	Based on bid and scope & scale
Caging of trees + maintenance (initial installation done already on many trees)	Selected spots; 25-40 trees/yr	Check every 2 years in spring if widening is needed	Based on bid and scope & scale; or approx. avg. 1 day/yr for two people (or volunteers/students)
Pond leveling device maintenance	Selected spots	When needed	4-6 crew member days per year; requiring lifting equipment
Beaver dam removal, bank stabilization, and fence repair	4 locations along Paseo Real	One time: TBD	Based on bid and scope & scale (prob. $4K-$5K)
Trail on terrace (see below)			

*) Contracts for willow and deadwood removal can be offered to contractors that specialize in riparian or stream restoration work, so that they can benefit from the willows they cut to transplant them elsewhere.

**) Thinning and pile burning costs based on State Forestry rates per acre plus contingency factor of 25%.

PINON-JUNIPER SLOPE AREA MAINTENANCE

The November 2015 field assessment revealed that the trail on the terrace on the east side of the riparian area needs considerable repair at several places to allow it to shed stormwater and to prevent further flooding and erosion. Even after the proposed repairs, the trail will need to be maintained annually.

Table 4. Inspection and Maintenance Recommendations for the Pinon-Juniper Slopes and Terrace on River Left (Terrain Management Unit 8).

MAINTENANCE ACTIVITY*	AREA & LOCATIONS	FREQUENCY	LABOR & COST ESTIMATE**
Remove berm to allow trail to drain off the banks and mitigate ponding after rainstorm and snow melt; import fill and regrade trail bed	Below entrance gate from Calle Debra	One time; annual maintenance	$500 - $600 for fill incl. delivery; $500-$1,000 for heavy equipment and operator; Total: $1,000-$1,600
Remove berm to drain trail; bring in fill dirt; increase trail elevation with 18” over a length of 100 yds (approx. 200 cu yd of fill = 20 short dump trucks); crew work includes grooming, sowing, raking and placing slash for cover	Approx. 1,200 ft down from Calle Debra	One time; annual maintenance	$5,500 - $6,000 for fill incl. delivery; $2,000-$2,500 for heavy equipment; $100 for seeding; $500 for crew; Total $8,100-$9,100
Install culvert to drain the arroyo coming from the east under the trail; remove boulder in the channel headcut; rebuild trail and banks and fill part of the channel to the current height of the boulder; regrade to direct flows to another (parallel) channel that runs 10’-15’ to the NW of the eroded channel and clean out this channel to enhance flows.*	Approx. 1,350-1,400 ft down from Calle Debra *	One time; annual maintenance	$4,000-$5,000 for equipment; $1,000-$2,000 for supplies; $2,000-$2,500 for. Total cost range: $7,000-$9,500.

*) The main problem at this location is that the trail on the terrace on river left is undermined by steep stream banks (2 successive 8’-10’ vertical banks, only 4’ from trail’s edge) and an eroding channel headcut. This situation is aggravated by a boulder that splits incoming flows that gather at headcut, sending one flow in a direction that scours the bank. This erosion condition coincides with a little arroyo channel flowing from east through the steep piñon-

juniper slopes. The job will require the use of an excavator with a thumb-bucket. Supplies include 20’ of 12”-culvert pipe and 2 tons of angular rock. A hand crew is needed to lay the culvert, build a culvert inlet protection with rock and an outflow protection with brush matting, and complete grooming, wood removal, seeding, raking, and placing slash for ground cover.

Table 5. Summary of Recommended Maintenance Activities for Different Time Periods.

Location Code	Management Activity	Location & Area Size	YR1	YR2	YR3	YR4	YR5	YR6-10	YR11-20	>YR20	Team	Logistical Needs	Labor & Cost Estimate
Entire property	Fence inspection and repair (all exterior fence)	Entire upland area: approx 10,500 lf									SFC-M (Crew)	Notepad/GPS (Avenza), camera	Annualy, 1-2 days for 2 people (16 hours)
LC-GRA-G/P/J/F	Managed grazing (select acreage yearly; a few wks/yr)	Rotations in pastures; area size TBD									Contractor	Community notification	TBD; based on bid
LC-GRA-J	Juniper removal (select area yearly)	Juniper area, unit 2, approx. 25 acres									Contractor or SFC Fire Dep	Community notification	A few acres/y; 2 full days for two people (16 h) or TBD; based on bid
LC-ARR	Waste Dump removal	0.5 ac and 1,377 cu yards along Arroyo Calabasas									Contractor or SFC-M crew	Arrange for backhoe and dumptruck and tipping fees waiver	$17,200 for heavy equipment and operators
LC-RIP	Field inspection	Entire riparian area; approx. 19 acres									SFC-M (Crew)	Notepad/GPS (Avenza), camera	35 times/y: 4 h for one person: 140 h/y
LC-RIP	Dead willow and woody debris removal	Select area yearly; 4 ac/y									Contractor or volunteers	Chainsaws and equipment for removal	TBD; based on bid (rough estimate: $14,175-$22,680/y)
LC-RIP	Invasive spp removal	Select area yearly									Contractor or volunteers	Chainsaws and equipment for removal	TBD: based on bid
LC-RIP	Piling and burning	Select area (once in 4 or 5 yr)									Contractor; with SFC Fire Dep	Community notification	TBD: based on bid
LC-RIP	Prescribed burn	When need arises									Contractor; with SFC Fire Dep	Community notification	TBD
LC-RIP	Tree protection	Select trees for caging									Volunteers	Get supllies	TBD: based on bid; OR approx. 1 day/y for 2
LC-RIP	Pond leveler maintenance or relocation; dam removal	Select locations									SFC-M (Crew)	Need crane?	TBD; perhaps 4-6 crew member days/y (48 person hours/y)
LC-RIP	Bank stabilization along County Road	Select areas when need arises									Contractor	SOW	TBD: based on bid
LC-RIP	Culvert cleanout										SFC-M (Crew)	Tools	TBD: based on bid OR approx. 64 h/y for crew
LC-RIP	County Road repair	When need arises									SFC-M (Crew)	SOW	TBD: based on bid
LC-RIP	Fence repair	Select areas when need arises									SFC-M (Crew)		TBD: based on bid
LC-WOO	Berm removal for proper drainage	Select areas when need arises									SFC-M (Crew) or contractor	SOW	TBD: based on bid
LC-WOO	Drainage and bank stabilization along trail	Select areas when need arises									SFC-M (Crew) or contractor	SOW	TBD: based on bid

Table 6. Summary of Recommended Maintenance Activities for Year-1 for suggested Human Capacity Entities for Implementation.

Location Code	Management Activity	Location	Staff Prep	Volunteer Activity	SF County-M (Crew)	Contractor	Costs
Entire property	Fence inspection and repair (all exterior fence)	Entire upland area: approx 10,500 lf	One time to establish standards and prescription				Annualy, 1-2 days for 2 people (16 hours)
LC-RIP	Field inspection	Entire riparian area: approx 19 ac					35 times/y: 4 h for one person: 140 h/y
LC-RIP	Dead wood removal	Select area yearly; 4 ac/y	One time to establish standards and prescription				TBD; based on bid (rough estimate: $14,175-$22,680/y)
LC-RIP	Invasive spp removal	Select area yearly					TBD: based on bid
LC-RIP	Piling and burning	Select area (once in 4 or 5 yr)					TBD: based on bid
LC-RIP	Tree protection	Select trees for caging	One time to establish standards and prescription				TBD: based on bid; OR approx. 1 day/y for 2 people (16 h/y)
LC-RIP	Pond leveler maintenance or relocation; dam removal	Select locations					TBD; perhaps 4-6 crew member days/y (48 person hours/y)
LC-RIP	Culvert cleanout						TBD: based on bid OR approx. 64 h/y for crew
LC-RIP	County Road repair	When need arises					TBD: based on bid
LC-RIP	Fence repair	Select areas when need arises	One time to establish standards and prescription				TBD: based on bid
LC-WOO	Berm removal for proper drainage	Select areas when need arises	One time to establish standards and prescription				TBD: based on bid
LC-WOO	Drainage and bank stabilization along trail	Select areas when need arises	One time to establish standards and prescription				TBD: based on bid

LC-GRA-P = Grassland – Pasture Unit

LC-GRA-F = Grassland – Old Fields Unit

LC-GRA-G = Grassland – Gravel Unit

LC-GRA-D = Grassland – Dry Unit

LC-GRA-J = Grassland – Juniper Unit

LC-ARR = Arroyos Unit

LC-RIP = Riparian Unit

LP-WOO = Woodland Unit

INSPECTIONS, MONITORING AND ADAPTIVE MANAGEMENT

Effective maintenance must be grounded in scheduled, periodic field inspections and a rigorous monitoring schedule. Findings from inspections and monitoring must lead to a confirmation of scheduled maintenance, and to specifications and adaptations in the scope and scale and timing of maintenance work. It may also lead to changes in the identification of who should do the maintenance work. Eventually, inspections and monitoring lead to adaptive management of the Open Space property and to lessons learned for all involved. This collaborative learning process will likely have both a practical aspect and an aspect of community building as the interaction of learning together may contribute to people's appreciation for the area and for the different people involved. The latter is important to grow people's interest, care, and respect for the place, and their support for recurring maintenance work.

Inspection Protocols

County staff must establish a regular inspection schedule based on the recommended maintenance tasks and their recommended inspection frequency as described above. Inspections follow a protocol by filling out an inspection form. Information is gathered by using all the senses and if possible by speaking with neighbors, users, or passersby. Santa Fe County already has an adequate inspection form. A template inspection protocol that outlines the communication and verification process and adaptive management for inspections is included in Appendix A.

Monitoring

Monitoring is the rigorous practice of documenting or measuring specific landscape features to verify whether a change of certain indicator factors is achieved or whether threshold levels of indicators are exceeded. Analysis of monitoring data will help ascertain whether the measured or observed changes are meeting management goals or not.

Monitoring can be done by taking photographs at very specific locations and comparing a time series of photographs at each photo point to detect change. Monitoring can also be done by taking specific measurements or documenting qualitative field observations on data logs.

Monitoring work must be based on a study design of the monitoring process, based on selected indicators which, in turn, reflect progress toward a stated goal. Therefore, monitoring protocols are goal and site specific, and it is not useful to present templates of monitoring protocols. However, there are monitoring Best Management Practices, such as those developed for the US Forest Service Collaborative Forest Restoration Program (CFRP), or for EPA and NRCS funded stream measurements. A selection of monitoring BMP references is included in the Santa Fe County Open Space Management Planning Guide.

Adaptive Management: Identifying Choices and Making Decisions

Feedback from inspections and monitoring will offer information that needs to be compared with goals and objectives for the property in order to decide whether the information points

toward progress in meeting goals and objectives or not. No action is needed in most cases if the information supports management goals. However, if the information indicates that the situation in the field is deviating from management goals, choices will have to be made about appropriate action.

Depending on the seriousness of the deviation of terrain conditions from management goals, a choice can be made to deliberately defer maintenance activities and letting nature take its course. This choice may be relevant if a triage is needed to allocate limited County resources to determine where maintenance efforts should be focused, or if County staff would like to experience what the consequences are of deferring maintenance.

Alternatively, County staff will want to make adjustments to either the management goals or to the terrain conditions by organizing maintenance or repair activities. It is useful to evaluate findings in a group of stakeholders and experts in order to learn from each other's viewpoints and arrive at a well-thought-out and broadly supported solution for corrective action. Such an approach also offers optimal collaborative learning opportunities and ensures strong, broadly carried stewardship over time.

LABOR REQUIREMENTS AND CAPACITY BUILDING

FTEs

The recommended maintenance and repair work for LCOS would require 0.18-0.27 FTE each year for regular maintenance, and up to 0.31 FTE of planning staff time for planning, coordination, and community outreach. Additionally, it would require approx. 0.04 FTE each year for the County Fire Crew or other chainsaw contractors to remove dead wood.

Santa Fe County Capacity

The maintenance work identified in this Maintenance Plan for LPOS will require capacity building among Santa Fe County staff and among volunteers who assist staff with plan implementation. The planning team recommends that capacity building includes:

1. Expansion of County maintenance staff to meet the required FTEs for LCOS maintenance.
2. Workshops and training for higher management on (a) strategies and methods of capacity building, continued education, and leadership development (for planning and oversight staff, supervisors, and crew); (b) content matter aspects of Open Space management, such as agricultural program development, interpretive planning, cultural resource preservation, trail and road management, vegetation management, soil & water conservation, etc.; and (3) the use of electronic (IT) tools, including GIS, for terrain management, labor allocation, budget control, and public outreach services.
3. Staff and crew training workshops, seminars, conferences, and literature on Best Management Practices (BMPs). Essential BMPs for maintenance of LPOS would include:

   a. Vegetation management, including botany and native plants, thinning, pruning, planting, mowing, etc.
   b. Grazing management and grassland restoration
   c. Integrated Pest Management, including approaches to weed control, invasive animal management, pathogen/vector management (e.g., mosquitoes)
   d. Wildlife management
   e. Riparian area management and restoration
   f. Soil and water conservation (erosion control, water quality improvement)
   g. Trail and road management and drainage
   h. Access management: Fencing, gates, stiles, and signage
   i. Acequia maintenance
   j. Inspections and monitoring
4. Collaborative collection and review of periodic inspection reports and monitoring reports, and joint analysis and discussion of corrective action needed or changes in management.
5. Staff training and guidance for managing community volunteers and site stewards, contractors, contracts and leases aimed at supporting field assessments, maintenance and repair at the Open Space properties.

Community Outreach and Engaging Volunteers

Santa Fe County has more Open Space, Parks and Trails assets and associated maintenance needs than it will likely have staff capacity and funds to address the needs. Therefore, and also in order to grow community buy-in and stewardship of the Open Space properties, Santa Fe County needs to strengthen its community outreach and volunteer engagement services.

Potential Volunteers

LCOS has a diverse spectrum of community stakeholders that are interested in the property and that Santa County can mobilize for volunteer stewardship work. These stakeholder groups include:

a. Immediate neighbors in La Cieneguilla
b. HIPICO Santa Fe
c. Downstream residents, farmers, and ranchers
d. The Santa Fe River Traditional Communities Collaborative
e. Area schools and their students, such as the MASTERS Program (high school as Santa Fe Community College), Santa Fe Indian School, the Santa Fe Girls' School, Desert Academy, and nearby elementary schools
f. Any regional conservation groups (such as Santa Fe Watershed Association), hiking and outdoor organizations, and other entities that could become interested in the LCOS – however, the involvement of such outside groups must be discussed first with local stakeholders in order to ensure good working relationships

Volunteer Maintenance Activities

Maintenance activities that are particularly suitable to be conducted with support from (small) groups of volunteer stewards include:

- Removal of dead wood and woody debris on the ground and in the river channel (during low flows) (in the late fall, early winter to prepare for spring runoff and summer storms)
- Cutting and removal of invasive plants (esp. juniper, elm, Russian olive, and tamarisk) (in the late fall and in the early spring)
- Tree protection: caging willow and cottonwood trees to protect them against beaver (quarterly inspections and repairs)
- Inspections and monitoring (spring and fall, dependent on monitoring goals)

The planning team recommends that volunteer activities are conducted in a regular schedule to establish precedent, leading to an accountable system that after several years may even become a "tradition". In this way, people will look forward to the maintenance events, and the events become part of the community calendar or the annual schedule of the volunteer groups. These activities also ensure periodic face to face contact between County staff and volunteer stewards. The more the activities include a sense of celebration, fun, sharing, and play, besides getting good work done that builds pride, the more participants will enjoy the events and return any next time.

Community Liaisons

Besides developing volunteer stewardship engagement, it may prove essential to cultivate a couple of community liaisons (one leader and several alternates) that can serve on a rotational basis to communicate with Santa Fe County staff and help mobilize and direct volunteer stewards. No liaisons have been identified thus far.

County Point Person

Volunteer activities need to be diligently prepared and coordinated to ensure participant safety, work effectiveness, and general enjoyment by all. It will be essential that Santa Fe County identify a staff member for LCOS who serves as the designated point person in the communication with the community liaisons and stewardship volunteers. This staff person would be in charge of fielding questions and alerts from the community, communicating messages from Santa Fe County, and organizing any volunteer stewardship events. This staff person also would need to identify and mobilize, when necessary, any technical experts, either in the community, within Santa Fe County staff, or among contractors, to assist with technical guidance and quality control before, during and after the volunteer stewardship events. Additionally, this person would be in charge of planning and coordination between staff and maintenance crew to assist and to provide equipment and supplies, such as fencing materials and baling wire or twine, or plant stock, soil amendments, mulch, and stone material. Last but not least, this staff person is responsible for any safety instructions and for ensuring that people

work in a safe manner and have adequate protective gear. Finally, Santa Fe County will need to develop a repository of tools, protective gear and supplies to provide during work days. Systems would need to be developed to account for tools and gear that is handed out, and a crew member or the County point person for the community would need to be in charge to account for the supplies and tools at the end of the work day.

APPENDIX A: Santa Fe County Open Space Inspection Checklist – La Cieneguilla OS

Inspected by: _____

Date: _____ Time: _____

Item to be Checked Use a separate page to describe the necessary repairs	**OK or FIX = needs work**	**Comments (corrective action r work needed, who needs to be contacted)**
Monthly		
Exterior Fences		
Culverts under Calle Debra for debris		
Beaver pond levelling devices		
Trail drainage and soil erosion		
Arroyo Calabasas culvert under Paseo Real		
Santa Fe County Open Space Signage		
Signs of garbage or illegal dumping		
Signs of illegal off-road vehicle use		
Annually		
Excess build-up of dead willows stands		
Wire protection cages around trees		
Invasive species		
Excess clogging of river channel by live willows		

APPENDIX D – Maintenance, Stewardship, and Restoration Projects for Year 1

List of Terrain Management project activities for year-1 aimed at land health restoration.

Location Code	Management Activity	Location	Staff Prep	Volunteer Activity	SF County-M (Crew)	Contractor	Costs
LC-RIP	Piling and burning	Select area (once in 4 or 5 yr)					TBD: based on bid
LC-RIP	County Road repair	When need arises					TBD: based on bid
LC-RIP	Berm removal for proper drainage along fire management road	Select areas when need arises	One time to establish standards and prescription				TBD: based on bid
LC-RIP	Drainage and bank stabilization along Paseo Rael	Select areas when need arises	One time to establish standards and prescription				TBD: based on bid
LC-ARR	Fencing of Arroyo de las Calabasa area	Entire arroyo area	One time to establish standards and prescription				TBD: based on bid
LC-ARR	Cleanup or removal of priority hazard features	Entire arroyo area	One time to establish standards and prescription				TBD: based on bid

List of Terrain Management maintenance and stewardship activities for year-1 aimed at land health maintenance.

Location Code	Management Activity	Location	Staff Prep	Volunteer Activity	SF County-M (Crew)	Contractor	Costs
LC-All TMUs	Fence inspection and repair (all exterior fence)	Entire upland area: approx 10,500 lf	One time to establish standards and prescription				Annualy, 1-2 days for 2 people (16 hours)
LC-RIP	Field inspection	Entire riparian area: approx 19 ac					35 times/y: 4 h for one person: 140 h/y
LC-RIP	Dead wood removal	Select area yearly; 4 ac/y	One time to establish standards and prescription				TBD; based on bid (rough estimate: $14,175-$22,680/y)
LC-RIP	Invasive spp removal	Select area yearly					TBD: based on bid
LC-RIP	Tree protection	Select trees for caging	One time to establish standards and prescription				TBD: based on bid; OR approx. 1 day/y for 2 people (16 h/y)
LC-RIP	Pond leveler maintenance or relocation; dam removal	Select locations					TBD; perhaps 4-6 crew member days/y (48 person hours/y)
LC-RIP	Culvert cleanout						TBD: based on bid OR approx. 64 h/y for crew
LC-RIP	Fence repair	Select areas when need arises	One time to establish standards and prescription				TBD: based on bid