Arroyo Threat Assessment Surveys of 15 Major Arroyos in the Santa Fe River Watershed

June 21, 2016

Santa Fe Watershed Association

Report to Melissa McDonald, River & Watershed Coordinator, Public Works Dept., City of Santa Fe 2016

Overview

There are hundreds of miles of arroyos within the Santa Fe River Watershed. They are used recreationally, roads and trails crisscross them, utility lines run through them, and by nature they are highly erodible. With the increase in severity of summer rainstorms combined with a larger population and thus, greater use, these arroyos have a large impact on the City of Santa Fe infrastructure. As we are learning, they require attention and maintenance. Additionally, proper care emphasizing specific measures to help control erosion, slow down storm-water, spread it across a broader area, and promote its absorption into the ground can add to the City of Santa Fe's longer-term water security by capturing more water from rainfall, helping to recharge aquifers, and promote greater ecological health. Slowing the erosion will also help protect municipal infrastructure such as electrical lines, sewage lines, etc.…which in turn protects public safety.

Between February 2015 – May, 2016, Santa Fe Watershed Association staff conducted assessments on fifteen different arroyo systems within the boundaries of the City of Santa Fe.

The City of Santa Fe Public Works Division requested this assessment in order to identify high priority areas for infrastructure repair as a part of the General Obligation Bonds funding dedicated to arroyo maintenance and repair.

Staff walked approximately 50 miles armed with a GPS camera and data sheets. The assessments examined the arroyos for erosion and decay in two primary areas: Infrastructure Risks (where erosive conditions are causing a risk to the general public or to Municipal infrastructure) and Channel Characteristics (areas of concern where continued erosion could endanger both public and private property assets). Specifically, Infrastructure Risks looked at: Trail deterioration (if there was a trail running along an arroyo), bank deterioration, damaged and restricted culverts, endangered utility lines (such as electrical, water, sewer), foot/bicycle/vehicle bridge damage. Channel characteristics were evaluated according to the following: Incised, incised & braided, constricted, collapsed banks, vertical banks, or deteriorating rip rap. A scoring system of 1-4, 1 being the worst, 4 being the best, was applied.

Other observations were noted and photographs were taken so that each situation could be mapped and referred to easily by City staff. The scores of each reach were recorded and tabulated. The data sheets for each reach are in Appendix A.

Included in the study were the following:

Arroyo de los Chamisos	Arroyo en Medio	Arroyo Foothill
Arroyo Rosario	Arroyo Ancha	Arroyo Cloudstone
Arroyo Saiz	Arroyo de los Pinos	Arroyo Nopal
Arroyo Mora	Arroyo Mascaras	Arroyo Torreon
Arroyo Cabra	Arroyo de la Piedra	Arroyo Chaparral

A map identifying the location of the arroyos is in Appendix B.

The report also includes a summary chart of the scores that each arroyo received. The lower the score, the higher priority the arroyo reach. The highest priority reaches are emphasized with a white background. Please refer to the notes for greater detail on the identifying problems.

Recommended Measures Defined: Within this report we are including our suggestions for possible measures that could be implemented to help correct the problems assessed. These are not major, large, engineered measures but rather possible measures that volunteer groups may be able to construct with assistance from professionals. They are:

1) Rip-rap: also known as shot rock, rock armor or rubble, rock or other material used to armor shorelines, streambeds, bridge abutments, pilings and other shoreline structures against scour and water or ice erosion.

2) One Rock Dams: A simple structure where a single layer of rock of approximately 10-12" in diameter is added to a drainage area for controlling the speed of water and sediment moving through it. ORDs are usually about 4' wide and can be installed on contour or simply in the low point of a drainage area.

3) Rock Run Downs: A *headcut* (the edge of a small waterfall or bluff) control structure where the face of the headcut has been laid back to a stable angle of repose (minimum of a 3:1 slope), and then covered with a single layer of rocks approximately 10-12" in diameter.

4) Zuni Bowls: A headcut control structure, composed of rock lined step falls and plunge pools, prevents headcuts from continuing to migrate upstream. Zuni Bowls stabilize actively eroding headcuts by dissipating the energy of falling water at the headcut pour-over and the bed of the channel. The structure converts the single cascade of an eroding headcut into a series of smaller step falls.

5) Vanes: Vanes are linear structures that extend out from the arroyo bank into the arroyo in an upstream direction. They are usually placed along the arroyo bank where erosion is occurring along the toe of the slope. The purpose of vanes is to reduce erosion along the arroyo bank by redirecting the stream flow toward the center of the stream.

6) Ramp Bank: Removal of soil to reduce the slope of very steep banks to a more stable angle and an increased area for the water to flow into.

7) Cover Exposed Utility: If the utility component is sound and not leaking, the recommendation is to re-trench and re-cover the exposed line or pipe.

8) Remove Obstruction: Often, the removing of an obstruction may be the easiest and simplest method to reduce the arroyo problem.

Like all natural environments inhabited by humans, these high-priority reaches require well-designed restorative actions to help stabilize, protect, and secure the infrastructure that runs through them.

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City-wide Watershed and Arroyo Projects

Arroyo Name	Segment Location, Upstream	Segment Location, Downstream	Recommended measures	Basin Size	Infrastructure Damage/Risk	Channel Character, Drainage
1. C. Arroyo de los Chamisos	Conejo Road	Saint Francis Drive	7^2,5^3,6,1	3	1.2	1.6
1. D. Arroyo de los Chamisos	S.Saint Francis Drive	Yucca Street	3^3,4^3,5^2,6		1.4	0.8
1. E. Arroyo de los Chamisos	Yucca Street	Carlos Camino Rey	3,5,6,8		2.4	1.7
1. F. Arroyo de los Chamisos	Camino Carlos Rey	Ave de las Campanas	4,5^2,6		1.7	1
1. G. Arroyo de los Chamisos	Ave de las Campanas	Rodeo Road	1^2,5,7		1.7	1.3
1. H. Arroyo de los Chamisos	Rodeo Road	Governor Miles Road	3,4,5		1.4	1.9
2. A. Arroyo Rosario	Below HWY 285-S	373 Calle Loma Norte	3^6,4^3,5,8^3	1	1	1.7
2. B. Arroyo Rosario	373 Calle Loma Norte	388 Calle Loma Norte			2.4	2.4
2. C. Arroyo Rosario	388 Calle Loma Norte	Los Arboles			NA	0.9
2. D. Arroyo Rosario	Los Arboles	Rio Grande Street			2.2	1.4
2. E. Arroyo Rosario	Rio Grande Street	Paseo de Peralta MASCARAS			2	2
3. Arroyo Saiz	Begin at Hyde Park + Gonzalez Rd	**SANTA FE RIVER**	3^3,4,5	1	1.7	1
4. Arroyo Mora (Upper Canyon Road)	South of Calle Militar	**SANTA FE RIVER**	4,5	1	NA	1.9
5. Arroyo Cabra (Cristo Rey Area)	Apodaca Hill	**SANTA FE RIVER**	4,5	1	NA	1.9
6. Arroyo en Medio	Old Santa Fe Trail	St Francis Drive CHAPARRAL	1,4,5,7		1.4	1.3
7. A. Arroyo Ancha	Near Ten Thousand Waves Spa	Cañada Sur	4^4,7^6	1	0.9	NA
7. B. Arroyo Ancha	Cañada Sur	**SANTA FE RIVER**	2,5		1.2	0.3
8. Arroyo de los Pinos *Upper A*	Camino Corrales/Lejo	Galisteo Street	8	3	NA	0.9
8. Arroyo de los Pinos *Upper B*	Camino Corrales/Lejano	Don Gaspar Street	$4^3$5,6,8		2	1.1
8. Arroyo de los Pinos *Ditch*	St. Michael's Drive	Siringo Road	4,5		1.4	1.8
8. B. Arroyo de los Pinos	St. Francis Drive	6th Street	2,3,4^3,5,8		2.3	2.5
8. C. Arroyo de los Pinos	St. Michael's Drive	Camino Carlos Rey	1^2,2,4,7^2		1.9	1.9
8. D. Arroyo de los Pinos	Camino Carlos Rey	Richards Avenue	1,2,3,4,5,6		2.7	2.2
8. E. Arroyo de los Pinos	Richards Avenue	**ARROYO DE LOS CHAMISOS**	1,2,3,4,5,6,8		1.9	1.6
9. A. Arroyo Mascaras	Bishop's Lodge Road	**ARROYO BARRANCA**	1	3	0.9	1.9
9. C. Arroyo Mascaras	Old Taos Highway	Paseo de Peralta Culvert	4		0.9	0.7
9. D. Arroyo Mascaras	Paseo de Peralta Culvert	**SANTA FE RIVER**	4		NA	1.2
10. A Arroyo de la Piedra East Fork	Calle Conejo	Camino Real	2,3,5,6,7^{3}8	1	NA	0.9
10. B Arroyo de la Piedra West Fork	Brownell-Howland	Hyde Park Road MASCARAS			1.1	1.1
11. Arroyo Foothill	Old Santa Fe Trail	**ARROYO DE LOS CHAMISOS**	1,2,3,4,5,6,7^{12}		1.2	1.2
12. A. Arroyo Cloudstone	Old Santa Fe Trail	Old Pecos Trail	2,4,5,7,8		0.8	0.5
12. B. Arroyo Cloudstone	Old Pecos Trail	**ARROYO DE LOS CHAMISOS**	1,2,4,5,8		1.4	1
13. Arroyo Nopal	East of Calle Nopal	W. Alameda	1,2,4,7		1.9	2.4
14. A. Arroyo Torreon	East of Buckman Rd	Camino de las Crucitas	5		1.2	1.1
14. B. Arroyo Torreon	Camino de las Crucitas	**SANTA FE RIVER**	1,2,3,4		0.9	0.7
15. B. Arroyo Chaparral	Galisteo Road	Esplendor Street	1,2,3,4,5,6		1.7	2
15. C. Arroyo Chaparral	Esplendor Street	**ARROYO DE LOS CHAMISOS**	2,2,3,7,8		0.9	1

Recommended Measures: **1 = Rip Rap 2 = One Rock Dam 3 = Rock Run Down 4 = Zuni Bowl 5 = Vanes 6 = Ramp bank 7=Cover exposed utility 8 =**

Graded Scoring System **A = 4 B = 3 C = 2 D = 1 F = 0**

Arroyo Chamisos 1

Arroyo Chamisos 2

Arroyo Chamisos 3

Arroyo Chamisos 4

Arroyo City-Wide Watershed and Arroyo Projects

I. Arroyo de los Chamisos

Valuable for recreation / wildlife corridor

Segment A. Approximately 800 ft. upstream from the Old Santa Fe Trail Bridge

Notes: Bank erosion is common in this segment of the arroyo despite its width. As a result of the arroyo's proximity to the mountains a suitable habitat for wildlife is provided. The arroyo is also popular for recreation. An exposed metal pipe spans part of the arroyo upstream from the Old Santa Fe Trail Bridge. Along a cut bank, downstream from the pipe, is a manhole. It was approximately 10-12" from the edge of the arroyo. An old dumpsite lies beneath the building of the Carmelite Sanctuary. As in 2012, minimal erosion continues to impact the upstream side of the arroyo bank adjacent to the bridge. If it were not for the Old Santa Fe Trail road crossing, this segment would be free of artificial constrictions.

Segment A/ Upper Arroyo de los Chamisos, 2016.

Segment B. Old Santa Fe Trail Bridge Crossing to Conejo Road

Notes: The channel of the Arroyo de los Chamisos broadens and becomes braided below Old Santa Fe Trail Bridge. The upper end of the arroyo is sparsely inhabited which provides wildlife a valuable corridor. Rabbits, lizards, and birds were sighted throughout the arroyo. The upper part of the arroyo is free of trail deterioration, exposed sewage lines, and deteriorating vehicle bridges. A stand of cottonwood trees continues to thrive in this section of the arroyo. Perhaps further restoration of this area and the addition of a water infiltration basin may enrich this part of the arroyo.

Approximately midway through the arroyo, the broad and braided channel begins to narrow and straighten. The channel continues to constrict as it nears the Conejo Road crossing. At this point of constriction, private property was heavily damaged by erosion. Sometime after 2012, gabion baskets were erected to protect this area from further damage. Walkers, bikers, and joggers frequent this segment.

Segment B/ Broad open plain on the Arroyo de los Chamisos, 2016.

Segment C. Conejo Road to the St. Francis Drive Bridge

Notes: This segment of the arroyo continues to be used as a walking, jogging or biking path. Beyond the Conejo Road crossing, the arroyo widens then branches left and right to reconnect downstream. An exposed utility was found between Ft. Union Road and Calle Sebastian Bridge. The sandy, incised arroyo channel continues to narrow as it passes under the overgrown Calle Sebastion Bridge towards the Old Pecos Trail Bridge. Rip rap in varying states of disrepair along with submerged gabion baskets were observed in this section.

Segment C/ Illustration of the channel characteristic in Arroyo de los Chamisos, 2016.

The arroyo flows beneath the Old Pecos Trail Bridge, over a concrete spillway and into a small riparian habitat of willow and cottonwood. Since the instance of bank erosion heightens beyond this growth, the riparian area that is currently stable, could be expanded upon to remediate further destruction of these banks.

In 2012 the bank erosion was considered severe. As of 2016, storm water continues to erode away 75 feet of a ~15 foot high vertical wall. Located on top this eroded bank is a sewage outlet. Bank loss continues to lessen the distance between this utility and the arroyo.

About 300 feet downstream from the spillway, high waters from storms could be slowed down to spread out in a large open basin like the area west of the main channel. At the lower end of this basin a stand of mature cottonwood trees has been established.

Approximately 1,000 feet downstream from the Old Pecos Trail Bridge, a concrete encased utility appears to be eroding from the bed of the arroyo.

Segment C/ Cottonwoods at base of spillway beneath Old Pecos Trail, 2016.

Segment C/ ~75 feet of eroded bank below spillway, Arroyo de los Chamisos, 2016.

Segment C/ Encased utility line, Arroyo de los Chamisos, 2016.

Between Old Pecos Bridge and Old Arroyo Chamisos Road, the arroyo is in various states of erosion ranging from moderate to severe. High banks, collapsed walls, and deep incisions reoccur throughout the channel. The erosion also threatens bank stabilizing mature trees located along the arroyo banks.

The arroyo continues beyond Old Arroyo Chamisos Road in the direction of Botulph Road. Between these two points, a bank restoration project begun in 2012 has matured and looks to be successfully retaining the banks of the arroyo.

Segment C / Arroyo bank remediation 2012, Arroyo de los Chamisos, 2016.

Segment C / Mature cottonwoods and willows at arroyo bank remediation started in 2012, Arroyo Chamisos.

The arroyo passes beneath Botulph Road where the channel widens. Several bridges that serve the Gail Ryba trail system span the Arroyo de los Chamisos. Approximately 175 feet beyond the southern foot bridge, a protective gabion wall has separated from the arroyo bank to sag into the channel. Segment C ends beneath the S. St. Francis bridges. Sometime between 2012 and 2016 the concrete supporting the roadbed has become rotten enough below the guardrails to expose rebar.

Segment C/Gabion walls coming off arroyo bank, 2016.

Segment C/ S. St. Francis Bridge with damage in 2016, Arroyo de los Chamisos, and 2016.

Segment C/ 2012 S. St. Francis Bridge same location as above photo, 2012 Arroyo de los Chamisos.

Segment D. South St. Francis Drive Bridge to Yucca Street Bridge

Notes: The arroyo segment has been severely incised due to poor drainage, soil type, natural and artificial constrictions. The height of an intermittent system of vertical walls increases as the arroyo channel drops in elevation. The corridor of these highly eroded vertical walls begins about 145 feet below the Santa Fe Rail Trail. The longest, continual, vertical wall system in the arroyo is approximately 1,300 feet in length. It is found in here. Although it is the longest corridor, the 1,150 foot section of vertical bank between the two Vo-Tech bridges is the most dangerous regarding trail safety and infrastructure stability.

Improvements since 2012 have helped protect sewage lines and minimized the impact of storm water in some areas. Segment D of Arroyo de los Chamisos is a high -risk area in much need of remediation. Immediate corrective action to the vertical banks along the Arroyo Chamisos trail between the Vo-Tech bridges is recommended.

Segment D/ Vo-Tech Bridges with examples of eroding banks and footings, Arroyo Chamisos, 2016.

Segment D/ Bank erosion, Arroyo de los Chamisos, 2016.

Segment D/ Corridor of vertical banks, Arroyo Chamisos, 2016.

Segment E. Yucca Street Bridge to Carlos Camino Rey Bridge

Notes: The arroyo in segment E is broader than Segments C and D. As expected, erosion continues throughout the entire length of the Arroyo de los Chamisos. Natural obstructions since 2012 have entered the arroyo bed and will affect the flow of storm water. The narrowest part of the entire Arroyo de los Chamisos is located in this segment. It measures roughly 20 feet across.

Segment E/ Erosion along arroyo bank, Arroyo de los Chamisos, 2016.

Segment F. Camino Carlos Rey Bridge to Ave de Las Campanas Bridge

Notes: The arroyo continues to be broad in nature maintaining this characteristic through to Governor's Miles Road. Below the Camino Carlos Rey Bridge the damaged rip rap of 2012 is being replaced in 2016. Storm water has increased the number of vertical banks in this section. The Ave de Las Campanas Bridge suffers from deteriorating concrete sides.

Segment F/ Bank erosion, Arroyo de los Chamisos, 2016.

Segment F/ Rotting concrete on Ave. de las Campanas Bridge, Arroyo de los Chamisos, 2016.

Segment F/Possible location for infiltration basin, Arroyo de los Chamisos, 2016.

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Segment G. Ave de Las Campanas Bridge to Rodeo Road Bridge

Notes: Between the Ave. de Las Campanas Bridge and the Rodeo Road Bridge several high cut banks exist that continue to threaten private property near the Kachina Heights subdivision. Rip rap used to stabilize the arroyo banks is undercut. Since 2012, a public utility, 300 feet upstream from a state maintenance yard has emerged from the arroyo bank. The chain link fence at this facility is flush with the arroyo bank. Also a steel culvert extends further into the arroyo than observed in 2012. It is in danger of being damaged by storm water.
Active transient use is common in this area thus creating unusually large amounts of trash to be prevalent in this segment. A concrete culvert beneath Camino de los Arroyos and Vegas Verdes Road and the west side over pass of Rodeo Road Bridge are continually inhabited producing biohazards, trash and safety issues to the public. Part of this section of the arroyo has been adopted by The Masters Program an early college charter high school and sponsored by Sam's Club.

Segment G/ Exposed utility pipe, Arroyo de los Chamisos, 2016.

Segment G/Bank erosion at State facility, Arroyo de los Chamisos, 2016.

Segment G/ Erosion below private property in Kachina Heights, Arroyo de los Chamisos, 2016.

Segment H. Rodeo Road Bridge to Governor Miles Bridge

Notes: The Arroyo de los Chamisos bike trail below Rodeo Road Bridge has suffered from more erosion since 2012. Soil is eroding from the footing of the foot bridge closest to the Villa Linda Park. Also the grate of a large culvert located near the mall parking lot is restricted by a huge volume of trash. Another drainage ditch flowing from Santa Fe Place into the Arroyo de los Chamisos has bypassed a check dam control point to erode a large channel into this arroyo. Storm floods since 2012 have removed a considerable amount of sediment from the base of a gabion wall. The last point of erosion from a storm drainage pour off pad belonging to a tenant of the auto park has carved a deep channel into the arroyo bank. The arroyo continues to be a popular place for dumping trash. More transient camp sites were encountered throughout this arroyo segment. This arroyo segment is heavily used by off road vehicles. There are many places for vehicle access from the Governor Miles Road Bridge to the Villa Linda Park as noted in 2012.

Segment H/Erosion threatens sidewalk, Arroyo de los Chamisos, 2016.

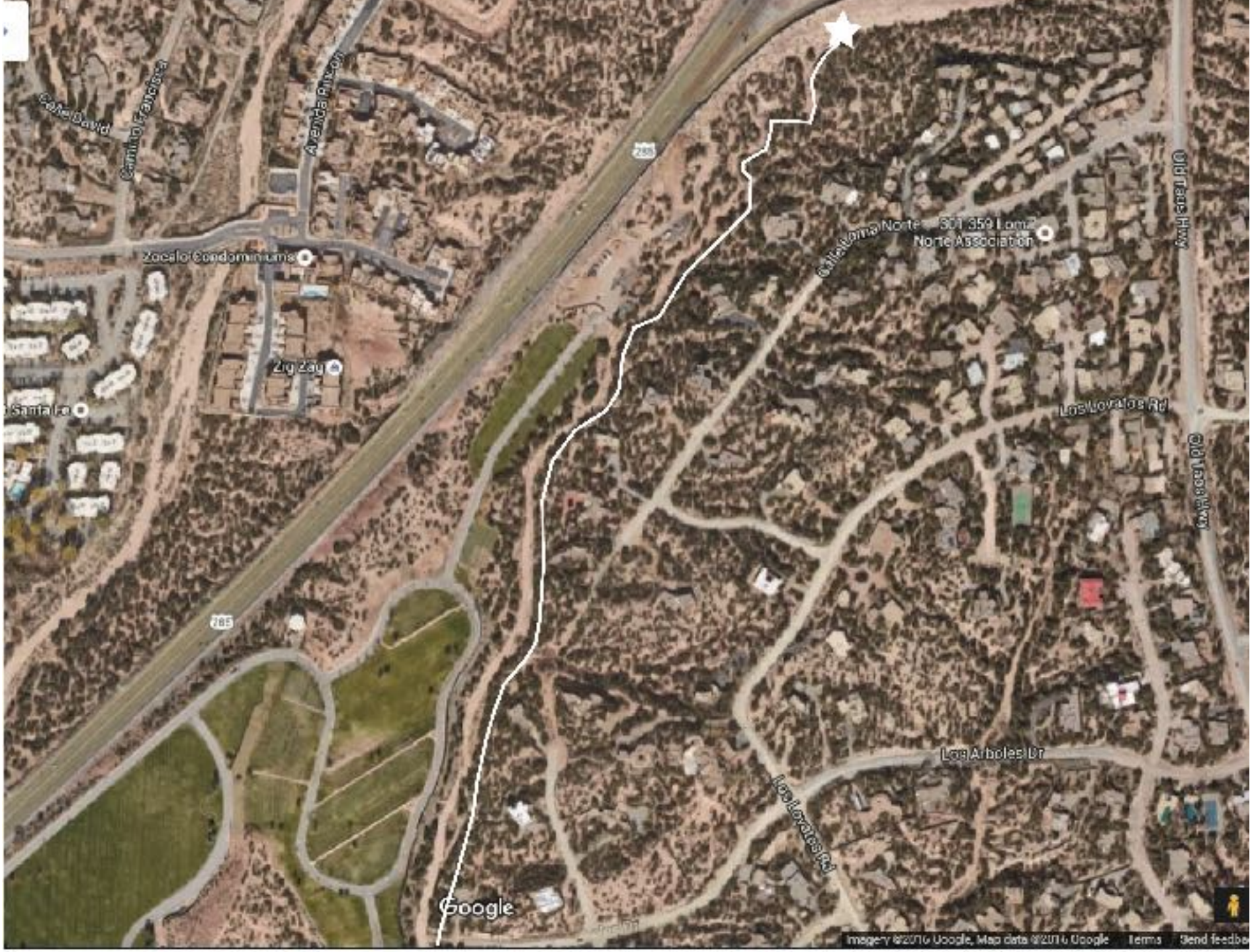
Segment H/Culvert obstructed with trash, Arroyo de los Chamisos, 2016.

Segment H/Pedestrian bridge with exposed footing, Arroyo de los Chamisos, 2016.

Segment H/Side channel bypasses gabion wall, Arroyo de los Chamisos, 2016.

Segment H/ Illustration of sediment fluctuations. Sediment levels remain intact against gabion wall at far right of photo while left and center sediment no longer exists, Arroyo de los Chamisos, 2016.

Segment H/ Trash a common presence from Segment G through Segment H, Arroyo de los Chamisos, 2016.



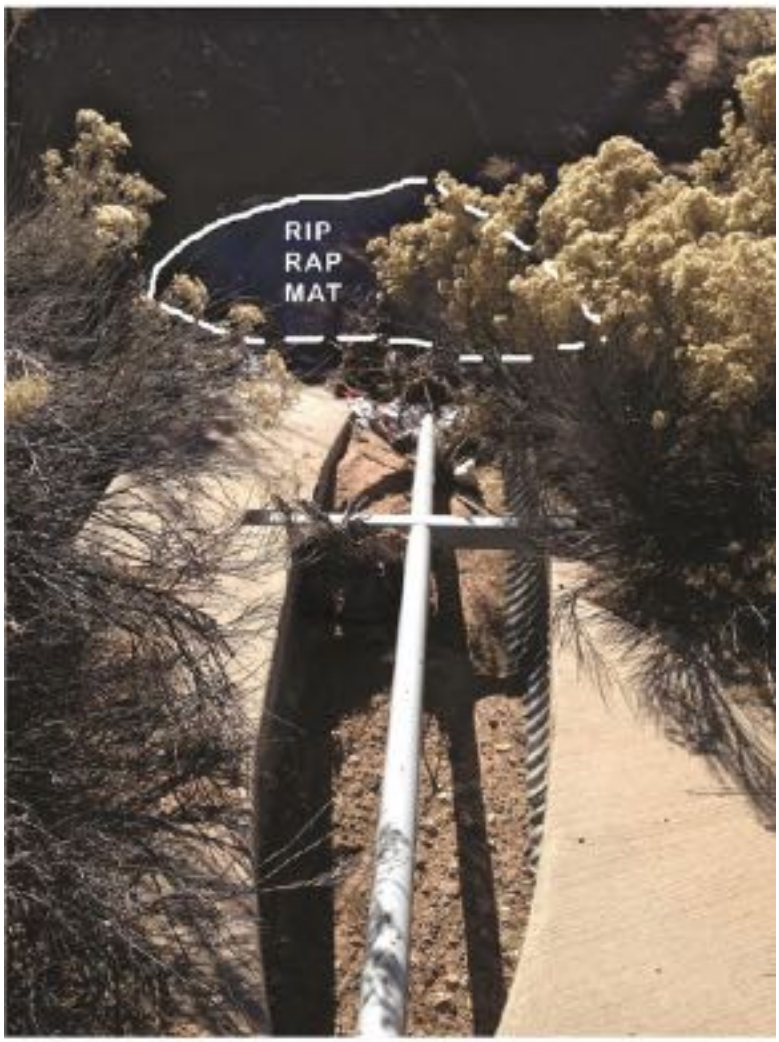
Arroyo Rosario Map 1

Arroyo Rosario Map 2

II. Arroyo Rosario- Headwaters-Paseo de Peralta

Valuable as a wildlife and recreational corridor.

Segment A/View of Arroyo Rosario from culvert.2016



Segment A/ Outlet and rip rap map at head of Arroyo Rosario, 2016.

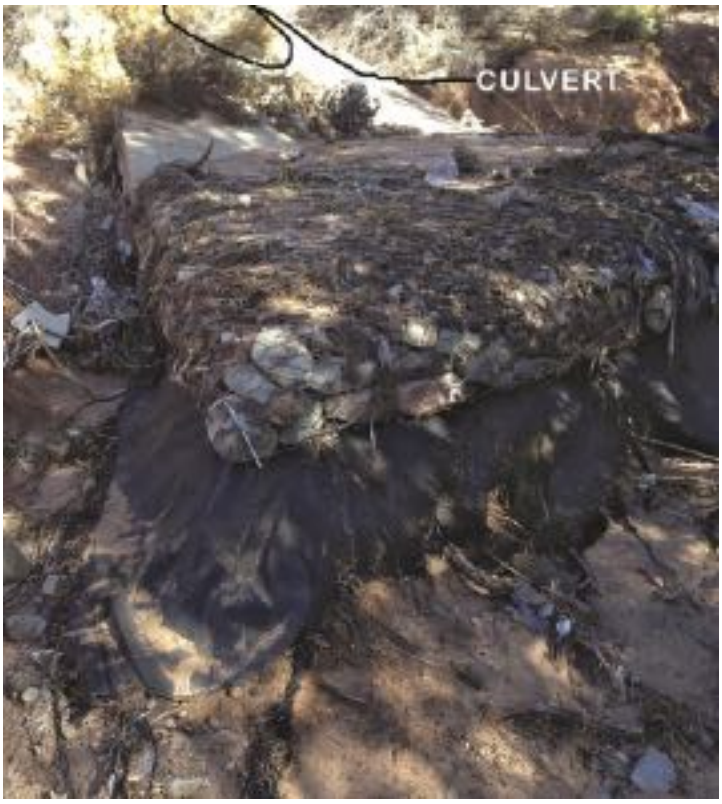
Notes: In general, the Arroyo Rosario is a city arroyo which begins at the base of a grade supporting the road bed for Hwy. 285 South, crossing Rio Grande Ave and flowing beneath the Paseo de Peralta Bridge box culvert. The main areas of concern are a culvert below 285 and the aforementioned bridge and surrounding area. Besides these concerns, the arroyo is a lively corridor for wildlife described by deer, coyote tracks, sighting of rabbits, in a juniper/piñon habitat. The arroyo is also home to recreational hiking, motorized vehicles, and Santa Fe's transient population. Evidence includes vehicle tracks, foot trails, campsites and encounters with hikers and homeless residents. Mature elm trees have successfully stabilized the banks of the arroyo's last segment.

Segment A. Headwaters to 373 Calle Loma Norte

Notes: The "head" of the Rosario is highly impacted by two sources of storm runoff coming from the surrounding landscape and the culvert placed at the base of a steep grade that supports Hwy. 285 south. As a result, drainage infrastructure and the arroyo channel itself are negatively impacted. The drainage system consists of a steel culvert, concrete footing surrounding the culvert, a grate, and a rip rap mat at the base of the outlet. Earth beneath the concrete footing and rip rap mat system is eroding rapidly. Since 2012, a significant change in the arroyo channel and the elevation of these two systems is apparent. The arroyo channel is ~ 2 feet below the rip rap mat's original elevation. Remediation measures are highly recommended since further erosion to these important components will bring about structural failure in the culvert which will adversely affect drainage from both the arroyo and the road bed of Hwy. 285.

Storm runoff has significantly changed the characteristics of this area of the Arroyo Rosario. Common to this area are constrictions, deep incisions, collapsed banks that have left natural obstructions such as trees that have caught debris, vertical walls and tight meanders in the arroyo. Erosion along the western banks in this area is common.

Another important factor to note in this segment of the Arroyo Rosario contributing to high erosion is storm runoff above the arroyo from the National Cemetery. An area above this bank has been cleared by heavy equipment causing a deep incision into an already vertical bank. An attempt to slow the damage has been made by brush piles. Observation of this area is recommended.



Segment A/ Erosion beneath rip rap mat, Arroyo Rosario, 2016.

Segment A/ Eroded bank, Arroyo Rosario, 2016

Segment A/ Tree blocking channel, Arroyo Rosario, 2016

Segment B. 373 Calle Loma Norte to 388 Calle Loma Norte

Notes: The arroyo channel in part of segment B continues to have deep incisions and tight meanders before it flows into segment C. As shown in Figure 6, banks are collapsed bringing trees into the channel. As debris is caught in the trees and builds a barrier the arroyo may back up and cause flooding.

Segment B/Trees become natural barriers, Arroyo Rosario, 2016.

Segment C. 388 Calle Loma Norte - Los Arboles

Notes: The arroyo channel transitions from deep incisions and tight meanders in segment B into a broad, lightly, meandering arroyo bed. There are two areas of concern to be monitored in the future. The first area is a vertical, ~5 foot, bank below a large retaining wall belonging to the National Cemetery. The other area of note is found along the arroyo bank where Los Arboles Rd. ends at the edge of the Rosario. Here, storm runoff from exits two steel culverts. The arroyo bank is deeply incised. The construction of a rain garden could be effective.

Segment D. Los Arboles to Rio Grande Road

Notes: The Arroyo Rosario's characteristics are like those in Segment C. The arroyo is broad with no areas of concern.

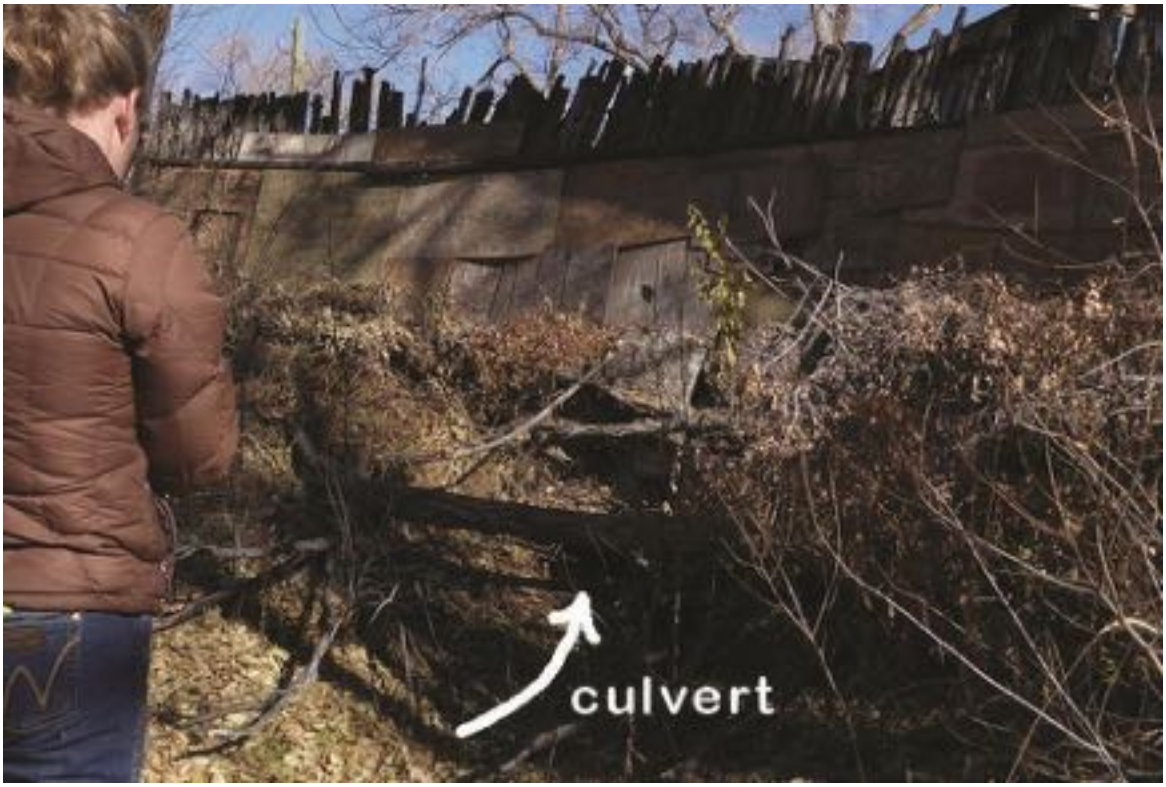
Segment E. Rio Grande Road to Paseo de Peralta

Notes: Notable areas of concern appear in close proximity of the Paseo de Peralta box culvert bridge. The box culvert itself continues to gain sediment from each storm event. Two feet of head room exist between the sandy bed of the arroyo and the top of the box culvert. Next to this structure is a concrete, 18", culvert extremely full of sand. There are approximately 7 "of head room left in this culvert. Another condition affecting this same culvert is erosion around its footings. Since the original rip rap barely remains, pedestrian traffic and water is wearing away the surrounding bank. Lastly, on the east bank of the arroyo above these places is a storm water outlet into the arroyo. Here, the culvert is recessed into the arroyo bank. The outlet is blocked by brush piled above and across it. This segment of the arroyo Rosario has been adopted by the Historic St. Catherine Neighborhood Association through the Santa Fe Watershed's Adopt and Arroyo program.

Segment E / Paseo de Peralta box filled with sand, Arroyo Rosario, 2016.

Figure 1 Segment E/ View of restricted outlet and eroded west bank,2016

Figure 2 Segment E / Birds eye view of eroded west bank and culvert shoulder, 2016



Segment E / East bank recessed, blocked storm outlet, 2016.

Segment E/ Mature elms hold banks in place, Arroyo Rosario, 2016.

Arroyo Saiz Map 1

Arroyo Saiz Map 2

River connection

III. Arroyo Saiz- Hyde Park Road/Gonzalez Road – The Santa Fe River

Valuable for recreation, wildlife corridor, historical rock work, teaching model.

Notes: Arroyo Saiz begins at the intersection of Gonzales and Hyde Park roads. The main channel is fed by a network of small tributaries that flow through piñon/juniper. Great attention in the past was put into this network of incised drainages running both parallel and opposite of Hyde Park Road by the placement of silt fences and superbly built stone check dams. Storm water run-off from Hyde Park road is eroding the road shoulder (arroyo bank) noted in 2012.

Old silt fencing in the upper Arroyo Saiz, 2016.

Erosion of f Hyde Park road into the Arroyo Saiz, 2016.

Casual recreational trails frequented by walkers and mountain bikers appear above the Avenida Primavera road arroyo crossing continuing through other areas of the arroyo and ending at Rodrigeuz Street. Wildlife such as deer, coyote and rabbit were represented by tracks found throughout this arroyo.

Two separate areas in the arroyo have been fenced off. These fences span the arroyo which may impede storm water flow and are questionable regarding public/private right of ways.

Fencing across the Arroyo Saiz,2016.

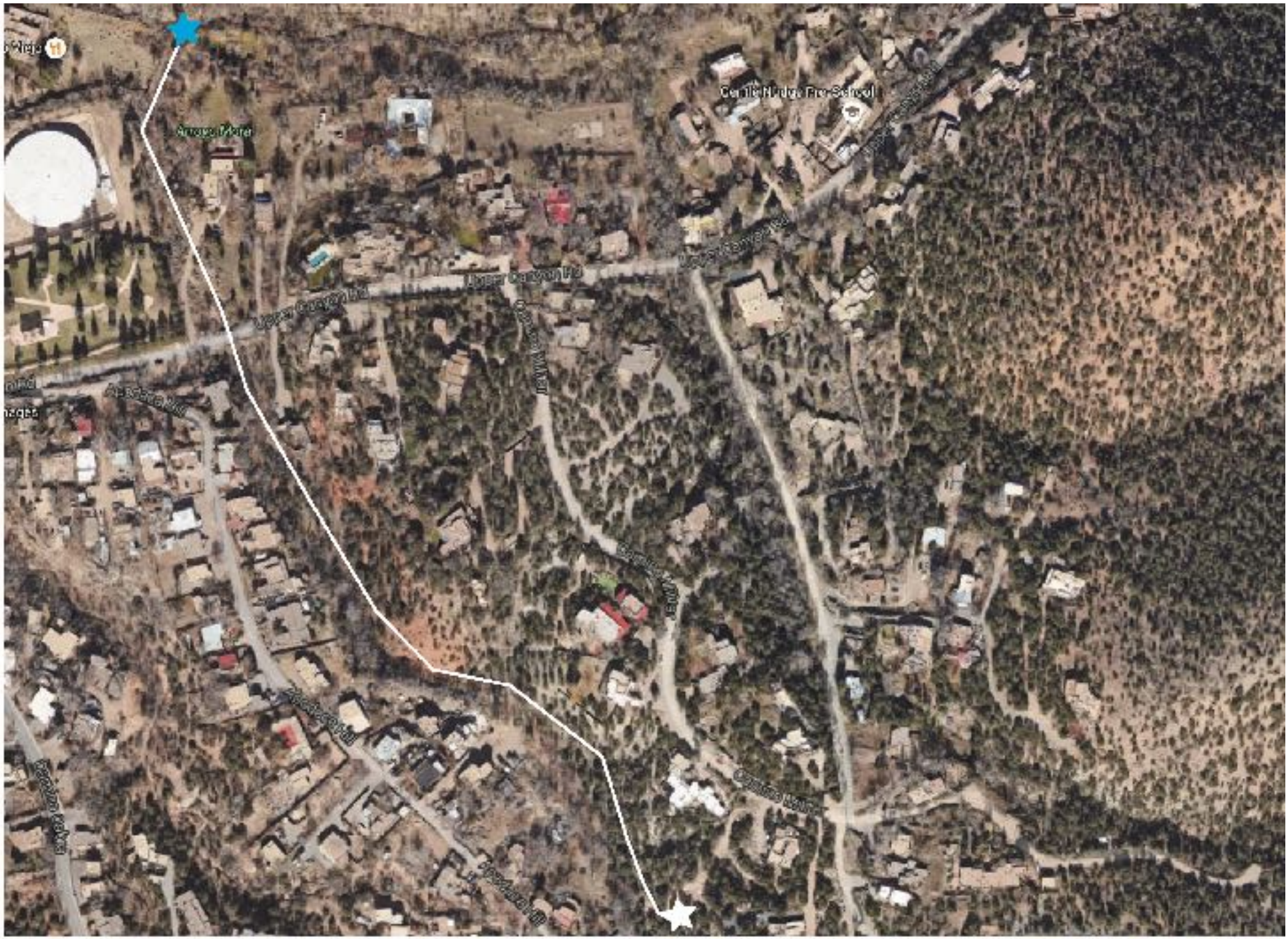
Before arriving at the Avenida Primavera crossing, one of these two fences has been erected across the channel twice. Inside the fence boundaries and in the arroyo channel, a grove of large cottonwoods thrive. From this grove of cottonwoods to the second Primavera crossing are intermittent zones of riparian vegetation.

Below the last Avenida Primavera crossing the Arroyo Saiz passes through the City Storm Water Infiltration Gardens built by Earthworks. Below the gardens, the arroyo begins to cut through hard, sandstone like substrate. As a result, the channel switches from a wide, sandy channel to a severely constricted, incised, corrido. Rock run downs and willows are common through this stretch. The most dramatic vertical walls dramatic appear in this section.

An incised area in the Arroyo Saiz, 2016.

The arroyo then drops down into the Lorenzo Road area. The existing culverts and bridges are silted in. Again, the arroyo is constricted as it passes between homes. One culvert remains restricted however it may no longer be in service.

Silt clogged culvert in the Arroyo Saiz, 2016.



Arroyo Mora Map

River connection

IV. Arroyo Mora – South of Calle Militar to the Santa Fe River

Valuable wildlife corridor.

Notes: The narrow Arroyo Mora begins above Apodaca Hill where it flows closely between homes that have been built on either side of it. Many property owners have extended their borders into the arroyo with buildings, dumped earth, yard trash and trimmings, fences and drainage pipes.

Questionable drainage below residence in Arroyo Mora, 2016.

Questionable drainage below residence in Arroyo Mora, 2016.

Running water with algae, Arroyo Mora, 2016.

Deer track in arroyo bed, Arroyo Mora, 2016.

The Mora quickly ends on the banks of the Santa Fe River. At the time of the field assessment in the early spring of 2016, running water with algal blooms was present at the time as were the presence of game trails. The arroyo Mora's channel can be characterized as a narrow, constricted, occasionally deeply incised arroyo with intermittent vertical walls. An iron pipe remains in the same condition that was noted in 2012. The dumps along the steep hillsides of the Arroyo Mora have remained the same and in some cases have been enlarged. The impacts of the arroyo used as a dumping ground of solid and liquid materials effects the quality of the water that enters the Santa Fe River.

Arroyo Cabra Map

River connection

arroyo

V. Arroyo Cabra- Apodaca Hill – Santa Fe River

Valuable as a wildlife corridor.

Notes: The Arroyo Cabra and the Arroyo Mora join the Santa Fe River. Both arroyos are similar to each other in character. Storm water from the mountains above Apodaca Hill quickly drains through both arroyos into the Santa Fe River. Both arroyos are steep, moderately constricted and do not allow for any significant braiding to occur to slow excess water. They are also deeply incised in some areas and less in others. Although bank deterioration is minimal, some areas are punctuated with the occasional vertical wall, the banks have been enhanced with dumped construction materials or fencing crosses the arroyo. Pollution from household trash has not improved since 2012. Below Alameda, the vegetation in both arroyos changes from a juniper/piñon zone to a diverse riparian zone attracting local wildlife.

A bank along the Arroyo Cabra continues to rapidly deteriorate in the same location as noted in 2012. Storm water, directed into the arroyo through a culvert, falls onto a rip rap mat that is no longer supported by an earthen bank. The high flow from this water will continue to aid in the rapid deterioration of the bank. The lower arroyo has been officially adopted by Desert Montessori through an Adopt an Arroyo program with the Santa Fe Watershed Association.

Undercut rip rap 2012 and trash below a culvert off Camino Cabra vs 2016, Arroyo Cabra, 2016