CITY OF ALBUQUERQUE COUNCIL SERVICES

PUEBLO ALTO & MILE HI NEIGHBORHOODS DRAINAGE STUDY SUMMARY REPORT

JULY 2022

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PREPARED BY:

groundworkstudio

Bohannan Huston

ACKNOWLEDGMENTS

CABQ CITY COUNCIL & COUNCIL STAFF

Councilor Tammy Fiebelkorn, CABQ City Council
Councilor Diane Gibson, CABQ City Council
Diane Dolan, CABQ City Council
Laura Rummler, CABQ City Council
Abigail Stiles, CABQ City Council

CABQ DEPARTMENT OF MUNICIPAL DEVELOPMENT STAFF

Kathy Verhage, CABQ DMD Engineering
John MacKenzie, CABQ DMD Engineering
Paula Dodge-Kwan, CABQ DMD Engineering

OUTREACH COMMITTEE

Tina Valentine, Pueblo Alto Neighborhood Association
Tyler Richter, Pueblo Alto Neighborhood Association
Hope Nelson, Pueblo Alto Neighborhood Association
Cynthia Serna, Mile Hi Neighborhood Association
Joan Davis, Mile Hi Neighborhood Association
Jeffrey Holland, Mile Hi Resident
Greg Boyd, Pueblo Alto Resident
Jasen Christensen, Pueblo Alto Resident
Anne Christensen, Pueblo Alto Resident
Sarah Hurteau, Arid Low Impact Development Coalition

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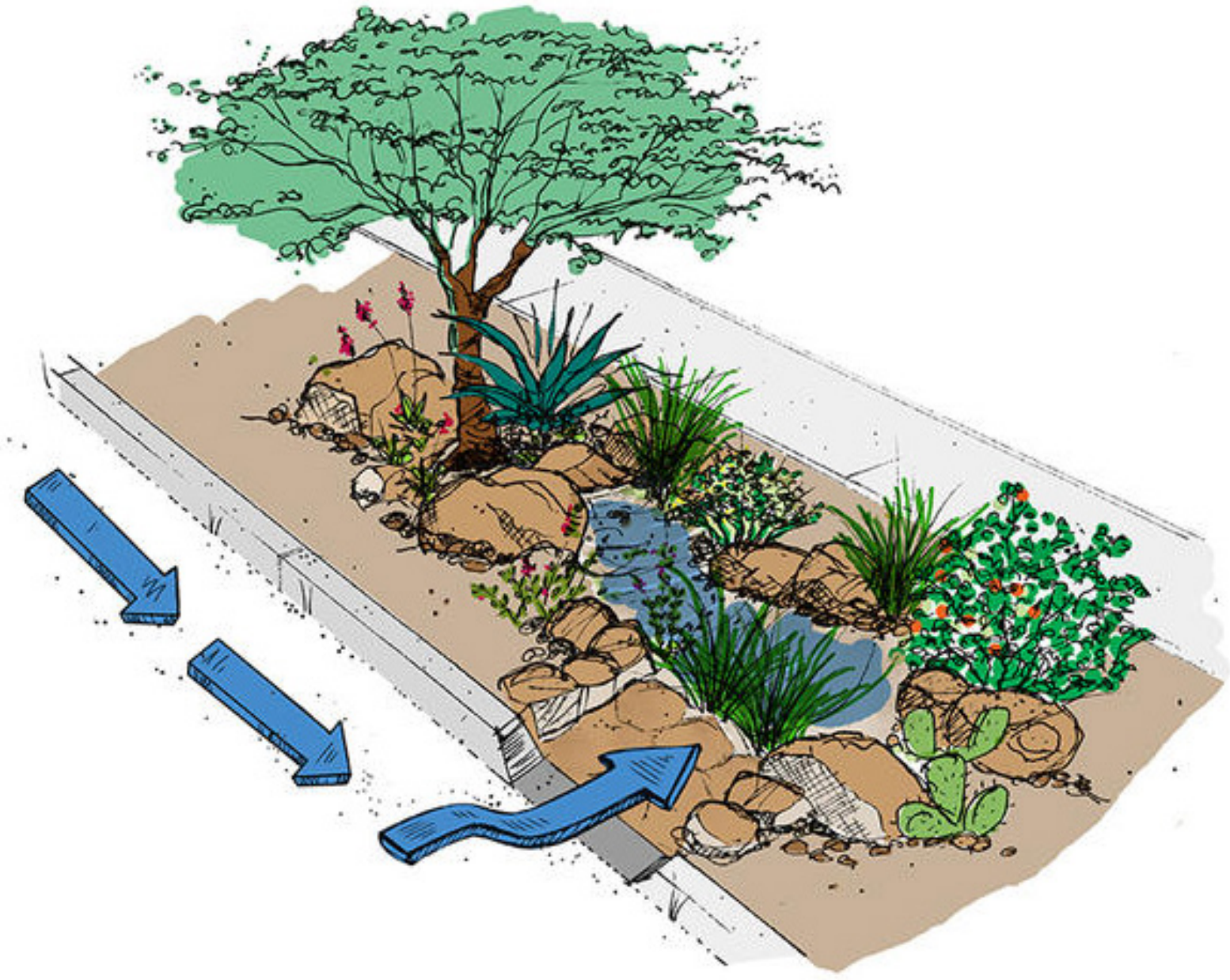


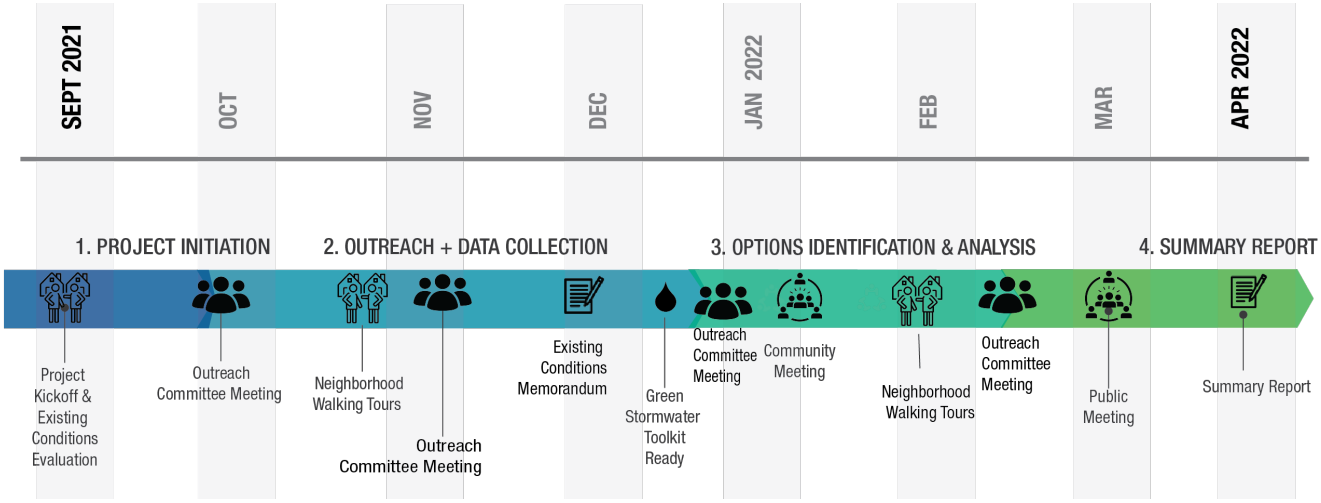
Chapter 1

Introduction

Project Introduction

STUDY OVERVIEW

The Pueblo Alto & Mile Hi Drainage Study Project was created to address flooding issues in Albuquerque neighborhoods. It focuses specifically on drainage problems south of Constitution Avenue to Lomas Boulevard, between San Pedro Drive and Washington Street. The City and AMAFCA have conducted various studies for the area, and as documented in the San Mateo to Moon Mini Drainage Management Plan (2017), determined that the existing storm drains in the basin, including the San Pedro and San Mateo storm drains, are severely under capacity. Surface runoff drains to the interceptor storm drains faster than these storm drains can convey the water. Once at capacity, interceptor storm drains cannot capture additional surface runoff. Therefore, surface runoff accumulates as it flows west and creates flooding during heavy rainfall events. The "Moon Mini" plan identified multiple locations in the Washington to Moon Drainage Basin for possible ponding sites. In 2018, a ponding site at nearby Twin Parks was being considered as a multi-use facility to mitigate neighborhood flooding; however, due to significant neighborhood opposition, the project was abandoned. This project seeks to find localized solutions to the drainage issues through on-going collaboration with surrounding neighborhoods. The project is a unique collaboration between City Council District 7 Councilor and staff, City of Albuquerque Department of Municipal Development hydrologists, BHI planners and engineers, Groundwork Studio landscape architects and planners, the ARID LID Coalition, Pueblo Alto Neighborhood Association, Mile Hi Neighborhood Association and local residents. The extent of the flooding necessitates a multi-phase approach to address flooding problems. This project is a first step that allows for the idenfication of locations and small-scale solutions that are acceptable to the community, while larger, regional-scale stormwater infrastructure improvements are also developed.

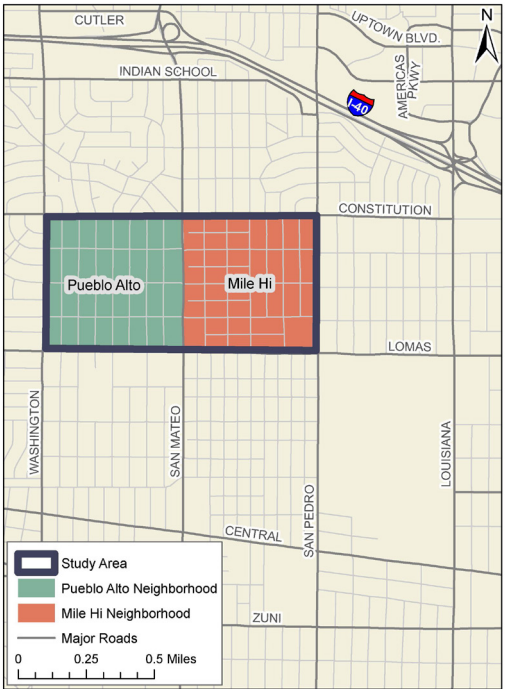


Project Scope and Sequence

Flooding in the Pueblo Alto neighborhood

Flooding in the Pueblo Alto neighborhood

Study Area: Pueblo Alto Neighborhood Drainage Study

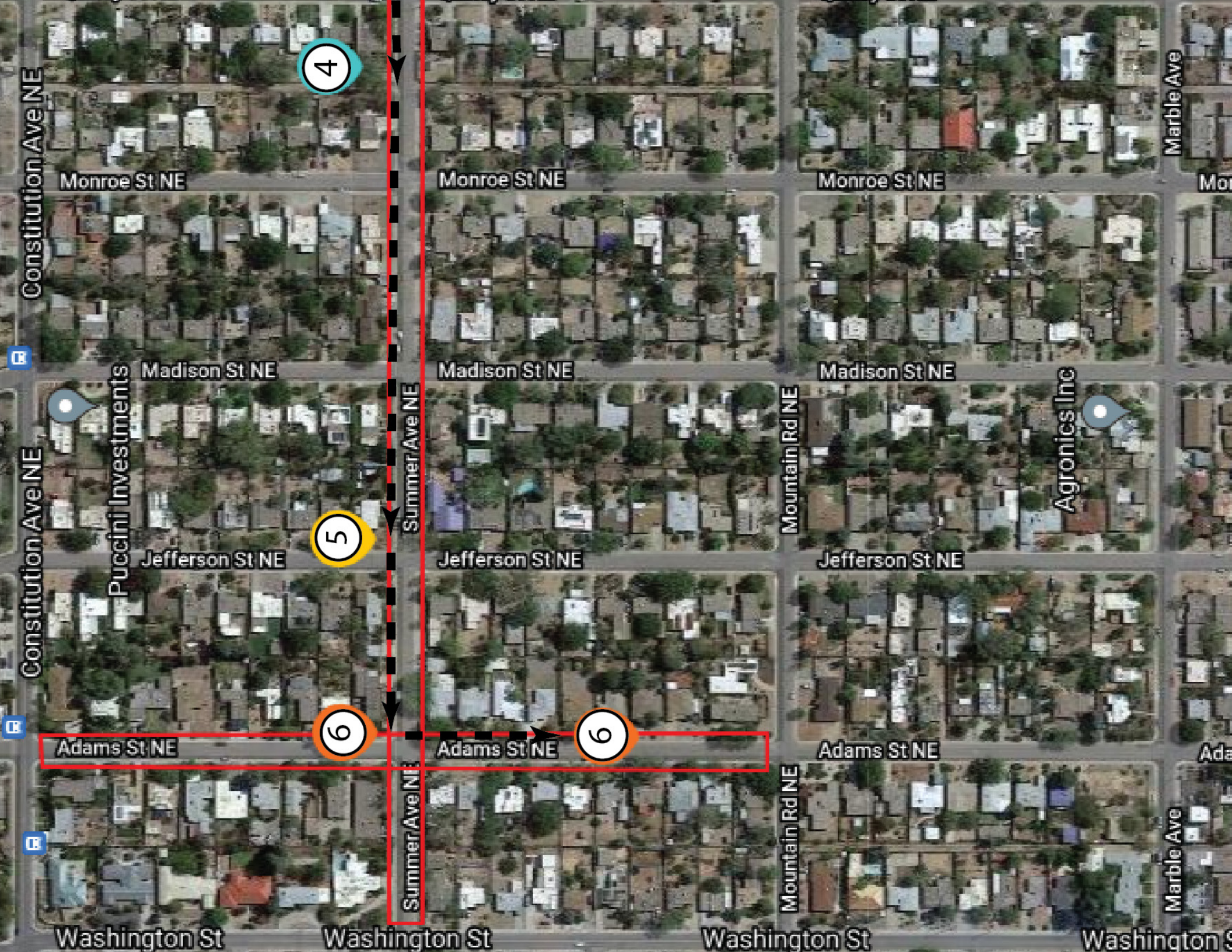


BHI Map of Neighborhood Study Area

GREEN STORMWATER INFRASTRUCTURE

According to the Watershed Management Group's Green Infrastructure for Southwestern Neighborhoods, Green Stormwater Infrastructure "*refers to constructed features that use living, natural systems to provide environmental services, such as capturing, cleaning, and infiltrating stormwater; creating wildlife habitat; shading and cooling streets and buildings; and calming traffic. [It] is a strategy that a growing number of communities are using to manage stormwater more sustainably, while using that water to grow vegetation that provides a myriad of benefits.*" This pilot project focuses on mitigating neighborhood level drainage issues through the use of small-scale green stormwater interventions. Not only does green stormwater infrastructure, or GSI, slow stormwater and increase soil infiltration, but it also offers additional co-benefits mentioned above. This project allowed for community members to envision and learn about GSI solutions that are options for their neighborhoods.

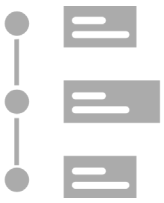
Pueblo Alto alleyway re-envisioned as a green alley with bioswales


4
5
6
6
Constitution Ave NE
Constitution Ave NE
Monroe St NE
Monroe St NE
Monroe St NE
Marble Ave
Madison St NE
Madison St NE
Madison St NE
Puccini Investments
Summer Ave NE
Mountain Rd NE
Agronics Inc
Jefferson St NE
Jefferson St NE
Jefferson St NE
Adams St NE
Adams St NE
Adams St NE
Summer Ave NE
Mountain Rd NE
Marble Ave
Washington St
Washington St
Washington St

Chapter 2

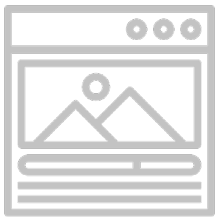
Public Engagement Activities

IN THIS CHAPTER



PROJECT TIMELINE

OUTREACH COMMITTEE



PROJECT WEBSITE

WALKING TOURS & COMMUNITY MAPPING

SURVEY RESULTS

COMMUNITY MEETINGS

Neighborhood Engagement Process

ENGAGEMENT OVERVIEW

The Pueblo Alto and Mile Hi neighborhood engagement process involved the creation of an outreach committee, neighborhood walking tours and hybrid community meetings. The project team sought neighborhood input regarding flooding locations, desired interventions and prioritization of green stormwater infrastructure co-benifits. The outreach committee created a bridge between the neighborhood associations, the City and the contractors in order to inform outreach processes. The project sought to reach neighborhood residents through multiple avenues including:

- Outreach Committee meetings
- Project website
- Neighborhood Walking Tours 1 and 2
- Community meetings 1 and 2 (virtual and in-person)
- On-line survey

OUTREACH COMMITTEE

The outreach committee was formed in order to ensure transparency in the project process as well as provide a clear line of communication between the neighborhoods and the project team. The committee met five times, from November 2021 to March 2022, in order to set timelines, assist with disseminating information and offer feedback on outreach methods.

Representation on the Outreach Committee included:

- Pueblo Alto Neighborhood Association
- Mile Hi Neighborhood Association
- Neighbors with flooding issues
- City of Albuquerque
  - City Council Services
  - Dept. of Municipal Development, Engineering
  - Councilor Gibson's Office
  - Councilor Fiebelkorn's Office
- Arid LID Coalition

Promotional flyer for first community meeting and second walking tour

Consistent feedback themes from Outreach Committee meetings included:

- The value of including mailers, flyers, postcards, social media and yard signs to communicate with neighbors.
- Neighbors were happy to have a chance to voice concerns and ideas to the City.
- The process created increased awareness around flooding locations.
- Weekday and weekend times for community meetings and events were preferred.
- The importance of clear communication around implementation timeframes.
- Community education around green stormwater infrastructure is valuable.
- Including neighborhood voices in community meeting presentations is a good way to share multiple perspectives.
- Ensuring the inclusion of GSI maintenance factors in the planning process is imporant.
- In addition to the drainage benefits, quality of life co-benefits factor into community support for GSI interventions.

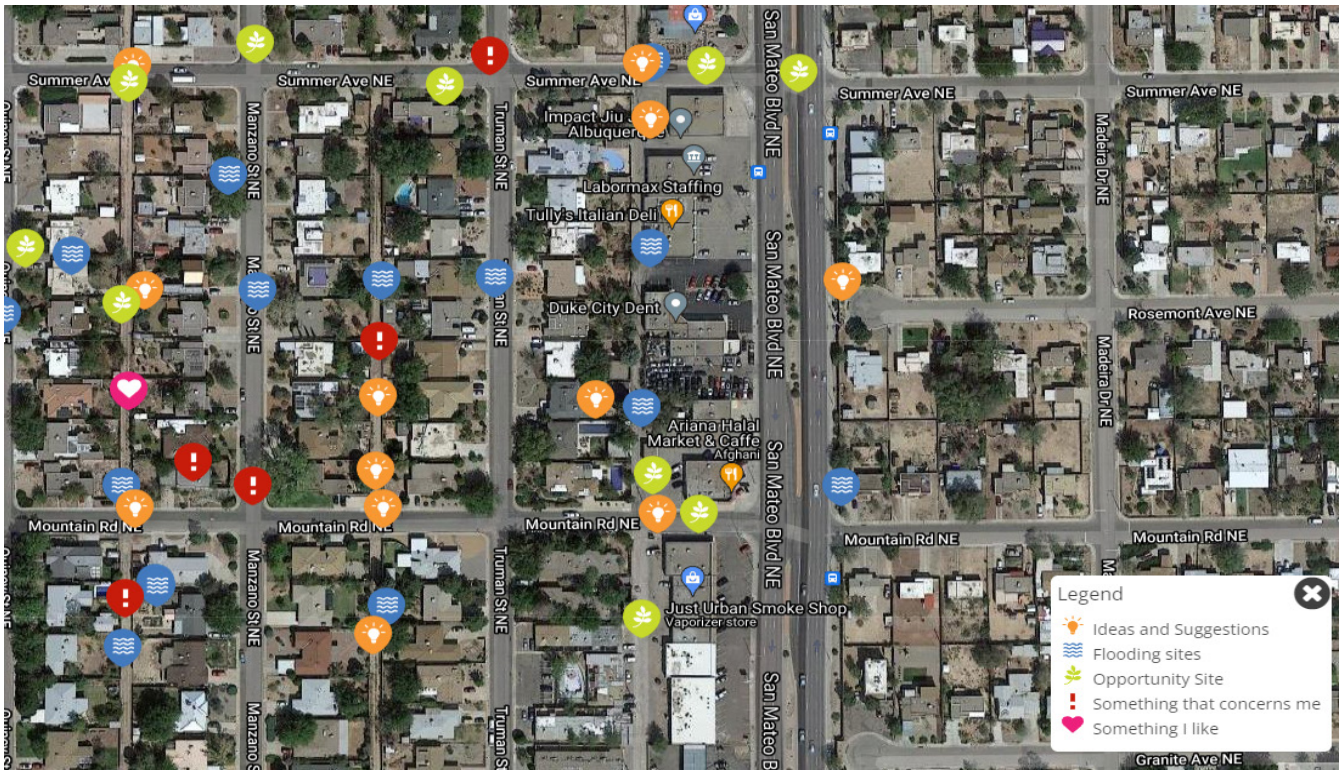
Please reference the Appendix A for full Outreach Committee Meeting Notes.

PROJECT WEBSITE

In October of 2021, the "Pueblo Alto Mile Hi Stormwater Interventions" project website was published. It served as an online communication tool for project information, data collection, and project updates including:

- Project intent, scope, and schedule
- Survey links
- Email sign-up
- Public meeting links & recordings
- Interactive Community Map
- Summaries of previous walking tours
- The Toolkit for Small-Scale Stormwater Management Techniques & Existing Drainage Conditions Summary Memo
- Frequently Asked Questions and Answers
- GSI Glossary
- Links to local resources, videos and guides on Green Stormwater Infrastructure

Using the Social Pinpoint platform, the website (https://gws.mysocialpinpoint.com/pueblo-alto-mile-hi) housed an embedded map of the two target neighborhoods. With this tool, the public was able to access the maps digitally through smart phones or computers, and mark locations in Pueblo Alto and Mile Hi that had flooding issues, were sites of opportunity or concern, and/or to note ideas and assets. A screen shot of the website is shown below. As the project transitions into the next phases, the website will continue to serve as an online communication tool for project information, updates, and email sign-up.



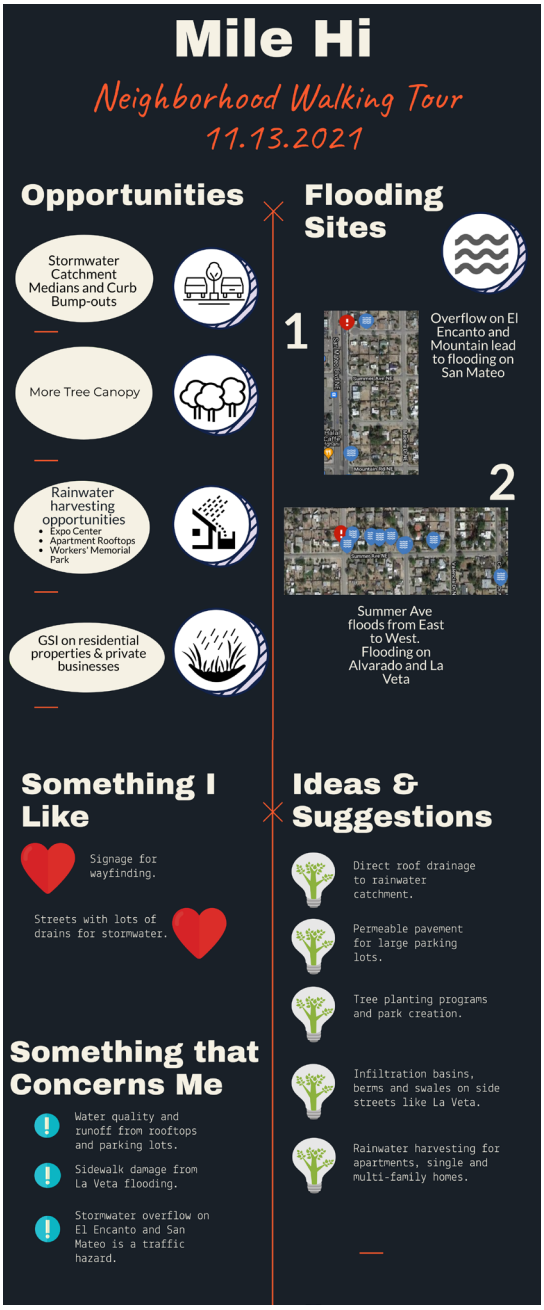
Screenshot: Interactive Social Pinpoint Map

NEIGHBORHOOD WALKING TOURS & COMMUNITY MAPPING

Four neighborhood walking tours, two in each neighborhood, were central to the community engagement process in this project. Ensuring on-the-ground, in-person conversations, while marking neighborhood maps, allowed the project team to accomplish multiple goals. During the first neighborhood walking tours in November 2021, participants identified flooding sites, neighborhood assets, noted their ideas, and explained concerns. Forty-eight people attended the first set of tours. While some attendees made comments on the map through their smart phones, others offered opinions that group leaders recorded on the digital maps. The routes were community directed, allowing for residents to direct project team leaders to high priority areas. In addition to the initial objectives, these first walking tours introduced neighborhood residents to concepts surrounding green stormwater infrastructure. Combining face to face explanations with the website's digital illustrations, allowed for informal stormwater education, while building trust in the process. Participant comments on the neighborhood maps were then shared publicly on the website and at the following Outreach Committee Meeting. Participant input was used to inform the locations and interventions that were explored during the second round of walking tours. As a way to incentivize participation, the top four contributors to comments on the map received gift certificates to a local plant nursery.

The second round of walking tours took place in February of 2022 and 28 people attended. During the activity, participants visited 4-6 neighborhood locations that residents had indicated were priority flooding areas during the last walking tours. Once again, through smart phones, paper maps and through group conversations, community members noted concerns and priorities regarding stormwater intervention locations and highlighted which interventions were most desired. These tours allowed the project team to narrow possible intervention locations and options. Groups also spent time discussing co-benefits of green stormwater infrastructure such as traffic calming effects, increased neighborhood green space and improved water quality.

Summary of Pueblo Alto Walking Tour Map Commentary



Summary of Mile Hi Walking Tour Map Commentary

COMMUNITY MAPPING RESULTS

The following is a summary of the public mapping comments collected in five categories during the first neighborhood walking tours.

FLOODING SITES

- Jefferson between Summer and Mountain.
- The southwest corner of Madison and Summer.
- Quincy and Manzano between Summer and Mountain.
- Alleyways Summer to Mountain between Quincy and Truman.
- Many Pueblo Alto alleys flood and cause drainage issues on properties adjacent to the alleys.
- Flooding on El Encanto and Mountain leads to flooding on San Mateo.
- Alvarado, Summer and La Veta have significant drainage issues that lead to flooding in yards.
- Summer Ave floods from east to west.

OPPORTUNITIES

- Curb bump outs
- Possible sites for murals
- Possible sites for pocket parks
- Replacement of pavement with permeable pavement
- Residential GSI workshops for property owners
- Green alleyways for pedestrians
- Planting more trees
- Closed-off pedestrian walkways/parklets (specifically La Veta)
- Stormwater catchment medians
- Roof-top rainwater harvesting- residential and business

IDEAS & SUGGESTIONS

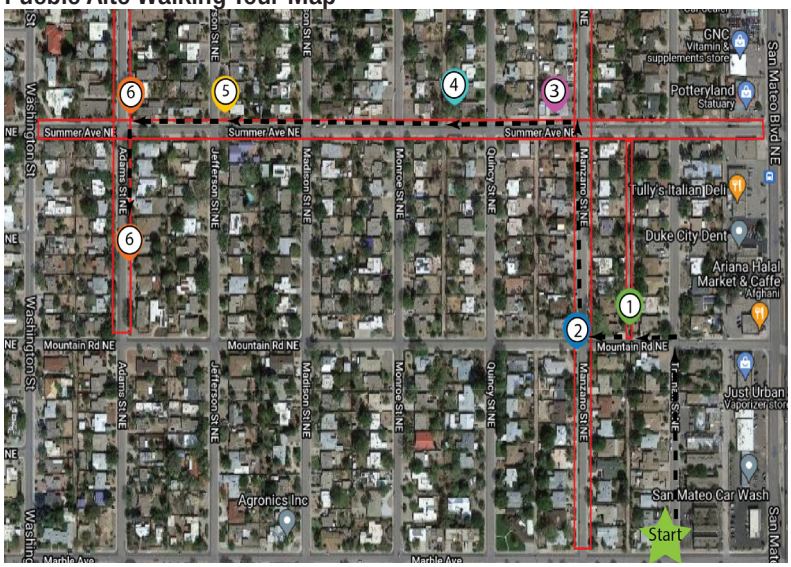
- Seek Federal funding for demonstration Green Stormwater Infrastructure project
- Lighting and vegetation for alleyways as green corridors
- Buyout of vacant properties to create pocket-parks
- Need for more stop signs/crossing lights on many streets
- Rainwater harvesting for apartments and home owners

In Pueblo Alto, the majority of ideas and suggestions revolved around water diversion and catchment systems in the alleyways along with ideas for replacement of pavement with permeable pavement in streets and lots. In Mile Hi, the most popular ideas included infiltration basins on the sides of streets like La Veta, permeable pavement for the large parking lots like Smith's, tree planting programs, the creation of pocket parks, and inclusion of apartment complexes/multifamily homes in rainwater harvesting. Both neighborhoods were in favor of programs to teach and incentivize residential property owners creating GSI, berms, swales and rain gardens in individual yards.

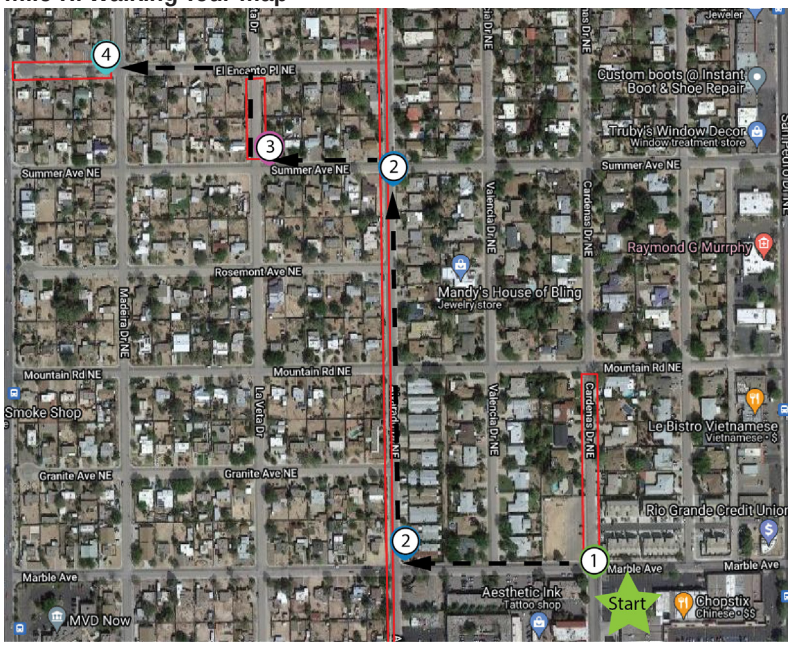
ONLINE SURVEY

The second walking tour involved an online survey that participants completed while visiting targeted neighborhood locations. The Pueblo Alto survey had six sites and seven questions while the Mile Hi survey had four sites and five questions. The survey was introduced and explained on the February walking tours and left open for four weeks to allow for community input throughout the month. In total, there were 75 surveys completed; 60 from Pueblo Alto and 15 from Mile Hi. The survey included visuals of the various stormwater interventions proposed, a link to the Toolkit for Small-Scale Stormwater Management Techniques, as well as a link to the project website. The following are the results from each neighborhood survey.

Pueblo Alto Walking Tour Map



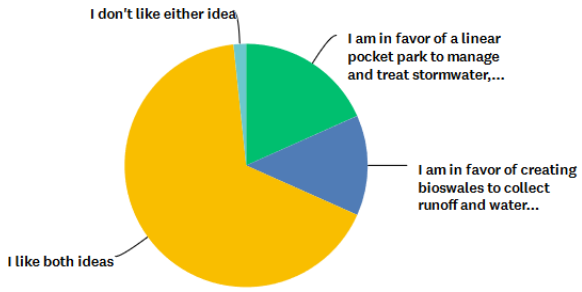
Mile Hi Walking Tour Map



Pueblo Alto Survey Question 1

Q1 The alley between Manzano St and Truman St., north of Mountain Rd and south of Summer Ave. (See the Green Stormwater Toolkit on our website for more pictures and deeper explanations of green stormwater solutions.) Please note that residents' access to alleyways would not be affected without express permission, and that any alleyway drainage improvements would be maintained by the City.

Answered: 60 Skipped: 0

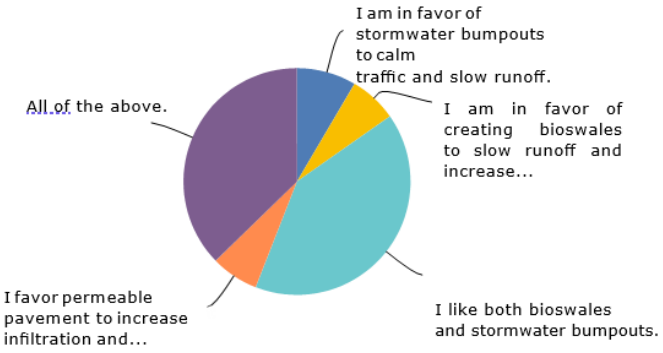


ANSWER CHOICES	RESPONSES	
I am in favor of a linear pocket park to manage and treat stormwater, possibly incorporating underground infiltration.	18.33%	11
I am in favor of creating bioswales to collect runoff and water vegetation.	13.33%	8
I like both ideas	66.67%	40
I don't like either idea	1.67%	1
TOTAL		60

Pueblo Alto Survey Question 2

Q2 Manzano St between Marble Ave and Constitution Ave. Please note that any drainage improvements in the public right-of-way would be maintained by the City.

Answered: 59 Skipped: 1

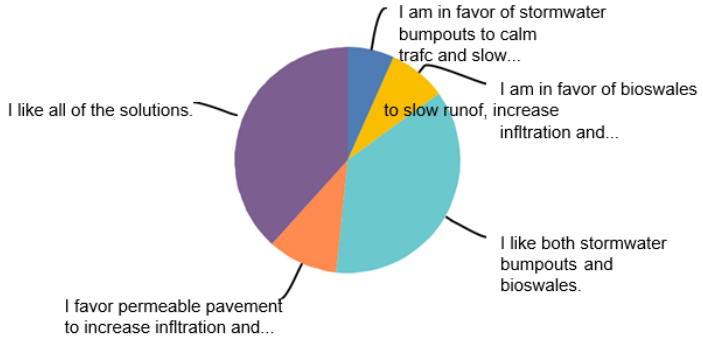


ANSWER CHOICES	RESPONSES	
None of the above	0.00%	0
I am in favor of stormwater bumpouts to calm traffic and slow runoff.	8.47%	5
I am in favor of creating bioswales to slow runoff and increase infiltration.	6.78%	4
I like both bioswales and stormwater bumpouts.	40.68%	24
I favor permeable pavement to increase infiltration and reduce runoff rates and volumes.	6.78%	4
All of the above.	37.29%	22
TOTAL		59

Pueblo Alto Survey Question 3

Q3 Summer Ave from San Mateo Blvd west to Washington St.

Answered: 60 Skipped: 0

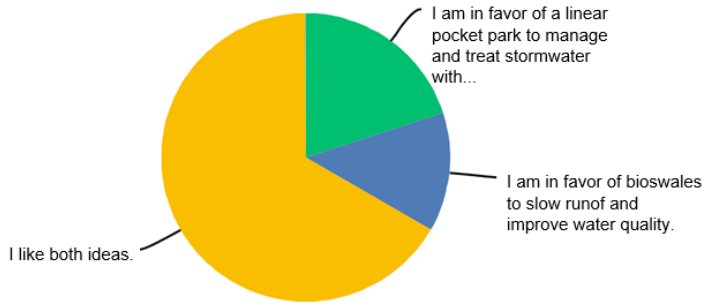


ANSWER CHOICES	RESPONSES	
None of the above	0.00%	0
I am in favor of stormwater bumpouts to calm traffic and slow runoff/increase infiltration.	6.67%	4
I am in favor of bioswales to slow runoff, increase infiltration and improve water quality.	8.33%	5
I like both stormwater bumpouts and bioswales.	36.67%	22
I favor permeable pavement to increase infiltration and reduce runoff volumes and rates.	10.00%	6
I like all of the solutions.	38.33%	23
TOTAL		60

Pueblo Alto Survey Question 4

Q4 The alleys between Manzano St., Quincy St., and Monroe St. north of Summer.

Answered: 60 Skipped: 0

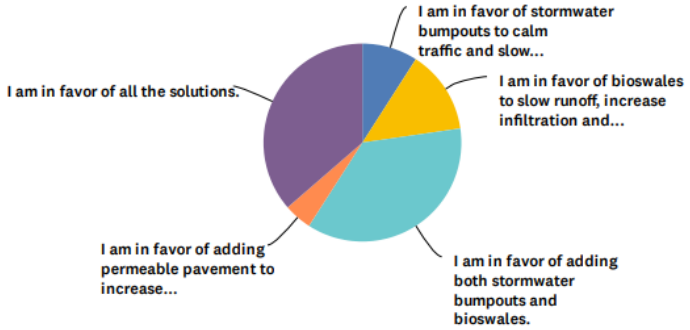


ANSWER CHOICES	RESPONSES	
I am in favor of a linear pocket park to manage and treat stormwater with underground filtration.	20.00%	12
I am in favor of bioswales to slow runoff and improve water quality.	13.33%	8
I like both ideas.	66.67%	40
I don't like either solution.	0.00%	0
TOTAL		60

Pueblo Alto Survey Question 6*

Q6 On Adams St between Mountain Rd and Constitution Ave.

Answered: 22 Skipped: 0



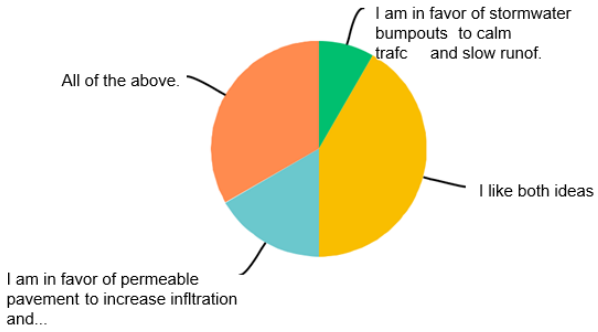
ANSWER CHOICES	RESPONSES	
None of the above	0.00%	0
I am in favor of stormwater bumpouts to calm traffic and slow runoff/increase infiltration.	9.09%	2
I am in favor of bioswales to slow runoff, increase infiltration and improve water quality.	13.64%	3
I am in favor of adding both stormwater bumpouts and bioswales.	36.36%	8
I am in favor of adding permeable pavement to increase infiltration and reduce runoff volumes and rates.	4.55%	1
I am in favor of all the solutions.	36.36%	8
TOTAL		22

*Questions 5 and 7 for the Pueblo Alto Survey were write-in answers and can be found in the Appendix.

Mile Hi Survey Question 1

Q1 Cardenas Dr. between Marble Ave. and Mountain.

Answered: 12 Skipped: 3

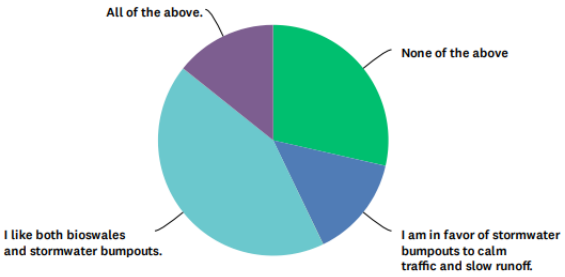


ANSWER CHOICES	RESPONSES	
I am in favor of stormwater bumpouts to calm traffic and slow runoff.	8.33%	1
I am in favor of creating bioswales to collect runoff and water vegetation.	0.00%	0
I like both ideas	41.67%	5
I am in favor of permeable pavement to increase infiltration and reduce runoff rates and volumes.	16.67%	2
All of the above.	33.33%	4
None of the above.	0.00%	0
TOTAL		12

Mile Hi Survey Question 2

Q2 Alvarado between Lomas and Constitution Ave.

Answered: 7 Skipped: 1

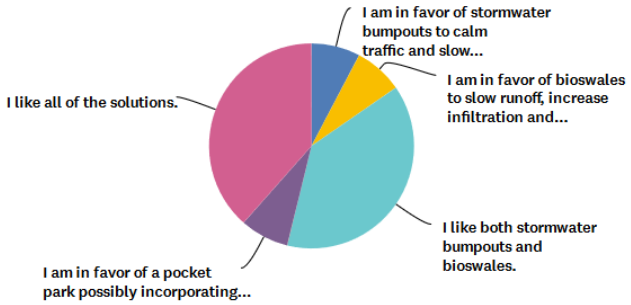


ANSWER CHOICES	RESPONSES	
None of the above	28.57%	2
I am in favor of stormwater bumpouts to calm traffic and slow runoff.	14.29%	1
I am in favor of creating bioswales to slow runoff and increase infiltration.	0.00%	0
I like both bioswales and stormwater bumpouts.	42.86%	3
I favor permeable pavement to increase infiltration and reduce runoff rates and volumes.	0.00%	0
All of the above.	14.29%	1
TOTAL		7

Mile Hi Survey Question 3

Q3 La Veta Dr. between El Encanto Pl. and Summer Ave.

Answered: 13 Skipped: 2

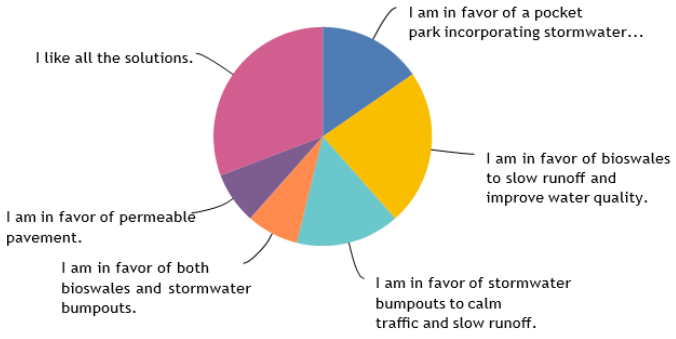


ANSWER CHOICES	RESPONSES	
None of the above	0.00%	0
I am in favor of stormwater bumpouts to calm traffic and slow runoff/increase infiltration.	7.69%	1
I am in favor of bioswales to slow runoff, increase infiltration and improve water quality.	7.69%	1
I like both stormwater bumpouts and bioswales.	38.46%	5
I favor permeable pavement to increase infiltration and reduce runoff volumes and rates.	0.00%	0
I am in favor of a pocket park possibly incorporating underground infiltration.	7.69%	1
I like all of the solutions.	38.46%	5
TOTAL		13

Mile Hi Survey Question 4

Q4 El Encanto Pl. between San Mateo Blvd and Madeira Dr.

Answered: 13 Skipped: 2



ANSWER CHOICES	RESPONSES	
None of the above	0.00%	0
I am in favor of a pocket park incorporating stormwater harvesting basins to improve water quality, capture and reduce runoff.	15.38%	2
I am in favor of bioswales to slow runoff and improve water quality.	23.08%	3
I am in favor of stormwater bumpouts to calm traffic and slow runoff.	15.38%	2
I am in favor of both bioswales and stormwater bumpouts.	7.69%	1
I am in favor of permeable pavement.	7.69%	1
I like all the solutions.	30.77%	4
TOTAL		13

Additional Survey Commentary

The last question of both neighborhood surveys asked, "The city isn't limited to the locations on the survey for new green stormwater interventions. If there are other neighborhood locations, not listed on this survey, that you would like to be considered for GSI, please note here." Locations noted included:

- Valencia and Cagua,
- Summer from San Pedro to La Veta,
- the alleys between Monroe and Quincy, Quincy and Manzano, and east of Truman between Summer and Mountain,
- Truman and Summer,
- the southwest corner of Constitution and Manzano.

Themes from written comments under multiple choice questions included:

- Prioritizing Summer Ave., specifically for the traffic calming benefits
- Permeable pavement was less attractive due to the need for additional maintenance equipment
- Support for any intervention that adds more neighborhood vegetation/green space
- Concern regarding responsibility for alleyway maintenance
- Ensuring interventions in alleys allow for vehicular access
- Support for pocket parks
- Support for City incentives for property owners who install green stormwater measures
- Support for residential GSI education, specifically focused on its co-benefits

Small group from the first Neighborhood Walking Tour

COMMUNITY MEETINGS

Two public meetings were held during the project as a way to communicate the walking tour results, share information on GSI, present possible GSI interventions and their impacts, and to gather additional input. The first community meeting was held virtually in January, 2022. The second was a hybrid meeting conducted in March 2022, allowing for participants to attend in person, at the Jerry Cline Tennis Center, or virtually, through zoom. At the January 20th meeting, 48 people were in attendance, while at the March 31st meeting, there were 25 on-line attendees and 15 in-person attendees.

Meetings were introduced and facilitated by Albuquerque Council Services, BHI, Groundwork Studio and the neighborhood associations. Both meetings included an overview and timeline of the project, explanation of the outreach process, results of the neighborhood walking tours, explanations of green stormwater infrastructure solutions, next steps, and time for questions and discussion. During the January meeting, a Toolkit of Small-Scale Stormwater Management Techniques[1] was introduced alongside a glossary[2] to be used as a reference for stormwater terminology. The first meeting helped to educate neighborhood residents about the sources of stormwater and drainage issues, the flooding locations, the difference between local and regional drainage issues and solutions, and the co-benefits of installing green stormwater interventions. By the second neighborhood walking tours, community members had increased their understanding of GSI and were able to voice concerns and preferences for specific solutions and possible locations. The second meeting, which followed up this walking tour, included more specific considerations such as relative cost, maintenance, and water capture attached to each intervention.

Feedback from the March 31st meeting included:

- Concern about stagnant water collecting in bioswales
- Concern about continued vehicular access in the alleyways if they were to be converted to include bioswales and rain capture.
- Excitement about the possibility of more green space and safer pedestrian spaces in the neighborhoods.
- Questions around implementation timeframe
- Enthusiasm for curb bump-outs that could also slow traffic
- Support for more residential GSI workshops, incentives and demonstration projects

To view community meeting recordings see:

1. January 20th, 2022 Public meeting: https://www.youtube.com/watch?v=ZGwFKBKtlK8
2. March 31, 2022 Public meeting: https://www.youtube.com/watch?v=I1VQG6km5F4

1 See Appendix B for the Toolkit of Small Scale Stormwater Management Techniques

2 See Appendix C for the GSI glossary

AFTER

BEFORE

La Veta Dr. at Summer Ave.

The graphics shown here are intended to illustrate green stormwater infrastructure concepts as they could be applied in Albuquerque, and are not meant to represent a proposed design for any specific location.

Community Meeting #2 slide showing potential GSI installation visualizations

Chapter 3

OPTIONS IDENTIFICATION & ANALYSIS

Combining input collected from the neighborhood walking tours, review of previous studies and existing drainage conditions, stormwater runoff calculations, and cost and benefits analyses, BHI determined which GSI interventions would be feasible options for the Pueblo Alto and Mile Hi neighborhoods to begin to mitigate drainage issues associated with small storm events while acknowledging that regional drainage improvements will still be needed to address the 100-year storm.

An Existing Drainage Conditions Summary Memo was prepared to summarize the history and causes of stormwater drainage issues for community members. A Toolkit for Small-Scale Stormwater Management Techniques was also created to provide diagrams and basic information on GSI functions, benefits and challenges. These two documents were used as resources for the project team and the public when weighing drainage options for the future.

The options analysis provides calculations related to specific GSI installations for use in identifying and prioritizing pilot projects.

IN THIS CHAPTER

SUMMARY OF THE EXISTING DRAINAGE CONDITIONS MEMO

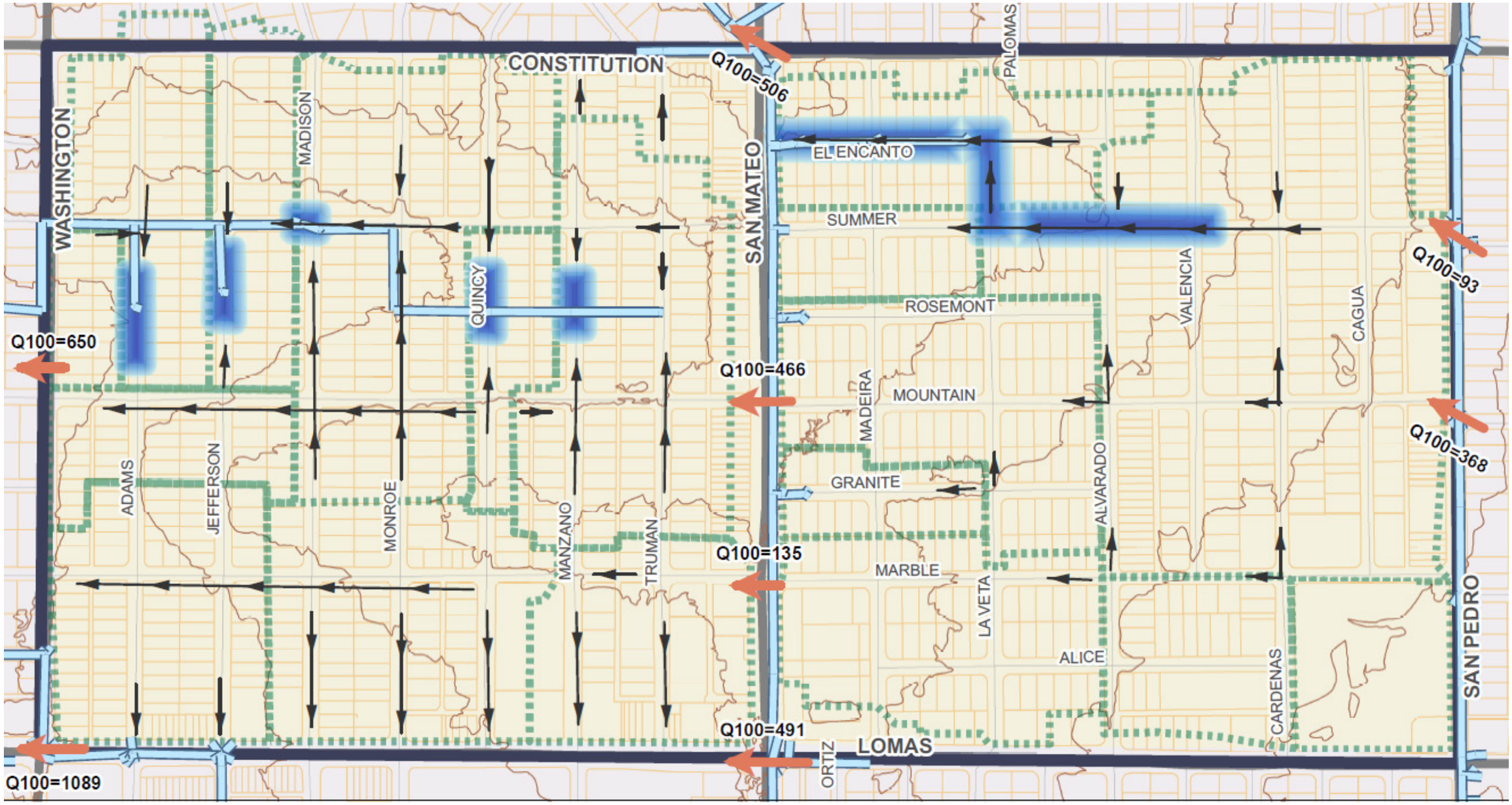
TOOLKIT OF SMALL-SCALE STORMWATER MANAGEMENT TECHNIQUES

OPTIONS ANALYSIS

Summary of the Existing Drainage Conditions Memo

Bohannan Huston Inc (BHI) compiled previous drainage studies of the Pueblo Alto and Mile Hi neighborhoods to summarize flooding issues in the neighborhood. The "Existing Drainage Conditions Summary Memo" summarizes these studies to help neighborhood residents better understand flooding locations and conditions under which stormwater has proven problematic. The Memo contains maps, diagrams, neighborhood topography, stormwater infrastructure history, and future long-range reconfiguration of storm drainage. The memo was presented to the public at the January 2022 community meeting, from which point it has been accessible through the project website.The memo in its entirity can be found in **Appendix B.**

The Existing Drainage Conditions Summary Memo explains that the existing underground stormwater drainage infrastructure in the targeted neighborhoods no longer has the capacity to withstand larger storm events, specifically 100-year storms. The memo goes on to state that expanding the capacity of storm drains on a regional level is necessary in the long-term, but is currently cost-prohibitive and requires an extended timeframe. It concludes that short and mid-term solutions can include smaller, neighborhood-level, green stormwater interventions could be implemented to mitigate local drainage issues, while the larger drainage projects are being planned and implemented.



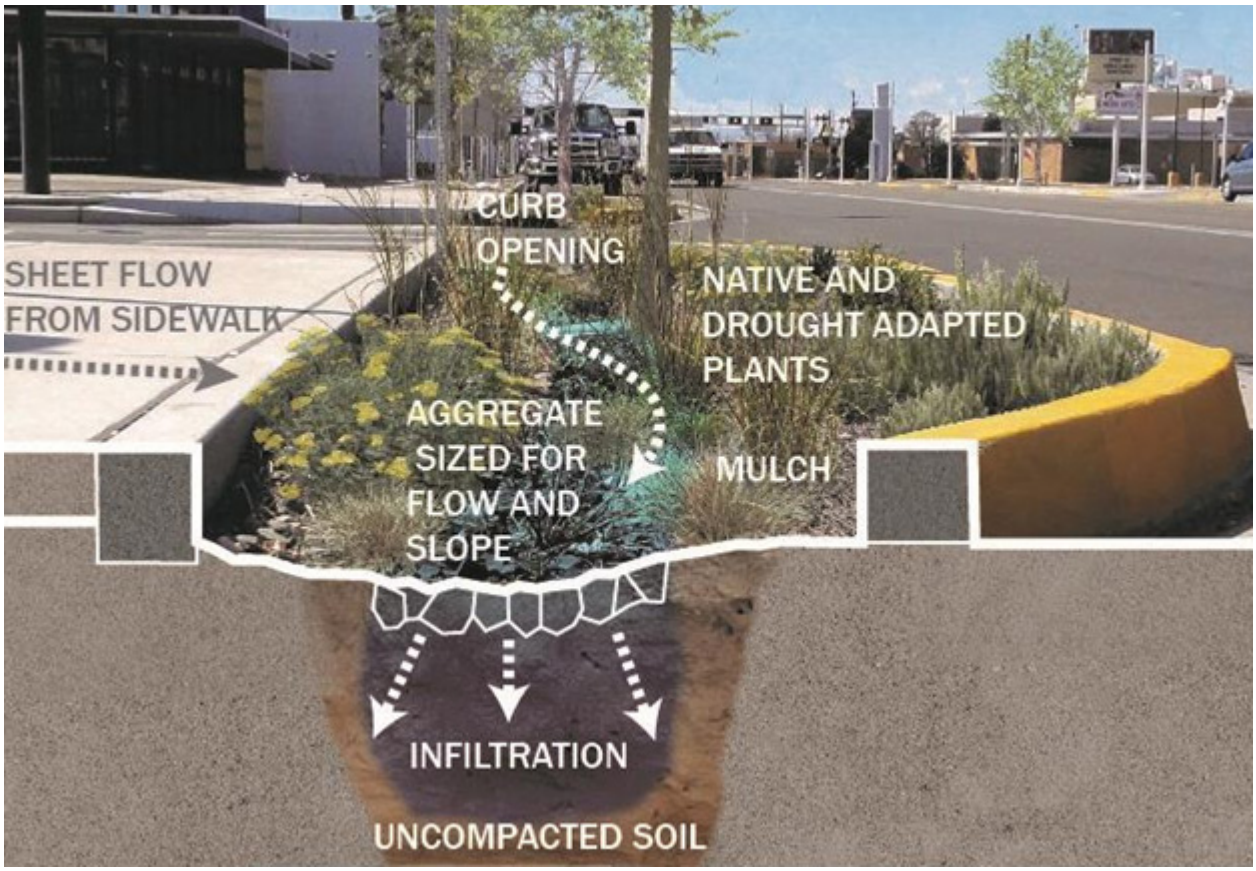
Existing Conditions Map found in the Existing Drainage Conditions Memo

Toolkit of Small-Scale Stormwater Management Techniques

The Toolkit of Small-Scale Stormwater Management Techniques has been created as a further resource for the project team and community members to better understand and visualize green stormwater interventions. It identifies small-scale, localized stormwater management techniques that may be applicable to the Pueblo Alto and Mile Hi neighborhoods as well as other neighborhoods across the Northeast Heights of Albuquerque. This toolkit is intended as an introduction to the small-scale techniques and establishes terminology for use by community members and stakeholders. It is intentionally brief and provides a basic understanding of each technique's advantages and limitations. It can serve as a resource for City staff and consultants when considering these techniques elsewhere in Albuquerque.

The Toolkit identifies five specific interventions that are likely best suited for the Northeast Heights of Albuquerque. It details the advantages, limitations, and maintenance needs of each technique. The potential intervention options identified for Pueblo Alto and Mile Hi include:

- Stormwater Harvesting Basins
- Bioswales
- Stormwater Bumpouts
- Permeable Pavement
- Underground Storage and Infiltration Systems



Stormwater Bump-out Diagram on page 6 of the Toolkit; sourced from Bernalillo County GSI LID Standards 2021

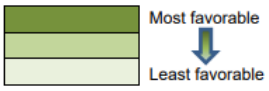
A chart within the toolkit simplifies the comparison of GSI options for the neighborhoods. It identifies benefit-cost considerations for the five stormwater intervention techniques by assessing relative cost, stormwater capture, co-benefits, implementation and maintenance side-by-side. During the second public meeting, participants were able to view this summary while discussing the best options for their neighborhoods. To view the Toolkit, see **Appendix C.**

Stormwater Technique Comparison Matrix

	Stormwater Harvesting Basin	Bioswale	Stormwater Bumpout	Permeable Pavement	Underground Storage and Infiltration
Cost	$	$	$$	$$	$$$
Stormwater Capture Potential	++	+	+	+	+++
GSI Co-Benefits[1]	+++	+++	+++	++	+
Ease of Implementation[2]	+++	+++	++	+	+
Maintenance Requirements	Low	Low	Low	Moderate	Moderate

Toolkit for Small-Scale Stormwater Management Techniques, page 11

1. "GSI Co-Benefits" is an assessment of the relative number and impact of co-benefits (described in Section IV of this toolkit) that could be created by each technique.
2. "Ease of Implementation" is an assessment of the relative complexity of each technique, acknowledging that less complex infrastructure systems are generally preferable. Increased complexity could be due to utility conflicts, right-of-way (ROW) limitations, design requirements, etc.



Options Analysis

This memo presents a variety of distributed stormwater management techniques (including the use green stormwater infrastructure (GSI) and low impact development (LID) practices) that could be implemented within the subject neighborhoods and identifies potential locations for implementation. This memo also presents an evaluation of the effectiveness of these potential improvements over a range of storm events (2-year, 10-year, and 100-year) and high-level cost estimates intended for planning and budgeting purposes.

For the purposes of this study, six potential locations for distributed stormwater management techniques were identified within existing City right-of-way based on various considerations, including local drainage patterns and topography, the location of existing drainage issues, maintaining existing access to adjacent properties, maintenance access, and co-benefit opportunities, among other considerations.

For each location, the most feasible stormwater management techniques from the Toolkit of Small-Scale Stormwater Management Techniques were identified. The potential locations and associated stormwater management techniques considered for this study are summarized in **Table 1**. These six locations represent a variety of conditions occurring elsewhere in the subject neighborhoods and are not intended to be the only location where distributed stormwater management techniques could be considered by the City for implementation. For example, conditions along Adams Street between Mountain Road and Constitution Avenue (Location 2) are similar to the blocks of Jefferson Street, Monroe Street, Quincy Street, Manzano Street, and Truman Street, therefore similar stormwater techniques could be considered along those other streets in the future.

Table 1 – Potential Locations and Stormwater Management Techniques

Location	Stormwater Management Techniques	Stormwater Concept Description[1]	Considerations
Location 1 Summer Ave. (Washington to San Mateo)	Stormwater Bumpouts	• 9-ft width • South side of road	• Associated GSI landscaping provides the most co-benefits, traffic calming among them • On-street parking would be reduced
	Permeable Pavement	• Pavement replacement (full width)	• High cost and maintenance requirements
Location 2 Adams St. (Mountain to Constitution)	Stormwater Bumpouts	• 9-ft width • One side of road (could alternate along roadway)	• Associated GSI landscaping provides the most co-benefits, traffic calming among them • On-street parking would be reduced
	Underground Storage	• At roadway low point • Overflow to existing storm drain	• Could be combined with stormwater bumpouts and/or permeable pavement
	Permeable Pavement	• Pavement replacement (full width)	• High cost and maintenance requirements
Location 3 Alleys (3, between Mountain & Summer)	Bioswale & Underground Storage	• Underground storage at alley low point • Overflow to existing storm drain	• Minimal surface capture volume can be provided while maintaining access to adjacent properties
Location 4 La Veta Dr. (Summer to El Encanto)	Stormwater Bumpouts	• 9-ft width • One side of road (road remains open)	• Associated GSI landscaping provides the most co-benefits, traffic calming among them • On-street parking would be reduced
	Stormwater Harvesting Basin & Underground Storage	• Pocket Park (closed to motor vehicles) • Surface storage and underground storage	• Associated GSI landscaping provides the most co-benefits
Location 5 Alvarado Dr. (Lomas to Constitution)	Stormwater Bumpouts	• 8-ft to 9-ft width • West side of road	• Associated GSI landscaping provides the most co-benefits, traffic calming among them • On-street parking would be reduced
	Permeable Pavement	• Pavement replacement (full width)	• High cost and maintenance requirements
Location 6 Cardenas Dr. (Marble to Constitution)	Stormwater Bumpouts	• 8-ft to 9-ft width • One side of road (could alternate along roadway)	• Associated GSI landscaping provides the most co-benefits • On-street parking would be reduced
	Permeable Pavement	• Pavement replacement (full width)	• High cost and maintenance requirements

Note: Simplified description and assumptions used for estimation of capture volume. See Section IV for additional assumptions.

Table 5 – Preliminary Project Costs

Location	Preliminary Project Costs & Cost per Cubic-Foot of Capture Volume							
	Stormwater Bumpout		Permeable Pavement		Underground Storage		Stormwater Bumpout with Underground Storage	
	Cost ($1000)	$/CF	Cost ($1000)	$/CF	Cost ($1000)	$/CF	Cost ($1000)	$/CF
1 – Summer	$630	$97	$5,226	$448	--	--	--	--
2 – Adams	$315	$100	$2,747	$450	$341	$32	$656	$48
3 – Alleys	$595	$91	--	--	$713	$31	$1,308	$45
4 – La Veta	$105	$88	--	--	$713	$32	$818	$35
5 – Alvarado	$595	$95	$5,025	$450	--	--	--	--
6 – Cardenas	$455	$65	$4,020	$448	--	--	--	--

Sections of the memo also include a runoff and capture volume analysis, hydrologic (runoff) analysis, capture volume analysis, and preliminary project costs. See Table 5 above for high level cost estimates. To read the full Evaluation of Distributed Stormwater Management Options Technical Memo, see **Appendix H** of this report.

Findings from the evaluation of potential locations and stormwater management techniques in the Pueblo Alto & Mile Hi Neighborhoods Drainage Study, as summarized by this memo, include:

- "Every little bit helps." – The storage volume of each individual stormwater management technique is small compared to the total contributing runoff volume. However, the collective storage volume of all locations and techniques is significant, especially for more frequent storms. For example, constructing stormwater bumpouts as conceptualized for all six locations and underground storage for Locations 2, 3, and 4 would capture around 48% of the 2-year runoff volume impacting those locations.
- Stormwater management techniques higher in the neighborhood watersheds (i.e., local drainage basins) would generally be more effective than improvements at the location of an existing drainage issue, which is consistent with LID concepts.
- Significantly reducing runoff would require distributed stormwater management techniques throughout the neighborhoods, and regional drainage improvements would likely still be required.

The following should be considered during the scoping, planning, and design of future implementation projects:

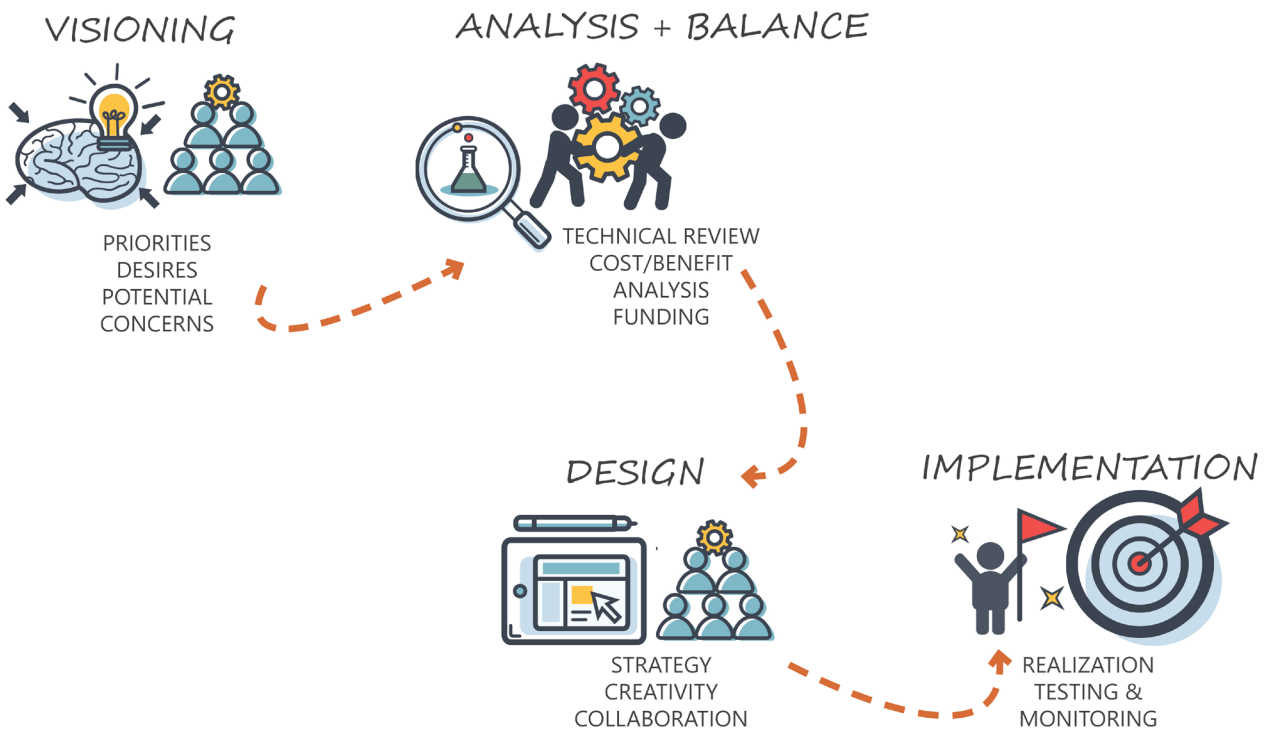
- Additional locations beyond those evaluated for this study could be considered for distributed stormwater management techniques.
- Detailed hydrologic and hydraulic analyses should be conducted as part of future projects. The hydrologic analysis presented by this memo is very simplified and is intended primarily for evaluating relative effectiveness of different locations and techniques.
- Traffic analyses should be considered to evaluate the impact of techniques that involve roadway narrowing.
- GSI offers co-benefits, as described by the Toolkit of Small-Scale Stormwater Management Techniques developed for this study, that should be considered.

Chapter 4

Next Steps

The next steps will be identifying one or more of the projects in the study for implementation as pilot projects. The study will guide the use of future funds secured for stormwater management in the neighborhoods.

Next Steps Timeline



NEXT STEPS

The diagram above illustrates three main tracks leading to implementation of the Green Stormwater Interventions in Pueblo Alto and Mile Hi neighborhoods: Visioning, Analysis & Balance, and Design. The Pueblo Alto & Mile Hi Drainage Study completes the visioning section of the timeline. Conducting a technical reveiw, a cost/benefit analysis and securing funding are the next steps. Thirdly the GSI techniques will be designed, after which construction can follow.

Appendices

A. OUTREACH COMMITTEE MEETING NOTES
B. EXISTING DRAINAGE CONDITIONS SUMMARY MEMO
C. TOOLKIT OF SMALL-SCALE STORMWATER MANAGEMENT TECHNIQUES
D. GSI GLOSSARY OF TERMS
E. WALKING TOUR SURVEY AND RESULTS
F. ATTENDANCE RECORDS: WALKING TOURS & PUBLIC MEETINGS
G. FREQUENTLY ASKED QUESTIONS
H. EVALUATION OF DISTRIBUTED STORMWATER MANAGEMENT OPTIONS TECHNICAL MEMO
I. ADDITIONAL GREEN STORMWATER INFRASTRUCTURE RESOURCES

APPENDIX A

Outreach Committee Meeting Notes

Pueblo Alto / Mile High Drainage Outreach – Outreach Committee Meeting

Notes: Meeting via Zoom Video Conference
October 15, 2021

Present

Amy Bell, Groundwork Studio
Erika Robers, Groundwork Studio
Aaron Sussman, BHI
Diane Dolan, City of Albuquerque City Council
Abigail Stiles, City of Albuquerque City Council
Councilor Diane Gibson, City of Albuquerque City Council District 7
Kathy Verhage, City of Albuquerque DMD Engineering
Sarah Hurteau, Arid LID Coalition
Tyler Richter, Pueblo Alto Neighborhood Association
Tina Valentine, Pueblo Alto Neighborhood Association
Cynthia Serna, Mile Hi Neighborhood Association
Joan Davis, Mile Hi Neighborhood Association

Notes

- ✓ Roundtable Introductions
  - Names, roles, "What is the thing you like best about your neighborhood?"
    - Amy Bell- Corrales: likes walkability, access to trails
    - Joan- Mile Hi Neighborhood Association: Interested in learning more about the drainage issues in the neighborhood and solving it with landscaping.
    - Aaron Sussman - Highland Neighborhood. Runs through the neighborhood all the time. Likes that it is walkable.
    - Sarah Hurteau- Likes the proximity to the river in Old Town and community that is walkable.
    - Diane Dolan- lives in Nob Hill and loves the walkability there.
    - Abigail Stiles: Lives in Nob Hill. Loves running through the neighborhoods.
    - Diane Gibson: Lives in Jerry Klein neighborhood- likes it because "You're there because you're either going somewhere, or you're lost."
    - Cynthia Serna: Lives in Mile Hi neighborhood. Centrally located neighborhood and it has a sense of history. It was built a year or two before she was born. A lot of long-term residents
    - Tina Valentine: Pueblo Alto neighborhood association. She's glad that we are working together with the neighborhood- she would like to incorporate the alley ways in the neighborhood. She likes that people walk in the neighborhood.
    - Kathy Verhage: Lived in the Far West neighborhood – friendly neighborhood. Centrally located. Likes to bike to work. Puts many miles on her bike.
    - Tyler Richter: President of the *Pueblo Alto NA.* Career is civil construction. Lots of potential here on this project. He loves walking and biking.
    -
  - Project background: this process started with the drainage proposal 3 years ago that didn't go well with the neighborhood. We wanted to make sure that moving forward, we are working with the neighborhoods that are impacted- that we would hear from the neighborhoods first regarding location and what needs need to be met. This process is primarily about listening, the City does not have anything planned at this point to solve the drainage problem.

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- It's exciting to see that the city is looking at more robust engagement processes with neighborhoods. Another thing that is different about this project is that the process will help inform the city about what various neighborhoods and individual residents can do around green infrastructure.
- Purpose of the Outreach Committee: Transparency in decision making and outreach to neighborhood so that we are as inclusive as possible. Also helping us to make sure that the activities are accessible and relevant to residents.

✓ Scope of Work

- Existing Conditions Memorandum
  - BHI will have to look at scale- what kind of impact can each intervention make? BHI will create maps and reports so that everyone can understand flow of water and understand what impact this will have at a local level. BHI will develop this information and report and we will send it out.
- Project website + interactive map - https://gws.mysocialpinpoint.com/pueblo-alto-mile-hi
  - Comment: Have a menu at the top of the website.
- Neighborhood Walking Tours (4) – 2 with each neighborhood
  - Existing conditions information collection: People will identify what kinds of flooding is happening in the neighborhood and where. We can come up with ways to reduce flooding impacts through other interventions- pollinator gardens and landscaping. With the initial walking tours, we may do a scavenger hunt. Everyone can do it themselves and can enter problems and opportunities. It's not just about problems but also opportunities and assets.
  - Exploration of potential intervention locations: take the initial comments into account and discussing which of the options we like best. Walk in the neighborhood to decide which interventions could go where in the neighborhood. We'll also have some photo realistic renderings of the spaces
- Neighborhood Meetings (2) – with both neighborhoods simultaneously
  - Initial community meeting. We need to find a good location and time. Introduce people to the project, explain what sorts of green storm water infrastructure are feasible (toolkit) and listen to feedback on what is preferred.
  - Key findings from walks and options identification
- Toolkit of Small-Scale Stormwater Management Techniques
- Stormwater Management Options Identification and Analysis
- Summary Report: We will prepare a report that will summarize our process and findings after that.

✓ Tentative Schedule

- General: Scheduling around the holidays is challenging. Prefer to take additional time if needed to work around holiday dates and make sure the neighborhoods have enough time to advertise.
- First neighborhood walking tours
  - November 13th 12:30 pm (Pueblo Alto), meet @ Truman/Marble and 2:30 pm (Mile Hi), meet @ Cardenas and Mountain
- First community meeting
  - First or week in December. Determine best timing through initial outreach and walking tours. This would allow for presentation of toolkit information. APS Family Focus Center may be a good indoor meeting space.
- Second neighborhood walking tours
  - TBD
- Toolkit ready for distribution
  - Second week of December
- Second Public Meeting
  - Second week of February
- Summary Report
  - Second week of March

- ✓ Discussion
  - Outreach methods
    - Zoom meetings are difficult, in-person meetings for neighbors are preferred.
  - Project promotion strategy
    - Flyering: GWS will design/print flier (600 per neighborhood), NA's to find volunteers to distribute.
    - Social Media: GWS will prepare post, NA's will distribute
  - Other: Does the project team want access to the neighbors who are experiencing most of the drainage issues? Aaron says he's going to get back to us regarding it after talking to Vince. Maybe we will go out and take measurements and include them in these meetings. The team definitely wants to be sure these folks are included in the outreach activities.
  -

- ✓ Next Meeting
  - Next meeting to be set at each meeting. We should try to time meetings so they are after an event, so we can debrief/evaluate and adjust future plans if needed.
  - Nov. Meeting = Nov. 18th at 3:30pm via Zoom.

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6501 Americas Pkwy NE, Ste. 300
Albuquerque, NM 87110

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Pueblo Alto / Mile Hi Drainage Notes– Outreach Committee Meeting #2

Notes: Meeting via Zoom Video Conference
November 18, 2021

Present/Not Present

Amy Bell, Groundwork Studio
Erika Robers, Groundwork Studio
Aaron Sussman, BHI
Diane Dolan, City of Albuquerque City Council
Abigail Stiles, City of Albuquerque City Council
Kathy Verhage, City of Albuquerque DMD Engineering
Tina Valentine, Pueblo Alto Neighborhood Association
Tyler Richter, Pueblo Alto Neighborhood Association
Hope Nelson, Pueblo Alto Neighborhood Association
Cynthia Serna, Mile Hi Neighborhood Association
Joan Davis, Mile Hi Neighborhood Association
Jeffrey Holland, Mile High Resident
Paula Dodge-Kwan, City of Albuquerque DMD Engineering

Notes

- ✓ Roundtable Introductions
  "*Share one insight or inspiration you gained from Saturday's neighborhood walking tour."*
  - Amy Bell; clarification of water flow from walking tours.
  - Tyler Richter; important to ask the engineers the right questions.
  - Jeffrey Holland; nice to meet new people.
  - Diane Dolan; huge learning experience to walk the neighborhood with the residents. Excited about the variety of ideas. Potential of vacating a street for a linear park.
  - Aaron Sussman: Important to figure out what questions we are responding to. People have been very receptive to new ideas and changes.
  - Erika Robers; GWS planner, unfortunately wasn't able to make the walk. Excited to look at everyone's comments.
  - Tina Valentine; didn't know that the Quincy area also floods. Water goes where its low- flooding areas follow historic location of arroyo.
  - Cynthia Serna; really interested in hearing everyone's' ideas and she is appreciative that the city is listening.
  - Kathy Verhage; she was really interested to learn about the manhole cover surge, likely because the pipes aren't sized for the necessary capacity. She unfortunately couldn't attend but will try to make the January walk.
  - Abigail Stiles; Counselor Gibson's office. She thought the neighbors were very engaged. She learned that there drainage also flowing over San Pedro from the east. She was able to hear peoples' stories who have houses that flood.

- ✓ Debrief of Neighborhood Walks
  - Review of comments received so far
    - Toby and Amy tried to capture the neighbors' comments as they were spoken on the map (why so many comments have groundworkstudio emails attached).
    - 47 people signed in on the sign in sheets.
    - Pueblo Alto- 80 comments. Mile Hi: 40 comments.
    - There were areas where comments were clustered. Mile Hi comments were in a distinct pattern because of the distinct drainage pattern.

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- Collecting comments until the end of November.
- GWS will send out the summary document to the group.
- GWS is putting together graphic summaries to share during the future community meetings.
- GWS to collaborate with BHI in compiling the comments to inform toolkit/proposed interventions
- Mile Hi is planning to get a newsletter out 2nd week in December- great to promote next community meeting.

- Assessment of inclusion and participation from neighborhood
  - Twin Parks also participated.
  - What did we do well in outreach?
    - Good participation
    - Nice to have a positive meeting instead of a meeting where only angry folks attend.
    - Neighbors enjoyed talking to others- some people were unaware of flooding.
    - Emails and Neighborhood Association communications worked well. GWS will follow up with emails to everyone who signed in at walking tours as well as email sign up on the website.
  - What can we do better next time?
    - Make sure the capture the neighborhood that commentary belongs to.
    - Next time we could do a more intentional path on the walking tour to visit pointed locations. Develop a tour that people could also walk on their own.
      - Beginning tour gave everyone a "lay of the land". Agreement that we should develop a specific path with suggestions that are solutions.
      - Importance of thinking long term: helpful to have a tour for the incoming city counselor.
    - Thank you to Joan for her help distributing fliers in the Mile Hi Neighborhood.
    - Signs were specifically created so that apartment residents could be more included. That was a useful tool. Tina reminded everyone to include apartment residents.
    - Flyers should be black and white and very simple- only a small amount of text is needed. Allows people to quickly read as they pass.
    -

✓ Next Steps

- BHI progress update on Existing Conditions memo Toolkit
  - Currently working on the existing conditions analysis and the toolkit. Both will be done in early January to review and then distribute at community meetings.
- Community Meeting- Early January (Dot preference and interactive mapping, key findings from walks and review of toolkit)
  - Majority of participants voted for weekday evening, in person meetings, some voted for virtual and/or weekend meetings.
  - Possible location- Jerry Kline Park is an option. It may be too small of a space to fit everyone. Diane will confirm capacity. Could have people register and remainder attend virtually.
  - Crossroads church is possible; not sure it's open. Abigail will get the contact information.
  - Make sure the in-person meeting is also available virtually for those who don't want to meet in-person. Diane will get with IT and figure out a hybrid meeting. Important to ensure that sound equipment functions.
  - Meeting will be recorded and posted on the website.
  - **Date**: Thursday January 20th - 6:30 pm.
- Second neighborhood walking tours
  - Important to bring temporary solutions to bear- two pronged solutions. There may need to be some solutions that could be done immediately and others that are more long term.
    - BHI will develop some short term temporary solutions.
  - Date: Saturday February 5th; 12:30-2pm Pueblo Alto; 2:30 to 4 Mile Hi (Same meeting locations)

✓ Next Meeting

- Thursday, January 6th at 3:30pm via zoom. GWS will send out calendar invite and link.

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Pueblo Alto / Mile High Drainage Outreach – Outreach Committee Meeting #3

Agenda: Meeting via Zoom Video Conference
January 6, 2022

Present

- ✓ Amy Bell, Groundwork Studio
- ✓ Erika Robers, Groundwork Studio
- ✓ Aaron Sussman, BHI
- ✓ Vince Steiner, BHI
- ✓ Diane Dolan, City of Albuquerque City Council
- ✓ Councilor Tammy Fiebelkorn, Albuquerque City Council District 7
- ✓ Donna Griffin, District 7 Policy Analyst
- ✓ Kathy Verhage, City of Albuquerque DMD Hydrology
- ✓ John McKenzie, City of Albuquerque DMD Hydrology
- ✓ Sarah Hurteau, Arid LID Coalition, The Nature Conservancy
- ✓ Tina Valentine, Pueblo Alto Neighborhood Association
- ✓ Tyler Richter, Pueblo Alto Neighborhood Association
- ✓ Hope Nelson, Pueblo Alto Neighborhood Association
- ✓ Cynthia Serna, Mile Hi Neighborhood Association
- ✓ Joan Davis, Mile Hi Neighborhood Association
- ✓ Jeffrey Holland, Mile High Resident, Endorphin Power Company

Notes

- ✓ Roundtable Introductions
  - "*Share one thing you hope to achieve during the public meeting January 20th.*"
  - Amy Bell - GWS- excited to share the GSI toolkit, understand the potential solutions.
  - Tammy Fiebelkorn- wants to hear what residents think of the project.
  - Joan Davis - excited to hear about the toolkit.
  - Kathy Verhage - excited about potential solutions. Wants to make sure that we are addressing interventions in relation to different sizes of storms.
  - Diane Dolan- wants to see a big turnout. Excited to learn more about how these green infrastructure projects work.
  - John MacKenzie - problems are occurring are from the larger storms. We have to address bigger storms and not only the small storms.
  - Jeffrey Holland - Resident that is highly affected by the flooding in the neighborhood.
  - Cynthia Serna - hoping that the meeting gets us all on the same page. Wants to set an expectation that the neighborhoods work in partnership with the City to solve community issues.
  - Hope Nelson- here to listen.
  - Vince Steiner - hoping to get people using a consistent vocabulary.
  - Aaron Sussman - excited about the level of engagement and participation. Appreciates peoples' open-mindedness. BHI's role is to reconcile what can actually happen with peoples' desires.
  - Tyler Richter- excited to hear about the toolkit.
  - Sarah Hurteau - interested to hear what resonates with neighborhood.
  - Donna Griffin- excited to learn about green infrastructure applications here.
  - Tina Valentine - interested to see who shows up from the neighborhood and what is in the toolkit.

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- ✓ Update on Deliverables
  - Existing Conditions Memo:
    - Intent is to look at the watershed that the two neighborhoods are built on and to make AMAFCA information digestible to the public.
  - Green Stormwater Infrastructure Toolkit
    - Content has been created and solidified. The toolkit will include five best storm water practices:
      1. Stormwater harvesting basins
      2. Bump outs or chicanes
      3. Bioswales
      4. Permeable pavement
      5. Underground infiltration chambers- possible for alleyways. Not a new technology but hasn't yet been used by City of Albuquerque DMD. Previous attempts for installations by DMD have not been supported either by DMD leadership or property owners.
    - Public meeting will include graphic representations of the possible interventions and some pros and cons (ie: budget, timeframe, effectiveness) for people to consider.
    - While other parts of the world use GSI, ABQ hasn't yet fully invested in GSI. Pulling from the Bernalillo County GSI guide that BHI co-created. Solutions must be specific and applicable to the NE Heights of ABQ. The toolkit targets the study area but also applies to other neighborhoods in the NE quadrant.
    - Important to provide both pictures and a glossary of terms for residents to understand the vocabulary associated with GSI.
  - Memo and Toolkit will be complete by January 13th, allowing for posting on the website/public distribution by January 14th (a week prior to public meeting).
- ✓ Public Meeting Planning
  - Confirmation of meeting format (hybrid) and location
    - Jerry Cline Tennis Center
    - Website is updated with zoom information for public meeting
  - Meeting Agenda
    - Project background
    - Project scope and schedule
    - Review of Existing Conditions
    - Review of feedback from walking tours
    - Review of GSI Toolkit
    - Feedback session/discussion
    - Information on upcoming walking tour
  - Diane requested that GWS sends the city the presentation and slides ahead of time so that they can prepare virtual meeting logistics/presentation.
  - Outreach Committee member participation – Tyler offered to provide a short presentation on project background and community involvement from the Pueblo Alto Neighborhood perspective.
- Question regarding DMD position on green infrastructure interventions:
  - Important to consult with CABQ maintenance to ensure appropriate maintaining of GSI interventions. DMD has done permeable paving in community centers and parking lots and bulb outs in different areas of the city. Once the neighborhood decides on specific interventions, City maintenance should be invited into the process.

- Over time GSI maintenance has improved- might have become easier through new technology.
- ARID LID has a funded grant to write a GSI maintenance manual and companion videos and is creating in-person trainings for maintaining GSI.

- Will there be GSI parkways that will help with pedestrian safety?
  - BHI is considering targeted locations in which parkways or medians would work.
  - Mile Hi has some streets in which none of the houses face the road and where driveways don't access those roads; those streets could be retrofitted with GSI.
  - GSI has multiple benefits beyond the drainage- safety, traffic calming effect. Walking tours considered what residents love about their neighborhood and what kinds of creative place making can happen as well.
  - Some streets are excessively wide and present a potential for parkways and narrowing the roadway to create GSI. La Veta is one of those.

- Meeting promotion
  - Mailers (both neighborhoods)- the postcards went out 1/5/22.
  - Flyers (how many?)- Joan Davis, Tyler Richter and Tina volunteered to pass out flyers. GWS will follow up with them directly on quantity and timing.
  - Yard signs- the yard signs should have a QR code. Locations should be in public ROW unless property owner gives express permission. They will be removed immediately after the walking tours on Feb. 5th.
  - Social Media posting- can be posted on the council website. GWS will send out a jpg of flyers to promote events on social media.
  - ONC newsletter.
  - It was agreed that a press release/newspaper would probably not be very effective.

✓ Next Steps
- Community Meeting- January 20, 6:30pm
- Second neighborhood walking tours- February 5th
  - Pueblo Alto 12:30-2
  - Mile High 2:30-4
  - Same meeting locations as last time
  - Tour will identify potential toolkit solutions, with info on budget/timeframe for multiple locations, collect feedback on preferences for particular interventions at each location
  - Map will be available online prior to the tour and for 2 weeks after, prizes given for participation
  - Next walking tour will be more targeted. Route will be mapped out and target specific locations and solicit comments on the various possible interventions at specific sites.

✓ Next Meeting
- Feb. 10th at 3:30. GWS will send out meeting invite and zoom link

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Pueblo Alto / Mile High Drainage Outreach – Outreach Committee Meeting #4

Agenda: Meeting via Zoom Video Conference
February 10, 2022

Present/Not Present

Amy Bell, Groundwork Studio
Erika Robers, Groundwork Studio
Aaron Sussman, BHI
Vince Steiner, BHI
Diane Dolan, City of Albuquerque City Council
Councilor Tammy Fiebelkorn, Albuquerque City Council District 7
Laura Rummler, District 7 Policy Analyst
Kathy Verhage, City of Albuquerque DMD Engineering
Sarah Hurteau, Arid LID Coalition
Tina Valentine, Pueblo Alto Neighborhood Association
Tyler Richter, Pueblo Alto Neighborhood Association
Hope Nelson, Pueblo Alto Neighborhood Association
Cynthia Serna, Mile Hi Neighborhood Association
Joan Davis, Mile Hi Neighborhood Association
Jeffrey Holland, Mile High Resident
Greg Boyd, Pueblo Alto Resident

Notes

- ✓ Roundtable Introductions
  - Names, roles, "What was your main takeaway from the walking tours?"
  - Happy to see it moving forward.
  - People are excited to be involved in the project
  - Great to see general enthusiasm and openness to various interventions
  - Good to see enthusiasm from residents- especially bulb outs and traffic calming measures.
  - Helpful for imagining the interventions in place.
  - Discussed potential locations for bulbouts for traffic calming. Summer and Mountain were ideal sites for interventions because it wouldn't take away parking and ideal for traffic calming. Alley discussion- they are only 16 feet wide. It poses a challenge to put storage in addition to drive space.
  - Happy that residents were able to understand and apply the GSI concepts quickly.
  - The walking tours helped identify that Summer and Mountain were the best options for slowing stormwater.
  - Highlighted potential for interventions between El Encanto and la Veta. Various solutions should be considered in combination with each other to yield multiple benefits.
  - Mountain and Summer are best options for bump outs and potentially bioswales on the North-South streets.
  - Seeing the runoff from the recent snow gives you a sense of direction of drainage. Mile Hi has a short alley way that would be ideal for a small park or greenway. Glad that residents experiencing flooding were present at walking tours.
  - Loved brainstorming together with residents about how various approaches to GSI will be implemented.
- ✓ Debrief of Neighborhood Walks
  - Review of survey results received so far
  - Assessment of inclusion and participation from neighborhood

One Park Square
6501 Americas Pkwy NE, Ste. 300
Albuquerque, NM 87110

T 505-212-9126
W groundworkstudionm.com

- More people came out for the first walking tour- could be weather-related.
- Advice to re-word the flyer- "This is your chance to have a voice in what happens."
- Include on flyer for the survey that these ideas came from the previous walks and survey/map.
- Will the bioswales be between the sidewalk and the road?
    - Locating them between the sidewalk and the road adds protection for walkers. Less likely to put the bioswales in peoples' yards. City cannot maintain GSI in peoples' yards. Most likely that the curb and bioswale would be next to the street. In Pueblo Alto on the North-South streets, there are lots of driveways where it's not ideal for bioswales/stormwater bumpouts.

- Revisions to survey, additional promotion (mailers, social media)
    - Mailers to promote survey and meeting
    - Fliers and Yard signs to promote the meeting in mid-March.

✓ Public Meeting #2

- March 31, 6:30pm
- Meeting format will be hybrid if the COVID numbers continue to decrease. Tyler votes for in-person. Hybrid will make meeting available for those who cannot come to the in-person meeting.
- BHI will work with DMD to identify potential options and the considerations, and assess potential volume of storage. GWS will create photo realistic renderings of options in specific locations. That will be part of the content in the second meeting.
- Meeting Agenda
    - Walking Tour Survey results
    - Options Identification and Analysis
    - Options visualizations
    - How to move forward with the outcomes of this outreach process (pilot project)
- Meeting promotion
    - Mailers
    - Flyers
    - Yard signs
    - Social Media posting

✓ Next Steps

- Options Identification and Analysis- BHI will develop in coordination with DMD, then our team will complete the final report. Tools will be provided for the community to continue on with the project.
- City Councilor says funding is available and the project is her priority. City budget- Ms. Fiebelkorn will advocate to get more money from City Council. This committee may continue to meet to move the project forward.
- Options visualizations-GWS
- Community Meeting- March 31, 6:30pm
- Summary Report will be made publicly available, and we will leave the website up to be used as a resource.

✓ Next Meeting

- March 10th- 3:30 pm

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Albuquerque, NM 87110

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Pueblo Alto / Mile High Drainage Outreach – Outreach Committee Meeting #5

Notes: Meeting via Zoom Video Conference
March 10, 2022

Present/Not Present

- ✓ Amy Bell, Groundwork Studio
- ✓ Erika Robers, Groundwork Studio
- ✓ Vince Steiner, BHI
- ✓ Diane Dolan, City of Albuquerque City Council
- ✓ Councilor Tammy Fiebelkorn, Albuquerque City Council District 7
- ✓ Laura Rummler, District 7 Policy Analyst
- ✓ Kathy Verhage, City of Albuquerque DMD Engineering
- ✓ Tina Valentine, Pueblo Alto Neighborhood Association
- ✓ Tyler Richter, Pueblo Alto Neighborhood Association
- ✓ Cynthia Serna, Mile Hi Neighborhood Association
- ✓ Joan Davis, Mile Hi Neighborhood Association
- ✓ Jeffrey Holland, Mile High Resident

Notes

- ✓ Roundtable Introductions
  - Names, roles, "What would you like to get out of the second community meeting?"
  - Amy - Hopes to get a clear sense of which interventions the community would prefer and the next steps in the process to move forward.
  - Joan - Hoping that residents will be excited to get going on the project and will have clear preferences.
  - Councilor Fiebelkorn- Hope to understand the next steps and understanding what we need in terms of funding for further phases.
  - Vince - Will share an understanding of the impacts of differing drainage solutions and the resulting analysis.
  - Tina - Same as what has been said.
  - Diane - Looking forward to communicating and understanding the impact of each of the stormwater interventions.
  - Kathleen - Understanding next steps clearly.
  - Laura - Wants to assess community satisfaction with this project and engagement processes, for use as a model with future projects.
  - Cynthia - Hopes for concrete benchmarks and steps to move forward. Clear understanding of our options and clear communication around how to continue being involved in the project.
  - Jeff - Improve the quality of life for people in the neighborhood and be on the cutting edge of innovative solutions for storm water drainage and community improvements.

- ✓ Neighborhood Walks Survey
  - 75 total (15 Mile Hi, 60 Pueblo Alto)
  - Review of survey results – see attached

- ✓ Options Identification and Analysis
  - Potential projects and locations

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6501 Americas Pkwy NE, Ste. 300
Albuquerque, NM 87110

T 505-212-9126
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- Map with selected sites for interventions was reviewed. Locations were based on the walking tours and the survey results and analysis of the neighborhood topography and drainage flow paths.
    - Summer between Washington and San Mateo- high level of stormwater flow through. Potential for stormwater bumpouts and permeable pavement.
    - Three alleys between Mountain and Summer- Monroe, Quincy, Manzano and Truman. Storm drain passes through them. Stormwater harvesting and potentially underground systems.
    - La Veta between El Encanto and Summer- Houses don't front this stretch. Option of either closing off to pedestrians only or creating bioswales on one side of the street and narrowing the street.
    - Alvarado- Constitution to Lomas- West side of the street. Minimal driveways and houses don't front to the street.
    - Cardenas, between Constitution and Marble- similar to Adams. Would have to work around the driveways.
    - Adams and Jefferson are very similar, one had to be chosen as a test case. When you drive through the neighborhood, most significant flooding is on Jefferson. Anyone of these on their own will not solve the flooding, but together they could lessen the drainage problems.
- BHI will be assessing the level of impact that each of the interventions would yield in terms of stormwater capture. Assessments around the impact will allow for us to apply these numbers to other similar locations.

- Renderings (in progress)
    - GWS will be doing photo realistic renderings of the streets with the interventions.
    - Goal is to allow for the residents to visualize what these solutions will look like.

✓ Public Meeting #2

- March 31, 6:30pm
- Hybrid (in-person and zoom) – Jerry Cline Tennis Center
- Meeting Agenda
    - Walking Tour/survey results
    - Options Identification and Analysis
    - Options visualizations
    - How to move forward with the outcomes of this outreach process (pilot project)
- Meeting promotion
    - Mailers (already sent)
    - Flyers – follow up with numbers from Neighborhood Associations.
    - Yard signs- will advertise with signs again.
    - Social Media posting- increases awareness of the project. Send out the posting to the group to include in newsletters. Remove the closed survey. Look into cost of mailers.
    - ONC posting
    - Emails to contact list
    - Press release

✓ Next Steps

- Options Identification and Analysis
- Options visualizations
- Community Meeting- March 31, 6:30pm
- Summary Report
- Future Outreach Committee meetings?
    - Councilor Fiebelkorn's office is willing to continue to facilitate community meetings in the next phase.
    - Mile Hi neighborhood meeting scheduled for April 30th. They would like an update for those who attend the meeting. Someone from council services will attend to give an update. Councilor Fiebelkorn is invited to attend.

APPENDIX B

Existing Drainage Conditions Summary Memo

Bohannan Huston

Engineering
Spatial Data
Advanced Technologies

Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335
www.bhinc.com
voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

M E M O R A N D U M

DATE: January 17, 2022

TO: Diane Dolan, Albuquerque City Council, Special Projects Analyst;
John MacKenzie, PE and Kathy Verhage, PE, City of Albuquerque, Dept. of Municipal Development, Storm Drain Section

FROM: Vince Steiner, PE, CFM

SUBJECT: **Pueblo Alto & Mile Hi Neighborhoods Drainage Study**
Existing Drainage Conditions Summary Memo

I. Study Background

The City of Albuquerque (City) contracted Bohannan Huston, Inc. (BHI) to perform the Pueblo Alto and Mile Hi Neighborhoods Drainage Study (under the Pueblo Alto Drainage Analysis and Outreach Effort on-call task order) in response to on-going drainage issues across the subject neighborhoods. In addition to the summary of existing drainage issues presented in this memo, this study consists of an extensive community outreach process, development of a small-scale stormwater management techniques toolkit, identification and evaluation of the potential techniques for the subject neighborhoods, and preparation of a summary report. **Figure 1 – Study Area Map** shows the area included in the current study, as well as the subject neighborhoods.

Upcoming portions of this study will focus on minimizing local drainage issues through the use of small-scale, distributed stormwater management techniques, including green stormwater infrastructure (GSI). The Small-Scale Stormwater Management Techniques Toolkit, prepared as a separate document, identifies a range of techniques that may be applicable for the subject neighborhoods and other small-scale applications across the City. The effectiveness of potential techniques will be evaluated for a range of storm events (i.e., 2-, 10-, and 100-year). The intent of the resulting study summary report is to be a resource for City staff in considering future stormwater improvement projects. At this time, it is unknown if the current study will lead directly to improvements.

II. Memo Purpose

This Existing Drainage Conditions Summary Memo is intended to summarize existing drainage conditions in a simplified manner, to inform study participants and stakeholders in a concise manner regarding the nature and magnitude of existing issues. This consistent understanding of existing drainage issues is critical for identifying the potential type and location of stormwater management techniques, and for evaluating the effectiveness of those potential techniques. This memo serves as a reference for study participants, including public agency staff and members of the community, in conjunction with the Small-Scale Stormwater Management Techniques Toolkit and subsequent documents prepared for this study. It primarily summarizes the key, relevant findings from previous engineering studies in a succinct form.

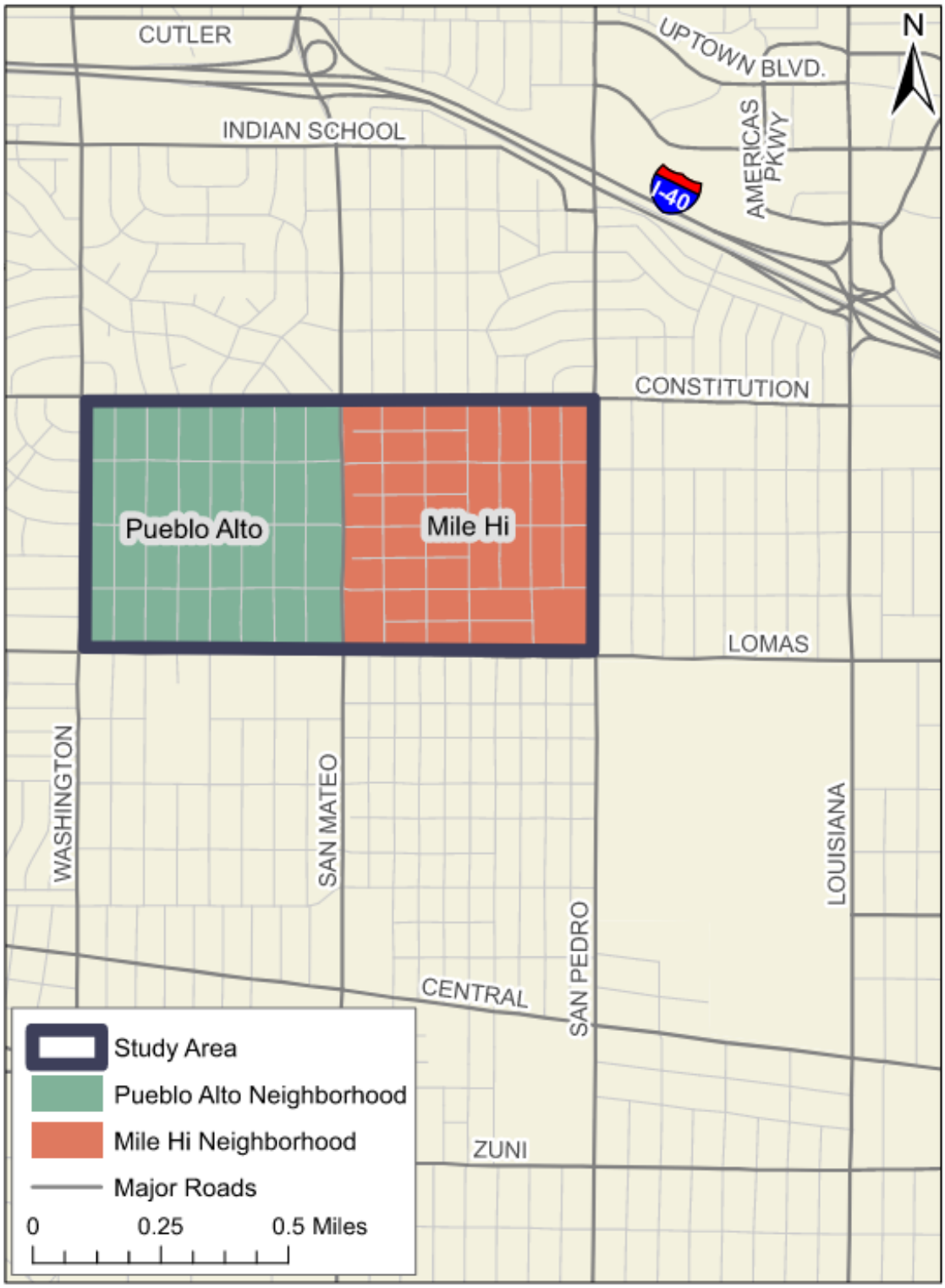


Figure 1 – Study Area Map

III. Existing Drainage Infrastructure & Drainage Patterns

The Pueblo Alto and Mile Hi neighborhoods were developed in the mid-20th century in a manner similar to many areas of the Northeast Heights of Albuquerque of similar age. Lot and street runoff is conveyed as surface flow (i.e., street flow) to storm drain inlets. Blocks and streets were generally developed in a grid and were not configured to the natural topography, resulting in a neighborhood drainage system that in places lacks surface flow paths or overflows, other than through private property. This is compounded by the lack of adequate capacity of existing storm drain systems, particularly downstream of the subject neighborhoods as further described later in this memo.

As shown on **Figure 2 – Existing Drainage Infrastructure**, much of the Pueblo Alto neighborhood is served by storm drain, but the majority of existing inlets within the neighborhood are at mid-block low points between Summer Avenue and Mountain Road. When runoff at these mid-block inlets cannot enter the storm drain system, it follows the topography through lots and alleys generally flowing to the west. The street layout of the Mile Hi neighborhood is better for conveying surface drainage (generally to the northwest), but there are streets with inadequate surface capacity due to flatter slopes. Further, the Mile Hi neighborhood has limited storm drain systems until you reach the downstream (west) end, nearing San Mateo Boulevard. While there are storm drain systems in Lomas Boulevard, San Mateo Boulevard, and San Pedro Drive, these systems are distant from existing drainage issues and already lack capacity due to downstream constraints, thus likely cannot accept additional runoff.

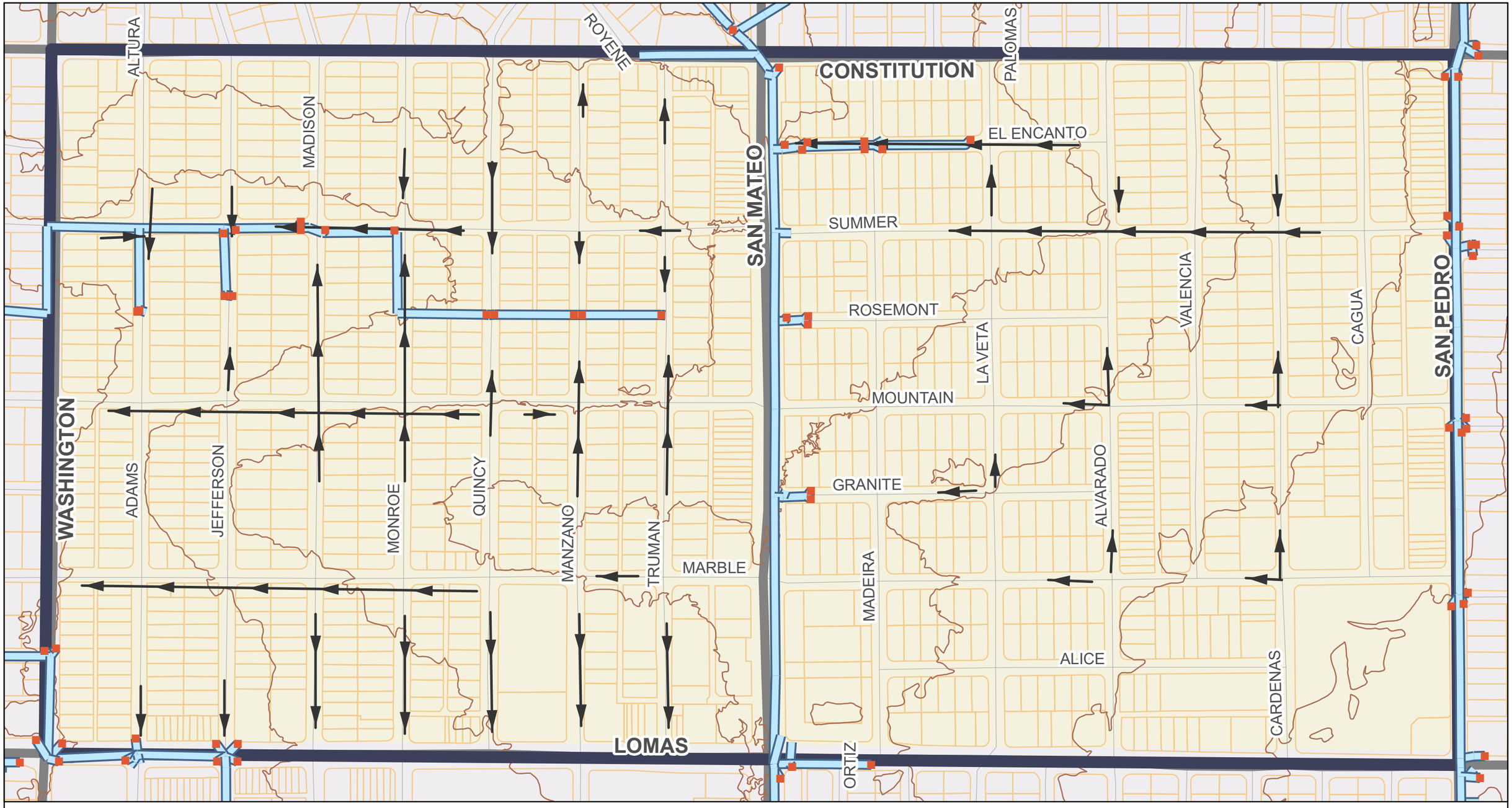
The existing condition drainage basins delineated for this study within the Pueblo Alto and Mile Hi neighborhoods and shown on **Figure 3 – Existing Drainage Issues** are based on field investigations and 2010 Mid-Region Council of Governments (MRCOG) LiDAR topographic data.

IV. Previous Drainage Studies

The Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) contracted Smith Engineering Company to prepare the *San Mateo to Moon Mini Drainage Management Plan*. That study was published in June 2016 and is referred to herein as the *San Mateo to Moon Mini-DMP*. The study area for the *San Mateo to Moon Mini-DMP* encompasses the current study area and extends further east and south (upstream), as shown in the excerpted basin map (Figure 2.0) provided in **Attachment 1**. Note that drainage basins delineated for the current study differ slightly from basins developed for the *San Mateo to Moon Mini-DMP*, but are generally smaller and more detailed.

Information presented in this memo on the general location and magnitude of runoff predicted to impact the Pueblo Alto and Mile Hi neighborhoods from the east is based on analyses presented in the *San Mateo to Moon Mini-DMP*. The estimated surface peak flows for the 100-year storm event provided on **Figure 3 – Existing Drainage Issues** were obtained from the *San Mateo to Moon Mini-DMP*. Some key-findings from the *San Mateo to Moon Mini-DMP* relevant to the current neighborhood study include:

- The existing interceptor storm drain systems along San Mateo Boulevard and San Pedro Drive, which are intended to collect neighborhood and roadway drainage and convey it north, are severely under capacity for existing condition 100-year flows. As a result, these existing systems are unable to accommodate peak flows from the surrounding neighborhoods during large storm events.



Existing Storm Drain Inlets
Existing Storm Drain Pipes
Surface Flow Direction
Contours (10' interval)
Study Area
Major Streets
Local Streets
Parcels

N

1 " = 400 feet

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Pueblo Alto & Mile Hi Neighborhoods Drainage Study

Figure #2
Existing Drainage Infrastructure

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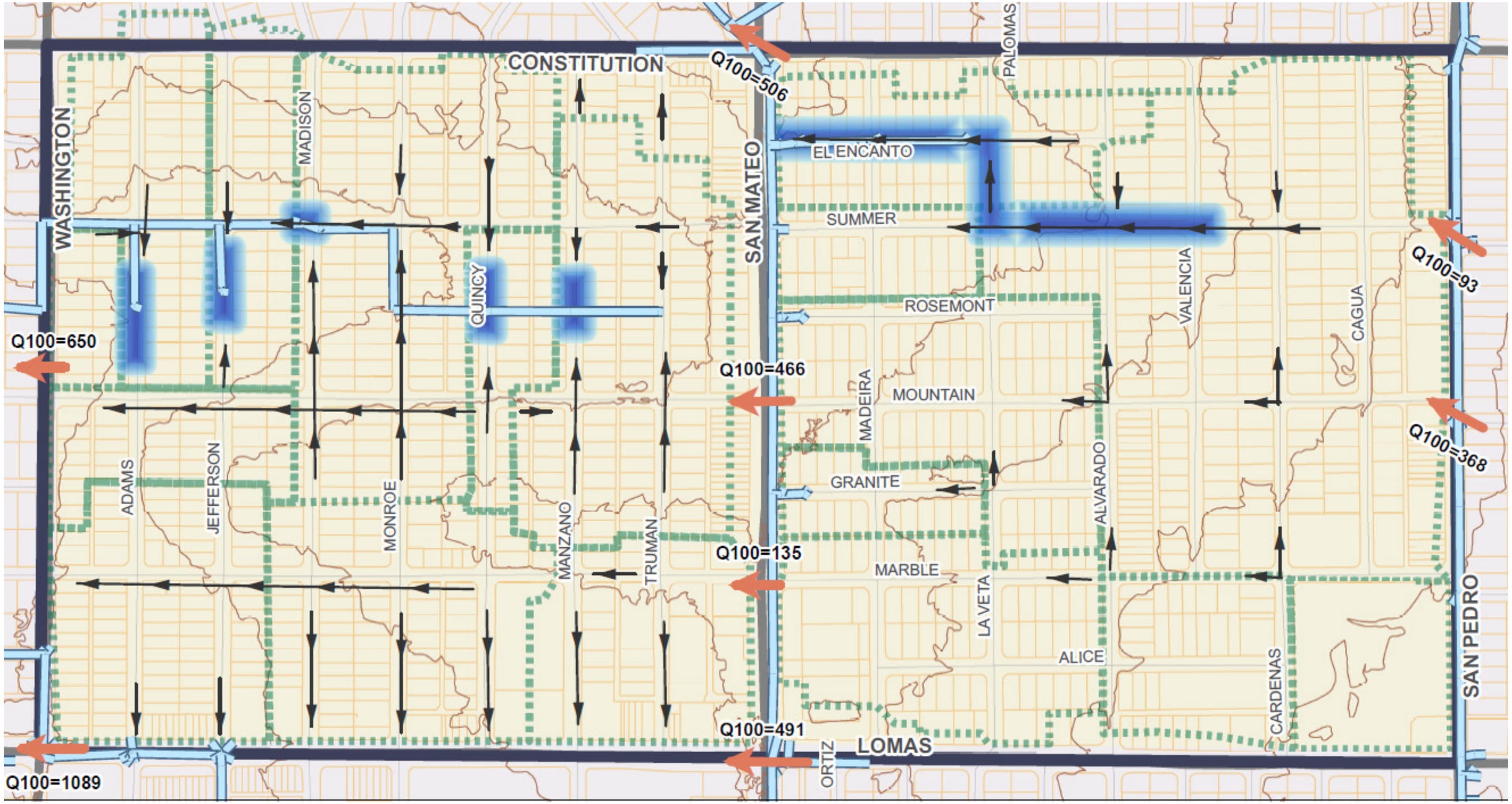
Author: chaley

January 2022



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Surface Bypass Flows (100-year)
Drainage Issue Locations
Basins
Contours (10' interval)
Surface Flow Direction
Existing Storm Drain Pipes
Study Area
Major Streets
Local Streets
Parcels

N
1 " = 400 feet

Pueblo Alto & Mile Hi Neighborhoods Drainage Study

Figure #3
Existing Drainage Issues

- The volume of storage required within basins contributing to the San Mateo Boulevard and San Pedro Drive storm drains, so that the existing interceptor storm drains would provide adequate 100-year capacity, was estimated. These storage volume estimates are identified on Figure 4.0A, provided in **Attachment 1**. Upsizing interceptor storm drains was not evaluated by the *San Mateo to Moon Mini-DMP*, as storm drain upsizing would need to extend north of I-40 and was deemed cost prohibitive and infeasible.
- The study identifies the need for a regional solution for 100-year flood protection, due to the magnitude of runoff, size of contributing basins, and lack of existing open space that could be utilized to provide stormwater storage.
- The study notes "further collaboration will be required between the City…and AMAFCA to determine localized solutions."

BHI initiated the Near Heights (Pueblo Alto) Storm Drain Improvements analysis and design project in 2018 under contract to the City of Albuquerque. The intent of that project was to identify drainage improvements to alleviate ongoing flooding issues within the Pueblo Alto neighborhood, primarily at the roadway low points along Adams Street and Jefferson Street between Mountain Road and Summer Avenue. That analysis identified severe capacity limitations within the existing local storm drain system and a lack of excess downstream capacity, which meant upsizing the local storm drain on its own would not provide protection against 100-year rainfall events. Based on recommendations from the *San Mateo to Moon Mini-DMP*, the 2018 BHI project identified Twin Parks as a potential opportunity for a multi-use facility that could retain its function as a park and provide flood storage volume. This concept faced significant stakeholder opposition; as a result, that analysis project was paused in 2019. The current Pueblo Alto and Mile Hi Neighborhoods Drainage Study is an out-growth of that previous analysis project, but with a very different purpose and approach to community engagement.

V. Existing Drainage & Flooding Issues

To inform study participants and stakeholders regarding the cause and magnitude of existing drainage issues, BHI reviewed the previous studies described above, resident drainage complaints provided by City staff, and information collected through the study webmap, and conducted field investigations (including the initial neighborhood walking tours for this current study, in November 2021). Based on review of that information and assessment of the existing condition drainage basins shown on **Figure 3 – Existing Drainage Issues,** we understand existing drainage issues in the subject neighborhoods to ***generally*** consist of the following:

- Lack of interceptor storm drain capacity, as determined by the *San Mateo to Moon Mini-DMP*;
- Lack of local storm drain capacity within the Pueblo Alto neighborhood, exacerbated by mid-block low points between Summer Avenue and Mountain Road where storm drain surcharge reaches the surface;
- General lack of surface drainage overflow paths to safely convey storm drain bypass, particularly at mid-block low points in the Pueblo Alto neighborhood;
- Inadequate street surface hydraulic capacity at various locations in the Mile Hi neighborhood, particularly towards the west (downstream) side of the neighborhood; and

- Surface bypass of San Pedro Drive and San Mateo Boulevard (where interceptor storm drains lack capacity) flowing west into the subject neighborhoods.

This list provides a general sense of the nature of existing local drainage issues in the subject neighborhoods indicated as “drainage issue locations” on **Figure 3 – Existing Drainage Issues** and is not intended to be exhaustive. In addition, the surrounding area of the City is predicted to be subject to severe surface flooding as described by the *San Mateo to Moon Mini-DMP*.

VI. Summary and Next Steps

The Pueblo Alto and Mile Hi neighborhoods face significant drainage issues that will require long-term planning and significant, costly improvements for 100-year flood protection to be provided.

The next steps in this study will focus on identifying smaller scale, distributed improvements that could be implemented in the near- to mid-term and will evaluate their likely effectiveness and mitigating drainage issues over a range of storm events (2-year, 10-year, and 100-year).

VCS/AS/ab

Attachments:

1. Excerpts – *San Mateo to Moon Mini-DMP* (Smith Engineering, 2016)
   - Figure 2.0 – Existing Conditions Drainage Basin Map (Annotated)
   - Figure 4.0A – Storage Volume Requirements for Drainage Corridors within San Mateo to Moon Mini DMP (Annotated)

Study Area - 2021 Pueblo Alto Neighborhood Drainage Study
(Pueblo Alto & Mile High Neighborhoods)

LEGEND

- 23 — BASIN BOUNDARY/ID
- STORM DRAIN
- FLOOD HAZARD BOUNDARY
- (4) — ANALYSIS POINT
- STORM DRAIN FLOW
- OVERLAND BYPASS FLOW

NOT TO SCALE

ANALYSIS POINT SUMMARY ON FIGURE 2.1 IN MAP POCKET

SAN MATEO TO MOON MINI DRAINAGE MANAGEMENT PLAN

FIGURE 2.0

EXISTING CONDITIONS DRAINAGE BASIN MAP

Prepared for: Albuquerque Metropolitan Arroyo Flood Control Authority

Prepared by: Smith Engineering Company

AMAFCA

JUNE, 2016

O:\SEC—PROJECTS\115115 AMAFCA SMM\MDP\ENGINEERING\Task C - Hydrologic Model\CAD\Figure 2.dwg Feb 26, 2016 - 11:28am Saved By cdrion

Study Area - 2021 Pueblo Alto Neighborhood Drainage Study
(Pueblo Alto & Mile High Neighborhoods)

THE WASHINGTON CORRIDOR. REQUIRES APPROXIMATELY 9 AC-FT OF STORAGE VOLUME TO ALLOW THE EXISTING STORM DRAINS TO FUNCTION AT CAPACITY AND TO DEAL WITH OFFSITE FLOWS FROM CAMPUS WASH

THE SAN MATEO CORRIDOR. REQUIRES APPROXIMATELY 22 AC-FT OF STORAGE VOLUME TO ALLOW THE EXISTING STORM DRAINS TO FUNCTION AT CAPACITY AND TO DEAL WITH OFFSITE FLOWS FROM CAMPUS WASH

THE SAN PEDRO CORRIDOR. REQUIRES APPROXIMATELY 41 AC-FT OF STORAGE VOLUME TO ALLOW THE EXISTING STORM DRAINS TO FUNCTION AT CAPACITY AND TO DEAL WITH OFFSITE FLOWS FROM CAMPUS WASH

THE LOUISIANA CORRIDOR. REQUIRES APPROXIMATELY 24 AC-FT OF STORAGE VOLUME TO ALLOW THE EXISTING STORM DRAINS TO FUNCTION AT CAPACITY AND TO DEAL WITH OFFSITE FLOWS FROM CAMPUS WASH

THE DALLAS CORRIDOR. REQUIRES APPROXIMATELY 30 AC-FT OF STORAGE VOLUME TO ALLOW THE EXISTING STORM DRAINS TO FUNCTION AT CAPACITY AND TO DEAL WITH OFFSITE FLOWS FROM CAMPUS WASH

THE WYOMING CORRIDOR WILL REQUIRE APPROXIMATELY 56 AC-FT OF STORAGE VOLUME TO ALLOW THE EXISTING STORM DRAINS TO FUNCTION AT CAPACITY

THE CAMPUS WASH WATERSHED CONTRIBUTES LARGE AMOUNTS OF BYPASS FLOWS INTO THE SAN MATEO TO MOON STUDY AREA. ANALYSIS AND IMPROVEMENTS IN THE CAMPUS WASH AREA WILL HELP IMPROVE DRAINAGE CONDITIONS IN THE SAN MATEO TO MOON WATERSHED

SAN MATEO INFLOW 46 CFS

SAN MATEO INFLOW 797 CFS

SAN PEDRO SD INFLOW 147 CFS

ALCAZAR SD INFLOW 412 CFS

DALLAS SD INFLOW 274 CFS

CONSTITUTION
WASH
SUMMER
MOUNTAIN
MARBLE
LOMAS
ROMA
MARQUETTE
GRAND
COPPER
DOMINGO
ZUNI
BELL
CENTRAL
ROSS
EASTERN
GIBSON
KATHRYN
ANDERSON
ORTIZ
PALOMAS
P100
I-40
SAN PEDRO
LOUISIANA
WYOMING
EUBANK
WASHINGTON
SAN MATEO
ALCAZAR
DALLAS

LEGEND

- EXISTING STORM DRAIN
- FLOOD HAZARD BOUNDARY

VARIOUS CORRIDORS WERE IDENTIFIED. THESE CORRIDORS WERE DELINEATED BASED ON THE MAIN CONVEYANCE SYSTEM THAT DRAINS THE CONTRIBUTING AREA. WITHIN THE CORRIDOR, THE RECOMMENDED STORAGE WILL BE NECESSARY TO DIVERT AND DETAIN OVERLAND FLOWS. THIS WILL ENABLE THE CONVEYANCE SYSTEMS TO OPERATE AT THEIR CAPACITY

- WYOMING CORRIDOR
- DALLAS CORRIDOR
- LOUISIANA CORRIDOR
- SAN PEDRO CORRIDOR
- SAN MATEO CORRIDOR
- WASHINGTON CORRIDOR
- CAMPUS WASH WATERSHED

NOTE THAT NO MODELING WAS DONE FOR THE CAMPUS WASH AREA

NOT TO SCALE

SAN MATEO TO MOON MINI DRAINAGE MANAGEMENT PLAN

FIGURE 4.0A

STORAGE VOLUME REQUIREMENTS FOR DRAINAGE CORRIDORS WITHIN SAN MATEO TO MOON MINI DMP

Prepared for: Albuquerque Metropolitan Arroyo Flood Control Authority

Prepared by: Smith Engineering Company

AMAFCA

JUNE 2016

Q:\SEC---PROJECTS\115\115 AMAFCA SMMDMP\ENGINEERING\Task D - Development of Options\FIGURE 4.0A.dwg Jun 07, 2016 - 8:51am Saved By: dmtm

APPENDIX C

Toolkit of Small-Scale Stormwater Management Techniques

Bohannan Huston

Engineering
Spatial Data
Advanced Technologies

Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335

www.bhinc.com

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

DATE: January 2022

SUBJECT: **Pueblo Alto & Mile Hi Neighborhoods Drainage Study**
Toolkit of Small-Scale Stormwater Management Techniques

I. Study Background

The City of Albuquerque (City) contracted Bohannan Huston, Inc. (BHI) to perform the Pueblo Alto and Mile Hi Neighborhoods Drainage Study (under the Pueblo Alto Drainage Analysis and Outreach Efforts on-call Task Order) in response to ongoing drainage issues across the subject neighborhoods. In addition to the development of this toolkit, this study consists of an extensive outreach process, identification and evaluation of techniques for the subject neighborhoods, and preparation of a summary report. **Figure 1 – Study Area Map** shows the neighborhoods included in the current study. The intent of the resulting study summary report is to become a resource for City staff in considering future stormwater improvement projects. At this time, it is unknown if the current study will lead directly to improvements.

II. Toolkit Purpose

This toolkit identifies small-scale, localized stormwater management techniques that may be specifically applicable to the Pueblo Alto and Mile Hi neighborhoods as well as other neighborhoods across the Northeast Heights of Albuquerque. This toolkit is intended as an introduction to the small-scale techniques and establishes terminology for use by study participants and stakeholders. It is intentionally brief and means to provide a basic understanding of the advantages and limitations of each technique. This toolkit is also intended to serve as a resource for City staff and consultants when considering these techniques elsewhere in Albuquerque.

Toolkit users who wish to learn more about these techniques may consult the attached reference documents for more detailed, technical information.

III. Stormwater Management Techniques

The five (5) small-scale stormwater management techniques presented below were selected through an initial assessment of the Pueblo Alto and Mile Hi neighborhoods and based on their potential applicability to existing neighborhoods in the Northeast Heights. Neighborhoods in the Northeast Heights tend to be mostly developed, with moderately steep slopes, adequate infiltration, limited excess right-of-way, and limited open space.

IV. Co-Benefits of Green Stormwater Infrastructure (GSI)

The techniques included in this toolkit are a combination of green stormwater infrastructure (GSI) practices and other practices that can be incorporated with GSI as part of an overall project. GSI can generally be described as constructed features that leverage ecological functions of natural systems to provide ecosystem services (including capturing, cleaning, and infiltrating stormwater, among other services). GSI practices provide a myriad of "co-benefits" beyond the noted stormwater benefits, including but not limited to:

- Reduction of urban heat island and climate change impacts
- Increased tree canopy and improved air quality
- Traffic calming
- Improved physical and mental health
- Pollinator habitat
- Reduced potable water use
- Increased property values

Additional information about GSI and the techniques presented in this toolkit can be found in the attached reference documents.

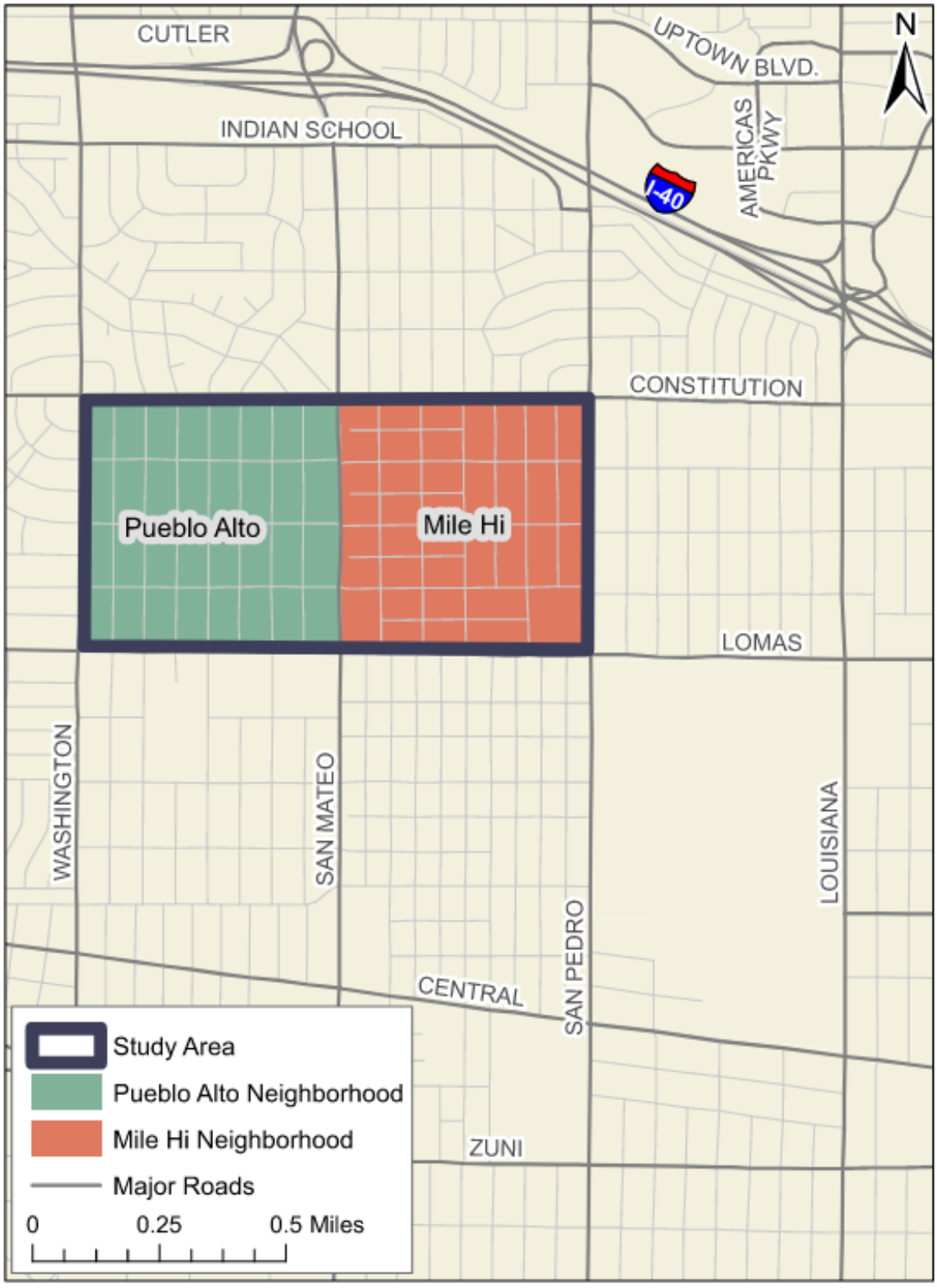


Figure 1 – Study Area Map

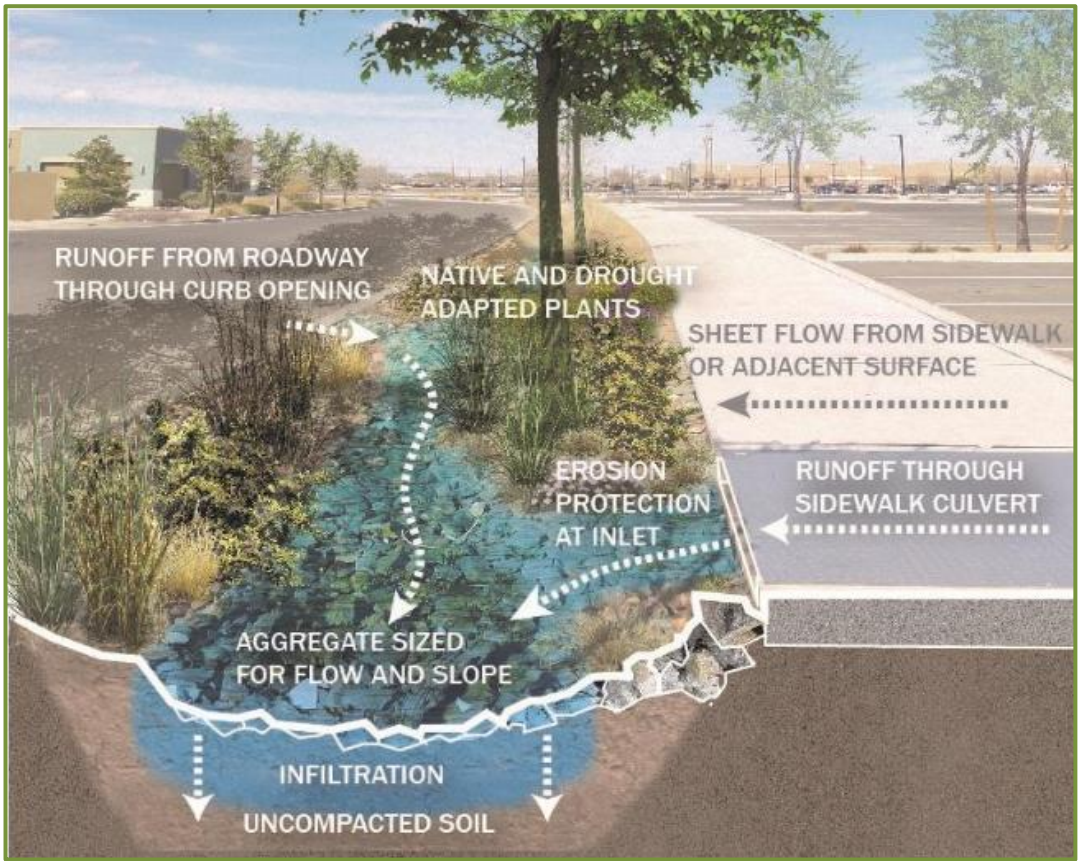
A. Stormwater Harvesting Basin

Description	• GSI practice consisting of a shallow, vegetated basin designed for capture and infiltration of stormwater runoff to support vegetation and improve water quality.
Advantages	• Captures and infiltrates runoff • Improves water quality • Reduces runoff volumes
Limitations	• Limited storage depth (typically 6”-9”) and volume
Maintenance	• Inspect after storms greater than ¼” (at least twice each year) • Remove trash, sediment
Other Considerations	• Recommended infiltration rate of at least 0.5-inch/hour • Irrigation or temporary watering should be provided for plant establishment • Overflow and erosion protection required

(Credit: *Bernalillo County GSI LID Standards,* 2021)

B. Bioswale

Description	• GSI practice consisting of a shallow, linear feature designed to improve water quality by conveying, slowing, and treating runoff; allows pollutants to settle out and promotes infiltration.
Advantages	• Slows runoff velocity and increases infiltration • Improves water quality • Compact footprint
Limitations	• Generally not appropriate where slopes are greater than 5% without tiered/stepped design • Minimal reduction to runoff volume or flowrate for large storms
Maintenance	• Inspect after storms greater than ¼" (at least twice each year) • Remove trash, sediment
Other Considerations	• Irrigation or temporary watering should be provided for plant establishment • Can be used in a depressed median or parkway application • Erosion protection required at concentrated inlets and outlets



(Credit: *Bernalillo County GSI LID Standards,* 2021)

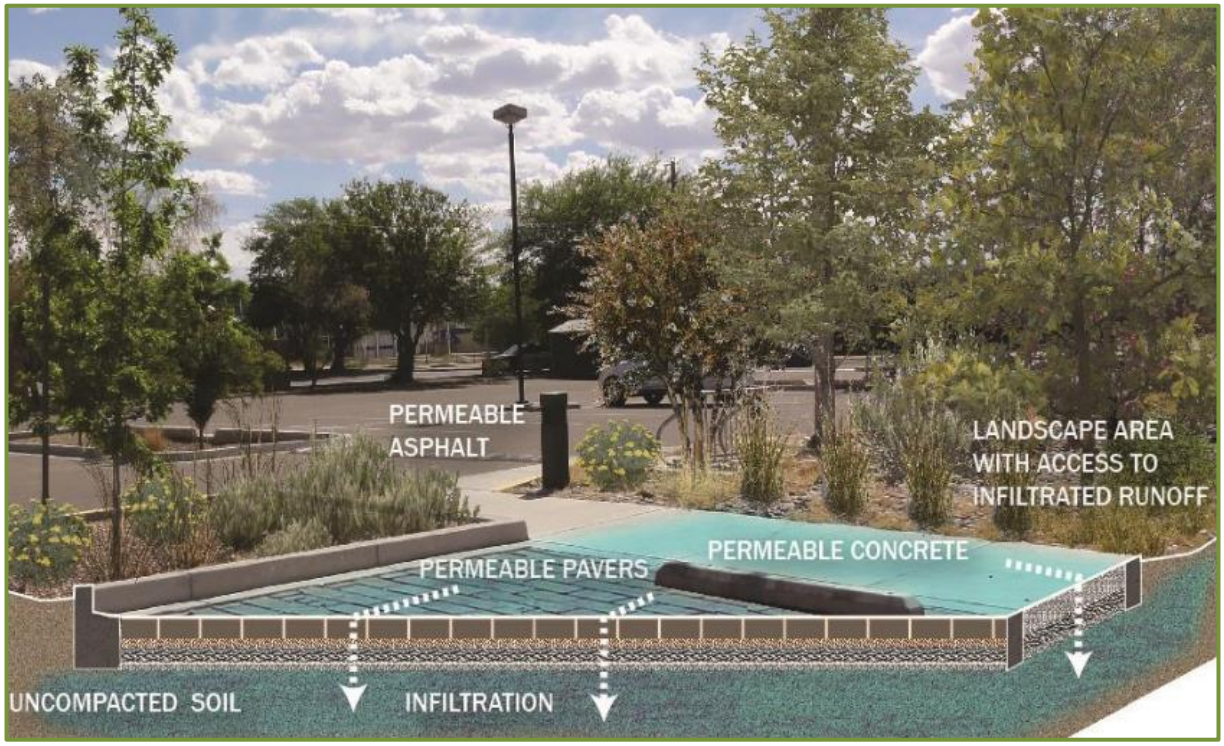
C. Stormwater Bumpout

Description	• An area for infiltration and green stormwater infrastructure intervention created when the curb and gutter is moved out into the portion of the roadway normally reserved for parking. Otherwise known as 'bulbouts', 'chicanes', and 'curb extensions'.
Advantages	• Calms traffic • Can be retrofitted into existing street, where appropriate • Slows runoff velocity and increases infiltration • Improves water quality
Limitations	• Reduces streetside parking • Limited storage depth (typically 6"-9") and volume
Maintenance	• Inspect after storms greater than ¼" (at least twice each year) • Remove trash, sediment
Other Considerations	• Maximize infiltration rates • Irrigation or temporary watering should be provided for plant establishment • Erosion protection required at concentrated inlets and outlets • Best for low-speed roadways and parking lots • Impact on street flow capacity should be considered

(Credit: *Bernalillo County GSI LID Standards,* 2021)

D. Permeable Pavement

Description	• Paving material that allows stormwater to move through the pavement's surface to a storage layer below, allowing infiltration into the underlying soil. Material options include porous asphalt, pervious concrete, pavers, and various plastic products for reinforcing gravel or grass.
Advantages	• Increases infiltration rates • Reduces runoff volumes and rates
Limitations	• Can clog – should not be used with sediment-heavy runoff • Should not be used with regular winter salting or sanding • Not for heavy or high-speed (>30mph) traffic areas • Specialized maintenance equipment is needed
Maintenance	• Inspect after storms greater than ¼" (at least twice each year) • Remove sediment • Routine and long-term maintenance with high-performance, regenerative air vacuuming
Other Considerations	• Generally for use in low to moderate-vehicular use areas • Subgrade infiltration rate and strength impacts pavement design • ADA requirements should be considered carefully

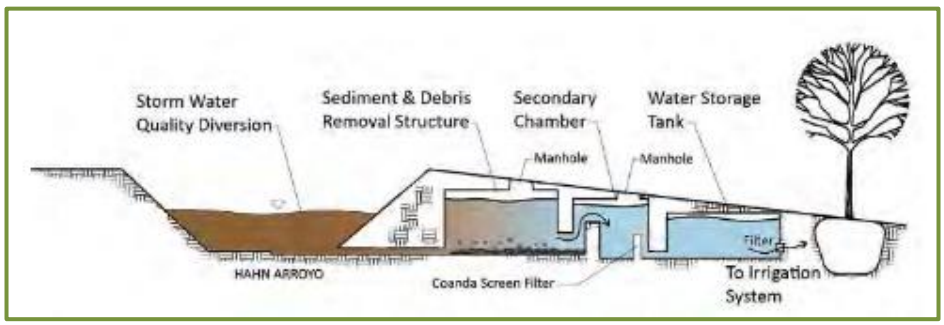


(Credit: *Bernalillo County GSI LID Standards,* 2021)

E. Underground Storage and Infiltration Systems

Description	• Various manufactured systems that capture and temporarily store stormwater collected from surrounding impervious surfaces.
Advantages	• Reduces runoff rates and volumes • Can incorporate water quality features • Useful when limited surface storage area is available
Limitations	• Relatively high cost • Inspection and maintenance are more difficult than other techniques in toolkit • Specialized maintenance equipment is needed
Maintenance	• Inspect monthly and after major storm events • Remove sediment using vacuum truck
Other Considerations	• Best used when stormwater has a low sediment load • Include sufficient access points • Include emergency overflow

(Credit: *NMDOT NPDES,* 2020)



(Credit: *NMDOT NPDES,* 2020)

V. Ideas for Application of Techniques

The graphics below present various ways in which GSI and other small-scale stormwater management techniques can be incorporated into a project. Design of these techniques should consider the project site characteristics as further described in the *Bernalillo County GSI/LID Standards*, Chapter 6 (Attachment A to this toolkit).

Bioswales and stormwater bumpouts generally lend themselves to use along roadways in the Northeast Heights of Albuquerque, particularly residential roadways. Stormwater harvesting areas can be implemented within relatively flat areas, including along roadways. Permeable pavement and underground storage systems can be utilized in a variety of settings with careful design considerations for existing utilities, constructability, and maintainability, but come at a higher cost.

A. Roadside Improvements Behind Existing Curbs or Sidewalks

Techniques presented in this toolkit can be retrofitted along roadways behind existing curb or behind existing sidewalk. Retrofits beyond the existing curb or sidewalk need to consider existing ROW width, existing utilities, and private improvements that may be constructed in public ROW, among other design considerations, but can be possible.

The graphic example below shows a conceptual stormwater harvesting basin behind an existing sidewalk, assuming there is adequate ROW for such a feature, integrated with other techniques to create a cohesive system.

(Credit: *Bernalillo County GSI LID Standards,* 2021)

B. Roadside Improvements as part of a Road Diet

Road diets involve the reduction in the number and/or narrowing of travel lanes to improve safety and make space for other improvements. The "before and after" example below shows a portion of 4th Street Revitalization, Phase 1 in the Village of Los Ranchos.

(Credit: Photos by BHI)

C. Pocket Parks

A pocket park is a small local park that is generally integrated into a neighborhood and provides health, social, and environmental benefits and can help manage and treat stormwater. Pocket parks can use stormwater harvesting basins to lower landscape irrigation costs and stormwater runoff rates.

(Credit: *Watershed Management Group GI for Desert Communities*)

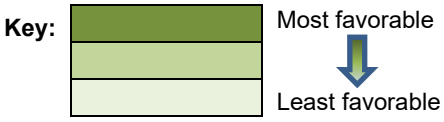
VI. Summary

This toolkit provides an introduction to small-scale stormwater management techniques that could be considered in the Pueblo Alto and Mile Hi neighborhoods, and elsewhere in the Northeast Heights of Albuquerque. The technique comparison matrix provided below can be used to help identify when and where these techniques may be appropriate.

Stormwater Technique Comparison Matrix

	Stormwater Harvesting Basin	Bioswale	Stormwater Bumpout	Permeable Pavement	Underground Storage and Infiltration
Cost	$	$	$$	$$	$$$
Stormwater Capture Potential	++	+	+	+	+++
GSI Co-Benefits[1]	+++	+++	+++	++	+
Ease of Implementation[2]	+++	+++	++	+	+
Maintenance Requirements	Low	Low	Low	Moderate	Moderate

1. "GSI Co-Benefits" is an assessment of the relative number and impact of co-benefits (described in Section IV of this toolkit) that could be created by each technique.
2. "Ease of Implementation" is an assessment of the relative complexity of each technique, acknowledging that less complex infrastructure systems are generally preferable. Increased complexity could be due to utility conflicts, right-of-way (ROW) limitations, design requirements, etc.



This toolkit was prepared by: Bohannan Huston, Inc. (Vince Steiner – Drainage Engineer; Rob Salazar)

RS/VCS/ab

Attachments

- Attachment A – *Bernalillo County Green Stormwater Infrastructure Low Impact Development Standards* (September 2021)
- Attachment B – *NMDOT National Pollutant Discharge Elimination System Manual - Appendix A* (December 2020)
- Attachment C – *Green Infrastructure for Desert Communities* (Watershed Management Group, January 2017)
- Attachment D – *Greater Phoenix Metro Green Infrastructure Handbook* (January 2019)
- Attachment E – *Sonoran Desert Green Infrastructure Resource Library* (2020)
- Attachment F – *Pocket Park Toolkit*

APPENDIX D.

GSI Glossary of Terms

Green Stormwater Infrastructure (GSI) Glossary

Principles of Green Stormwater Infrastructure:

1. Protects and restores natural areas
2. Uses natural systems to serves multiple functions like calming traffic, improving pedestrian spaces, cooling streets, cleaning stormwater runoff, creating wildlife habitat
3. Often includes community participation

See the "**Pueblo Alto Mile Hi Stormwater Interventions"** website for more information

https://gws.mysocialpinpoint.com/pueblo-alto-mile-hi/pueblo-alto-drainage-home

- **Underground Storage and Infiltration**: Underground storage is the capture and temporary storage of stormwater collected from surrounding impervious surfaces. Stormwater is stored subsurface in individual or interconnected manufactured units or systems.

- **Berms and Swales:** Swales are sloped water retention areas created to hold and slow water, thereby preventing erosion. Berms are the sides of the swales, built up with soil, directing the water to infiltrate soils and water surrounding vegetation.

- **Bioswale:** GSI practice consisting of a shallow, linear feature designed to improve water quality by conveying, slowing, and treating runoff; allows pollutants to settle out and promotes infiltration. (Includes depressed medians)

- **Bioretention:** The process of removing sediments and pollutants from stormwater through use of plants, soils and gravels.

- **Chicanes (see stormwater bumpouts below)**

- **Impervious surface:** Material that does not allow water to pass through.

- **Infiltration/percolation:** The process where water passes through a porous surface layer into a deeper layer of soil material.

- **Intervention:** See "Technique vs. Intervention" below.

- **Landscape buffer:** A strip of vegetation that provides a barrier between the street and pedestrian walking or biking spaces.

- **LID- Low Impact Development:** Practices in land development that mimic natural processes to minimize the environmental impact and improve water and air quality.

- **Non-point Source Pollution:** Rain or snowfall runoff carrying pollutants from one area to another, potentially depositing them into bodies of water.

- **Permeable pavement:** Paving material that allows stormwater to move through the pavement's surface to a storage layer below, allowing infiltration into the underlying soil. Material options include porous asphalt, pervious concrete, pavers, and various plastic products for reinforcing gravel or grass.

Source- Watershed Management Group: "Green Infrastructure for Southwestern Neighborhoods"

- **Pocket parks:** A pocket park is a small local park. They provide health, social, and environmental benefits. They can help manage and treat stormwater.

- **Regional vs. Localized solutions**: Regional drainage solutions address larger watershed- or City-scale issues, whereas localized solutions address neighborhood-scale runoff. GSI and LID practices are generally better suited for addressing local issues.

- **Road Diet:** Road diets involve the reduction in the number and/or narrowing of travel lanes to improve safety and make space for other improvements.

- **Stormwater harvesting basin:** A shallow, vegetated basin designed for capture and infiltration of stormwater runoff to support vegetation, slow stormwater flow, and improve water quality.

- **Stormwater bumpout:** An area for infiltration and green infrastructure interventions created when the curb and gutter is moved out into the portion of the roadway normally reserved for parking. Otherwise known as **'bulb outs'**, '**chicanes**', and '**curb extensions'**.

- **Technique vs. Intervention**: When referring to green stormwater infrastructure (GSI), a technique represents one portion of improvements to an area to slow and capture water to infiltrate the soil. Multiple GSI techniques or practices are typically integrated into an overall plan or project. An intervention indicates a larger plan, that may include various solutions addressing flooding and drainage issues.

- **Two-Year and One-Hundred-Year Floods**: The terms are used by engineers and hydrologists to describe the capacity of drainage infrastructure. These expressions can be misleading as people tend to think that they mean rainfall or flooding that happen every 100 or every 2 years, respectively. Instead, these terms describe the probability that a storm event of a particular rainfall depth will occur. A 100-year storm has a 1% chance of occurring in any given year. A 2-year storm event has with a 50% chance of occurring in any given year.

Save the Date!

Pueblo Alto and Mile Hi Walking Tours

Saturday, February 5th

Pueblo Alto: 12:30 to 2:00 PM
Location: Truman and Marble

Mile Hi: 2:30 to 4:00 PM
Location: Marble and Cardenas

Don't forget to mask up!

Source- Watershed Management Group: "Green Infrastructure for Southwestern Neighborhoods"

APPENDIX E

Mile Hi & Pueblo Alto Walking Tour Survey & Results

Mile Hi Green Stormwater Interventions

Mile Hi Walking Tour 2: Possible GSI solutions

The purpose of this survey is to generate discussion about potential local drainage interventions and the associated pros and cons in certain types of locations as well as document general support and/or concerns about particular interventions. While walking the neighborhood, please answer each question regarding which green stormwater intervention you are most in favor of for each location. Scroll past question 5 to see visuals of the various stormwater interventions proposed. If you would like more details on the pros and cons of various green stormwater infrastructure- see our website Pueblo Alto Mile Hi Drainage Project website or go directly to the Green Stormwater Toolkit.
If you have questions, please check out our FAQs or contact Amy Bell at amy@groundworkstudionm.com.

Mile Hi Neighborhood Map

1. Cardenas Dr. between Marble Ave. and Mountain.

- ◯ I am in favor of stormwater bumpouts to calm traffic and slow runoff.
- ◯ I am in favor of creating bioswales to collect runoff and water vegetation.
- ◯ I like both ideas
- ◯ I am in favor of permeable pavement to increase infiltration and reduce runoff rates and volumes.
- ◯ All of the above.
- ◯ None of the above.

Other (please specify)

2. Alvarado between Lomas and Constitution Ave.

- ◯ I am in favor of stormwater bumpouts to calm traffic and slow runoff.
- ◯ I am in favor of creating bioswales to slow runoff and increase infiltration.
- ◯ I like both bioswales and stormwater bumpouts.
- ◯ I favor permeable pavement to increase infiltration and reduce runoff rates and volumes.
- ◯ All of the above.
- ◯ None of the above

Other (please specify)

3. La Veta Dr. between El Encanto Pl. and Summer Ave.

- ◯ I am in favor of stormwater bumpouts to calm traffic and slow runoff/increase infiltration.
- ◯ I am in favor of bioswales to slow runoff, increase infiltration and improve water quality.
- ◯ I like both stormwater bumpouts and bioswales.
- ◯ I favor permeable pavement to increase infiltration and reduce runoff volumes and rates.
- ◯ I am in favor of a pocket park possibly incorporating underground infiltration.
- ◯ I like all of the solutions.
- ◯ None of the above

Other (please specify)

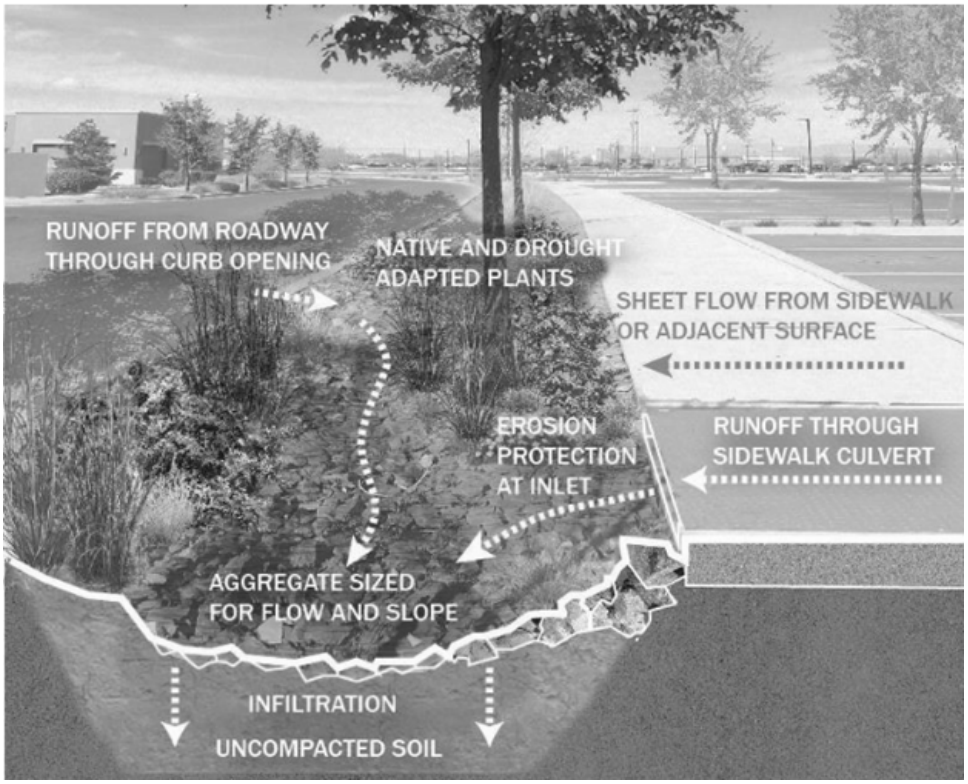
4. El Encanto Pl. between San Mateo Blvd and Madeira Dr.

- ◯ I am in favor of a pocket park incorporating stormwater harvesting basins to improve water quality, capture and reduce runoff.
- ◯ I am in favor of bioswales to slow runoff and improve water quality.
- ◯ I am in favor of stormwater bumpouts to calm traffic and slow runoff.
- ◯ I am in favor of both bioswales and stormwater bumpouts.
- ◯ I am in favor of permeable pavement.
- ◯ I like all the solutions.
- ◯ None of the above

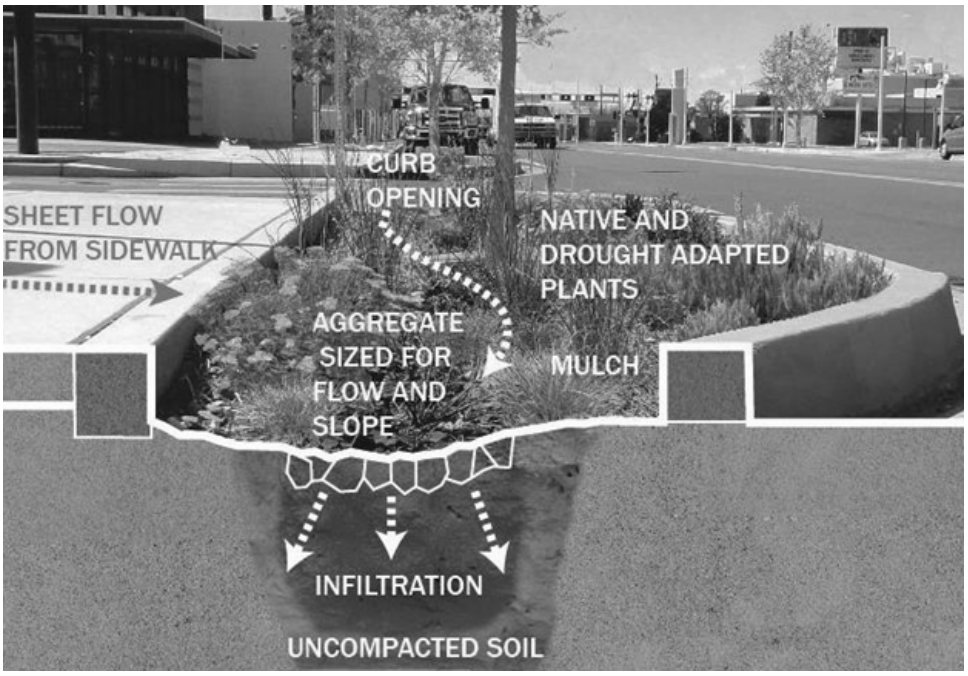
Other (please specify)

5. The city isn't limited to the locations on the survey for new green stormwater interventions. If there are other neighborhood locations, not listed on this survey, that you would like to be considered for GSI, please note here.

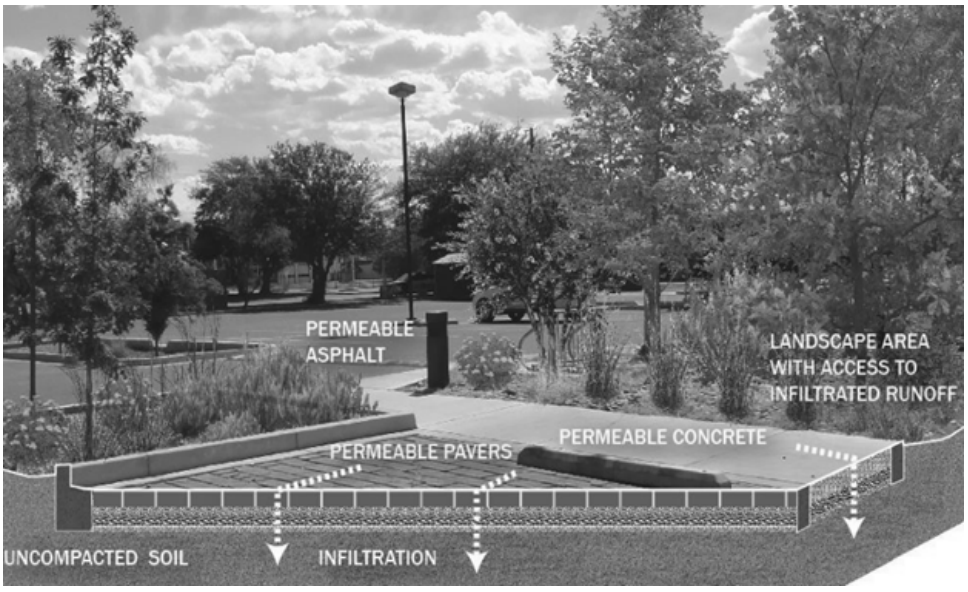
Bioswale Diagram



Stormwater Bumpout Diagram



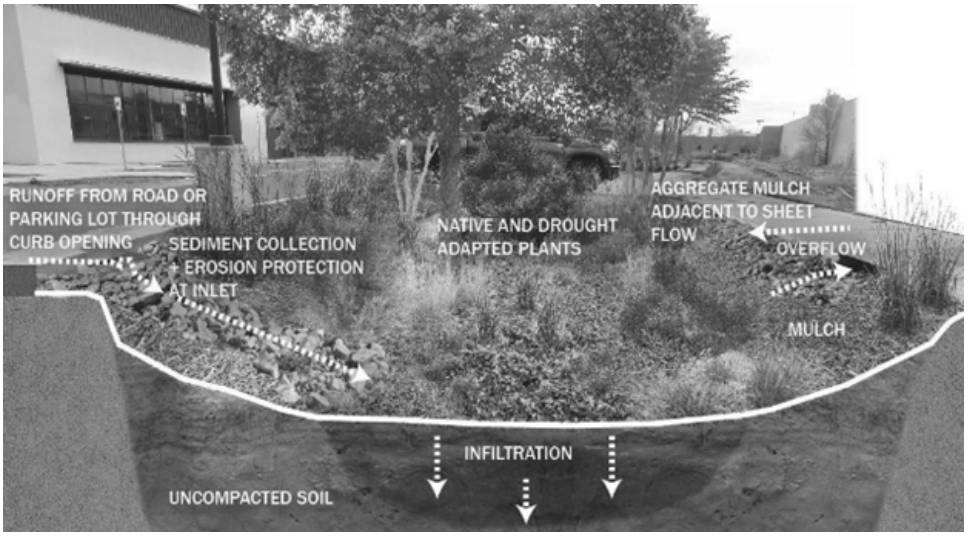
Permeable Pavement Diagram



Pocket Park in Alley Design

Figure 63: Conceptual rendering of the Avalon Project
Image Credit: SALT Landscape Architects

Stormwater Harvesting Basin



Underground Water Storage and Infiltration System

Pueblo Alto Green Stormwater Interventions

Pueblo Alto Walking Tour 2: Possible GSI solutions

The purpose of this survey is to generate discussion about potential local drainage interventions and the associated pros and cons in certain types of locations as well as document general support and/or concerns about particular interventions. While walking the neighborhood, please answer each question regarding which green stormwater intervention you are most in favor of for each location. Scroll past question 7 to see visuals of the various stormwater interventions proposed. If you would like more details on the pros and cons of various green stormwater infrastructure- see our website Pueblo Alto Mile Hi Drainage Project website or go directly to the Green Stormwater Toolkit.
If you have questions, please check out our FAQs or contact Amy Bell at amy@groundworkstudionm.com.

Pueblo Alto Neighborhood Map

1. The alley between Manzano St and Truman St., north of Mountain Rd and south of Summer Ave. (See the Green Stormwater Toolkit on our website for more pictures and deeper explanations of green stormwater solutions.) Please note that residents' access to alleyways would not be affected without express permission, and that any alleyway drainage improvements would be maintained by the City.

- ◯ I am in favor of a linear pocket park to manage and treat stormwater, possibly incorporating underground infiltration.
- ◯ I am in favor of creating bioswales to collect runoff and water vegetation.
- ◯ I like both ideas
- ◯ I don't like either idea

Other (please specify)

2. Manzano St between Marble Ave and Constitution Ave. Please note that any drainage improvements in the public right-of-way would be maintained by the City.

- ◯ I am in favor of stormwater bumpouts to calm traffic and slow runoff.
- ◯ I am in favor of creating bioswales to slow runoff and increase infiltration.
- ◯ I like both bioswales and stormwater bumpouts.
- ◯ I favor permeable pavement to increase infiltration and reduce runoff rates and volumes.
- ◯ All of the above.
- ◯ None of the above

Other (please specify)

3. Summer Ave from San Mateo Blvd west to Washington St.

- ◯ I am in favor of stormwater bumpouts to calm traffic and slow runoff/increase infiltration.
- ◯ I am in favor of bioswales to slow runoff, increase infiltration and improve water quality.
- ◯ I like both stormwater bumpouts and bioswales.
- ◯ I favor permeable pavement to increase infiltration and reduce runoff volumes and rates.
- ◯ I like all of the solutions.
- ◯ None of the above

Other (please specify)

4. The alleys between Manzano St., Quincy St., and Monroe St. north of Summer.

- ◯ I am in favor of a linear pocket park to manage and treat stormwater with underground filtration.
- ◯ I am in favor of bioswales to slow runoff and improve water quality.
- ◯ I like both ideas.
- ◯ I don't like either solution.

Other (please specify)

5. As you walk west on Summer, note that Quincy St., Monroe St., Madison St., and Jefferson St. could also be considered for stormwater bumpouts and bioswales or permeable pavement. Note which streets and which interventions you support.

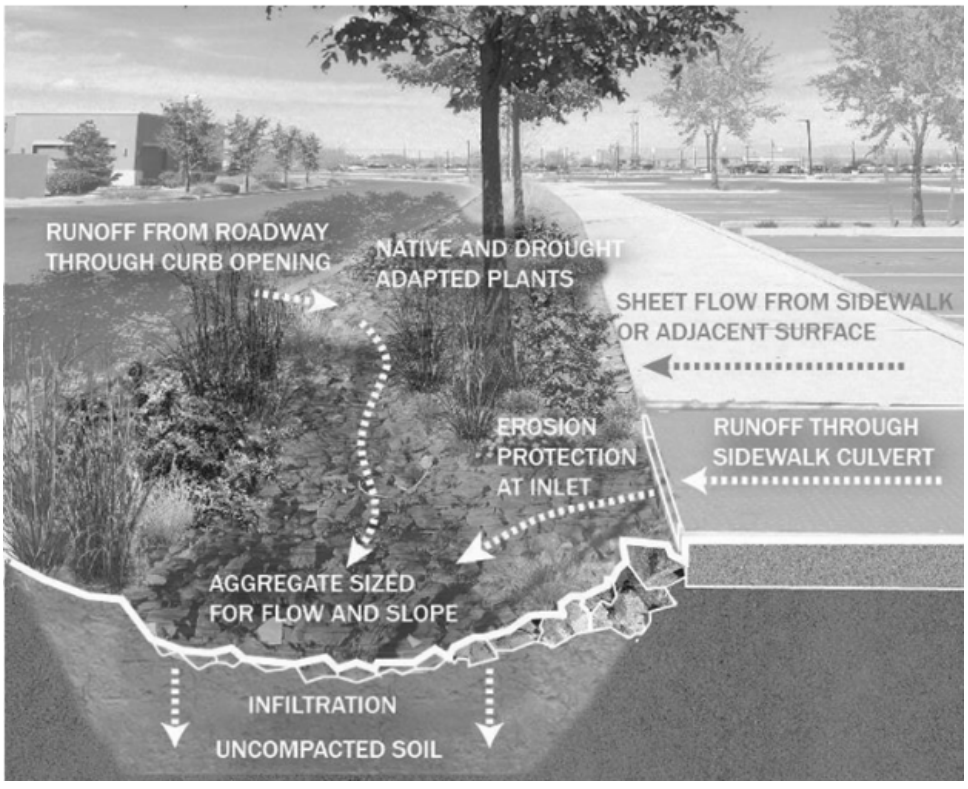
6. On Adams St between Mountain Rd and Constitution Ave.

- ◯ I am in favor of stormwater bumpouts to calm traffic and slow runoff/increase infiltration.
- ◯ I am in favor of bioswales to slow runoff, increase infiltration and improve water quality.
- ◯ I am in favor of adding both stormwater bumpouts and bioswales.
- ◯ I am in favor of adding permeable pavement to increase infiltration and reduce runoff volumes and rates.
- ◯ I am in favor of all the solutions.
- ◯ None of the above

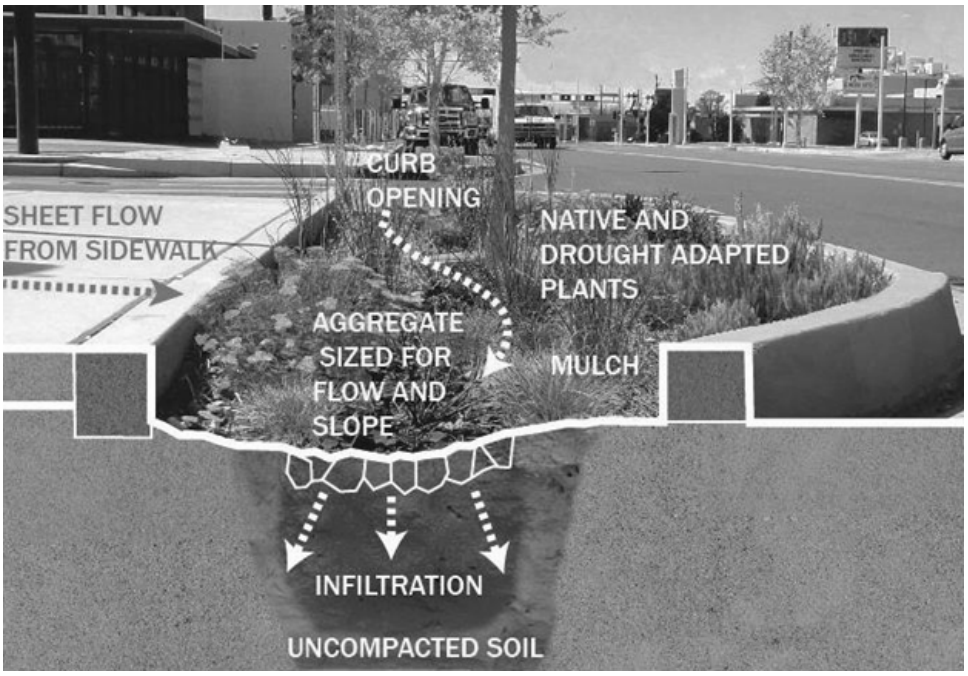
Other (please specify)

7. The city isn't limited to the locations on the survey for new green stormwater interventions. If there are other neighborhood locations, not listed on this survey, that you would like to be considered for GSI, please note here.

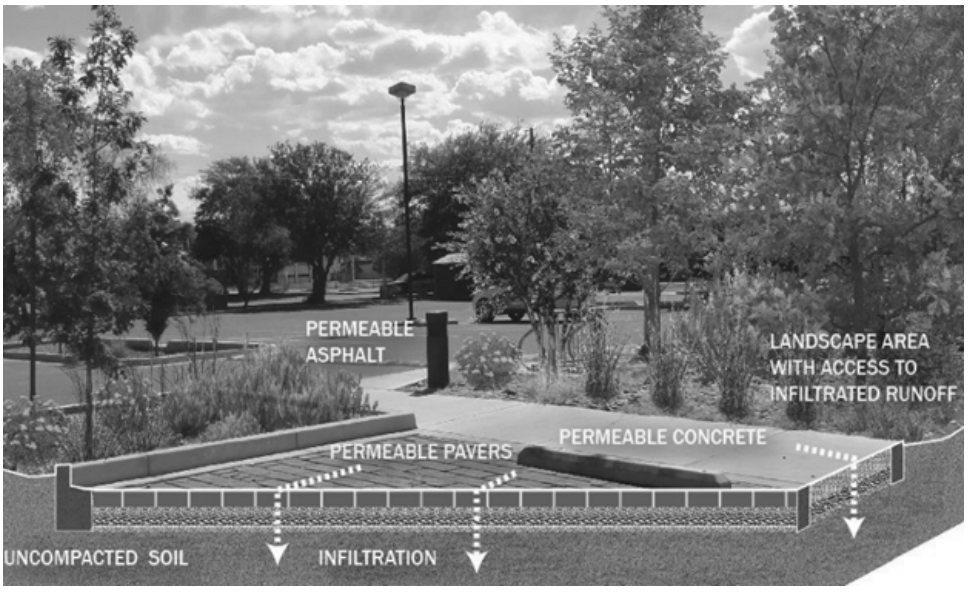
Bioswale Diagram



Stormwater Bumpout Diagram



Permeable Pavement Diagram



Pocket Park in Alleyway Design

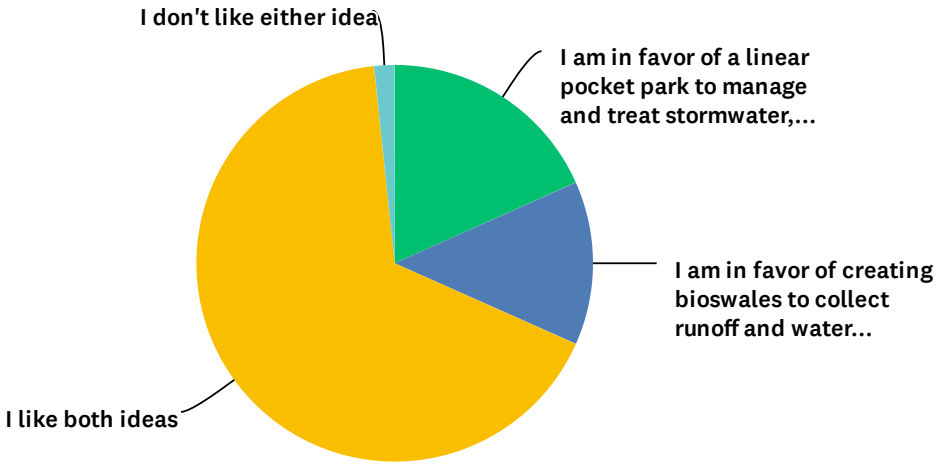
Figure 63: Conceptual rendering of the Avalon Project
Image Credit: SALT Landscape Architects

Underground Water Storage and Infiltration Systems

Pueblo Alto Survey Results

Q1 The alley between Manzano St and Truman St., north of Mountain Rd and south of Summer Ave. (See the Green Stormwater Toolkit on our website for more pictures and deeper explanations of green stormwater solutions.) Please note that residents' access to alleyways would not be affected without express permission, and that any alleyway drainage improvements would be maintained by the City.

Answered: 60 Skipped: 0

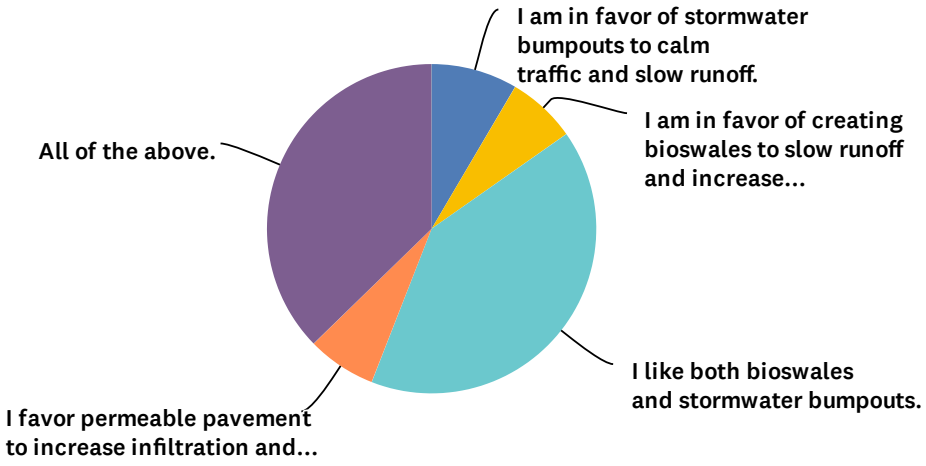


ANSWER CHOICES	RESPONSES	
I am in favor of a linear pocket park to manage and treat stormwater, possibly incorporating underground infiltration.	18.33%	11
I am in favor of creating bioswales to collect runoff and water vegetation.	13.33%	8
I like both ideas	66.67%	40
I don't like either idea	1.67%	1
TOTAL		60

#	OTHER (PLEASE SPECIFY)	DATE
1	However, it's important not to impede vehicle traffic in the alley.	2/19/2022 1:20 PM
2	I'm not sure how this would actually be implemented and keep the alley as a functional alleyway. Also would the city in reality actually maintain it? Who is responsible for maintenance at the present time because it's not happening. If this project were to actually happen, would it not make the alley more attractive to drug users? Why not a permeable roadway?	2/13/2022 9:24 AM
3	The alley seems too narrow for bios Wales. French drains maybe ?	2/8/2022 3:44 PM
4	Please make sure property owners have access to their yards if they want it.	2/6/2022 12:37 PM

Q2 Manzano St between Marble Ave and Constitution Ave. Please note that any drainage improvements in the public right-of-way would be maintained by the City.

Answered: 59 Skipped: 1

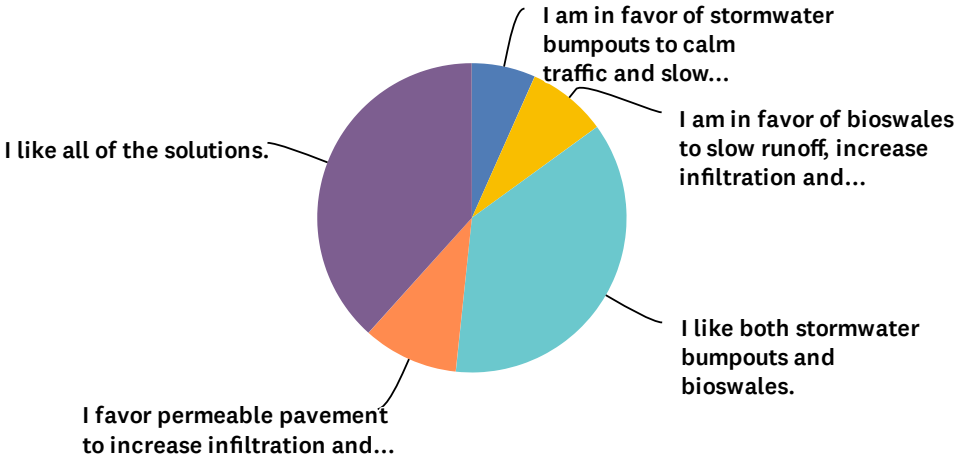


ANSWER CHOICES	RESPONSES	
None of the above	0.00%	0
I am in favor of stormwater bumpouts to calm traffic and slow runoff.	8.47%	5
I am in favor of creating bioswales to slow runoff and increase infiltration.	6.78%	4
I like both bioswales and stormwater bumpouts.	40.68%	24
I favor permeable pavement to increase infiltration and reduce runoff rates and volumes.	6.78%	4
All of the above.	37.29%	22
TOTAL		59

#	OTHER (PLEASE SPECIFY)	DATE
1	I am hesitant about permeable pavement Bec of the specialized equipment needed to maintain it.	2/19/2022 1:20 PM
2	I think the residents on that portion of Manzano should decide what they want since they are the ones affected.	2/13/2022 9:24 AM
3	I like bioswales in order to have more vegetation and more natural habitats for wildlife and pollinators. This also will cool off our area during the summer months.	2/7/2022 9:10 PM
4	and bioswales	2/7/2022 5:53 PM

Q3 Summer Ave from San Mateo Blvd west to Washington St.

Answered: 60 Skipped: 0

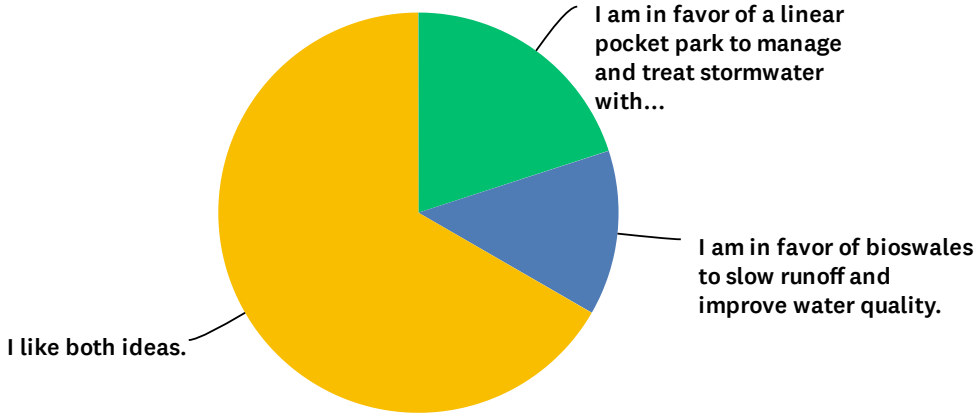


ANSWER CHOICES	RESPONSES	
None of the above	0.00%	0
I am in favor of stormwater bumpouts to calm traffic and slow runoff/increase infiltration.	6.67%	4
I am in favor of bioswales to slow runoff, increase infiltration and improve water quality.	8.33%	5
I like both stormwater bumpouts and bioswales.	36.67%	22
I favor permeable pavement to increase infiltration and reduce runoff volumes and rates.	10.00%	6
I like all of the solutions.	38.33%	23
TOTAL		60

#	OTHER (PLEASE SPECIFY)	DATE
1	See note above re permeable pavement	2/19/2022 1:20 PM
2	Since Summer is the low point and collects a lot of water, underground storage would seem to make the most sense followed by permeable pavement.	2/13/2022 9:24 AM
3	Summer is a high traffic street and could use some calming.	2/8/2022 3:44 PM
4	and bioswales	2/7/2022 5:53 PM
5	And permeable pavement. I don't know that Summer needs traffic calming, especially up and down the whole street.	2/6/2022 12:37 PM
6	I think Summer is the priority street if you have to choose one.	2/5/2022 3:29 PM

Q4 The alleys between Manzano St., Quincy St., and Monroe St. north of Summer.

Answered: 60 Skipped: 0



ANSWER CHOICES	RESPONSES	
I am in favor of a linear pocket park to manage and treat stormwater with underground filtration.	20.00%	12
I am in favor of bioswales to slow runoff and improve water quality.	13.33%	8
I like both ideas.	66.67%	40
I don't like either solution.	0.00%	0
TOTAL		60

#	OTHER (PLEASE SPECIFY)	DATE
1	Would the park impede auto traffic in the alley? If it does then I do not support it.	2/19/2022 1:20 PM
2	I'm not sure how this would actually be implemented and keep the	2/13/2022 9:24 AM
3	Underground storage. We need to maintain access	2/8/2022 3:44 PM
4	As long as homeowners can access their yards from the alley if they want.	2/6/2022 12:37 PM

Q5 As you walk west on Summer, note that Quincy St., Monroe St., Madison St., and Jefferson St. could also be considered for stormwater bumpouts and bioswales or permeable pavement. Note which streets and which interventions you support.

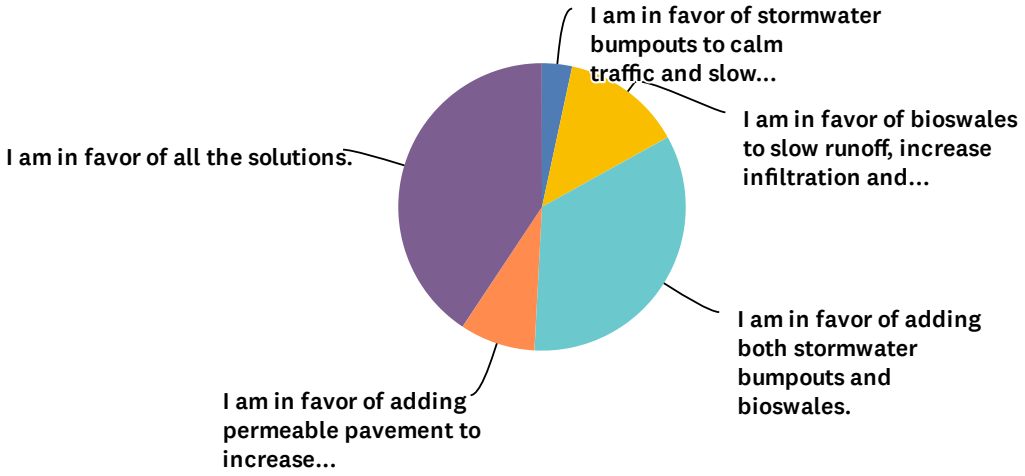
Answered: 34 Skipped: 26

#	RESPONSES	DATE
1	Jefferson Street-- could consider all. Also, speed bumps were added several years ago at the intersections of Jefferson and Adams with Mountain after flash flooding on Jefferson inundated several back yards-- this has helped with runoff somewhat, but runoff still comes down Jefferson from Summer, and I am not sure why speed bumps could not have been added at the intersections of Jefferson and Adams with Summer as well.	2/25/2022 12:36 PM
2	I support all three streets and all options	2/23/2022 11:06 AM
3	All streets	2/21/2022 3:45 PM
4	Quincy St., I favor bioswales	2/21/2022 2:40 PM
5	Jefferson and Madison. All three would be fine. Really like bump outs and bioswales	2/20/2022 9:55 PM
6	None.	2/19/2022 5:49 PM
7	What is the effect of these measures on parking?	2/19/2022 1:20 PM
8	I support permeable pavement in all these areas. I'm skeptical of stormwater bumpouts in our neighborhood, as they may make it more difficult for runners, cyclists, and dog walkers to use the streets. I like the idea of bioswales in the alleys.	2/16/2022 9:05 PM
9	bump outs and bioswales	2/15/2022 10:15 PM
10	I like both of these ideas on the four streets mentioned.	2/15/2022 9:28 AM
11	Bioswales for all	2/15/2022 6:51 AM
12	All the above.	2/14/2022 5:26 PM
13	All streets should be consider for stormwater bumpouts, bioswales, and permeable pavement!	2/13/2022 5:45 PM
14	I'd be in favor of stormwater bumpouts on Quincy St., in particular, because it's in great need of help calming traffic, as well as runoff management. It's a popular, fast traffic route for people who cut through the neighborhood to avoid San Mateo. A combination of bumpouts and bioswales, and strategically placed permeable pavement would be helpful on the other streets and may enhance the neighborhood.	2/13/2022 12:49 PM
15	Jefferson	2/13/2022 12:37 PM
16	Permeable pavement for all. Wouldn't bioswales reduce the streets to one lane of traffic? As is, there isn't any land between the sidewalks and the street for a bioswale except to reduce the width of the street.	2/13/2022 9:24 AM
17	Favor any & all of the above	2/13/2022 8:36 AM
18	Bumpouts or bioswales on Madison. The more native trees we can put in (rather than pavement), the better!	2/13/2022 8:18 AM
19	All	2/13/2022 7:26 AM
20	All of the interventions.	2/12/2022 12:07 PM
21	Any.	2/8/2022 3:44 PM
22	I support all interventions.	2/8/2022 2:11 PM

23	I like the stormwater bumpouts and bioswales. If Manzano and Summer both have water diversions, it would nice to also have two other streets, like Monroe and Madison or Jefferson to have the same thing. I prefer bioswales to stormwater bumpouts if I can have only one solution.	2/7/2022 9:10 PM
24	I would support both bump outs and bioswales on all of these streets	2/7/2022 8:52 PM
25	Permeable pavement anywhere we can put it. and bioswales. bumpouts, I am not sure of.	2/7/2022 5:53 PM
26	I support all the interventions in these areas/streets.	2/7/2022 8:47 AM
27	Madison and Summer- bioswales or bumpouts	2/7/2022 8:46 AM
28	bioswales/permeable pavement	2/7/2022 8:45 AM
29	all	2/7/2022 8:43 AM
30	Most of these streets have hills so I am not sure about the effectiveness of any of these ideas at Summer. Madison collects more water at Lomas during heavy rains. Maybe permeable pavement for these so they absorb water before pooling at Lomas?	2/6/2022 12:37 PM
31	Storm water bumpouts and bioswales	2/6/2022 8:10 AM
32	All the above named streets with bumpouts and/or bioswales, though it appears that with all the driveways on the streets that run north-south that bioswales would be the better option.	2/5/2022 3:29 PM
33	All of them. But I live on Madison and would like to see them there.	2/5/2022 3:18 PM
34	All of them and all options.	2/5/2022 3:06 PM

Q6 On Adams St between Mountain Rd and Constitution Ave.

Answered: 59 Skipped: 1



ANSWER CHOICES	RESPONSES	
None of the above	0.00%	0
I am in favor of stormwater bumpouts to calm traffic and slow runoff/increase infiltration.	3.39%	2
I am in favor of bioswales to slow runoff, increase infiltration and improve water quality.	13.56%	8
I am in favor of adding both stormwater bumpouts and bioswales.	33.90%	20
I am in favor of adding permeable pavement to increase infiltration and reduce runoff volumes and rates.	8.47%	5
I am in favor of all the solutions.	40.68%	24
TOTAL		59

#	OTHER (PLEASE SPECIFY)	DATE
1	Again, I think the residents on that portion of Adams should decide what they want since they are the ones affected.	2/13/2022 9:24 AM
2	Would like to see the same options for Jefferson which has the same flooding issue in approximately the same area of the 800 block	2/7/2022 8:52 PM

Q7 The city isn't limited to the locations on the survey for new green stormwater interventions. If there are other neighborhood locations, not listed on this survey, that you would like to be considered for GSI, please note here.

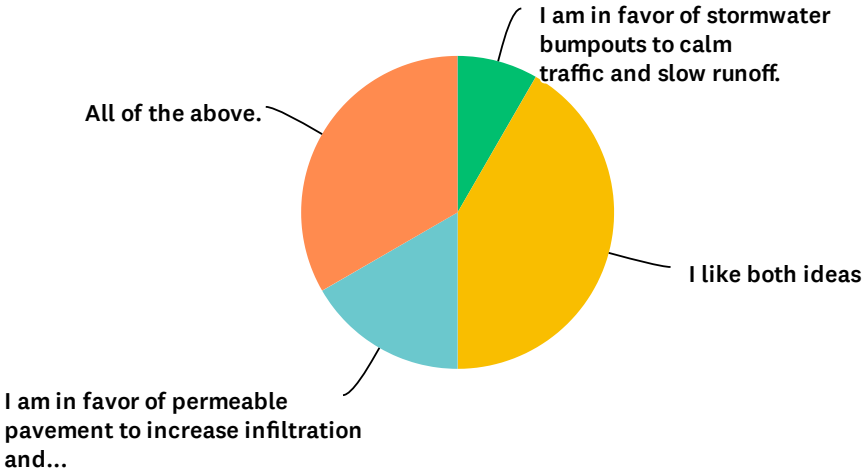
Answered: 8 Skipped: 52

#	RESPONSES	DATE
1	My only concern is that the interventions could make auto traffic on the streets excessively slow. Some slowing might be helpful. I suggest that the interventions be tested on one street and gather neighborhood opinion after a year.	2/19/2022 1:20 PM
2	Please consider adding the alley between Monroe Quincy. This alley has considerable slope and can benefit from stormwater mitigation. Thanks for taking the time to read by post.	2/17/2022 7:13 PM
3	I would love to see a bioswale in the alley between Quincy and Manzano, running from Mountain to Summer.	2/16/2022 9:05 PM
4	The alley east of Truman between Summer and Mountain. Our home backs the alley and our backyard got about 6inches of flooding during heavy rain. It also floods our garage that opens into the alley.	2/15/2022 4:09 PM
5	The intersection of Truman and Summer could also use some sort of intervention, like a bumpout of bioswale.	2/14/2022 1:50 PM
6	Southwest corner of Constitution and Manzano	2/13/2022 9:44 AM
7	Bioswales or permeable pavement for all of the alleys in the Pueblo Alto neighborhood.	2/13/2022 9:24 AM
8	Alley between Quincy & Monroe, south of Summer -- pocket park? Seems few residents use this for vehicular access...	2/13/2022 8:36 AM

Mile Hi Survey Results

Q1 Cardenas Dr. between Marble Ave. and Mountain.

Answered: 12 Skipped: 3



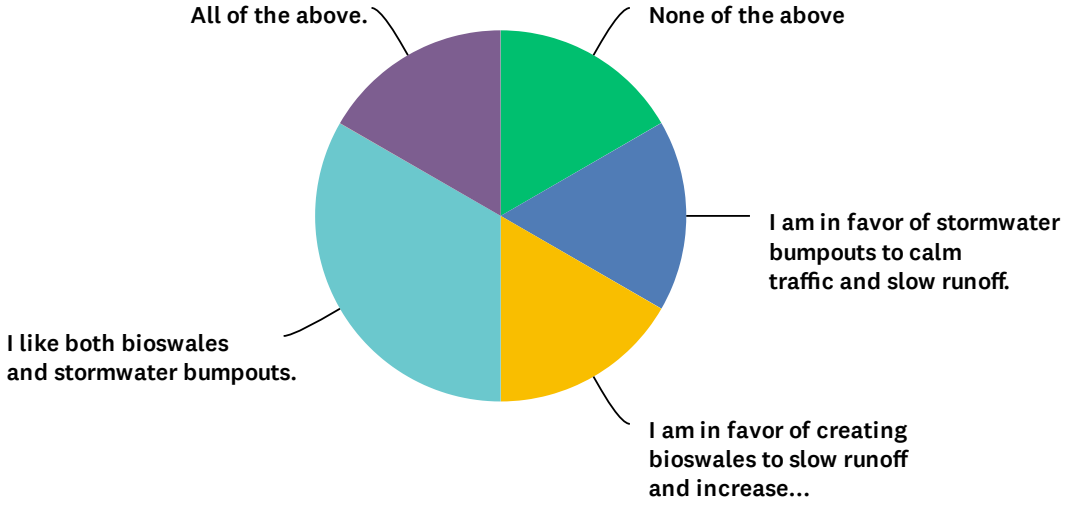
ANSWER CHOICES	RESPONSES	
I am in favor of stormwater bumpouts to calm traffic and slow runoff.	8.33%	1
I am in favor of creating bioswales to collect runoff and water vegetation.	0.00%	0
I like both ideas	41.67%	5
I am in favor of permeable pavement to increase infiltration and reduce runoff rates and volumes.	16.67%	2
All of the above.	33.33%	4
None of the above.	0.00%	0
TOTAL		12

#	OTHER (PLEASE SPECIFY)	DATE
1	The ally between Cagua and San Pedro, Marble and Summer is ideal for permeable pavement. Established streets need to be kept open and clear for emergency vehicles. Bump outs/green swales pose unexpected obstacles to traffic and would cause accidents. Handicapped accessibility needs to be protected and increased. Standing stormwater would attract mosquitoes. According to the city's website, runoff from streets and parking lots is "sewerage." It is biologically and chemically toxic and could harm pets, children and wildlife. Therefore, any standing pools of storm water should be immediately drained and avoided.	2/24/2022 1:47 PM
2	No opinion	2/18/2022 2:25 PM
3	Many people park on the street here, so there's not a lot of room for bump outs. Between marble and Lomas could benefit from traffic slowing down, though it may interfere with trucks entering the smiths lot. Project should incorporate Smiths parking lot if possible.	2/9/2022 1:27 PM
4	I think bioswales or bumpouts would be difficult to install in this area.	2/8/2022 3:49 PM
5	I would love to beautify the area with bioswales.	2/7/2022 8:40 AM
6	I would like to suggest that there is a list of co-benefits associated with each type with the option to add co-benefits not yet identified. I'd also like to suggest that there are short video explanations so people can quickly acquire and understand the argument for integration of	2/5/2022 4:36 PM

	designs & co-benefits that each design might as a standalone. It would be nice to have and allow the values of the neighborhood to interface with the co-benefits so the co-benefits could be prioritized and informed a final decision and benefit to the community. I would ask that curb cutting which could be situational and benefit to the community. It would be nice to offer curb cuts as an additional option of integration. I would also like to see incentives be offered to property owners as a way of incentivizing the benefits the community has such as the pocket park on La Veta or as a way of incentivizing solutions that have many co-benefits.	
7	Can landscape buffers work to slow flooding. Which of these are the most effective in absorbing rain water?	2/5/2022 10:18 AM

Q2 Alvarado between Lomas and Constitution Ave.

Answered: 12 Skipped: 3



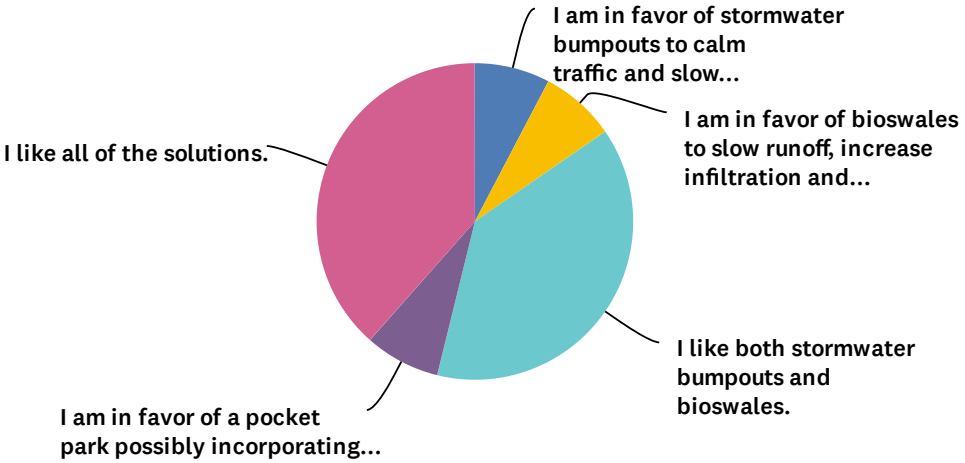
ANSWER CHOICES	RESPONSES	
None of the above	16.67%	2
I am in favor of stormwater bumpouts to calm traffic and slow runoff.	16.67%	2
I am in favor of creating bioswales to slow runoff and increase infiltration.	16.67%	2
I like both bioswales and stormwater bumpouts.	33.33%	4
I favor permeable pavement to increase infiltration and reduce runoff rates and volumes.	0.00%	0
All of the above.	16.67%	2
TOTAL		12

#	OTHER (PLEASE SPECIFY)	DATE
1	This street was completely replaced during the San Juan Chama construction. It is the best paved street in the neighborhood. Slowing traffic can be accomplished by returning the stop signs to Marble & Mountain which were removed for the bicycle boulevard. Again, bump outs would be unexpected obstacles and increase risk for accidents. There are many driveways and residential landscaped areas which must be protected.	2/24/2022 1:47 PM
2	no opinion	2/18/2022 2:25 PM
3	This is a nice wide street, not many people parking on the street. Consider protected bikeways or trees to reduce noise. La Veta could have the same treatment extents.	2/9/2022 1:27 PM
4	love bioswale idea	2/7/2022 8:40 AM
5	I would like to suggest that there is a list of co-benefits associated with each type with the option to add co-benefits not yet identified. I'd also like to suggest that there are short video explanations so people can quickly acquire and understand the argument for integration of designs & co-benefits that each design might as a standalone. It would be nice to have and allow the values of the neighborhood to interface with the co-benefits so the co-benefits could be prioritized and informed a final decision and benefit to the community. I would ask that curb cutting which could be situational and benefit to the community. It would be nice to offer curb cuts as an additional option of integration	2/5/2022 4:36 PM

6	Can landscape buffers work to slow flooding. Which of these are the most effective in absorbing rain water?	2/5/2022 10:18 AM

Q3 La Veta Dr. between El Encanto Pl. and Summer Ave.

Answered: 13 Skipped: 2



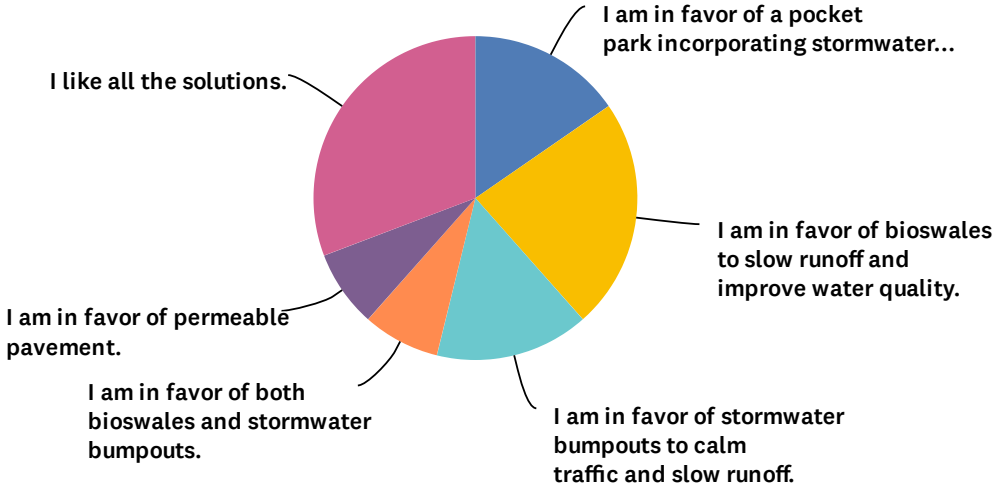
ANSWER CHOICES	RESPONSES	
None of the above	0.00%	0
I am in favor of stormwater bumpouts to calm traffic and slow runoff/increase infiltration.	7.69%	1
I am in favor of bioswales to slow runoff, increase infiltration and improve water quality.	7.69%	1
I like both stormwater bumpouts and bioswales.	38.46%	5
I favor permeable pavement to increase infiltration and reduce runoff volumes and rates.	0.00%	0
I am in favor of a pocket park possibly incorporating underground infiltration.	7.69%	1
I like all of the solutions.	38.46%	5
TOTAL		13

#	OTHER (PLEASE SPECIFY)	DATE
1	This is a major N-S emergency vehicle access. Again, it should be preserved and not sacrificed by tearing up the street.	2/24/2022 1:47 PM
2	low area collects lots of sand in the street.	2/18/2022 2:25 PM
3	Also homeowners should be encouraged to reduce runoff, there’s a lot of runoff from lots shown by dirt collecting on the street after rain.	2/9/2022 1:27 PM
4	Also would like to look at potential for pocket park.	2/8/2022 3:49 PM
5	a pocket park would be great	2/7/2022 8:40 AM
6	I would like to suggest that there is a list of co-benefits associated with each type with the option to add co-benefits not yet identified. I'd also like to suggest that there are short video explanations so people can quickly acquire and understand the argument for integration of designs & co-benefits that each design might as a standalone. It would be nice to have and allow the values of the neighborhood to interface with the co-benefits so the co-benefits could be prioritized and informed a final decision and benefit to the community. I would ask that curb	2/5/2022 4:36 PM

	cutting which could be situational and benefit to the community. It would be nice to offer curb cuts as an additional option of integration	
7	Can landscape buffers work to slow flooding. Which of these are the most effective in absorbing rain water?	2/5/2022 10:18 AM

Q4 El Encanto Pl. between San Mateo Blvd and Madeira Dr.

Answered: 13 Skipped: 2



ANSWER CHOICES	RESPONSES	
None of the above	0.00%	0
I am in favor of a pocket park incorporating stormwater harvesting basins to improve water quality, capture and reduce runoff.	15.38%	2
I am in favor of bioswales to slow runoff and improve water quality.	23.08%	3
I am in favor of stormwater bumpouts to calm traffic and slow runoff.	15.38%	2
I am in favor of both bioswales and stormwater bumpouts.	7.69%	1
I am in favor of permeable pavement.	7.69%	1
I like all the solutions.	30.77%	4
TOTAL		13

#	OTHER (PLEASE SPECIFY)	DATE
1	This section currently spreads floodwater, and drains well down to 8 drains. These drains must be regularly maintained. Abby Styles got them cleaned out after the 5/31/21 flood. They have functioned well since then. The hydroplaning on San Mateo was due to these 8 clogged drains, NOT to the 10 foot diameter drain overflowing.	2/24/2022 1:47 PM
2	I would not favor an "alley" pocket park but rather one like Diagram c in the toolkit. An alley to San Mateo would surely increase homeless and theft activity in the neighborhood as it is a very easy entrance between streets. High traffic and accidents from SanMat could easily destroy it as well..	2/21/2022 9:30 AM
3	I live here. Curb-high water every 2 years runs off into San Mateo. Drains are frequently clogged; I clean them off as the city does NOT. There are no alleys here.	2/18/2022 2:25 PM
4	This area has a lot of cars parked in the streets and driveways, so the project footprint may be limited. Noise dampening would benefit this area.	2/9/2022 1:27 PM
5	Honestly not sure what will work best here, since it's a cul de sac and issue is existing drains not effective	2/8/2022 3:49 PM

6	trees and vegetation are my number one priority	2/7/2022 8:40 AM
7	I would like to suggest that there is a list of co-benefits associated with each type with the option to add co-benefits not yet identified. I'd also like to suggest that there are short video explanations so people can quickly acquire and understand the argument for integration of designs & co-benefits that each design might as a standalone. It would be nice to have and allow the values of the neighborhood to interface with the co-benefits so the co-benefits could be prioritized and informed a final decision and benefit to the community. I would ask that curb cutting which could be situational and benefit to the community. It would be nice to offer curb cuts as an additional option of integration.	2/5/2022 4:36 PM
8	Can landscape buffers work to slow flooding. Which of these are the most effective in absorbing rain water?	2/5/2022 10:18 AM

Q5 The city isn't limited to the locations on the survey for new green stormwater interventions. If there are other neighborhood locations, not listed on this survey, that you would like to be considered for GSI, please note here.

Answered: 3 Skipped: 12

#	RESPONSES	DATE
1	Significant stormwater flows down Valencia and Cagua, not just Alvarado. These need to be addressed, as do the shorter drainages from Constitution to Summer.	2/24/2022 1:47 PM
2	Summer Avenue from San Pedro to La Veta. Summer Ave. is the main channel to which most of the north-south streets drain.	2/21/2022 5:28 PM
3	I'd like to see bump outs installed and more stop signs installed in the Pueblo Alto & Mile Hi Neighborhoods. As a daily dog walker, cyclist, and future parent anything we can do to slow down traffic and improve water management is a bonus. There are roads that have "speed bumps" to divert water along a street and I'd like to see those easy solutions throughout the neighborhood as well in that it seems moving water East-to-West through the neighborhood is better for the houses in the lower floodplain between Marble & Summer west of San Mateo.	2/12/2022 12:20 PM

APPENDIX F

Records of Attendance at Walking Tours & Public Meetings

PUEBLO ALTO / MILE HI NEIGHBORHOOD WALKING TOURS SIGN IN

Name	Email	How did you hear about the event?	Please circle your preferences for a community meeting in January
Tyler Richter	tyler.richter@gmail		virtual **in-person** **weekday evening** weekday lunch hour weekend
Chris Pennebaker	cdpenne@hotmail.com	Neighbors	virtual **in-person** **weekday evening** weekday lunch hour weekend
Andy Young	ayoungnm@q.com	Neighbors	virtual **in-person** **weekday evening** weekday lunch hour weekend
Cary Morrow			virtual in-person weekday evening weekday lunch hour weekend
Russell Munk	rmunk@acl.com	N A	virtual **in-person** **weekday evening** weekday lunch hour weekend
Tony Klesert	a/klesert@mac.com	email	virtual in-person weekday evening weekday lunch hour weekend
Kate LaMothe	mklamotheehotmail/com mail		virtual **in-person** weekday evening weekday lunch hour weekend
PETER TAYLOR	taylorpeter@hotmail.com	signs	virtual in-person weekday evening weekday lunch hour weekend
CATHY DRAKE	drakelavallefamily@gmail. com	clear flyer	NA virtual in-person weekday evening weekday lunch hour weekend; (any) virtual in-person weekday evening weekday lunch hour weekend
Aubrey Harris	aubreyha@protonmail.com		(any) virtual in-person weekday evening weekday lunch hour weekend
Ryan Lewis	rclewis13@gmail.com	flyer	(any) virtual in-person weekday evening weekday lunch hour weekend
Sharon + Isaac Eastvold	safe48@icloud.com	"	virtual **in-person** weekday evening weekday lunch hour weekend
Suzanne Beeman	beepedal@yahoo.com	been involved in issue for a long time	virtual **in-person** weekday evening weekday lunch hour weekend
Grant Mossman	grantmossmanagmail.com	Sign	virtual in-person **weekday evening** weekday lunch hour weekend
JEFFREY ADAMS		Resident	virtual **in-person** weekday evening weekday lunch hour weekend

PUEBLO ALTO / MILE HI NEIGHBORHOOD WALKING TOURS SIGN IN

Name	Email	How did you hear about the event?	Please circle your preferences for a community meeting in January
Bill Fanning	wmfan@swcp.com	neighbor	virtual in-person **weekday evening** weekday lunch hour weekend
Mercedes Mejia	mercedesmejia@comcast.net	flyer	virtual in-person **weekday evening** weekday lunch hour weekend
Eli Tafoya	eli.87110@yahoo.com	flyer	virtual in-person **weekday evening** weekday lunch hour weekend
Coral Pitkin	cpitkin715@gmail		virtual in-person **weekday evening** weekday lunch hour weekend
Tina Valentine	auntiesyn@msn.com	e-mail	virtual in-person **weekday evening** weekday lunch hour weekend
Vicky Kauffman	vickykauffman53@gmail.com	NA - Twin Parks	virtual in-person **weekday evening** weekday lunch hour weekend
David & Celia Klaus	adolclaus@msn.com	email	virtual in-person **weekday evening** weekday lunch hour weekend
KENROMIG	KENROMDESIGN.ORG	EMAIL	virtual in-person **weekday evening** weekday lunch hour weekend
Jane Jones	jmjabq@gmail	email	virtual in-person **weekday evening** weekday lunch hour weekend
Terri Wallis	tnwallis@pm.me	PANA meeting	virtual in-person **weekday evening** weekday lunch hour weekend
S. Hile	hikeabq@yahoo.com		virtual in-person weekday evening weekday lunch hour weekend
Carol Morris	Carolamorris@aol.com	PANA	**virtual** in-person **weekday evening** weekday lunch hour weekend
Anne Christensen	anne.e.christensen@gmail.com	PANA	virtual in-person **weekday evening** weekday lunch hour weekend
Amy Gallanter	amygallanter@gmail.com	PANA	virtual in-person **weekday evening** weekday lunch hour weekend
Vic Crowe	stvicrowe@gmail.com	Flyer sign email	virtual in-person weekday evening weekday lunch hour weekend

PUEBLO ALTO / MILE HI NEIGHBORHOOD WALKING TOURS SIGN IN

Name	Email	How did you hear about the event?	Please circle your preferences for a community meeting in January
SARAH HURTEAU	Sarah.Hurteau@tnc.org	Amy/Rebecca	whatever works for others virtual in-person weekday evening weekday lunch hour weekend
HOPE TRAN	hopehal@hotmail.com	ON THE STEERING COMMITTEE	ANYTIME virtual in-person weekday evening weekday lunch hour weekend
Michelle Simon	mrslehua@gmail.com	email	virtual in-person weekday evening weekday lunch hour weekend
Sally Little	sl.little@unm.edu	email	virtual in-person weekday evening weekday lunch hour weekend
Thelma Giomi	tgiomi@gmail.com	UNCA	virtual in-person weekday evening weekday lunch hour weekend
Tess Hale	tess.hale@gmail.com	email	virtual in-person weekday evening weekday lunch hour weekend
Ryan Younger	ryounger@galves.com	Email	virtual in-person weekday evening weekday lunch hour weekend
Terry W. Edwards	edwardstw@hotmail.com		virtual in-person weekday evening weekday lunch hour weekend
James Moreno	jbmyamoreno10@gmail	N.A.	virtual in-person weekday evening weekday lunch hour weekend
Joan Davis	jbd2946@hotmail.com	flyer	virtual in-person weekday evening weekday lunch hour weekend
Alice Scott	alice.scott0990@gmail.com		virtual in-person weekday evening weekday lunch hour weekend
MATT THOMSON	MATHEN2@GMAIL.COM	FLYER & SIGNS	virtual in-person weekday evening weekday lunch hour weekend
IRIS WEINSTEIN + STEVE MARGULIN	IRISABIN@aol.com	sign in paile	virtual in-person weekday evening weekday lunch hour weekend
			virtual in-person weekday evening weekday lunch hour weekend
			virtual in-person weekday evening weekday lunch hour weekend

PUEBLO ALTO / MILE HI NEIGHBORHOOD WALKING TOURS SIGN IN

Name	Email	How did you hear about the event?	Please circle your preferences for a community meeting in January
David Welch	grapejuice5@Hotmail		virtual in-person weekday evening weekday lunch hour weekend
Sayrah Namaste	sayrahnamaste hotmail	signs Erika Robles	virtual in-person weekday evening weekday lunch hour weekend
Andrea Vigil	andreapirlot@gmail	Door Sign	virtual in-person weekday evening weekday lunch hour weekend
			virtual in-person weekday evening weekday lunch hour weekend
			virtual in-person weekday evening weekday lunch hour weekend
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			virtual in-person weekday evening weekday lunch hour weekend

Project: Pueblo Alto

groundworkstudio

Date: 2/5/22

Name/Affiliation	Email	Phone
Russell Munk PANA	rfmunk@aol.com	
John MacKenzie	jmackenzie@cabq.gov	505 768 3965
Lee Ann Lloyd	lalloyd2525@yahoo.com	505-506-9109
Jane Penrod	janepenrod1@gmail.com	505-265-1642
NEAL + JO O'CALLAGHAN		
Hope Tran	hopeha@hotmail.com	
Rebecca Bolen	rbolen@cabq.gov	906-778-0150
Susan Glacken		505-396-3737
Tina Valentine	auntiesym@msn.com	505-948-0760
Andy Young	" "	" "
Chandler Wigton	cawigton@gmail.com	970-759-1836
James Moreno	jbmoreno@gmail	505-966-5[illegible]
Tyler Richter	—	—
Jane Jones	—	

Project:

groundworkstudio

Date:

Name/Affiliation	Email	Phone
Anne Schultz	aschultz@unm.edu	
Jeremy Beel	JT Beel@Yahoo	480 221 9492
Vince Steiner	vsteiner@bhinc.com	505-823-1000
Sarah Hurteau/TNC	Sarah.Hurteau@tnc.org	928-225-0272
Terri Wallis	tnwallis@proton mail.com	505-681-7785
Steven Hile	hilesab@yahoo.com	505 266 5365

Project: Mile Hi Walking Tour

groundworkstudio

Date: 2/5/22

Name/Affiliation	Email	Phone
Joan Davis	jbd2946@hotmail.com	505-410-9379
Suzanne Beeman	beepedal@yahoo.com	505-264-1412
Cynthia Serna	serna.cynthia@gmail.com	505-453-6499
Kathy Verhage	kverhage@cabq.gov	505-768-3654
Matthew Carroll	mbcarr92@gmail.com	
Jeff Holland	heavyink911@yahoo.com	
Sayrah Namaste	sayrahn@hotmail.com	

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Project:

Date:

Name/Affiliation	Email	Neighborhood
Tyler Richter / PANA	tyler.richter@gmail.com	PANA
Paul Rongstad	[illegible]@yahoo.com	Alta
Marion Simons	marian.simons@[illegible].com	PANA
Sharon Eastvold	safe48@icloud.com	Mile Hi
Julia North	jjnorth123@gmail.com	mile Hi
Joan Davis	jbd2946@hotmail.com	Mile Hi
Kathy Verhage	kverhage@cabq.gov	DMD, Storm ~~Drainage~~ Drainage
Jasen Christensen	~~jasen~~ jasen99@hotmail.com	~~PANA~~
Tina Valentine	auntiesym@msn.com	PANA
Jane Jones	jmjabq@gmail.com	PANA
Larry Seckinger		McDuffie
Bruce Thomson (AMAFCA)	LibTNov1@aol.com	SEHNA
Brad Bingham	bbingham@amafca.org	PHNA
SandyBryan	~~@~~ssters@swcp.com	PANA

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Project:

Date:

Name/Affiliation	Email	Neighborhood
Abi Olvera	olverabi@gmail.com	McDuffie Twin Parks

APPENDIX G

Frequently Asked Questions

Frequently Asked Questions
(Available on the Pueblo Alto and Mile Hi Drainage Project Website)

1. Why do the Pueblo Alto and Mile Hi Neighborhoods flood?

There are multiple factors that lead to the flooding that occurs within the Pueblo Alto and Mile Hi neighborhoods. In general, the underground storm drain systems in this area of the city are not currently sized to efficiently move stormwater runoff away from these neighborhoods. During large storm events, these pipes can fill to capacity, which causes runoff to back up in the streets and into yards. Other conditions related to topography and drainage patterns within the neighborhoods also cause additional localized areas of flooding. A summary of existing conditions leading to flooding will be provided in the "Existing Conditions Memorandum", and will available to download soon. While the City plans to replace undersized storm drain with a larger system, the replacement is extremely costly (+/-$150 million) and will take many years to implement. This study and outreach effort is intended to identify solutions that could be implemented to help alleviate some flooding issues in the near term.

2. Why is the City having meetings and tours before addressing the drainage and flooding issues?

The current outreach effort is intended to help the City identify localized drainage interventions that are desirable and acceptable to the surrounding community. Previous studies resulted in clear community concerns regarding larger interventions such as co-locating or incorporating drainage facilities within existing parks or acquiring a large number of properties in neighborhoods for detention ponds. This project, working closely with community members, will identify flooding location and concerns, as well as opportunities for smaller, more localized solutions like green stormwater infrastructure. Meetings and tours are critical opportunities for the City and consultant team to hear concerns as well as ideas for opportunities and solutions.

3. What is Green Stormwater Infrastructure (GSI) and how does it work?

According to the Watershed Management Group's Green Infrastructure for Southwestern Neighborhoods, Green Stormwater Infrastructure "refers to constructed features that use living, natural systems to provide environmental services, such as capturing, cleaning, and infiltrating stormwater; creating wildlife habitat; shading and cooling streets and buildings; and calming traffic. [It] is a strategy that a growing number of communities are using to manage stormwater more sustainably, while using that water to grow vegetation that provides myriad benefits."

4. How are maintenance considerations different for GSI than for more conventional stormwater controls?

Both GSI and conventional stormwater systems require periodic maintenance. GSI maintenance is frequently associated with weeds or sediment clogging drains or impeding infiltration. GSI installations usually require more manual labor and less heavy equipment – such as hand weeding or removing sediment and debris from swales and basins. While municipal maintenance crews may not be typically trained in this type of maintenance, it is possible to contract with specialized crews and/or develop a GSI maintenance program.

5. Where can the City of Albuquerque install and maintain GSI?

The City is limited to funding, installing, and maintaining GSI on City property and rights-of-way, such as public parks, streetscapes, and alleyways. The City cannot directly fund, install, or maintain GSI on private property, in compliance with the State's Anti-Donation Clause (Article IX, Section 14) that prohibits the government from giving gifts of money, property, or credit to private parties. However, it may be possible to create a rebate or grant program to support GSI installations on private and residential properties.

6. Can the City make the owners of properties that have a large volume of stormwater runoff improve the drainage on their site, such as installing new drainage features?

If a site was designed and built in compliance with ordinances and codes in effect at the time of approval, the City cannot subsequently compel a property owner to make changes or improvements to their existing site. However, in the event of redevelopment, new development, or changes to an approved site plan, that involve more than 500 CY of earthwork, 1000 SF building and/or 10000 SF of paving, the new/current regulations will apply. Changes and amendments to the Drainage Ordinance are not retroactive and only apply to site plans, building permits, and construction that occur after the adoption of the changes.

7. Can I install GSI on my property and will it help the flooding issues in my neighborhood?

You can install GSI on your property! GSI is a great way to collect the rainwater that falls on your property to supplement irrigation, supporting landscaping and urban wildlife habitat. It is important to be educated about how GSI works and how it must be maintained. Luckily, there are several resources listed on this website to help demonstrate different types of GSI that you can install and maintain in your yard. Installing GSI in your yard will not solve the flooding issues in your neighborhood alone, but it will contribute to the overall effort to reduce the amount of water reaching and filling the overtaxed storm drains.

8. What do the terms 100-year storm event and 2-year storm event mean?

The terms are used by engineers and hydrologists to describe the capacity of drainage infrastructure. These expressions can be misleading as people tend to think that they mean rainfall or flooding that happen every 100 or every 2 years, respectively. Instead, these terms describe the probability that a storm event of a particular rainfall depth will occur. A 100-year storm has a 1% chance of occurring in any given year. A 2-year storm event has with a 50% chance of occurring in any given year.

9. There is a lot of concern about the quality of water from urban stormwater runoff, particularly from Fair Plaza. Is the stormwater runoff from Fair Plaza a biohazard? Is urban stormwater runoff dangerous for plants?

There is nothing to indicate the runoff from Fair Plaza is more of a biohazard or of greater toxicity than runoff from any other parking lot or street in Albuquerque. As in any other urbanized area, pollutants such as oil and other automotive fluids, fats and grease, paints, food waste, bird and animal droppings, construction waste, and vegetation accumulate on impervious surfaces and are carried by runoff during

storm events. GSI can help treat urban runoff before the water is returned to the river or aquifer – healthy soils, plant roots, and organic matter filter and break down the common pollutants found in urban stormwater runoff. While GSI can help improve water quality, GSI installations receiving urban stormwater runoff should not include edible plants, as the plants may absorb the toxins from the runoff and become unsafe for consumption.

10. What should I do if I see evidence of illegal dumping or discharge?

In the event of there being evidence of an illegal dumping or discharge from one of the properties at the site, the individual should call 311, as this is the best method for properly documenting the circumstance. At that time, the City will send an inspector to visit the specified property and investigate the specific complaint. The City is unable to investigate generic complaints or a "general statement" that may be speculative.

11. These neighborhoods have been experiencing these flooding issues for many years. How soon can the community expect to see these proposed interventions implemented?

At this point, the team is still receiving input and developing potential interventions. A majority of this outreach process is understanding which potential interventions would be acceptable to the community, which is still in progress. When deciding which intervention is appropriate for a particular location, it will be important to weigh considerations around timing, cost, and effectiveness. It is still too early to be able to tie interventions with costs, timelines, and impact.

APPENDIX H

Evaluation of Distributed Stormwater Management Options Technical Memo

Bohannan Huston

Engineering
Spatial Data
Advanced Technologies

Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335
www.bhinc.com
voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

MEMORANDUM

DATE: August 16, 2022

TO: Diane Dolan, Albuquerque City Council Services
Kathy Verhage, City of Albuquerque, Department of Municipal Development, Storm Drainage Section

FROM: Vince Steiner, PE, CFM
Rob Salazar, EI

SUBJECT: **Pueblo Alto & Mile Hi Neighborhoods Drainage Study**
Evaluation of Distributed Stormwater Management Options Technical Memo

I. Study Background

As part of the *Pueblo Alto & Mile Hi Neighborhoods Drainage Study*, Bohannan Huston, Inc. (BHI) produced the *Existing Drainage Conditions Summary Memo* (BHI, 2022). As described in that memo, the Pueblo Alto and Mile Hi neighborhoods face significant drainage issues that are both local (associated with local stormwater runoff) and regional (due to runoff originating outside the neighborhoods) in nature. Providing 100-year flood protection in those neighborhoods will require long-term planning and significant, costly improvements. As a result, this study focuses on small-scale, distributed stormwater management techniques that can be implemented in the near- to mid-term to minimize local drainage issues.

II. Memo Purpose

This technical memo was developed as an attachment to the *Pueblo Alto & Mile Hi Neighborhoods Drainage Study*. This memo presents a variety of distributed stormwater management techniques, including the use green stormwater infrastructure (GSI) and low impact development (LID) practices, that could be implemented within the subject neighborhoods and identifies potential locations for implementation. This memo also presents an evaluation of the effectiveness of these potential improvements over a range of storm events (2-year, 10-year, and 100-year) and high-level cost estimates intended for planning and budgeting purposes.

III. Potential Stormwater Techniques and Locations

Stormwater management techniques considered for implementation in the *Pueblo Alto and Mile Hi Neighborhoods Drainage Study* are listed below and presented in the *Toolkit of Small-Scale Stormwater Management Techniques* (BHI, January 2022). This list represents techniques that can be implemented on a small-scale, and are also scalable, but is not intended to be exhaustive. The *Toolkit of Small-Scale Stormwater Management Techniques* was developed as part of this study and describes the various stormwater management techniques, as well providing design and maintenance considerations. Descriptions of the techniques, listed below, are not repeated in this memo but are available in the toolkit.

- Stormwater Harvesting Basin
- Bioswale
- Stormwater Bumpout
- Permeable Pavement
- Underground Storage and Infiltration Systems

For the purposes of this study, six potential locations for distributed stormwater management techniques were identified within existing City right-of-way based on various considerations, including local drainage patterns and topography, the location of existing drainage issues, maintaining existing access to adjacent properties, maintenance access, and co-benefit opportunities, among other considerations. The six identified potential locations are shown in **Figure 1**. For each location, the most feasible stormwater management techniques from the *Toolkit of Small-Scale Stormwater Management Techniques* (listed above) were identified.

The potential locations and associated stormwater management techniques considered for this study are summarized in **Table 1**.

Table 1 – Potential Locations and Stormwater Management Techniques

Location	Stormwater Management Techniques	Stormwater Concept Description[1]	Considerations
Location 1 Summer Ave. (Washington to San Mateo)	Stormwater Bumpouts	• 9-ft width • South side of road	• Associated GSI landscaping provides the most co-benefits, traffic calming among them • On-street parking would be reduced
	Permeable Pavement	• Pavement replacement (full width)	• High cost • Greatest maintenance requirements, including the use of specialized equipment
Location 2 Adams St. (Mountain to Constitution)	Stormwater Bumpouts	• 9-ft width • One side of road (could alternate along roadway)	• Associated GSI landscaping provides the most co-benefits, traffic calming among them • On-street parking would be reduced
	Underground Storage	• At roadway low point • Overflow to existing storm drain	• Could be combined with stormwater bumpouts and/or permeable pavement
	Permeable Pavement	• Pavement replacement (full width)	• High cost • Greatest maintenance requirements, including the use of specialized equipment
Location 3 Alleys (3, between Mountain & Summer)	Bioswale & Underground Storage	• Underground storage at alley low point • Overflow to existing storm drain	• Minimal surface capture volume can be provided while maintaining access to adjacent properties
Location 4 La Veta Dr. (Summer to El Encanto)	Stormwater Bumpouts	• 9-ft width • One side of road (road remains open)	• Associated GSI landscaping provides the most co-benefits, traffic calming among them • On-street parking would be reduced
	Stormwater Harvesting Basin & Underground Storage	• Pocket Park (closed to motor vehicles) • Surface storage and underground storage	• Associated GSI landscaping provides the most co-benefits
Location 5 Alvarado Dr. (Lomas to Constitution)	Stormwater Bumpouts	• 8-ft to 9-ft width • West side of road	• Associated GSI landscaping provides the most co-benefits, traffic calming among them • On-street parking would be reduced
	Permeable Pavement	• Pavement replacement (full width)	• High cost • Greatest maintenance requirements, including the use of specialized equipment
Location 6 Cardenas Dr. (Marble to Constitution)	Stormwater Bumpouts	• 8-ft to 9-ft width • One side of road (could alternate along roadway)	• Associated GSI landscaping provides the most co-benefits • On-street parking would be reduced
	Permeable Pavement	• Pavement replacement (full width)	• High cost • Greatest maintenance requirements, including the use of specialized equipment

Note: Simplified description and assumptions used for estimation of capture volume. See Section IV for additional assumptions.

These six locations represent a variety of conditions occurring elsewhere in the subject neighborhoods and are not intended to be the only location where distributed stormwater management techniques could be considered by the City for implementation. For example, conditions along Adams Street between Mountain Road and Constitution Avenue (Location 2) are similar to the blocks of Jefferson Street, Monroe Street, Quincy Street, Manzano Street, and Truman Street, therefore similar stormwater techniques could be considered along those other streets in the future.

IV. Runoff and Capture Volume Analysis

The effectiveness of the potential stormwater management techniques at improving local drainage conditions for a range of storm events (2-year, 10-year, and 100-year) were evaluated. For the purposes of comparing potential locations and techniques for this study, effectiveness was evaluated by calculating the percentage of runoff volume captured to the estimated runoff volume reaching a location. A higher percentage infers that a particular location and/or technique will provide more benefit.

This preliminary analysis is intended for planning purposes only. Detailed hydrologic and hydraulic analysis should be performed as part of the design of future projects that may be based on concepts identified by this study.

A. Hydrologic (Runoff) Analysis

Hydrologic analysis was performed to estimate the local runoff volume and peak discharge impacting the six identified locations for the 2-year, 10-year, and 100-year storm events using methodology presented in Part 6-2(A) Procedure for 40-Acre and Smaller Basins of the *City of Albuquerque Development Process Manual* (City DPM). The Pueblo Alto and Mile Hi neighborhoods are located within City DPM precipitation zones 2 and 3, respectively. Land treatments were estimated based on aerial imagery and City DPM treatment-type descriptions. Drainage basins (shown in **Figure 2**) were delineated based on available topographic information and field observation.

Runoff estimates prepared for this study exclude areas outside of the study area (i.e., excludes runoff originating outside the subject neighborhoods, primarily from east of San Pedro Drive). In the existing condition, particularly during large storm events, significant runoff from east of San Pedro Drive contributes to Mile Hi neighborhood. However, based on recommended future regional improvements identified by the *AMAFCA San Mateo to Moon Mini Drainage Management Plan* (Smith, 2016) it was assumed that bypass of San Pedro would not occur in the future. This is especially reasonable for smaller storm events (i.e., 2-year storms), which are not evaluated by the *Moon Mini DMP*, during which bypass is considerably less because storm drain capacity limitations are less severe. The results of this hydrologic analysis are included in **Attachment A.**

Runoff contributing to each potential location evaluated by this study was estimated by proportioning upstream subbasin runoff, with the resulting volumes shown in **Table 2**. Flow proportioning was based on observed flow split locations in roads and on the placement of potential locations within subbasins. Drainage basin delineation and flow proportioning utilized for this preliminary study should be re-evaluated as part of the planning and design of future projects.

Table 2 – Preliminary Runoff Volume Results

Location	6-Hour Runoff Volume Reaching Each Location (ac-ft)		
	2-Year	10-Year	100-Year
1 – Summer	5.4	9.3	15.7
2 – Adams	5.4	9.4	15.8
3 – Alleys	4.8	8.3	14.0
4 – La Veta	4.2	7.1	11.8
5 – Alvarado	4.1	6.9	11.4
6 – Cardenas	1.9	3.3	5.5

B. Capture Volume Analysis

The potential capture volume of stormwater management techniques considered at each location was estimated based on the assumptions described below.

- Stormwater Bumpouts – Estimation of volume capture for stormwater bumpouts assumed the following:
    - Width based on maintaining 24-feet roadway (curb to curb), generally resulting in 8-feet to 9-feet wide bumpout on one side of road.
    - Storage (retention) depth of 9-inches.
    - Located between existing driveways, based on aerial imagery.
- Permeable Pavement – Estimation of volume capture for permeable pavement assumed the following:
    - Storage depth (i.e. storage layer thickness) of six inches with a void ratio of 0.3.
    - During future project-specific planning and design, additional storage layer thickness could be considered if additional volume is desired. This would reduce the cost per cubic foot capture volume, but permeable pavement will still be the more costly technique.
- Underground Storage and Infiltration Systems – Estimation of volume capture assumed the following:
    - Five-foot diameter pipe systems (to fit within existing utility and ROW constraints) with storage of 27.8 cubic feet per linear foot.
    - During future project-specific planning and design, larger systems could be considered (including constructability and impacts to existing improvements) if additional volume is desired.

The capture volume analysis is included in **Attachment B** and is summarized in **Table 3**.

Table 3 – Preliminary Runoff Capture Volumes

Location	Potential Volume Capture (ac-ft)			
	Stormwater Bumpout	Permeable Pavement	Underground Storage	Stormwater Bumpout with Underground Storage
1 – Summer	0.15	0.27	--	--
2 – Adams	0.07	0.14	0.24	0.31
3 – Alleys	0.15	--	0.53	0.85
4 – La Veta	0.03	--	0.52	0.55
5 – Alvarado	0.14	0.26	--	--
6 – Cardenas	0.16	0.21	--	--

Volume capture effectiveness, shown in **Table 4**, was calculated as the percent of runoff reaching a location that could be captured by the proposed stormwater management technique at that location.

Table 4 – Preliminary Volume Capture Effectiveness – 2-Year

Location	Volume Capture Effectiveness – 2-Year			
	Stormwater Bumpout	Permeable Pavement	Underground Storage	Stormwater Bumpout with Underground Storage
1 – Summer	3%	5%	--	--
2 – Adams	1%	3%	5%	6%
3 – Alleys	3%	--	11%	14%
4 – La Veta	1%	---	12%	13%
5 – Alvarado	4%	6%	--	--
6 – Cardenas	8%	11%	--	--

A pocket park at the La Veta Drive location (Location 4) was also evaluated with a stormwater harvesting basin and underground storage. The pocket park is estimated to provide 0.69 ac-ft of storage, with a capture effectiveness of 16% for the 2-year storm event.

V. Preliminary Project Costs

High-level cost estimates (for planning, design, and construction), intended for preliminary planning purposes, were developed for each potential location and are summarized in **Table 5.** Unit costs were developed for each stormwater management technique, using historical cost information from (based on the City Engineer's Estimated Unit Prices for Contract Items 2021) and the conceptual sizes of the techniques described above. Historical price information was

adjusted for inflation using RS Means construction cost indexes, but due to the current economic climate, additional inflation should be considered in project budgeting.

Unit costs (i.e., dollars per linear foot of stormwater bumpout, dollars per square foot of permeable pavement, etc.) were applied to the identified stormwater management techniques at each location, including for the inclusion of GSI landscaping. A 30% contingency was applied to all cost estimates due to the preliminary nature of this study. Project-specific planning, design, and construction phase professional services were accounted for as a percentage of construction cost. The actual cost of professional services would likely vary based on the size and complexity of specific projects. In general, it would be most efficient to plan, design, and build projects that lump together multiple locations across the subject neighborhoods. Maintenance costs are not included in this study. Cost estimate summary information is included in **Attachment C**.

Table 5 – Preliminary Project Costs

Location	Preliminary Project Costs & Cost per Cubic-Foot of Capture Volume							
	Stormwater Bumpout		Permeable Pavement		Underground Storage		Stormwater Bumpout with Underground Storage	
	Cost ($1000)	$/CF	Cost ($1000)	$/CF	Cost ($1000)	$/CF	Cost ($1000)	$/CF
1 – Summer	$630	$97	$5,226	$448	--	--	--	--
2 – Adams	$315	$100	$2,747	$450	$341	$32	$656	$48
3 – Alleys	$595	$91	--	--	$713	$31	$1,308	$45
4 – La Veta	$105	$88	--	--	$713	$32	$818	$35
5 – Alvarado	$595	$95	$5,025	$450	--	--	--	--
6 – Cardenas	$455	$65	$4,020	$448	--	--	--	--

The La Veta pocket park with underground storage had a preliminary estimated cost of $1,064,000 ($35/CF of captured volume).

VI. Maintenance Considerations

The frequency, type, and complexity of maintenance required for each potential stormwater management technique should be considered during the scoping, planning, and design of future implementation projects. Maintenance considerations for each technique considered by this study include, but are not necessarily limited to:

- GSI Techniques (Stormwater Harvesting Basins, Bioswales, and Stormwater Bumpouts)
    - Regular vegetation maintenance and debris, trash, and sediment removal will be necessary. The frequency of maintenance will depend on the conditions of the contributing drainage area. Installations will likely need to be inspected a minimum of twice per year.

    - Due to the size of these features, access with large maintenance equipment (backhoes, skid steers, etc.) will likely not be accommodated.
    - Irrigation should be provided for plant establishment.
    - Additional maintenance considerations are presented by the Bernalillo County GSI/LID Standards (anticipated to be published in Fall 2022).
- Permeable Pavement
    - Specialized equipment (high performance, regenerative air vacuuming) for the removal of debris and sediment from the pavement surface is typically required. The frequency of maintenance will depend on the conditions of the contributing drainage area.
    - Winter salting or sanding is typically not allowed with permeable pavement.
- Underground Storage and Infiltration Systems
    - Removal of debris, trash, and sediment will be required. The frequency of maintenance will depend on the conditions of the contributing drainage area.
    - A pretreatment system should be considered during design to collect debris, trash, and sediment. Design should consider access to and maintainability of the pretreatment system.

VII. Summary

Findings from the evaluation of potential locations and stormwater management techniques in the *Pueblo Alto & Mile Hi Neighborhoods Drainage Study*, as summarized by this memo, include:

- "Every little bit helps." – The storage volume of each individual stormwater management technique is small compared to the total contributing runoff volume. However, the collective storage volume of all locations and techniques is significant, especially for more frequent storms. For example, constructing stormwater bump outs as conceptualized for all six locations and underground storage for Locations 2, 3, and 4 would capture around 48% of the 2-year runoff volume impacting those locations.
- Stormwater management techniques higher in the neighborhood watersheds (i.e., local drainage basins) would generally be more effective than improvements at the location of an existing drainage issue, which is consistent with LID concepts.
- Significantly reducing runoff would require distributed stormwater management techniques throughout the neighborhoods, and regional drainage improvements would likely still be required.

The following should be considered during the scoping, planning, and design of future implementation projects:

- Additional locations beyond those evaluated for this study could be considered for distributed stormwater management techniques.
- Detailed hydrologic and hydraulic analyses should be conducted as part of future projects. The hydrologic analysis presented by this memo is very simplified and is intended primarily for evaluating relative effectiveness of different locations and techniques.

- Traffic analyses should be considered to evaluate the impact of techniques that involve roadway narrowing.
- Maintenance considerations, including those noted in Section VI, above.
- GSI offers co-benefits, as described by the *Toolkit of Small-Scale Stormwater Management Techniques* developed for this study, that should be considered.

RS/VCS/ab

Attachments:

Figure 1 – Stormwater Management Locations for Evaluation

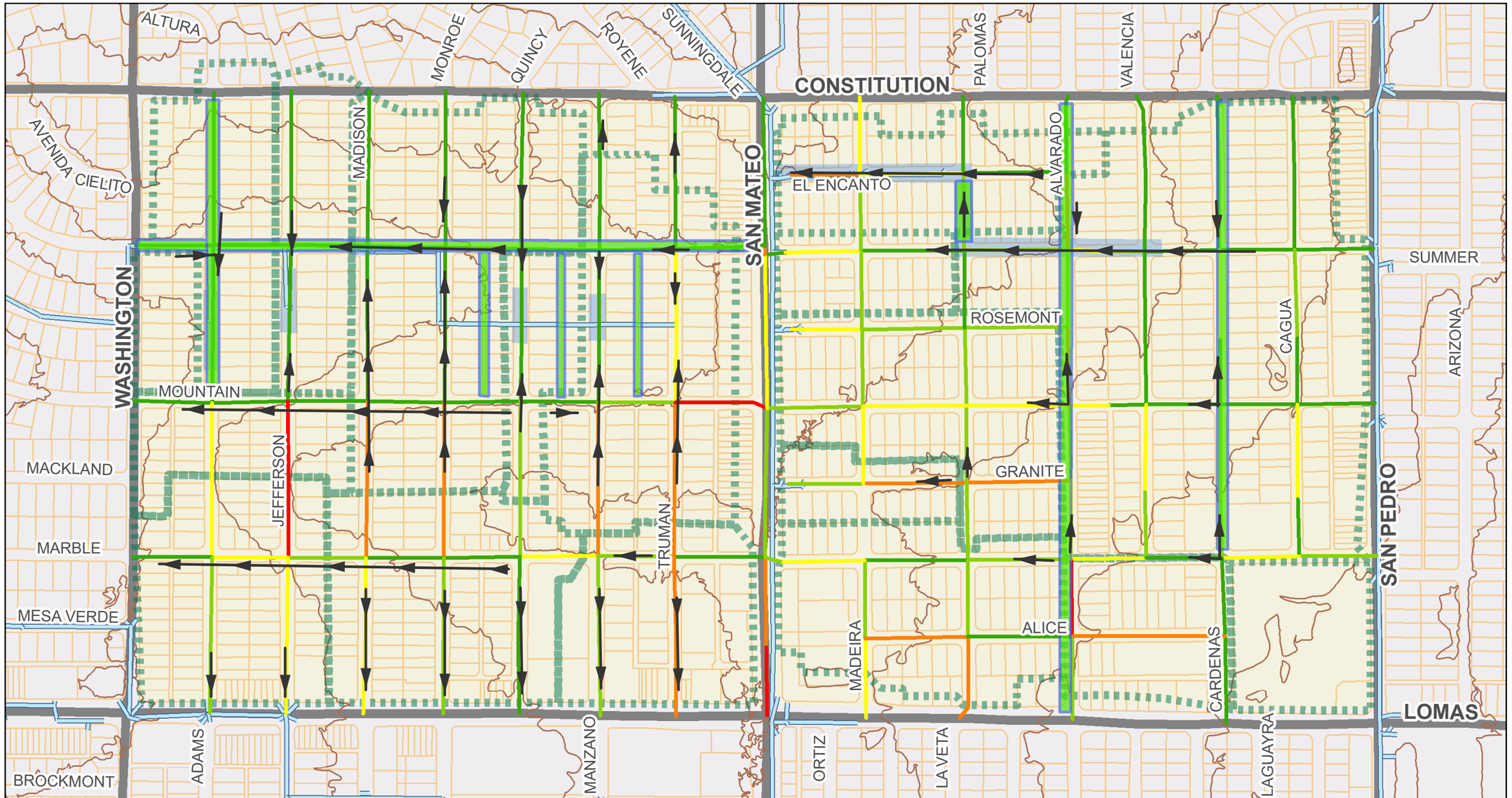
Figure 2 – Neighborhood Drainage Basin Map

Attachment A – Hydrologic Calculations and Results

Attachment B – Capture Volume Analysis

Attachment C – Preliminary Cost Estimates

FIGURE 1 – STORMWATER MANAGEMENT LOCATIONS FOR EVALUATION



Bohannan Huston
www.bhinc.com 800.877.5332

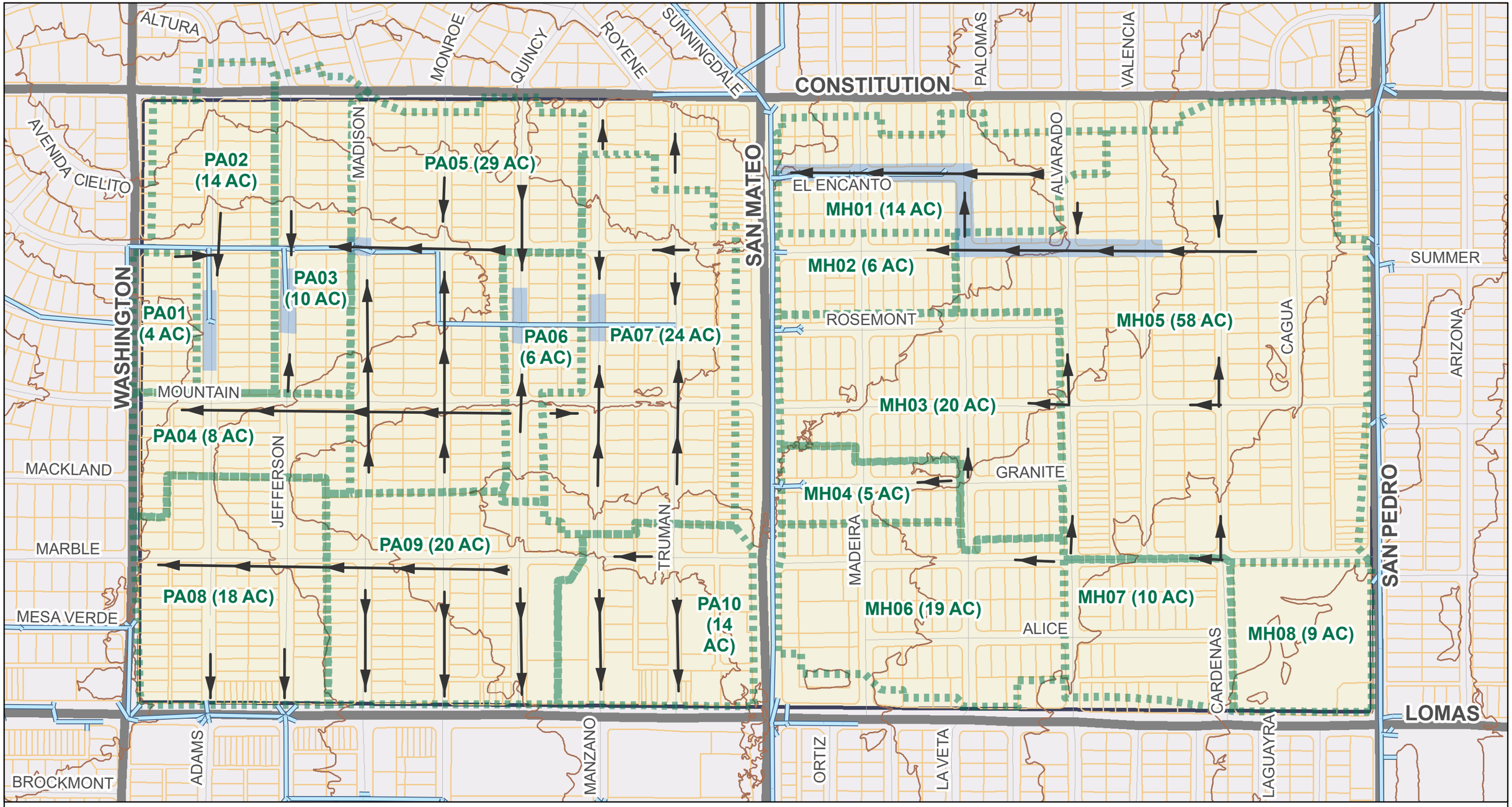
Pueblo Alto & Mile Hi Neighborhoods Drainage Study

Figure 1
Stormwater Management Locations for Evaluation

\\a-abq-fs2\projects\20220231\WR\Reports\Summary Report\Figures\MXDs\20220231_Fig1_EvalLocations.mxd
Author: rsalazar

June 2022

FIGURE 2 – NEIGHBORHOOD DRAINAGE BASIN MAP



Surface Flow Direction
Existing Storm Drain Pipes
Drainage Issue Locations
Basins
Contours (10' interval)
Major Streets
Local Streets
Parcels
Study Area

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N
1 " = 400 feet

Pueblo Alto & Mile Hi Neighborhoods Drainage Study

Figure 2
Neighborhood Drainage Basin Map

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Author: rsalazar

June 2022

ATTACHMENT A – HYDROLOGIC CALCULATIONS AND RESULTS

Hydrologic Analysis - COA DPM Small Basin Method

Project Name: Pueblo Alto Drainage Analysis & Outreach
Project Number: 20220231
Prepared By: RGS
Date: 6/21/2022

Color Key: Input | Linked Cell | Calculation

These calculations are based on the COA DPM (2020) Part 6-2(A) "Procedure for 40-Acre and Smaller Basins"

TABLE 1
PUEBLO ALTO DRAINAGE ANALYSIS & OUTREACH EFFORTS - HYDROLOGIC CALCULATIONS - 2 YEAR

SUB-BASIN ID	Zone	Area (SQ. FT)	Area (AC.)	Land Treatment Percentages A	B	C	D	Q (cfs/ac.)	Q (cfs)	WT E (inches)	V_{360} (CF)	V_{360} (AC-FT)	V_{1440} (CF)	V_{1440} (AC-FT)
(1)	(2)	(1)		(3)	(3)	(3)	(3)	(4)		(5)	(6)		(7)	
MH01	3	589641	13.54	0%	10%	41%	49%	1.15	16	0.60	29354	0.7	36300	0.8
MH02	3	262835	6.03	0%	10%	41%	49%	1.15	7	0.60	13085	0.3	16200	0.4
MH03	3	877698	20.15	0%	10%	41%	49%	1.15	23	0.60	43695	1.0	54100	1.2
MH04	3	221471	5.08	0%	10%	41%	49%	1.15	6	0.60	11026	0.3	13600	0.3
MH05	3	2507873	57.57	0%	20%	21%	59%	1.20	69	0.67	139898	3.2	175700	4.0
MH06	3	811491	18.63	0%	0%	40%	60%	1.32	25	0.71	47743	1.1	59500	1.4
MH07	3	430805	9.89	0%	10%	15%	75%	1.42	14	0.82	29474	0.7	37300	0.9
MH08	3	374924	8.61	0%	5%	5%	90%	1.60	14	0.96	29900	0.7	38100	0.9
PA01	2	161976	3.72	0%	5%	46%	49%	1.10	4	0.55	7489	0.2	9100	0.2
PA02	2	588523	13.51	0%	25%	26%	49%	0.99	13	0.53	25836	0.6	31700	0.7
PA03	2	449786	10.33	0%	15%	36%	49%	1.05	11	0.54	20270	0.5	24700	0.6
PA04	2	361630	8.30	0%	10%	41%	49%	1.07	9	0.55	16508	0.4	20100	0.5
PA05	2	1278289	29.35	0%	35%	16%	49%	0.94	28	0.51	54626	1.3	67300	1.5
PA06	2	271907	6.24	0%	25%	26%	49%	0.99	6	0.53	11937	0.3	14600	0.3
PA07	2	1066063	24.47	0%	23%	23%	56%	1.09	27	0.59	52433	1.2	64500	1.5
PA08	2	762780	17.51	0%	10%	21%	69%	1.28	22	0.71	45246	1.0	55900	1.3
PA09	2	891602	20.47	0%	15%	15%	70%	1.27	26	0.71	52976	1.2	65600	1.5
PA10	2	605339	13.90	0%	0%	16%	84%	1.49	21	0.85	42818	1.0	53100	1.2

Notes

1 Basin parameters from "20220231_DrainageBasinMap" MXD
2 Zones based on descriptions in COA DPM (2020) Table 6.2.7 "Precipitation Zones"
3 Land treatment based on aerial imagery and COA DPM (2020) Tables 6.2.9 "Land Treatments" & 6.2.10 "Percent Treatment D (Impervious)
4 Peak discharge per acre calculated using COA DPM (2020) Equation 6.6 and Table 6.2.14
5 Weighted 6-hr excess precipitation calculated using COA DPM (2020) Equation 6.1 and Table 6.2.13
6 6-hr runoff volume calculated using COA DPM (2020) Equation 6.2
7 24-hr runoff volume calculated using COA DPM (2020) Equation 6.3 and Table 6.2.8

Hydrologic Analysis - COA DPM Small Basin Method

Project Name: Pueblo Alto Drainage Analysis & Outreach
Project Number: 20220231
Prepared By: RGS
Date: 6/21/2022

Color Key: Input | Linked Cell | Calculation

These calculations are based on the COA DPM (2020) Part 6-2(A) "Procedure for 40-Acre and Smaller Basins"

TABLE 2
PUEBLO ALTO DRAINAGE ANALYSIS & OUTREACH EFFORTS - HYDROLOGIC CALCULATIONS - 10 YEAR

SUB-BASIN ID	Zone	Area (SQ. FT)	Area (AC.)	Land Treatment Percentages A	B	C	D	Q (cfs/ac.)	Q (cfs)	WT E (inches)	V_{360} (CF)	V_{360} (AC-FT)	V_{1440} (CF)	V_{1440} (AC-FT)
(1)	(2)	(1)		(3)	(3)	(3)	(3)	(4)		(5)	(6)		(7)	
MH01	3	589641	13.54	0%	10%	41%	49%	2.18	29	1.05	51633	1.2	59600	1.4
MH02	3	262835	6.03	0%	10%	41%	49%	2.18	13	1.05	23016	0.5	26600	0.6
MH03	3	877698	20.15	0%	10%	41%	49%	2.18	44	1.05	76857	1.8	88700	2.0
MH04	3	221471	5.08	0%	10%	41%	49%	2.18	11	1.05	19394	0.4	22400	0.5
MH05	3	2507873	57.57	0%	20%	21%	59%	2.23	128	1.14	239251	5.5	279900	6.4
MH06	3	811491	18.63	0%	0%	40%	60%	2.36	44	1.19	80608	1.9	94000	2.2
MH07	3	430805	9.89	0%	10%	15%	75%	2.47	24	1.34	48178	1.1	57100	1.3
MH08	3	374924	8.61	0%	5%	5%	90%	2.67	23	1.52	47459	1.1	56700	1.3
PA01	2	161976	3.72	0%	5%	46%	49%	2.11	8	0.98	13170	0.3	15000	0.3
PA02	2	588523	13.51	0%	25%	26%	49%	1.98	27	0.94	46086	1.1	52800	1.2
PA03	2	449786	10.33	0%	15%	36%	49%	2.04	21	0.96	35897	0.8	41000	0.9
PA04	2	361630	8.30	0%	10%	41%	49%	2.07	17	0.97	29132	0.7	33300	0.8
PA05	2	1278289	29.35	0%	35%	16%	49%	1.91	56	0.92	98183	2.3	112800	2.6
PA06	2	271907	6.24	0%	25%	26%	49%	1.98	12	0.94	21293	0.5	24400	0.6
PA07	2	1066063	24.47	0%	23%	23%	56%	2.10	51	1.03	91060	2.1	105000	2.4
PA08	2	762780	17.51	0%	10%	21%	69%	2.30	40	1.17	74543	1.7	86800	2.0
PA09	2	891602	20.47	0%	15%	15%	70%	2.28	47	1.17	87228	2.0	101800	2.3
PA10	2	605339	13.90	0%	0%	16%	84%	2.53	35	1.35	67859	1.6	79700	1.8

Notes
1 Basin parameters from "20220231_DrainageBasinMap" MXD
2 Zones based on descriptions in COA DPM (2020) Table 6.2.7 "Precipitation Zones"
3 Land treatment based on aerial imagery and COA DPM (2020) Tables 6.2.9 "Land Treatments" & 6.2.10 "Percent Treatment D (Impervious)
4 Peak discharge per acre calculated using COA DPM (2020) Equation 6.6 and Table 6.2.14
5 Weighted 6-hr excess precipitation calculated using COA DPM (2020) Equation 6.1 and Table 6.2.13
6 6-hr runoff volume calculated using COA DPM (2020) Equation 6.2
7 24-hr runoff volume calculated using COA DPM (2020) Equation 6.3 and Table 6.2.8

Hydrologic Analysis - COA DPM Small Basin Method

Project Name: Pueblo Alto Drainage Analysis & Outreach
Project Number: 20220231
Prepared By: RGS
Date: 6/21/2022

Color Key: Input | Linked Cell | Calculation

These calculations are based on the COA DPM (2020) Part 6-2(A) "Procedure for 40-Acre and Smaller Basins"

TABLE 3
PUEBLO ALTO DRAINAGE ANALYSIS & OUTREACH EFFORTS - HYDROLOGIC CALCULATIONS - 100 YEAR

SUB-BASIN ID	Zone	Area (SQ. FT)	Area (AC.)	Land Treatment Percentages A	B	C	D	Q (cfs/ac.)	Q (cfs)	WT E (inches)	V_{360} (CF)	V_{360} (AC-FT)	V_{1440} (CF)	V_{1440} (AC-FT)
(1)	(2)	(1)		(3)	(3)	(3)	(3)	(4)		(5)	(6)		(7)	
MH01	3	589641.4015	13.54	0	0.1	0.41	0.49	3.75	51	1.80	88304	2.0	98200	2.3
MH02	3	262835.1087	6.03	0	0.1	0.41	0.49	3.75	23	1.80	39362	0.9	43800	1.0
MH03	3	877698.0513	20.15	0	0.1	0.41	0.49	3.75	76	1.80	131443	3.0	146100	3.4
MH04	3	221471.325	5.08	0	0.1	0.41	0.49	3.75	19	1.80	33167	0.8	36900	0.8
MH05	3	2507873.071	57.57	0	0.2	0.21	0.59	3.81	220	1.92	401908	9.2	452500	10.4
MH06	3	811491.1544	18.63	0	0	0.4	0.6	3.96	74	1.98	134167	3.1	150800	3.5
MH07	3	430805.4821	9.89	0	0.1	0.15	0.75	4.09	40	2.18	78425	1.8	89500	2.1
MH08	3	374923.6609	8.61	0	0.05	0.05	0.9	4.32	37	2.42	75594	1.7	87100	2.0
PA01	2	161975.981	3.72	0	0.05	0.46	0.49	3.65	14	1.66	22346	0.5	24300	0.6
PA02	2	588523.0205	13.51	0	0.25	0.26	0.49	3.51	47	1.61	78936	1.8	86100	2.0
PA03	2	449785.748	10.33	0	0.15	0.36	0.49	3.58	37	1.63	61190	1.4	66700	1.5
PA04	2	361629.6273	8.30	0	0.1	0.41	0.49	3.61	30	1.64	49543	1.1	54000	1.2
PA05	2	1278288.834	29.35	0	0.35	0.16	0.49	3.44	101	1.59	169000	3.9	184700	4.2
PA06	2	271907.2475	6.24	0	0.25	0.26	0.49	3.51	22	1.61	36470	0.8	39800	0.9
PA07	2	1066063.392	24.47	0	0.23	0.23	0.56	3.67	90	1.73	153309	3.5	168200	3.9
PA08	2	762780.4052	17.51	0	0.1	0.21	0.69	3.87	68	1.90	121028	2.8	134200	3.1
PA09	2	891601.772	20.47	0	0.15	0.15	0.7	3.85	79	1.91	141579	3.3	157200	3.6
PA10	2	605339.2928	13.90	0	0	0.16	0.84	4.13	57	2.12	107044	2.5	119800	2.7

Notes
1 Basin parameters from "20220231_DrainageBasinMap" MXD
2 Zones based on descriptions in COA DPM (2020) Table 6.2.7 "Precipitation Zones"
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6 6-hr runoff volume calculated using COA DPM (2020) Equation 6.2
7 24-hr runoff volume calculated using COA DPM (2020) Equation 6.3 and Table 6.2.8

ATTACHMENT B – CAPTURE VOLUME ANALYSIS

Options Analysis

Project Name: Pueblo Alto Drainage Analysis & Outreach
Project Number: 20220231
Prepared By: RGS
Date: 6/21/2022

Color Key
Input | Linked Cell | Calculation

Location #	Location ID	Conceptual SW Management Technique	Capture Volume (AC-FT)	6-Hour Runoff Volume 2-Year (AC-FT)	6-Hour Runoff Volume 10-Year (AC-FT)	6-Hour Runoff Volume 100-Year (AC-FT)	Percent of Runoff Captured 2-Year	Percent of Runoff Captured 10-Year	Percent of Runoff Captured 100-Year
		Bumpout in Existing Roadway	0.15	5.4	9.3	15.7	3%	2%	1%
		Bumpout Extended into Right-of-Way	0.35	5.4	9.3	15.7	7%	4%	2%
1	1-SUMMER	Permeable Pavement	0.27	5.4	9.3	15.7	5%	3%	2%
		Bumpout in Existing Roadway with Underground Storage	0.31	5.4	9.4	15.8	6%	3%	2%
		Bumpout Extended into Right-of-Way	0.43	5.4	9.4	15.8	8%	5%	3%
2	2-ADAMS	Permeable Pavement	0.14	5.4	9.4	15.8	3%	1%	1%
3	3-ALLEYS	Bioswale in Alley with Underground Storage	0.67	4.8	8.3	14.0	14%	8%	5%
		Bumpout in Existing Roadway with Underground Storage	0.54	4.2	7.1	11.8	13%	8%	5%
4	4-LA VETA	40'-Wide Park	0.69	4.2	7.1	11.8	16%	10%	6%
		Bumpout in Existing Roadway	0.14	4.1	6.9	11.4	4%	2%	1%
		Bumpout Extended into Right-of-Way	0.39	4.1	6.9	11.4	10%	6%	3%
5	5-ALVARADO	Permeable Pavement	0.26	4.1	6.9	11.4	6%	4%	2%
		Bumpout in Existing Roadway	0.16	1.9	3.3	5.5	8%	5%	3%
		Bumpout Extended into Right-of-Way	0.35	1.9	3.3	5.5	18%	11%	6%
6	6-CARDENAS	Permeable Pavement	0.21	1.9	3.3	5.5	11%	6%	4%

Options Analysis - 2-Year Capture Effectiveness

Project Name: Pueblo Alto Drainage Analysis & Outreach
Project Number: 20220231
Prepared By: RGS
Date: 6/22/2022

Color Key
Input | Linked Cell | Calculation

Percent of 2-Year Runoff Volume Captured

Location #	Location ID	Conceptual SW Management Technique	Stormwater Bumpout	Underground Storage	Total
1	1-SUMMER	Bumpout in Existing Roadway	2.8%	0.0%	2.8%
		Bumpout Extended into Right-of-Way	6.5%	0.0%	6.5%
2	2-ADAMS	Bumpout in Existing Roadway with Underground Storage	1.3%	4.5%	5.8%
		Bumpout Extended into Right-of-Way	3.5%	4.5%	8.0%
3	3-ALLEYS	Bioswale in Alley with Underground Storage	3.1%	10.9%	14.0%
4	4-LA VETA	Bumpout in Existing Roadway with Underground Storage	0.6%	12.3%	12.9%
		40'-Wide Park	4.1%	12.3%	16.4%
5	5-ALVARADO	Bumpout in Existing Roadway	3.5%	0.0%	3.5%
		Bumpout Extended into Right-of-Way	9.5%	0.0%	9.5%
6	6-CARDENAS	Bumpout in Existing Roadway	8.2%	0.0%	8.2%
		Bumpout Extended into Right-of-Way	17.8%	0.0%	17.8%

*Stormwater bumpout volume represents surface storage in bioswale

Permeable Pavement

Location #	Location ID	Conceptual SW Management Technique	Percent of 2-Year Runoff Volume Captured
1	1-SUMMER	Permeable Pavement	5.0%
		Permeable Pavement w/ Bumpout	3.6%
2	2-ADAMS	Permeable Pavement	2.6%
		Permeable Pavement w/ Bumpout	1.9%
5	5-ALVARADO	Permeable Pavement	6.3%
		Permeable Pavement w/ Bumpout	4.6%
6	6-CARDENAS	Permeable Pavement	10.6%
		Permeable Pavement w/ Bumpout	7.8%

Options Analysis - Technique Capture Volume

Project Name: Pueblo Alto Drainage Analysis & Outreach
Project Number: 20220231
Prepared By: RGS
Date: 6/22/2022

Color Key
Input | Linked Cell | Calculation

Location #	Location ID	Conceptual SW Management Technique	Stormwater Bumpout (CF)	Stormwater Bumpout (AC-FT)	Underground Storage (CF)	Underground Storage (AC-FT)	Total (CF)	Total (AC-FT)
		Bumpout in Existing Roadway	6528	0.15	0	0.00	6528	0.15
1	1-SUMMER	Bumpout Extended into Right-of-Way	15302	0.35	0	0.00	15302	0.35
		Bumpout in Existing Roadway with Underground Storage	3151	0.07	10498	0.24	13649	0.31
2	2-ADAMS	Bumpout Extended into Right-of-Way	8199	0.19	10498	0.24	18697	0.43
3	3-ALLEYS	Bioswale in Alley with Underground Storage	6517	0.15	22871	0.53	29388	0.67
		Bumpout in Existing Roadway with Underground Storage	1191	0.03	22518	0.52	23709	0.54
4	4-LA VETA	40'-Wide Park	7478	0.17	22518	0.52	29996	0.69
		Bumpout in Existing Roadway	6257	0.14	0	0.00	6257	0.14
5	5-ALVARADO	Bumpout Extended into Right-of-Way	16878	0.39	0	0.00	16878	0.39
		Bumpout in Existing Roadway	6975	0.16	0	0.00	6975	0.16
6	6-CARDENAS	Bumpout Extended into Right-of-Way	15104	0.35	0	0.00	15104	0.35
		Total (Max)	69477	1.59	55887	1.28	125364	2.88

*Stormwater bumpout volume represents surface storage in bioswale

Permeable Pavement

Location #	Location ID	Conceptual SW Management Technique	Permeable Pavement (CF)	Permeable Pavement (AC-FT)
		Permeable Pavement	11670	0.27
1	1-SUMMER	Permeable Pavement w/ Bumpout	8487	0.19
		Permeable Pavement	6104	0.14
2	2-ADAMS	Permeable Pavement w/ Bumpout	4440	0.10
		Permeable Pavement	11164	0.26
5	5-ALVARADO	Permeable Pavement w/ Bumpout	8150	0.19
		Permeable Pavement	8973	0.21
6	6-CARDENAS	Permeable Pavement w/ Bumpout	6591	0.15
		Total (No Bumpout)	37911	0.87
		Total (With Bumpout)	27668	0.64

Options Analysis - Stormwater Harvesting Bumpout Capture Volume

Project Name: Pueblo Alto Drainage Analysis & Outreach
Project Number: 20220231
Prepared By: RGS
Date: 6/21/2022

OBJECTID *	SHAPE *	EVAL_LOC	GSI ROW WIDTH	GSI PAVE WIDTH	SHAPE_Length	Paved + ROW Width (FT)	Reduced Paved Width (FT)	Reduced Paved + ROW Width (FT)	Reduced Length (FT)	GSI on Paved Area (SF)	GSI In Paved + ROW Area (SF)	Storage Depth (FT)	GSI on Paved Volume (CF)	GSI In Paved + ROW Volume (CF)	Note
107	Polyline	1	21	9	97.870957	19.5	5.9	16.4	87.9	516.2	1438.9	0.75	387.2	1079.2	
128	Polyline	1	10	9	79.652429	14.0	5.9	10.9	69.7	409.2	757.5	0.75	306.9	568.1	
129	Polyline	1	10	9	16.777334	14.0	5.9	10.9	6.8	39.8	73.7	0.75	29.9	55.3	
130	Polyline	1	10	9	90.753186	14.0	5.9	10.9	80.8	474.4	878.2	0.75	355.8	658.6	
131	Polyline	1	13	9	81.503615	15.5	5.9	12.4	71.5	420.1	884.9	0.75	315.1	663.6	
132	Polyline	1	13	9	45.912141	15.5	5.9	12.4	35.9	211.0	444.4	0.75	158.2	333.3	
133	Polyline	1	13	9	106.069707	15.5	5.9	12.4	96.1	564.4	1188.9	0.75	423.3	891.6	
134	Polyline	1	21	9	49.11478	19.5	5.9	16.4	39.1	229.8	640.5	0.75	172.3	480.4	
135	Polyline	1	21	9	62.992704	19.5	5.9	16.4	53.0	311.3	867.8	0.75	233.5	650.8	
136	Polyline	1	18	9	105.344665	18.0	5.9	14.9	95.3	560.1	1418.3	0.75	420.1	1063.7	
137	Polyline	1	18	9	91.820787	18.0	5.9	14.9	81.8	480.7	1217.1	0.75	360.5	912.8	
138	Polyline	1	18	9	64.066168	18.0	5.9	14.9	54.1	317.6	804.2	0.75	238.2	603.2	
139	Polyline	1	18	9	97.518357	18.0	5.9	14.9	87.5	514.2	1301.8	0.75	385.6	976.4	
140	Polyline	1	18	9	54.095683	18.0	5.9	14.9	44.1	259.1	655.9	0.75	194.3	491.9	
141	Polyline	1	18	9	70.116168	18.0	5.9	14.9	60.1	353.2	894.2	0.75	264.9	670.7	
142	Polyline	1	18	9	85.418446	18.0	5.9	14.9	75.4	443.1	1121.8	0.75	332.3	841.4	
143	Polyline	1	18	9	70.266544	18.0	5.9	14.9	60.3	354.1	896.5	0.75	265.5	672.3	
144	Polyline	1	16	9	112.105745	17.0	5.9	13.9	102.1	599.9	1416.7	0.75	449.9	1062.5	
145	Polyline	1	16	9	96.927599	17.0	5.9	13.9	86.9	510.7	1206.1	0.75	383.0	904.6	
146	Polyline	1	12	9	111.038496	15.0	5.9	11.9	101.0	593.6	1199.8	0.75	445.2	899.9	
147	Polyline	1	12	9	77.461273	15.0	5.9	11.9	67.5	396.3	801.1	0.75	297.3	600.8	
148	Polyline	1	12	9	34.750653	15.0	5.9	11.9	24.8	145.4	293.9	0.75	109.1	220.4	
91	Polyline	2	22	9	85.222837	20.0	5.9	16.9	75.2	441.9	1269.4	0.75	331.5	952.0	
92	Polyline	2	22	9	37.411238	20.0	5.9	16.9	27.4	161.0	462.6	0.75	120.8	346.9	
93	Polyline	2	22	9	38.798444	20.0	5.9	16.9	28.8	169.2	486.0	0.75	126.9	364.5	
94	Polyline	2	22	9	82.790354	20.0	5.9	16.9	72.8	427.6	1228.3	0.75	320.7	921.3	
95	Polyline	2	22	9	37.759099	20.0	5.9	16.9	27.8	163.1	468.4	0.75	122.3	351.3	
96	Polyline	2	22	9	48.497092	20.0	5.9	16.9	38.5	226.2	649.6	0.75	169.6	487.2	
97	Polyline	2	22	9	44.339743	20.0	5.9	16.9	34.3	201.7	579.5	0.75	151.3	434.6	
98	Polyline	2	22	9	41.569379	20.0	5.9	16.9	31.6	185.5	532.7	0.75	139.1	399.5	
99	Polyline	2	16	9	43.993284	17.0	5.9	13.9	34.0	199.7	471.7	0.75	149.8	353.7	
100	Polyline	2	16	9	48.497417	17.0	5.9	13.9	38.5	226.2	534.2	0.75	169.6	400.6	
101	Polyline	2	16	9	44.68678	17.0	5.9	13.9	34.7	203.8	481.3	0.75	152.8	361.0	
102	Polyline	2	16	9	52.306966	17.0	5.9	13.9	42.3	248.6	587.0	0.75	186.4	440.3	
103	Polyline	2	16	9	83.743139	17.0	5.9	13.9	73.7	433.2	1023.2	0.75	324.9	767.4	
104	Polyline	2	16	9	48.670199	17.0	5.9	13.9	38.7	227.2	536.5	0.75	170.4	402.4	
105	Polyline	2	16	9	43.306378	17.0	5.9	13.9	33.3	195.7	462.1	0.75	146.8	346.6	
106	Polyline	2	16	9	93.529507	17.0	5.9	13.9	83.5	490.7	1159.0	0.75	368.1	869.2	
71	Polyline	3	0	9	18.836492	9.0	5.9	5.9	8.8	51.9	51.9	0.75	38.9	38.9	9'-wide harvesting basin proposed in alleys
72	Polyline	3	0	9	145.27259	9.0	5.9	5.9	135.3	794.7	794.7	0.75	596.0	596.0	9'-wide harvesting basin proposed in alleys
73	Polyline	3	0	9	156.104118	9.0	5.9	5.9	146.1	858.4	858.4	0.75	643.8	643.8	9'-wide harvesting basin proposed in alleys
74	Polyline	3	0	9	168.221809	9.0	5.9	5.9	158.2	929.6	929.6	0.75	697.2	697.2	9'-wide harvesting basin proposed in alleys
75	Polyline	3	0	9	54.587468	9.0	5.9	5.9	44.6	262.0	262.0	0.75	196.5	196.5	9'-wide harvesting basin proposed in alleys
81	Polyline	3	0	9	18.836497	9.0	5.9	5.9	8.8	51.9	51.9	0.75	38.9	38.9	9'-wide harvesting basin proposed in alleys
82	Polyline	3	0	9	145.272598	9.0	5.9	5.9	135.3	794.7	794.7	0.75	596.0	596.0	9'-wide harvesting basin proposed in alleys
83	Polyline	3	0	9	156.104139	9.0	5.9	5.9	146.1	858.4	858.4	0.75	643.8	643.8	9'-wide harvesting basin proposed in alleys
84	Polyline	3	0	9	168.221818	9.0	5.9	5.9	158.2	929.6	929.6	0.75	697.2	697.2	9'-wide harvesting basin proposed in alleys
85	Polyline	3	0	9	54.587449	9.0	5.9	5.9	44.6	262.0	262.0	0.75	196.5	196.5	9'-wide harvesting basin proposed in alleys
86	Polyline	3	0	9	18.83682	9.0	5.9	5.9	8.8	51.9	51.9	0.75	38.9	38.9	9'-wide harvesting basin proposed in alleys
87	Polyline	3	0	9	145.272581	9.0	5.9	5.9	135.3	794.7	794.7	0.75	596.0	596.0	9'-wide harvesting basin proposed in alleys
88	Polyline	3	0	9	156.104094	9.0	5.9	5.9	146.1	858.4	858.4	0.75	643.8	643.8	9'-wide harvesting basin proposed in alleys
89	Polyline	3	0	9	168.221801	9.0	5.9	5.9	158.2	929.6	929.6	0.75	697.2	697.2	9'-wide harvesting basin proposed in alleys
90	Polyline	3	0	9	54.587488	9.0	5.9	5.9	44.6	262.0	262.0	0.75	196.5	196.5	9'-wide harvesting basin proposed in alleys
66	Polyline	4	20	9	280.37788	40.0	5.9	36.9	270.4	1588.5	9970.2	0.75	1191.4	7477.6	40'-wide full street replace with harvesting basin
45	Polyline	5	12	9	72.747761	15.0	5.9	11.9	62.7	368.6	745.1	0.75	276.5	558.8	

46	Polyline	5	12	9	32.915879	15.0	5.9	11.9	22.9	134.6	272.1	0.75	101.0	204.1
47	Polyline	5	12	9	63.222662	15.0	5.9	11.9	53.2	312.7	632.0	0.75	234.5	474.0
48	Polyline	5	20	8	59.822308	18.0	4.9	14.9	49.8	242.9	741.1	0.75	182.2	555.8
49	Polyline	5	20	8	111.288199	18.0	4.9	14.9	101.3	493.8	1506.7	0.75	370.3	1130.0
50	Polyline	5	20	8	61.92877	18.0	4.9	14.9	51.9	253.2	772.4	0.75	189.9	579.3
51	Polyline	5	20	9	71.0208	19.0	5.9	15.9	61.0	358.5	968.7	0.75	268.9	726.5
52	Polyline	5	20	9	95.271325	19.0	5.9	15.9	85.3	501.0	1353.7	0.75	375.7	1015.3
53	Polyline	5	20	9	68.414284	19.0	5.9	15.9	58.4	343.2	927.3	0.75	257.4	695.5
54	Polyline	5	20	9	82.277613	19.0	5.9	15.9	72.3	424.6	1147.4	0.75	318.5	860.6
55	Polyline	5	20	9	21.629374	19.0	5.9	15.9	11.6	68.3	184.6	0.75	51.2	138.5
56	Polyline	5	20	9	100.890548	19.0	5.9	15.9	90.9	534.0	1442.9	0.75	400.5	1082.2
57	Polyline	5	21	9	73.185593	19.5	5.9	16.4	63.2	371.2	1034.7	0.75	278.4	776.0
58	Polyline	5	21	9	55.434747	19.5	5.9	16.4	45.4	266.9	744.0	0.75	200.2	558.0
59	Polyline	5	21	9	77.087743	19.5	5.9	16.4	67.1	394.1	1098.6	0.75	295.6	823.9
60	Polyline	5	20	9	27.54234	19.0	5.9	15.9	17.5	103.1	278.5	0.75	77.3	208.9
61	Polyline	5	20	9	37.969576	19.0	5.9	15.9	28.0	164.3	444.0	0.75	123.2	333.0
62	Polyline	5	20	9	80.556673	19.0	5.9	15.9	70.6	414.5	1120.1	0.75	310.9	840.1
63	Polyline	5	20	9	74.30453	19.0	5.9	15.9	64.3	377.8	1020.8	0.75	283.3	765.6
149	Polyline	5	21	9	102.211096	19.5	5.9	16.4	92.2	541.7	1510.0	0.75	406.3	1132.5
150	Polyline	5	21	9	86.627126	19.5	5.9	16.4	76.6	450.2	1254.8	0.75	337.6	941.1
151	Polyline	5	20	9	106.521382	19.0	5.9	15.9	96.5	567.1	1532.3	0.75	425.3	1149.2
152	Polyline	5	20	9	77.088046	19.0	5.9	15.9	67.1	394.1	1065.0	0.75	295.6	798.8
153	Polyline	5	20	9	54.577012	19.0	5.9	15.9	44.6	261.9	707.7	0.75	196.4	530.7
1	Polyline	6	10	9	14.202478	14.0	5.9	10.9	4.2	24.7	45.7	0.75	18.5	34.3
2	Polyline	6	10	9	45.037874	14.0	5.9	10.9	35.0	205.8	381.0	0.75	154.4	285.8
3	Polyline	6	10	9	51.094337	14.0	5.9	10.9	41.1	241.4	446.9	0.75	181.1	335.2
4	Polyline	6	10	9	33.340995	14.0	5.9	10.9	23.3	137.1	253.8	0.75	102.8	190.4
5	Polyline	6	10	9	30.310145	14.0	5.9	10.9	20.3	119.3	220.9	0.75	89.5	165.7
6	Polyline	6	10	9	102.191423	14.0	5.9	10.9	92.2	541.6	1002.6	0.75	406.2	751.9
7	Polyline	6	10	9	20.784193	14.0	5.9	10.9	10.8	63.4	117.3	0.75	47.5	88.0
8	Polyline	6	14	9	145.496198	16.0	5.9	12.9	135.5	796.0	1744.5	0.75	597.0	1308.4
9	Polyline	6	14	9	72.744675	16.0	5.9	12.9	62.7	368.6	807.8	0.75	276.5	605.9
10	Polyline	6	14	9	55.434768	16.0	5.9	12.9	45.4	266.9	585.0	0.75	200.2	438.7
11	Polyline	6	14	9	51.52741	16.0	5.9	12.9	41.5	244.0	534.7	0.75	183.0	401.0
12	Polyline	6	14	9	55.861956	16.0	5.9	12.9	45.9	269.4	590.5	0.75	202.1	442.9
13	Polyline	6	14	9	123.005911	16.0	5.9	12.9	113.0	663.9	1455.0	0.75	497.9	1091.2
14	Polyline	6	12	8	45.465382	14.0	4.9	10.9	35.5	172.9	385.7	0.75	129.7	289.3
15	Polyline	6	12	8	19.055359	14.0	4.9	10.9	9.1	44.1	98.5	0.75	33.1	73.9
16	Polyline	6	12	8	16.887199	14.0	4.9	10.9	6.9	33.6	74.9	0.75	25.2	56.2
17	Polyline	6	12	8	39.403353	14.0	4.9	10.9	29.4	143.3	319.8	0.75	107.5	239.8
18	Polyline	6	12	8	40.269169	14.0	4.9	10.9	30.3	147.6	329.2	0.75	110.7	246.9
19	Polyline	6	12	8	42.43583	14.0	4.9	10.9	32.4	158.1	352.7	1.75	276.7	617.3
20	Polyline	6	12	8	46.336933	14.0	4.9	10.9	36.3	177.1	395.2	2.75	487.1	1086.7
21	Polyline	6	12	8	42.435828	14.0	4.9	10.9	32.4	158.1	352.7	3.75	593.0	1322.8
22	Polyline	6	12	8	49.796856	14.0	4.9	10.9	39.8	194.0	432.8	4.75	921.5	2055.8
23	Polyline	6	12	8	57.590344	14.0	4.9	10.9	47.6	232.0	517.5	5.75	1334.0	2975.9

Options Analysis - Permeable Pavement Capture Volume

Project Name: Pueblo Alto Drainage Analysis & Outreach
Project Number: 20220231
Prepared By: RGS
Date: 6/21/2022

OBJECTID *	SHAPE *	EVAL_LOC	ROAD_WIDTH	SHAPE_Length	Width w/ Bumpout (FT)	Area w/o Bumpout (SF)	Area w/ Bumpout (SF)	Storage Depth (FT)	Void Ratio (CF/CF)	Storage w/o Bumpout (CF)	Storage w/ Bumpout (CF)
1	Polyline	1	33	293.610421	24	9689	7047	0.5	0.3	1453	1057
2	Polyline	1	33	291.477912	24	9619	6995	0.5	0.3	1443	1049
3	Polyline	1	33	289.339713	24	9548	6944	0.5	0.3	1432	1042
4	Polyline	1	33	292.545498	24	9654	7021	0.5	0.3	1448	1053
5	Polyline	1	33	292.568593	24	9655	7022	0.5	0.3	1448	1053
6	Polyline	1	33	292.553966	24	9654	7021	0.5	0.3	1448	1053
7	Polyline	1	33	291.477883	24	9619	6995	0.5	0.3	1443	1049
8	Polyline	1	33	313.906854	24	10359	7534	0.5	0.3	1554	1130
9	Polyline	2	33	616.603819	24	20348	14798	0.5	0.3	3052	2220
10	Polyline	2	33	616.603819	24	20348	14798	0.5	0.3	3052	2220
11	Polyline	5	33	285.790051	24	9431	6859	0.5	0.3	1415	1029
12	Polyline	5	32	280.618357	24	8980	6735	0.5	0.3	1347	1010
13	Polyline	5	33	283.206396	24	9346	6797	0.5	0.3	1402	1020
14	Polyline	5	33	284.938223	24	9403	6839	0.5	0.3	1410	1026
15	Polyline	5	33	286.670377	24	9460	6880	0.5	0.3	1419	1032
16	Polyline	5	33	282.332318	24	9317	6776	0.5	0.3	1398	1016
17	Polyline	5	33	280.63034	24	9261	6735	0.5	0.3	1389	1010
18	Polyline	5	33	279.734672	24	9231	6714	0.5	0.3	1385	1007
19	Polyline	6	33	618.355002	24	20406	14841	0.5	0.3	3061	2226
20	Polyline	6	33	614.891223	24	20291	14757	0.5	0.3	3044	2214
21	Polyline	6	32	597.587187	24	19123	14342	0.5	0.3	2868	2151

*COA DPM Part 6-11(F) Rock Void Space for Pond Volume
*COA DPM Part 6-12(B)(1) Landscape Category

Options Analysis - Underground Storage Capture Volume

Project Name: Pueblo Alto Drainage Analysis & Outreach

Project Number: 20220231

Prepared By: RGS

Date: 6/21/2022

OBJECTID *	SHAPE *	DIAMETER_FT	NUM_PIPES	STOR_PER_FT	TOT_STOR	EVAL_LOC	SHAPE_Length
1	Polyline	5	1	27.8	10497.90702	2	377.622565
2	Polyline	5	1	27.8	5874.304613	3	211.305927
3	Polyline	5	1	27.8	9004.139847	3	323.889931
4	Polyline	5	1	27.8	7992.894589	3	287.514202
5	Polyline	5	1	27.8	22518	4	810

Table 6-2

Storage Capacities of N-12®, N-12® ST, and N-12® WT Pipes

Nominal Inside Diameter	Average Outside Diameter	"X" Spacing	"S" Spacing[1]	"C" Spacing[1]	Pipe Volume[2]	Stone Void Volume[3,4,5]	Total Retention Storage	Retention Surface Area Required	Detention Surface Area Required
in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	ft^3/ft (m^3/m)	ft^3/ft (m^3/m)	ft^3/ft (m^3/m)	ft^2/ft^3 (m^2/m^3)	ft^2/ft^3 (m^2/m^3)
12 (300)	14.5 (368)	8 (210)	10.9 (280)	25.4 (650)	0.81 (0.07)	0.84 (0.08)	1.65 (0.15)	1.3 (4.2)	2.7 (8.6)
15 (375)	18 (457)	8 (210)	10.9 (280)	28.9 (750)	1.2 (0.11)	1.1 (0.10)	2.3 (0.21)	1.1 (3.5)	1.97 (6.4)
18 (450)	21 (533)	9 (230)	14.3 (360)	35.3 (900)	1.8 (0.16)	1.4 (0.13)	3.2 (0.29)	0.93 (3.0)	1.6 (5.4)
24 (600)	28 (711)	10 (260)	13.4 (340)	41.4 (1050)	3.1 (0.29)	2.0 (0.18)	5.1 (0.47)	0.68 (2.2)	1.1 (3.6)
30 (750)	36 (914)	18 (460)	17.1 (430)	53.1 (1350)	4.9 (0.46)	3.1 (0.28)	8.0 (0.74)	0.55 (1.8)	0.90 (3.0)
36 (900)	42 (1067)	18 (460)	21 (530)	63.0 (1600)	7.1 (0.66)	4.2 (0.39)	11.3 (1.05)	0.47 (1.5)	0.74 (2.4)
42 (1050)	48 (1219)	18 (460)	24 (610)	72 (1830)	9.2 (0.87)	5.8 (0.53)	15.0 (1.40)	0.40 (1.3)	0.65 (2.1)
48 (1200)	54 (1372)	18 (460)	24.5 (620)	78.5 (2000)	12.4 (1.15)	6.7 (0.62)	19.1 (1.77)	0.34 (1.1)	0.53 (1.7)
60 (1500)	67 (1702)	18 (460)	23 (580)	90 (2290)	19.3 (1.79)	8.5 (0.78)	27.8 (2.57)	0.27 (0.89)	0.39 (1.3)

Notes:

See Figure 6-2 for typical cross section used in volume calculations. Bedding depth assumed 4" for 12"-24" pipe and 6" for 30"-60" pipe.

1. *Based on A-profile pipe.*
2. *Actual ID values used in calculation.*
3. *Stone Porosity assumed 40%.*
4. *Stone height above crown of pipe is not included in void volume calculations.*
5. *Calculation is based on the average OD of the pipe.*

See "Design Aids" for a system design tool to calculate total HDPE pipe system storage with an example calculation.

Options Analysis - Subbasin Contribution to Evaluation Locations

Project Name: Pueblo Alto Drainage Analysis & Outreach
Project Number: 20220231
Prepared By: RGS
Date: 6/21/2022

SUBBASIN	% OF SUBBASIN REACHING EVAL LOCATION 1-SUMMER	2-ADAMS	3-ALLEYS	4-LA VETA	5-ALVARADO	6-CARDENAS	Notes
MH01	0%	0%	0%	20%	0%	0%	Flows from MH01 captured by San Mateo SD or surface flow to San Mateo. In both cases, MH01 does not contribute to Pueblo Alto basins/locations.
MH02	50%	50%	50%	0%	0%	0%	assumed 50% of MH basins intercepted by San Mateo SD
MH03	0%	0%	75%	0%	0%	0%	MH03 does not contribute to Summer or Adams; Assumed 25% captured by San Mateo SD & remaining 75% bypasses San Mateo and contributes to PA basins
MH04	0%	0%	50%	0%	0%	0%	MH04 does not contribute to Summer or Adams; assumed 50% runoff intercepted by San Mateo SD, because of the small basin size
MH05	75%	50%	50%	95%	95%	50%	assumed 25% of MH basins intercepted by San Mateo SD, and then only portion of that diverted from Summer to N-S streets
MH06	0%	0%	0%	0%	0%	0%	
MH07	25%	25%	25%	75%	75%	0%	
MH08	40%	40%	40%	75%	75%	50%	
PA01	0%	0%	0%	0%	0%	0%	
PA02	75%	100%	0%	0%	0%	0%	
PA03	100%	100%	0%	0%	0%	0%	
PA04	0%	0%	0%	0%	0%	0%	
PA05	75%	75%	20%	0%	0%	0%	
PA06	100%	100%	100%	0%	0%	0%	
PA07	20%	75%	100%	0%	0%	0%	Only portion of basin north of Summer can contribute to Summer
PA08	0%	0%	0%	0%	0%	0%	
PA09	0%	0%	0%	0%	0%	0%	
PA10	0%	0%	0%	0%	0%	0%	

Options Analysis - Runoff at Each Eval Location

Project Name: Pueblo Alto Drainage Analysis & Outreach

Project Number: 20220231

Prepared By: RGS

Date: 6/21/2022

Location #	Location ID	Q (CFS)			V_{6hr} (AC-FT)			V_{24hr} (AC-FT)		
		2-yr	10-yr	100-yr	2-yr	10-yr	100-yr	2-yr	10-yr	100-yr
1	1-SUMMER	117	224	389	5.4	9.3	15.7	6.7	10.8	17.5
2	2-ADAMS	118	227	396	5.4	9.4	15.8	6.7	10.8	17.5
3	3-ALLEYS	106	199	344	4.8	8.3	14.0	6.0	9.6	15.6
4	4-LA VETA	90	163	277	4.2	7.1	11.8	5.3	8.3	13.4
5	5-ALVARADO	86	157	267	4.1	6.9	11.4	5.1	8.1	12.9
6	6-CARDENAS	41	76	128	1.9	3.3	5.5	2.5	3.9	6.2

ATTACHMENT C – PRELIMINARY COST ESTIMATES

Preliminary Cost Estimate - Quantities

Project Name: Pueblo Alto Drainage Analysis & Outreach

Project Number: 20220231

Prepared By: RGS

Date: 5/26/2022

Color Key

Input	Linked Cell	Calculation

Location	Bumpout in Existing Roadway (FT)	Bumpout Extended into Right-of-Way (FT)	Underground Storage (CF)	Permeable Pavement (Full Road) (SF)	Permeable Pavement (w/ Bumpout) (SF)
1	1800	1800	0	78000	57000
2	900	900	11000	41000	30000
3	1700	1700	23000	0	0
4	300	300	23000	0	0
5	1700	1700	0	75000	55000
6	1300	1300	0	60000	44000

*full bumpout length, not reduced for ends

Preliminary Cost Estimate - Costs

Project Name: Pueblo Alto Drainage Analysis & Outreach

Project Number: 20220231

Prepared By: RGS

Date: 6/23/2022

Input	Linked Cell	Calculation

Location	Unit Cost ($/X)	Bumpout in Existing Roadway ($/LF) $ 350.00	Bumpout Extended into Right-of-Way ($/LF) $ 600.00	Permeable Pavement ($/SF) $ 67.00	Underground Storage ($/CF) $ 31.00	Bumpout in Existing Roadway with Underground Storage
1		$ 630,000	$ 1,080,000	$ 5,226,000	$ -	-
2		$ 315,000	$ 540,000	$ 2,747,000	$ 341,000	$ 656,000
3		$ 595,000	$ 1,020,000	$ -	$ 713,000	$ 1,308,000
4		$ 105,000	$ 180,000	$ -	$ 713,000	$ 818,000
5		$ 595,000	$ 1,020,000	$ 5,025,000	$ -	-
6		$ 455,000	$ 780,000	$ 4,020,000	$ -	-

	Unit Cost ($/X)	SW Harvesting Basin ($/LF) $ 1,170.00	Permeable Pavement ($/SF) $ 67.00	Underground Storage ($/CF) $ 31.00	Total Pocket Park Cost
	Length (ft)				
4 - Pocket Park	300	$ 351,000	$ -	$ 713,000	$ 1,064,000

APPENDIX I

Additional Green Stormwater Infrastructure Resources

Green Stormwater Infrastructure Resources

The Pueblo Alto Mile Hi Stormwater Interventions website also provided the public with in-depth resources on local expert organizations, GSI best practice handbooks, water utility authority incentives, and instructional videos. The following is a list of green stormwater infrastructure resources accessible to the community at large.

Manuals

- Bernalillo County Green Stormwater Infrastructure; Low Impact Design Strategies for Desert Communities
- Green Infrastructure for Southwestern Neighborhoods; Watershed Management Group
- Greater Phoenix Metro Green Infrastructure Handbook; Low Impact Development Details for Alternative Stormwater Management
- Build Your Own Basin; Watershed Management Group

Organization Websites

- Arid LID Coalition; Low Impact Development in the Middle Rio Grande Watershed: https://aridlidcoalition.org/
- ABQ Backyard Refuge Program: https://friendsofvalledeoro.org/abq-backyard-refuge/
- Albuquerque Bernalillo County Water Utility Authority Rebates: https://www.abcwua.org/conservation-rebates-rebates/

Instructional Videos

- Introduction to Residential Rainwater Harvesting Training: https://www.youtube.com/watch?v=jLGPB3jRJHo
- Rainwater Harvesting and Management: https://www.youtube.com/watch?v=rKt_yllqQFg