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CITY OF ALBUQUERQUE

GREEN INFRASTRUCTURE AND CLIMATE RESILIENCY CHARRETTE

AUGUST 11-12, 2015

SUMMARY

Prepared by Tetra Tech

1 BACKGROUND

In recent years, a number of important events have converged in Albuquerque to impact the stormwater program. First, weather has been more extreme. A number of recent climate studies for the region by USGS, USEPA, USBR, MRCOG, local universities and others predict that by mid-century there will be continued flooding, hotter temperatures, longer and more severe droughts, significant drops in stream flow, and curtailed surface water allocation. Many of these studies call for using green infrastructure to lessen the threats to water supplies, public health, property, and the environment—in essence, to make the City more climate resilient (see Figure 1).

Green infrastructure includes trees and natural areas as well as engineered practices such as vegetated swales, raingardens, cisterns, and permeable paving designed to slow, filter, cleanse, and infiltrate stormwater runoff. Green infrastructure attempts to mimic predevelopment hydrology and reduce the impacts of stormwater runoff through infiltration, evapotranspiration, and beneficial use such as irrigation. It can be designed to meet multiple functions (e.g., landscaping, recreation, source water demand and energy demand reduction, etc.)

In a second important event, this year the State and USEPA began implementing a new Municipal Separate Storm Sewer System (MS4) permit for the City of Albuquerque (and other MS4 permit holders in the region). This permit requires new development and redevelopment to retain stormwater on site in a way that more closely mimics predevelopment conditions and reduces stormwater runoff impacts. Again, green infrastructure was recommended to meet these permit requirements.

Figure 1. Example Green Infrastructure Practices

Even before this permit was issued, the market and climate conditions in Albuquerque have driven the use of green infrastructure in a number of new development projects.

In May 2013, the City of Albuquerque was designated by EPA as an Urban Waters Partnership city. This designation means that multiple federal agencies are coordinating their efforts and leveraging federal technical and financial resources to help restore the Rio Grande in Albuquerque, boost recreation, boost the local economy, create jobs, and protect the health of the City's citizens. The Partnership asked, "*How could green infrastructure be used in this arid environment to meet multiple City needs?*"

On August 11-12, 2015, the EPA Green Infrastructure Program and Urban Waters Partnership Program hosted a Green Infrastructure and Climate Resiliency Charrette. The purposes of the Charrette were to

- Increase understanding of how climate change may affect the Albuquerque region;
- Explore how green infrastructure can be used to help meet the region's stormwater permit requirements, address flooding, and make the community more resilient;

- Share a screening technique for identifying the good candidate green infrastructure sites that meet multiple community needs;
- In four diverse districts of the city, evaluate potential green infrastructure BMPs as examples of how green infrastructure could be used to meet multiple community needs; and
- Discuss green infrastructure implementation issues and ways to move forward.

The same education and screening approach used in this Charrette can be used in other districts of the city and by other MS4 communities to identify the best candidate sites for green infrastructure.

More than forty people attended the Green Infrastructure and Climate Resiliency Charrette, including City of Albuquerque staff, Albuquerque Bernilillo County Water Utility Authority (ABCWUA), Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA), representatives from other MS4 communities in the region, NM Department of Transportation, the Business Water Task Force, and technical design professionals (such as engineers and landscape architects) from local non-profit organizations and consulting firms. Day 1 consisted of presentations on a number of climate resiliency and green infrastructure topics. Day 2 focused on group participation in a charrette exercise to identity and evaluate multiple options for implementing green infrastructure concepts and practices for four city districts.

Below is a summary of the key findings and recommendations of the Green Infrastructure and Climate Resiliency Charrette. Presentation slides can be found at: http://www.urbanwaters.gov/mid-riogrande/index.hmtl.

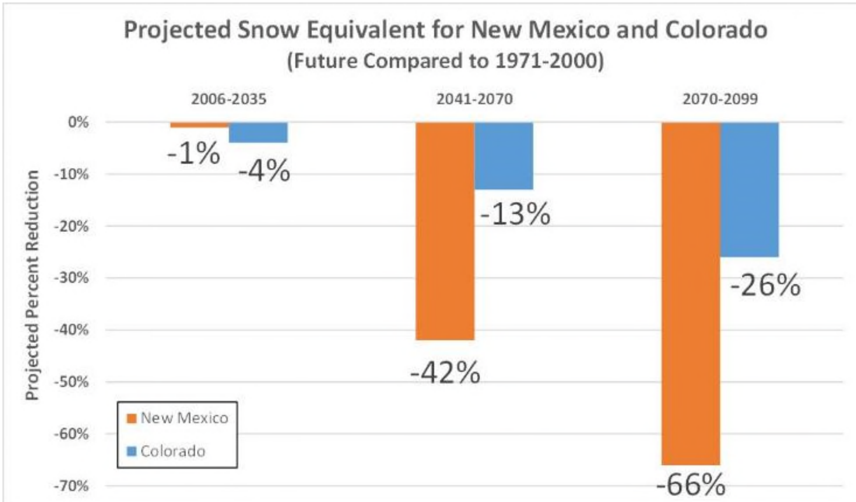
2 CLIMATE CHANGE IN ALBUQUERQUE BY MID-CENTURY

Climate Change Projections

A number of agencies have conducted studies evaluating how climate may change in the Albuquerque region by mid-century and beyond, and how these changes may impact the region's water resources. The Charrette presented some of the major findings of these studies including:

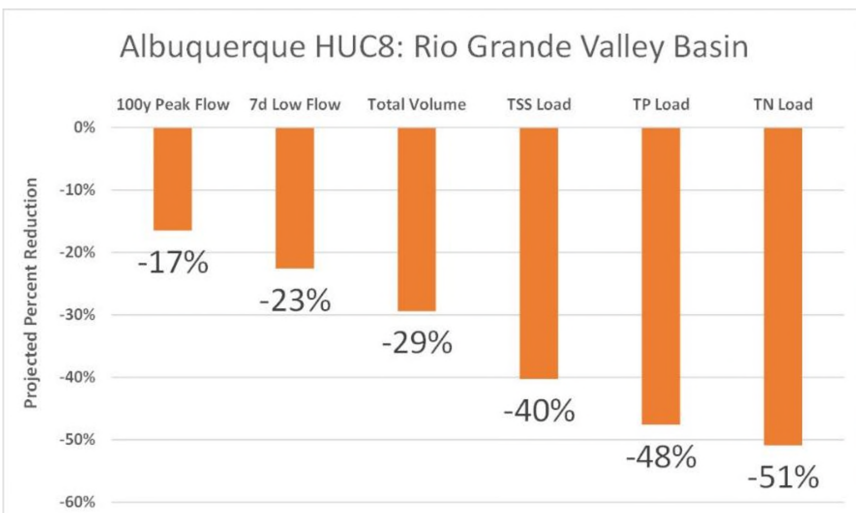
- Snow water equivalent is projected to drop 42 percent in New Mexico and 13 percent in Colorado in the 2041-2070 period compared to the 1971-2000 period (see Figure 2; Melillo et al. 2014).
- Regional annual average temperatures in New Mexico are projected to rise by up to 5.5o F by the period 2041-2070 compared to the 1971-2000 period, with longer and hotter summer heat waves, decreased winter cold outbreaks, and slightly reduced winter and spring precipitation (Melillo et al. 2014).
- By mid-century, in Bernalillo County, average annual maximum and minimum temperatures are projected to increase by 7.2oF and 6.2oF, respectively, compared to the 1950-2005 baseline period (USGS 2014).
- No substantial change is predicted for mean annual precipitation, but due to the increases in heat, there will be large increases in evapotranspiration (USEPA 2013; Volpe National Transportation Systems Center 2015).
- Given climate change and urban development projections at mid-century, the Rio Grande at Albuquerque is projected to have significant reductions in high flow (as measured by the 100-year peak flow), low flow (as measured by the 7-day low flow), total volume, nutrient loading (including nitrogen and phosphorus) and sediment loading (see Figure 3; USEPA 2013).

- Precipitation intensity and flooding risks are not projected to increase substantially (USEPA 2013; Southern Sandoval County Arroyo and Flood Control Authority 2015).
- Flows in the San Juan River, the region's surface water supply source, are projected to decrease by 25 percent by 2050-2099 compared to the baseline period 1950-1999 (Sandia National Lab and U.S. Bureau of Reclamation 2013).



Source: Melillo et al. 2014

Figure 2. Projected Snow Equivalent for New Mexico and Colorado



Source: USEPA 2013

Figure 3. Rio Grande at Albuquerque – Mid Century Compared to 1971-2000 Period

How would these climate and river flow changes impact the Albuquerque region?

These studies also projected how changes in climate and river flows would impact the Albuquerque region. Increased heat will increase air conditioning demands and frequency of power outages.[1] More water will be needed for irrigation and to meet the potable water demands of a growing population, but at the same time there will be less river flow (Hurd and Coonrod 2007; Melillo et al. 2014; Sandia National Lab and U.S. Bureau of Reclamation 2013; Southern Sandoval County Arroyo and Flood Control Authority 2015; USGS 2014; USEPA 2013; Volpe National Transportation Systems Center 2015). The San Juan Chama project, which transports and stores San Juan River water rights allocations to the Albuquerque region, is projected to decrease allocations by 15 percent by mid-century (Sandia National Lab and U.S. Bureau of Reclamation 2013). Only 72 percent of the region's allocation would be met by 2050 and 62 percent by 2099 (Sandia National Lab and U.S. Bureau of Reclamation 2013). Already, the water allocations have been difficult to use due to drought and ash-laden water from increased forest fire activity (Sandia National Lab and U.S. Bureau of Reclamation 2013). As air conditioning demands rise, so will the disruptions in the region's energy supplies. More electricity will be needed at a time of decreasing river flows, resulting in a projected fifty percent reduction in hydropower production (Sandia National Lab and U.S. Bureau of Reclamation 2013). Coal and gas-fired power plants will also need water.

In short, severe and sustained droughts will increase competition for water and power among farmers, cities, and energy producers.

As the water supply decreases and the demand increases, water prices will increase. A study conducted by UMN and NMSU[7] estimated that there could be a 15 percent increase in water prices by 2030 due solely to climate-change-related supply and demand, and greater than 100 percent increase in prices by 2080 (using mid-range price increase forecasts). This would be in addition to price increases planned or projected for other budget demands.

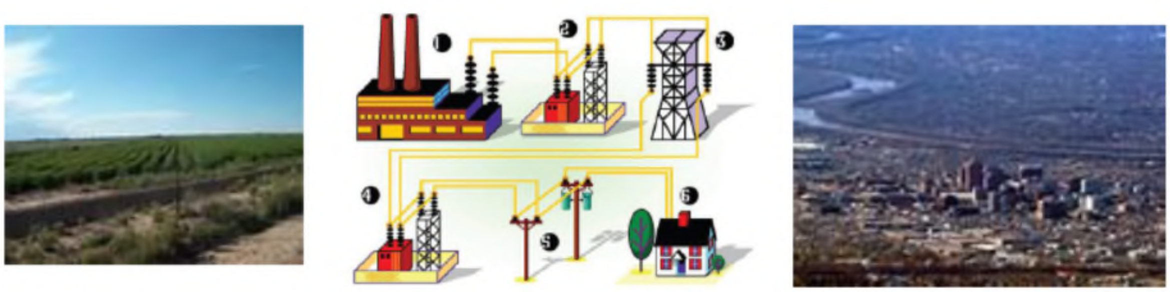


Figure 4. Competition for water and power will increase among cities, farmers, and energy producers

These climate changes are projected to increase the frequency and severity of illnesses and deaths due to the urban heat and smoke from forest fires (Melillo et al. 2014).

Finally, although less pollution will be discharged to the river and streams, some studies predict that the concentrations of pollution in the river are likely to be higher due to the lower flow. This would impact aquatic life and increase the cost of meeting wastewater discharge permit requirements. The ecosystem as a whole would be stressed—and in some cases destroyed—due to increased drought, heat, and forest fires (Sandia National Lab and U.S. Bureau of Reclamation 2013; Hurd and Coonrod 2007).

In face of such threats, some communities are taking steps to improve their climate resiliency.

What is climate resiliency and how can green infrastructure help?

Climate resiliency is improving community resiliency to threats posed by climate change to critical infrastructure, water quality, and human health (USEPA 2014). Green infrastructure concepts can be integral to this resiliency by storing rainwater for groundwater reserves; harvesting rainwater on-site for irrigation or other uses; preserving areas in the city with high-infiltration soils; conserving areas around floodplains; using green infrastructure practices, such as bioretention areas, to reduce localized flooding and water quality impacts; and using trees and living roofs to lower building energy use and reduce the urban heat island effect. See Figure 5 through Figure 9 for examples of green infrastructure to improve climate resiliency.

Source: Tetra Tech

Figure 5. Example Green Infrastructure to Improve Climate Resiliency: Vegetative Roofs

Source: Tetra Tech

Figure 6. Example Green Infrastructure to Improve Climate Resiliency: Planting Barren Land with Native Plants

Source: Tetra Tech

Figure 7. Example Green Infrastructure to Improve Climate Resiliency: Cisterns for Water Harvesting

Source: Tetra Tech

Figure 8. Example Green Infrastructure to Improve Climate Resiliency: Bioretention Areas

Source: Tetra Tech

Figure 9. Example Green Infrastructure to Improve Climate Resiliency: Trees

3 USING GREEN INFRASTRUCTURE TO ADDRESS REQUIREMENTS

Presenters reviewed the current state of stormwater management and related regulations in the City and shared information on how to develop green infrastructure practices with climate change in mind. The most promising green infrastructure practices for addressing climate resiliency, flooding issues, and water rights constraints include:

- Bioretention areas/bioswales with internal water storage design features that hold water longer
- Permeable pavement
- Water harvesting devices such as cisterns
- Tree and vegetation plantings in barren areas of the city (drought tolerant plants/vegetation that will not require irrigation after the establishment period)
- Planter boxes (again, drought tolerant plants/vegetation that will not require irrigation after the establishment period)
- Other devices that bioremediate runoff by passing flows through a plant- and soil-based filtration system where pollutants are removed through a variety of physical, biological, and chemical processes

There are key constraints to consider in developing these green infrastructure practices in Albuquerque:

- The Office of the State Engineer (OSE) Policy on use of Rainwater Harvesting and Snowmelt: OSE encourages the harvesting, collection, and use of rainwater from residential and commercial roof surfaces for on-site landscape irrigation and other on-site domestic uses. However, such harvesting should not reduce the amount of runoff that would have occurred from the site in its natural, pre-development state. Water that does not fall on rooftops cannot have on-site beneficial uses such as irrigation.

- The green infrastructure practice should hold the rainwater and infiltrate it in less than 96 hours to avoid triggering a water rights/compact issue. Rainwater that cannot be infiltrated in less than 96 hours must be released off-site.
- Certain infiltration practices require groundwater infiltration permits, which can add delays and expense to the permitting process.

The Charrette included presentations of a number of case studies of how green infrastructure has been used in public and private development projects over the last ten years to meet multiple needs on the site, including yielding irrigation water supply; treating stormwater; reducing impacts of flooding and peak stormwater flow; landscaping; providing shading and cooling for buildings, parking areas, and sidewalks; increasing wildlife habitat; and so on (see Figure 10).

Source: Sites Southwest

Figure 10. Examples of Green Infrastructure Implemented in Recent Albuquerque Developments

Presentations also included funding options that communities are using to implement green infrastructure concepts. These generally include taxes, bonds, fees, partnerships, and incentives. It was noted that incentives for new development are critical, including but not limited to

- Volume/retention performance standards
- Allowing green infrastructure to count towards and be constructed in required landscaping, perimeter screening, open space, and recreation area (so it is not competing for valuable land)
- Reduction of code requirements in exchange for using green infrastructure
- Increased allowable development
- Fee waivers
- Expedited reviews
- Tax incentives
- Awards and recognition programs

The Charrette participants noted that:

- Green infrastructure is happening in the region because new, prolonged climate conditions and the market are creating a demand.
- The City and County's Comprehensive Plan is being updated this year, and the City's code is being updated by the end of 2016. Participants stressed the importance of incorporating new policies into the Comprehensive Plan and new incentives into the Code to make green infrastructure easier and more cost effective to use.
- There is a need for clear maintenance requirements in local codes, manuals, and operations and maintenance agreements. City staff reported that the City has a draft Water Quality ordinance, under review, that addresses maintenance requirements for stormwater quality best management practices.
- Green infrastructure practices that require minimal maintenance should be encouraged.
- The need for a simple matrix that MS4 permittees can use with the development community to show the types of green infrastructure BMPs that are appropriate for different types of developments. The City staff noted that it is developing design guidance for different BMPs that is being reviewed/vetted internally.
- Most existing residences in Albuquerque hold the majority of the rainwater on their property due to perimeter walls; if there were a cistern or other green infrastructure feature onsite, this rainwater could be used/managed more rationally and for more benefit.
- In the future, cross-sector management options should be explored that could achieve the region's water conservation and water quality goals most cost-effectively (e.g., municipal and agricultural partnerships).

4 GREEN INFRASTRUCTURE SCREENING PROCESS

Screening Criteria

The Workshop included presentation of a screening process to identify good candidate sites for green infrastructure. The process (Figure 11) uses GIS analysis to eliminate from consideration parcels where green infrastructure would be infeasible (based on slopes, soil contamination, etc.) and then set priorities, using a quantitative or qualitative prioritization matrix, for the remaining opportunity parcels or sites using criteria such as

- Public ownership
- Proximity to environmentally sensitive areas
- Infiltration capacity
- Parcel area and percent imperviousness
- Proximity to storm drainage networks
- Proximity to existing BMPs
- Proximity to parks, schools, and other public property
- Contributing drainage area
- Known stormwater issues (i.e., localized flooding, undersized drainage network, high pollutant concentrations from a known source, etc.)

Source. Tetra Tech

Figure 11. Screening Process for Identifying Good Candidate Infrastructure Sites.

Prior to the Charrette, four City districts were identified to focus on in the Charrette exercise. The four districts all have existing flooding issues, represent a wide range of land uses and socioeconomic status, and include various scales:

South Broadway Area—100 acres; urban mixed use development

Glenrio—70 acres; residential development

Mid-Valley—450 acres; residential development

Ventana Dam—270 acres residential; 560 acres undeveloped

For each of these districts, an aerial basemap was developed showing parcels, buildings, roads, storm drain network, location of publically owned parcels, hydrology, and existing BMPs, along with a transparent overlay showing existing flooding problems, topography, and soil infiltration categories. This map series allowed a “zooming in” of areas of interest in each district. See the next section for maps of the districts that were the focus of the Charrette exercise on Day 2.

Prior to the Charrette, a review of locally adopted plans and strategies was conducted to identify goals, actions, and factors that relate to or support climate resiliency. On Day 1, these were reviewed and revised by the group as key criteria in evaluating different green infrastructure options. A qualitative prioritization matrix was developed that the group could use on Day 2 to evaluate different green infrastructure options based on stormwater runoff, climate resiliency, and community livability benefits (see Figure 12 and the Appendix to see how each option was evaluated).

	Improves Climate Resiliency & Stormwater Runoff											Improves Community Livability						
Benefit	Reduces Water Treatment Needs	Improves Water Quality	Reduces Grey Infrastructure Needs	Reduces Flooding	Increases Available Water Supply	Increases Groundwater Recharge	Reduces Salt Use	Reduces Energy Use	Improves Air Quality	Reduces Atmospheric CO_2	Reduces Urban Heat Island	Improves Aesthetics	Increases Recreational Opportunity	Reduces Noise Pollution	Improves Community Cohesion	Urban Agriculture	Improves Habitat	Cultivates Public Education Opportunities
Option										CO_2								
#1																		
#2																		

Source: Adapted from the Center for Neighborhood Technology

Figure 12. Green Infrastructure Option Prioritization Matrix

5 FOUR DISTRICTS POTENTIAL GREEN INFRASTRUCTURE

South Broadway Area

For the purposes of this Charrette, the South Broadway district is approximately 100 acres of urban mixed use development. The vulnerable areas include existing areas of flooding of streets, commercial areas, and houses, particularly below street level houses in the East San Jose area. Key areas for green infrastructure opportunity over the next ten years include acquiring a vacant lot and locating a detention basin/multi-purpose park on William Street; use of bulb-outs and bumpouts with vegetated green infrastructure practices along William Street to both slow traffic and manage stormwater; a voluntary tree planting program on private property lining Kathryn Street in conjunction with installation of street permeable pavers that capture stormwater for irrigation of the trees; use of a city-owned parcel for a butterfly garden or potentially a community garden (however, given the industrial nature of the site, care should be taken to clean the stormwater before using for a community garden); and use of depressed, vegetated roundabouts. The group’s long-term vision included creating a San Jose Walking Path that loops around and links to the Community Center. This walking path could include the historic Barelas Ditch, which is a historical trade route, and vegetated green infrastructure practices. See Figure 13 and the South Broadway Area evaluation matrix in the Appendix.

Glenrio

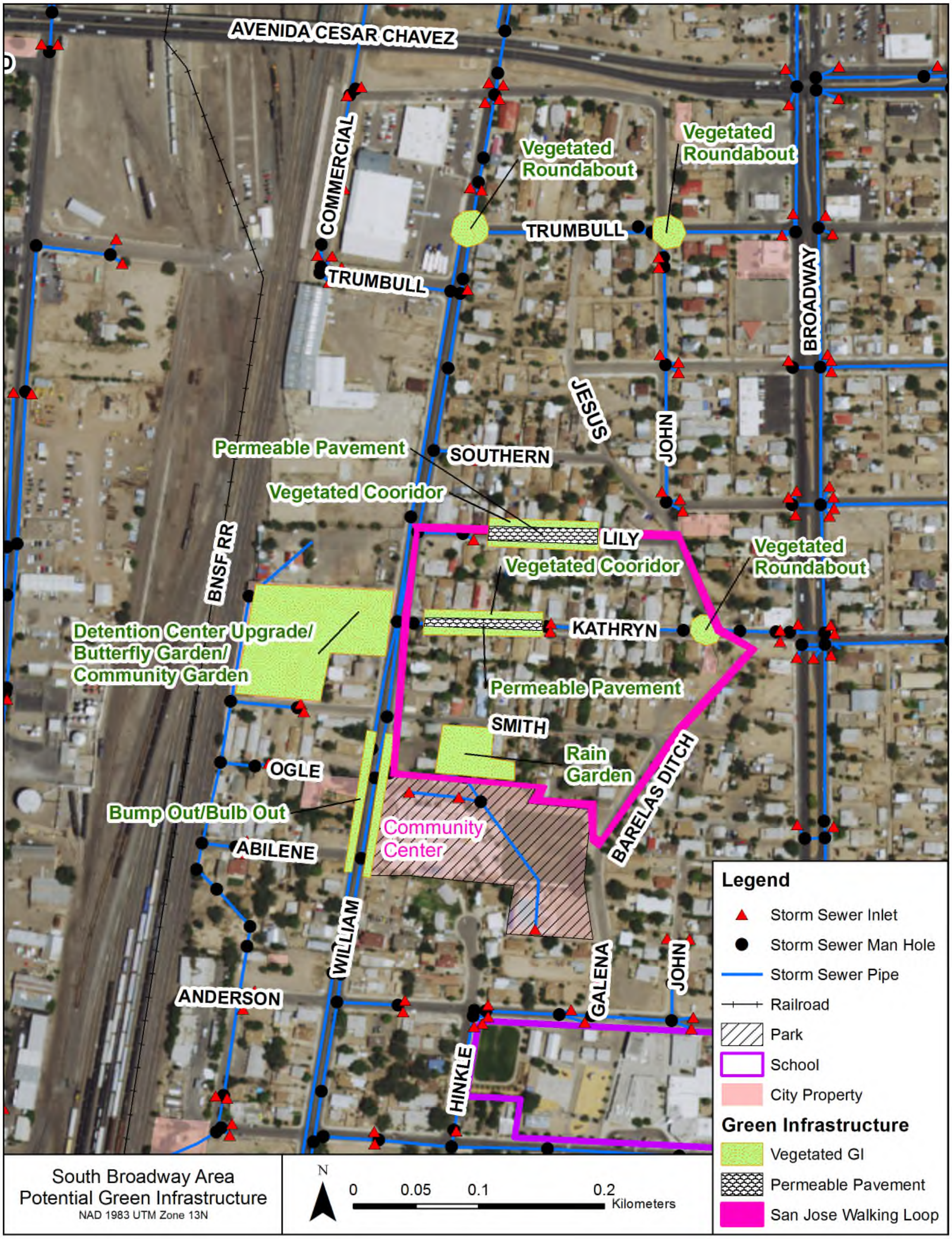
The Glenrio district that the group focused on is 70 acres of single-family residential development built in the 1950s. Both streets and property flood within the neighborhood, with vulnerable areas being Hanover Street (a sump area with inadequate inlets to drain the area); 54th Street and 55th Street; the church property; the east-west dirt channel, which is too flat to properly drain (beginning at Loma Hermosa North); and homes along the channel. Potential green infrastructure to install in the next 10 years to address flooding and climate resiliency issues include acquiring vacant property to install a surge pond, infiltration galley, and recreation area; installation of street permeable pavement; voluntary tree planting and urban agriculture program at the school; voluntary public tree plantings and fruit trees on private property (in conjunction with Cooperative Extension); and a rebate program to assist the church and homeowners with installing cisterns. The latter would also be a long-term funding project for the City. See Figure 14 and the Glenrio Area evaluation matrix in the Appendix.

Mid-Valley

The group evaluated a 450- acre section of the Mid-Valley District (in Barelas) comprised of single family residential development built in the 1920-40s. Existing flooding areas include Coal Street to Stover Street up to 2nd Ave and 4th Ave as water drains from the north and overwhelms the older, undersized drainage systems; the Riverside drain, which no longer functions as a drain; and the Railyard drainage to the east. Potential green infrastructure for this district included permeable paving on Iron/10th (and the Zoo Parking); a railyard bioretention pond; a nuisance stormwater reuse system at Stover/12th (feeding into Zoo duck pond and other nuisance water); a tree planting project in the neighborhood tied to water harvesting systems to feed them; pocket parks along Iron Street; a community garden at 7th/Stover; pavement cuts plus bioretention and infiltration at the National Hispanic Cultural Center and Zoo Parking; Bosque bioretention/swale at the Alcalde pump station and Cesar Chavez; permeable pavement and bioretention landscaping in parking lots; and bioretention areas on abandoned, vacant sites in the neighborhood. See Figure 15 and the Mid-Valley Area evaluation matrix in the Appendix.

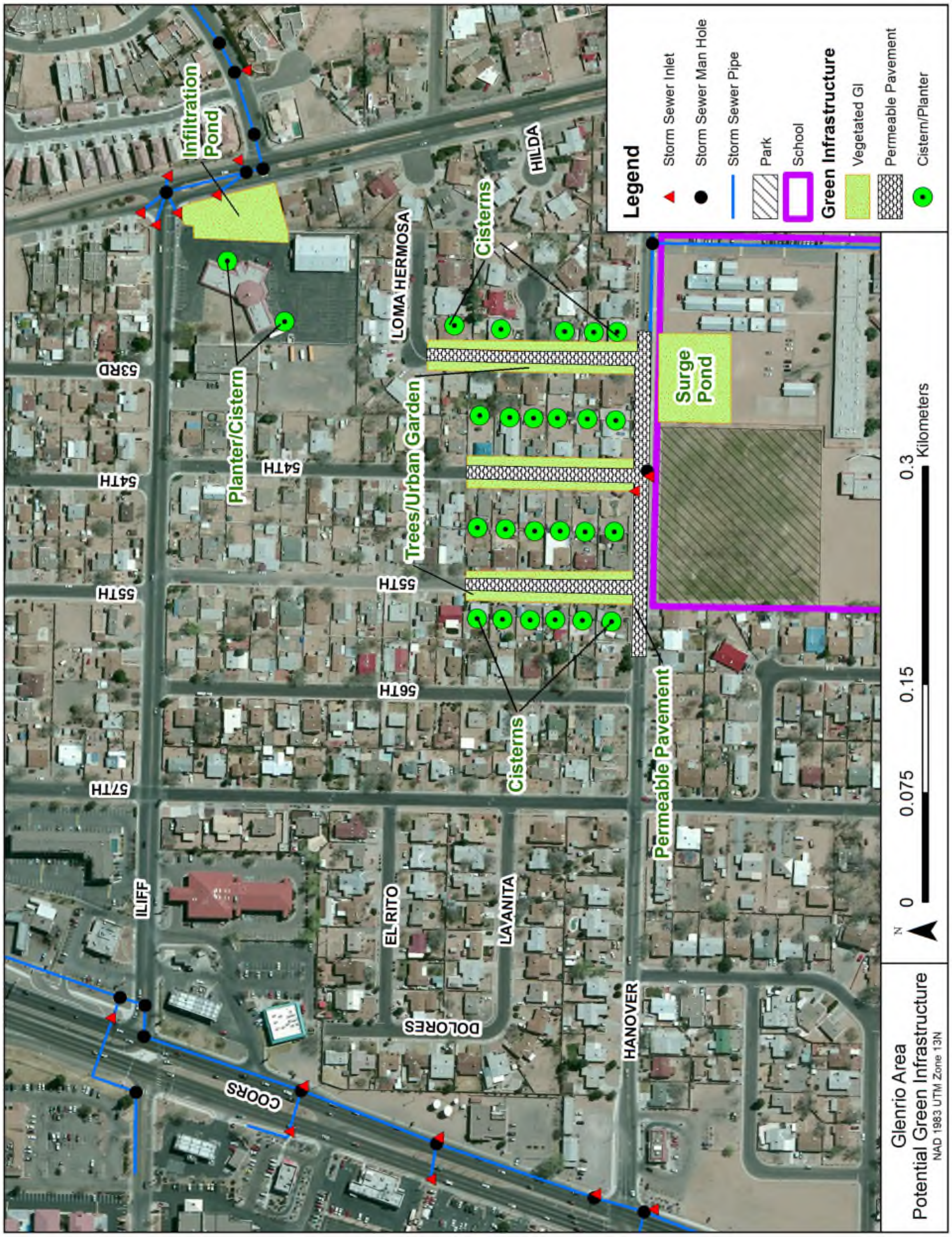
Ventana Dam Area

The Ventana Dam Area is a large area of existing planned unit developments and a large swath of undeveloped land that is planned for residential development in the coming decade. A smaller, representative area (comprising 270 acres of existing residential development and 560 undeveloped acres) was “zoomed in” to form the district for the Charrette Exercise. For future development, the group considered two alternative approaches. First, building homes, streets, schools, streets/highways, and parks with distributed green infrastructure practices, including open channels and bioswales in the median of 4-lane streets; permeable pavement in residential streets; tree plantings in street medians and lots; a continuation of existing footpaths; community gardens; and incentives for individual homeowners to have cisterns. A second approach would be to use a development agreement to preserve land that has low infiltration/rocky soil, cluster development on more appropriate/easy to develop land, develop land with use of green infrastructure practices, and install major green infrastructure practices before development occurs. Planners would need to monitor the Paseo de Vulcan roadway expansion and new development concept plans to work green infrastructure into the plans early. See Figure 16 and the Ventana Dam Area evaluation matrix in the Appendix.



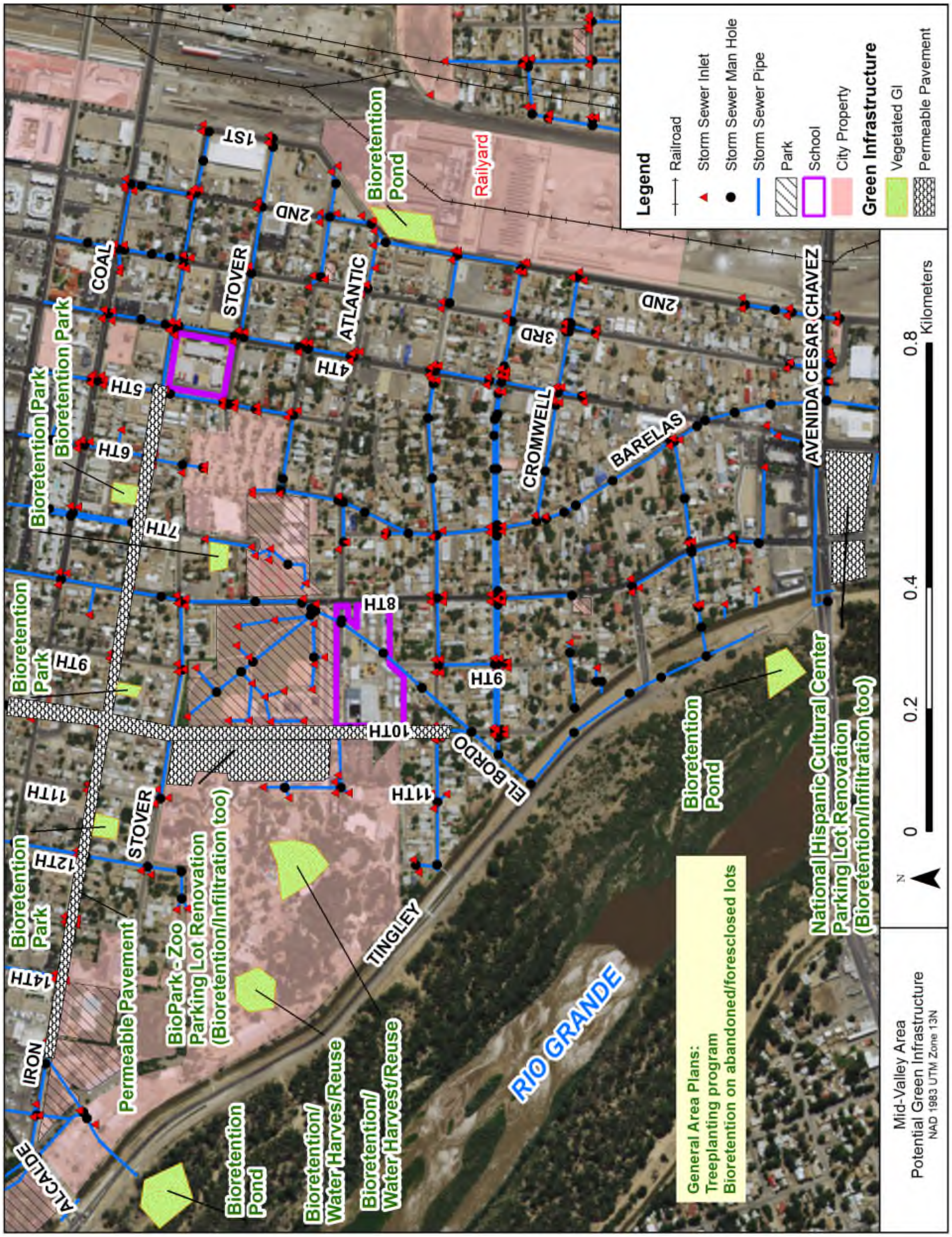
Source: Tetra Tech

Figure 13. South Broadway District Potential Green Infrastructure BMPs



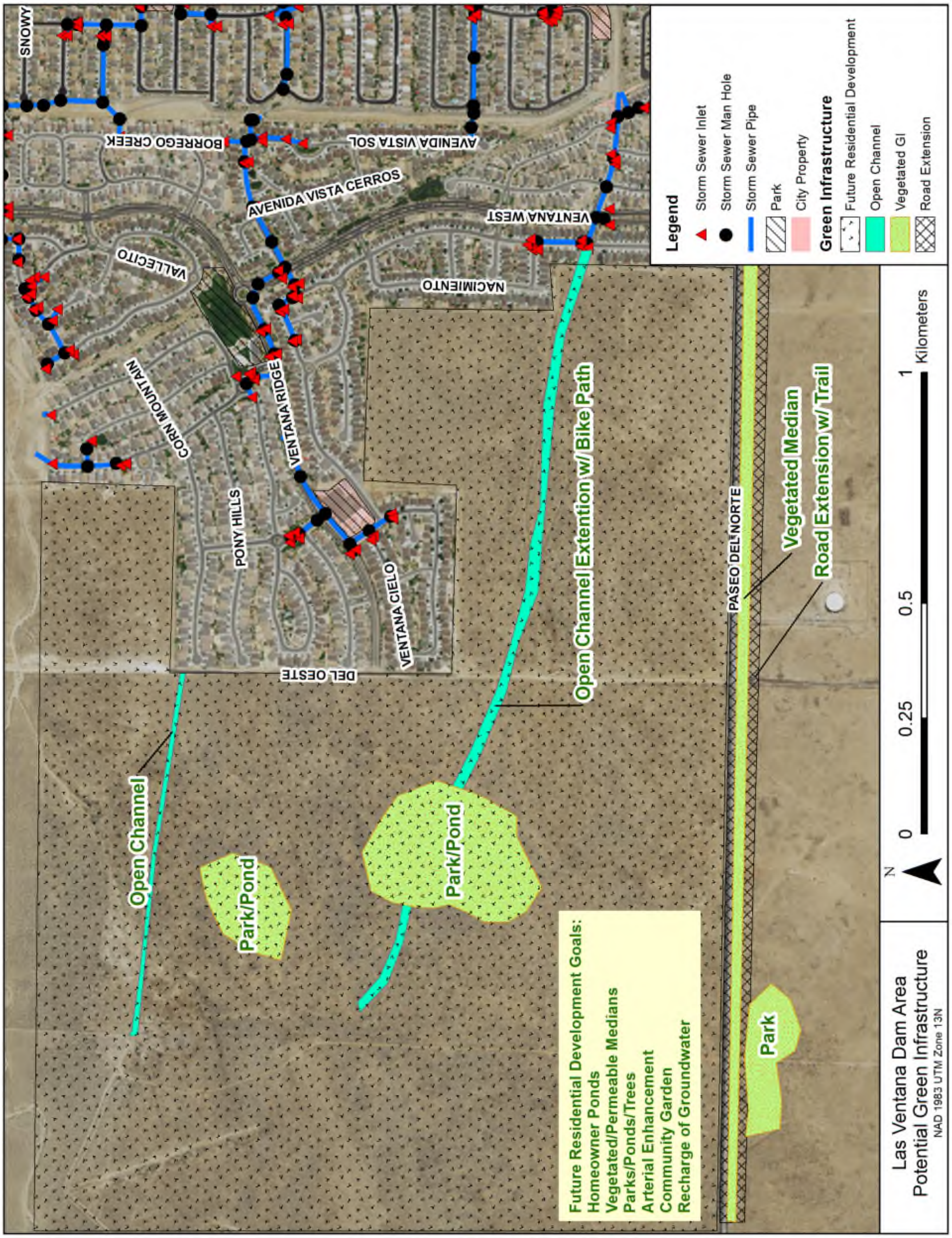
Source: Tetra Tech

Figure 14. Glenrio Potential Green Infrastructure BMPs



Source: Tetra Tech

Figure 15. Mid-Valley Potential Green Infrastructure BMPs



Source: Tetra Tech

Figure 16. Ventana Dam Area Potential Green Infrastructure

Figure 17 is a summary of the potential stormwater runoff, climate resiliency, and community benefits of these combined green infrastructure options for each district.

Benefit	Improves Climate Resiliency & Stormwater Runoff											Improves Community Livability						
	Reduces Water Treatment Needs	Improves Water Quality	Reduces Grey Infrastructure Needs	Reduces Flooding	Increases Available Water Supply	Increases Groundwater Recharge	Reduces Salt Use	Reduces Energy Use	Improves Air Quality	Reduces Atmospheric CO_2	Reduces Urban Heat Island	Improves Aesthetics	Increases Recreational Opportunity	Reduces Noise Pollution	Improves Community Cohesion	Urban Agriculture	Improves Habitat	Cultivates Public Education Opportunities
District										CO_2								
S. Broadway		✓		✓					✓	✓	✓	✓	✓		✓		✓	✓
Glenrio	✓	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mid Valley	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓		✓	✓	✓	✓
Ventana	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓

Figure 17. Green Infrastructure Benefits for Each District

6 NEXT STEPS

Who needs to hear about these findings?

The Charrette closed with a discussion of next steps. The group discussed who needed to hear the findings and recommendations of the Charrette and divided the communication and outreach into three areas:

1. General education about the approach and findings of the charrette;
2. Financial/funding strategies; and
3. Tailored outreach to the four district areas.

Below are the group's recommendations on each.

General Education

The group recommended that the charrette summary prepared by Tetra Tech be shared with the agencies and groups listed below. The broad message to these groups should be: Here is the approach we used and the key findings of the charrette; these are examples of how green infrastructure could be used to meet multiple community needs in four diverse districts of the City; and this same approach could be used in other districts and other MS4 communities to identify best candidate sites for green infrastructure.

- MS4 Permittees (Technical Advisory Group)
- City Planning Department Staff coordinator leading the Comprehensive Plan Update and the Integrated Development Ordinance update (updates to be completed in 2015 and 2016, respectively).

- County Planning Department Staff coordinator leading the Comprehensive Plan Update (update to be completed in 2015).
- City Planning Department staff leading update on new landscape ordinance
- City Council members
- County Commission members
- Water Utility staff and board
- Metropolitan Redevelopment Authority
- Development Process Manual Group
- Development community including Homebuilders' Association; Chambers of Commerce; NAIOP; Business Water Task Force, and others
- Albuquerque Public Schools
- University of New Mexico
- Central New Mexico Community College
- State legislators
- Urban Waters Partnership members

Financial/Funding Strategies

The group identified two key pathways for identifying, coordinating, and leveraging funding opportunities: the Urban Waters Partners (leveraging funding/resources from multiple federal agencies) and the City Stormwater Program (leveraging funding/resources from local agencies). Needs identified included:

- Getting/funding demonstration projects.
- Having a local staff person with time dedicated to writing and tracking grants (including federal, foundation, and other types of grants). Needing to have a point person to navigate the complex grant system to be able to effectively take advantage of outside funding.
- Having a joint forum for prioritizing projects that meet multiple agency needs (including coordinating on CIP funds and the design of such projects to meet multiple community needs).
- Helping find a cost effective way to meet inspection/maintenance requirements for green infrastructure on public property, particularly green infrastructure projects that cross multiple departmental/agency functions.

Tailored Outreach to the Four Districts

A key next step is finding or determining if there is a champion for each of the four districts. Once a champion is identified, the next step would be to review the ideas generated by the Charrette groups and see where there is already traction/interest by the City stormwater program, AMAFCA, the Water Utility, the County or others (e.g., a project is already being studied or it fits within a strategic plan or sector plan). Next, the champion (working with city staff) should develop a communication/outreach plan for his or her district to begin a dialog. The initial message should be: We know you have existing flooding problems here. We'd like to work with you to think about ways to solve those problems and meet other neighborhood needs at the same time. We'd like to hear your ideas and share ideas that we have.

The group stressed that it is critical to get *visible, attractive, effective demonstration projects* in these areas. In choosing the types of demonstration projects in these districts, one criterion should be that the green infrastructure practices are scalable to other districts in the City (the most scalable types of best management practices that could be implemented across the City appear to be tree planting, water harvesting bioswales, permeable pavement, planter boxes, and underground infiltration/bioremediation practices).

Key groups that need to be contacted for each district include:

<u>Mid-Valley</u>

Albuquerque Zoo
Hispano Chamber of Commerce
Rail yard
Barelas Community Garden
City Council representative for this district
HUD
AMAFCA
Barelas Neighborhood Association
Barelas Community Coalition

<u>Glenrio</u>

West Mesa Neighborhood Association
Hispano Chamber of Commerce
Church
Albuquerque Public Schools
City Council representative for this district

<u>South Broadway</u>

Neighborhood Association
Hispano Chamber of Commerce
Business owners
Church
City Parks and Recreation
City Family and Community Services
South Broadway Neighborhood Association
San Jose Neighborhood Association
City Council representative for this district

<u>Ventana Dam Area</u>

City of Rio Rancho
MRCOG
Sandoval County Planning and Zoning
City of Albuquerque Open Space Division

7 CITATIONS

Hurd, B., and J. Coonrod. 2007. *Climate Change and Its Implications for New Mexico's Water Resources and Economic Opportunity*. New Mexico State University Technical Report #45. Accessed September 1, 2015. http://aces.nmsu.edu/pubs/research/economics/TR45.pdf.

Melillo, J.M., T.C. Richmond, and G.W. Yohe, Eds. 2014. *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2.

Sandia National Lab and U.S. Bureau of Reclamation. 2013. *West-Wide Climate Risk Assessment: Upper Rio Grande Impact Assessment*. Accessed September 1, 2015. www.usbr.gov/WaterSMART/wcra/reports/urgla.html.

Southern Sandoval County Arroyo and Flood Control Authority. 2015. Flood Risk Analysis Potential Impacts of Climate Change on the Upper Calabacillas Arroyo.

U.S. Environmental Protection Agency (USEPA). 2013. *Watershed Modelling to Assess the Sensitivity of Streamflow, Nutrient, and Sediment Loads to Potential Climate Change and Urban Development in 20 U.S. Watersheds*. Accessed September 1, 2015. cfpub.epa.gov/ncea/global/recorddisplay.cfm.

U.S. Environmental Protection Agency (USEPA). 2014. Green Infrastructure for Climate Resiliency. Accessed September 1, 2015. http://water.epa.gov/infrastructure/greeninfrastructure/upload/climate_res_fs.pdf.

U.S. Geological Survey (USGS). 2014. *National Climate Change Viewer (NCCV) Home*. Accessed September 1, 2015. www.usgs.gov/climate_landuse/clu_rd/nccv.asp.

Volpe National Transportation Systems Center. 2015. *Integrating Climate Change in Transportation and Land Use Scenario Planning: An Inland Example*.