

COMMUNITY GREENING PLAN



for Avondale Borough, Pennsylvania
April 2023

TABLE OF CONTENTS

INTRODUCTION 3

SECTION 1: EXISTING CONDITIONS 4

WATERSHED CONTEXT AND FLOOD MAPPING 4

BENEFITS AND LIMITATIONS OF GSI 4

LAND COVER 4

SITE VISIT 6

SECTION 2: COMMUNITY-LED RESEARCH RESULTS 7

RESEARCH BACKGROUND 7

RESULTS 7

SECTION 3: GREEN STORMWATER INFRASTRUCTURE OPPORTUNITY ANALYSIS 8

THE WATER CYCLE AND GREEN STORMWATER INFRASTRUCTURE 8

GSI OPPORTUNITY ANALYSIS PROCESS 8

TYPES OF GSI IN THE AVONDALE GREENING PLAN 9

GSI OPPORTUNITY ANALYSIS DISCUSSION 10

SECTION 4: FUTURE NEEDS AND POTENTIAL COLLABORATION OPPORTUNITIES 12

FUTURE NEEDS 12

COLLABORATION OPPORTUNITIES 12

CHESTER COUNTY PLANNING COMMISSION REVIEW AND INPUT 12

SECTION 5: PROJECT PRIORITIZATION 13

LIST OF FIGURES

FIGURE 1: AVONDALE LOCATION MAP 4

FIGURE 2: CHRISTIANA RIVER BASIN 4

FIGURE 3: FEMA FLOOD MAP 5

FIGURE 4: AVONDALE EXISTING CONDITIONS 6

FIGURE 5: SURVEY RESPONSES TO SURVEY QUESTION 15 (PREFERRED FLOOD REDUCTION/MITIGATION STRATEGIES) 7

FIGURE 6: SURVEY RESPONSES TO SURVEY QUESTION 22 (FUTURE CHANGES TO AVONDALE) 7

FIGURE 7: NATURAL WATER CYCLE 8

FIGURE 8: ALTERED WATER CYCLE 8

FIGURE 9: GREEN STORMWATER INFRASTRUCTURE OPPORTUNITIES PLAN 11

FIGURE 10: GSI PROJECT PRIORITIZATION MAP 13

LIST OF TABLES

TABLE 1: GREEN STORMWATER INFRASTRUCTURE OPPORTUNITIES SUMMARY 10

TABLE 2: NEEDS, POTENTIAL PARTNERSHIPS & FUNDING OPPORTUNITIES SUMMARY 12

TABLE 3: GSI PROJECT EVALUATION AND PRIORITIZATION 13

APPENDICES

APPENDIX A: COMMUNITY LED RESEARCH RESULTS SUMMARY

APPENDIX B: POMEROY RAIN GARDEN CONCEPT PLAN

INTRODUCTION

The White Clay Watershed Association (WCWA) received funding from the National Park Foundation to create a Community Greening Plan for Avondale Borough with a focus on incorporating climate equity and resilience into the overall Green Stormwater Infrastructure (GSI) plan. GSI, as defined by the 2019 Water Infrastructure Improvement Act, is “the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspire stormwater and reduce flows to sewer systems or to surface waters.” The WCWA Wild and Scenic Program engaged Meliora Design to develop this plan for Avondale Borough.

While GSI provides water resources benefits (e.g. reduces peak stormwater runoff, sediment and nutrient loads to receiving waters), it can have many other ancillary benefits, including:

- Increasing the number and amount of green spaces in urban areas
- Reducing infrastructure costs by addressing multiple community needs
- Improving pedestrian and bicycle safety
- Mitigating heat island by reducing impervious coverage
- Improving community aesthetics
- Creating habitat

This Community Greening Plan has been developed based on input from the local community. The WCWA partnered with River Network to utilize their Community- Led Research Toolkit to engage members of the community with planning processes that directly impact them. This outreach method moves away from the typical “community engagement” model and uses community-led research to center community members’ needs and experience in developing a shared understanding of how climate change impacts them and aids in identifying more equitable climate resilience strategies within the borough that garner community support and provide multiple benefits to those most directly impacted. The research results are summarized in Section 2 of this plan and have been used to inform the GSI types of practices selected in the area of opportunity analysis.

The goals of the projects recommended in this plan are to manage stormwater while improving the community. The majority of the projects identified overlap with other infrastructure improvements (e.g. sidewalk improvements) and are focused on improving the vegetative cover and community aesthetics.

This community greening plan is organized in the following sections:

Section 1 Existing Conditions: This section discusses the larger watershed context, the primary causes of flooding in Avondale and the potential impacts of GSI implementation in Avondale.

Section 2 Community-Led Research Results: This section summarizes the Community-Led research process and results.

Section 3 Green Stormwater Infrastructure Opportunity Analysis: This section summarizes the goals of GSI, the opportunity analysis process and the results of the analysis. Sixteen potential GSI projects were identified.

Section 4 Additional Needs, Potential Partnerships & Potential Funding Sources: This Section summarizes the future community needs uncovered during the developing of this plan, organizations to partner with for implementation and potential grant opportunities.

Section 5 Project Prioritization This Section provides a prioritized list of the identified GSI projects.



Pomeroy Park, Avondale Borough

SECTION I: EXISTING CONDITIONS

WATERSHED CONTEXT AND FLOOD MAPPING

Avondale Borough is located in Southern Chester County, Pennsylvania, approximately 30 miles southwest of Philadelphia (see Figure 1). The Borough is nestled between the East Branch of White Clay Creek and an Unnamed Tributary of the East Branch of White Clay Creek.

The East Branch of White Clay Creek is classified by PA Code Chapter 93 as Cold Water Fisheries (CWF) and is listed as impaired on the Pennsylvania Department of Environmental Protection's eMapPA and 2022 Integrated Report for siltation due to urban runoff/storm sewers, nutrients due to agriculture, and pathogens. The creek is within the Christina River Basin (see Figure 2), which has total maximum daily loads (TMDLs) for bacteria and sediment, nutrient and low dissolved oxygen under high-flow conditions, and nutrient and dissolved oxygen under low-flow conditions. The Christina River flows into the Delaware River just east of Wilmington, Delaware.

The Federal Emergency Management Agency (FEMA) maintains flood maps for many water bodies in the United States. The FEMA delineated flood areas in Avondale are noted on Figure 3. These FEMA maps identify the floodway as well as the 1% chance of flood area (Base Flood Elevation). According to the FEMA Flood Insurance Study for Chester County PA, revised September 29, 2017:

“Avondale Borough, Chester County: A substantial portion of the Borough is inundated by flood waters due to confluence of the East Branch of the White Clay Creek, Trout Run and Chatham Run. The bridges and culverts at Route 41 (Gap Network Pike) and the Rail Road crossing are undersized. The apartments at 1st Street and Route 41, located adjacent to the East Branch of the White Clay Creek, are most notable for being subject to serious flooding, primarily due to the bridge culvert cells downstream being blocked by sediment.”

In 2021, the WCWA applied for funding from the National Fish and Wildlife Federation to develop a targeted watershed assessment report and restoration plan for the 12-square mile drainage area above the main area of flooding in Avondale Borough. This study is currently underway and will be completed by the end of 2023.

BENEFITS AND LIMITATIONS OF GSI

GSI Practices are typically designed to capture smaller storms (1-1.5-inches of rainfall). These storms make up the majority of

storms that occur in a given year. GSI therefore manages stormwater from the majority of annual storms and has been shown to have water quality and ecological benefits. While GSI will play a role in the majority of storm events, it will have limited impact on the flood areas in Avondale during large storms. This is due to the size of these larger events, which will overwhelm and bypass the GSI, and the size of Avondale compared to the upstream drainage area (0.5 square miles out of 12 square miles).

While GSI within the Borough of Avondale will have little impact on the flood elevations, stormwater practices implemented on a watershed scale (implemented throughout Avondale's upstream 12-square mile drainage area) could have an impact on the flood elevations.

LAND COVER

Avondale Borough is approximately 0.5 square miles (320 acres). Impervious areas cover approximately 73 acres of the borough and include land cover such as streets, sidewalks driveways and roofs, . The pervious areas include forested areas, lawns and vegetated areas.

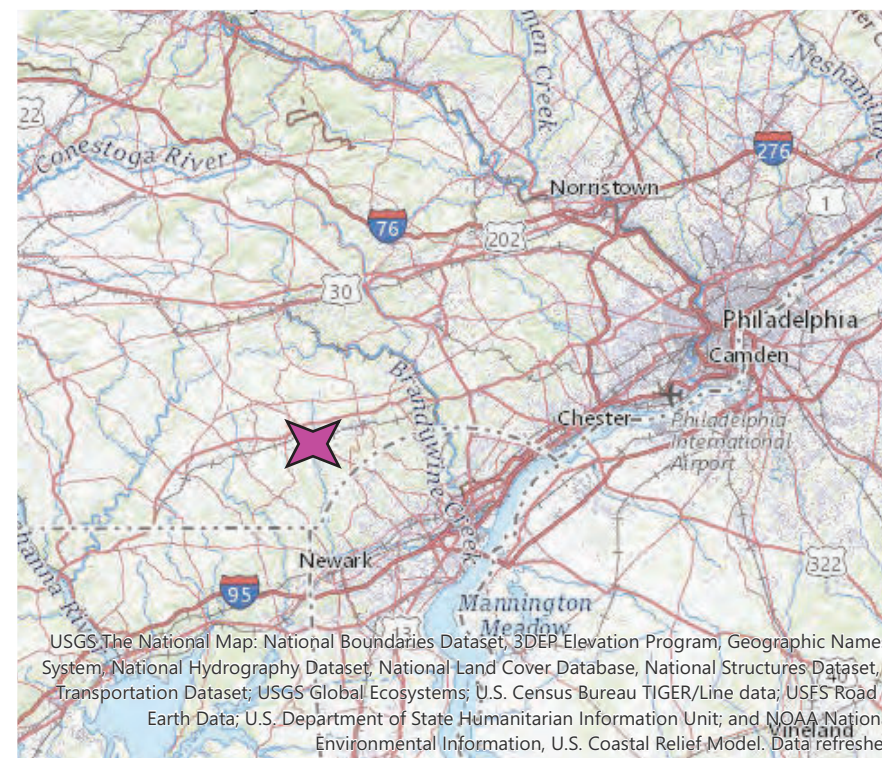


Figure 1: Avondale Location Map

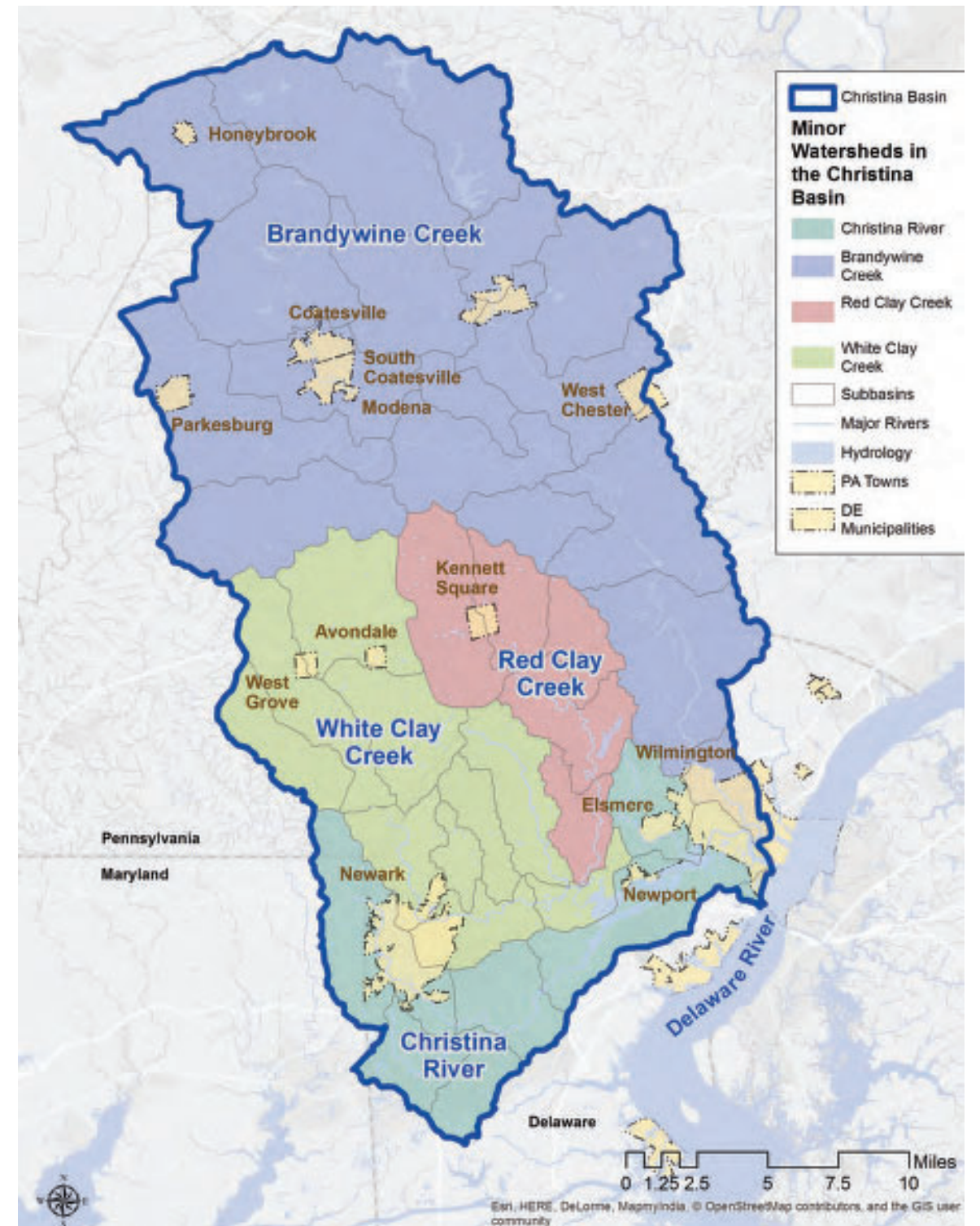


Figure 2: Christina River Basin

Source: <https://www.wrc.udel.edu/public-service/christina-basin-clean-water-partnership/>

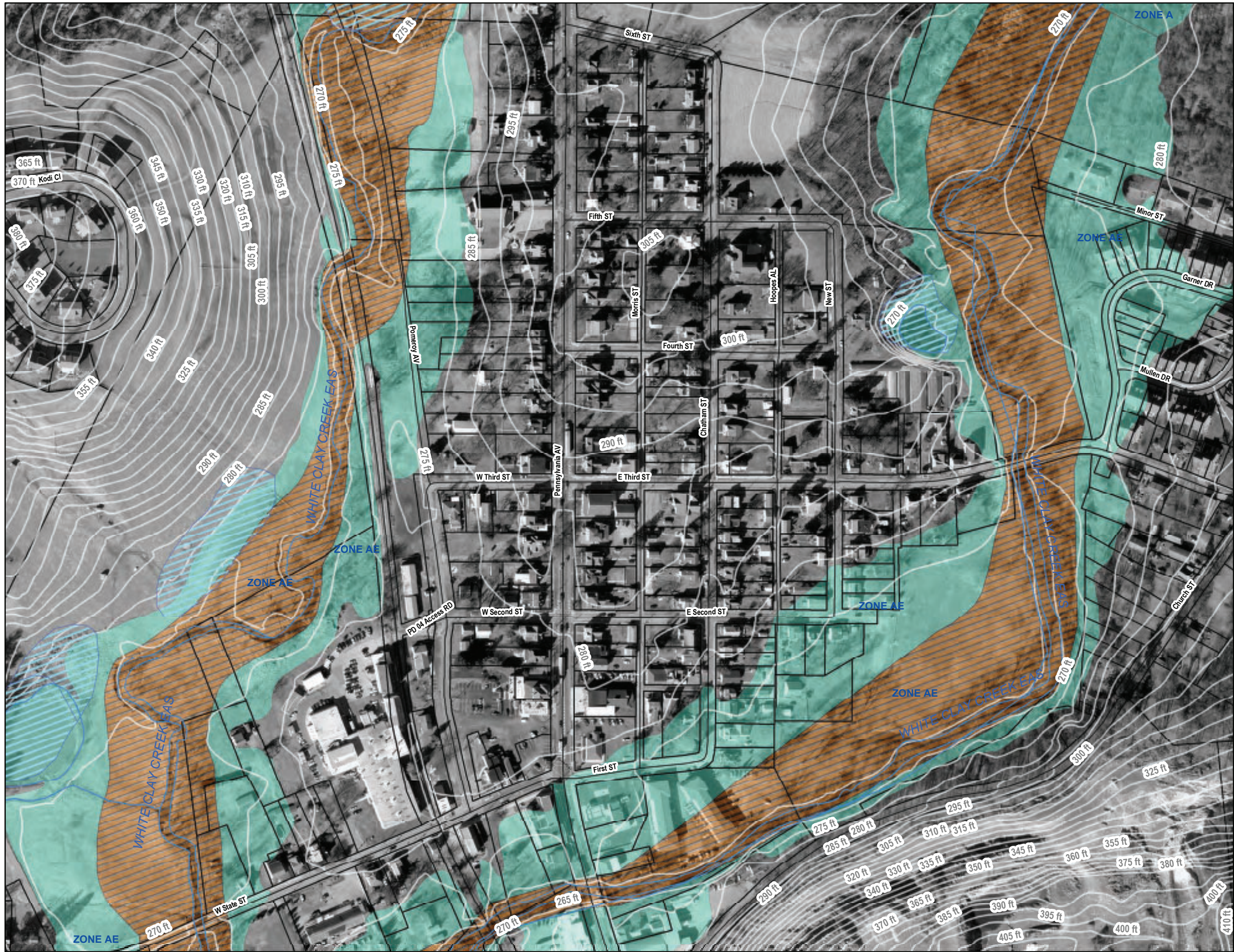


Figure 3: FEMA Flood Map

- Legend**
- Roads
 - Streams
 - ▨ Wetlands
 - ▭ Parcels
- FEMA Flood Hazards**
- ▭ A,
 - ▭ AE,
 - ▨ AE, FLOODWAY

0 60 120 240 Feet

1 inch = 240 feet

meliora

PAGE 5

SITE VISIT

On May 18, 2022, Meliora and the WCWA toured Avondale Borough to observe existing stormwater infrastructure, land cover and green infrastructure opportunities. Figure 4 is a map of Avondale with key observation photos. Additional observations include:

- Limited stormwater infrastructure (inlets and piping)
- Storm outlets filled with sediment
- Tree cover limited in some areas



SECTION 2: COMMUNITY-LED RESEARCH RESULTS

RESEARCH BACKGROUND

WCWA partnered with River Network to utilize their Community-Led Research Toolkit to better understand the impacts of flooding on community members and identify related needs and community improvement priorities. The goal of the community-led research is to better understand community members' needs and experiences and develop a shared understanding of personal impacts from climate change. This understanding will then be used to inform more equitable climate resilience and flood protection strategies within the borough.

The community-led research process included creating a team of community advisors, developing a survey along with the advisors, administering the survey to residents and analyzing the data. 104 responses were collected and analyzed. A full description of the project, the survey administered and the data analysis is provided in Appendix A.

The results of the community-led research have been used to inform the areas of GSI opportunity discussed in Section 3 of this plan. As noted in the introduction, GSI can be strategically implemented to improve community infrastructure while improving drainage patterns and downstream water quality. For example, increased tree cover can reduce the amount of stormwater runoff while improving community aesthetics and reducing heat island effects.

RESULTS

The survey results provided information on community demographics and impacts from flooding as well as community infrastructure uses and desires. The responses to questions 15 and 22 are particularly useful in providing direction for the development of the GSI areas of opportunity plan and are provided in Figures 5 and 6, respectively. Responses to the other survey questions have been used to further understand the community and additional needs. Survey questions 15 and 22 are as follows (the list of options for the respondent's to select from are provided in Appendix A):

Survey Question 15: What strategies would you most like to see used to reduce the impacts of flooding in your neighborhood? (check top 3)

Survey Question 22: In what ways would you like to see Avondale change in the future? (Select top five choices)

The top three responses to survey question 15 included improved street drainage, more green space and more affordable housing outside of the flood zones. While it should be noted that GSI in Avondale will have limited impact on the FEMA mapped base flood elevation. On the other hand, GSI can improve drainage and downstream water quality, while improving community infrastructure, for small storm events. Improved street drainage and more green space are addressed in Section 3 while more affordable housing outside of the flood zone is addressed in Section 4 of this plan.

The top five responses to survey question 22 included safer crosswalks, improved playgrounds, better paths to green/open spaces, more green space and more community gardens. In light of these responses a GSI demonstration project was identified and a grant was submitted to the Pennsylvania Department of Environmental Protection's Growing Greening Grant Program in June of 2022 and was awarded for the project. The demonstration project includes providing a rain garden in the lawn area parallel to Pomeroy Avenue. The project is intended to capture and infiltrate stormwater and increase the diversity of vegetation in the open space.

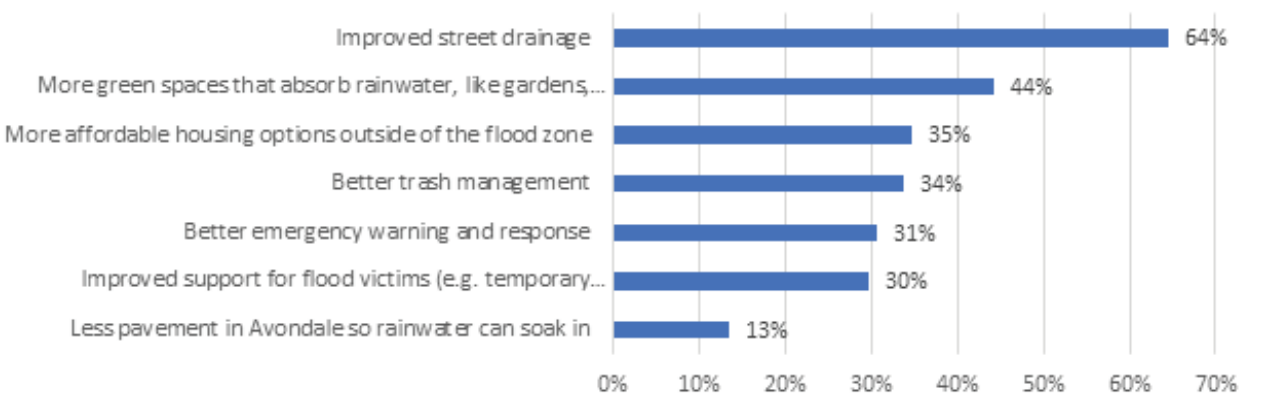


Figure 5: Survey Responses to Survey Question 15 (Preferred Flood Reduction/Mitigation Strategies)

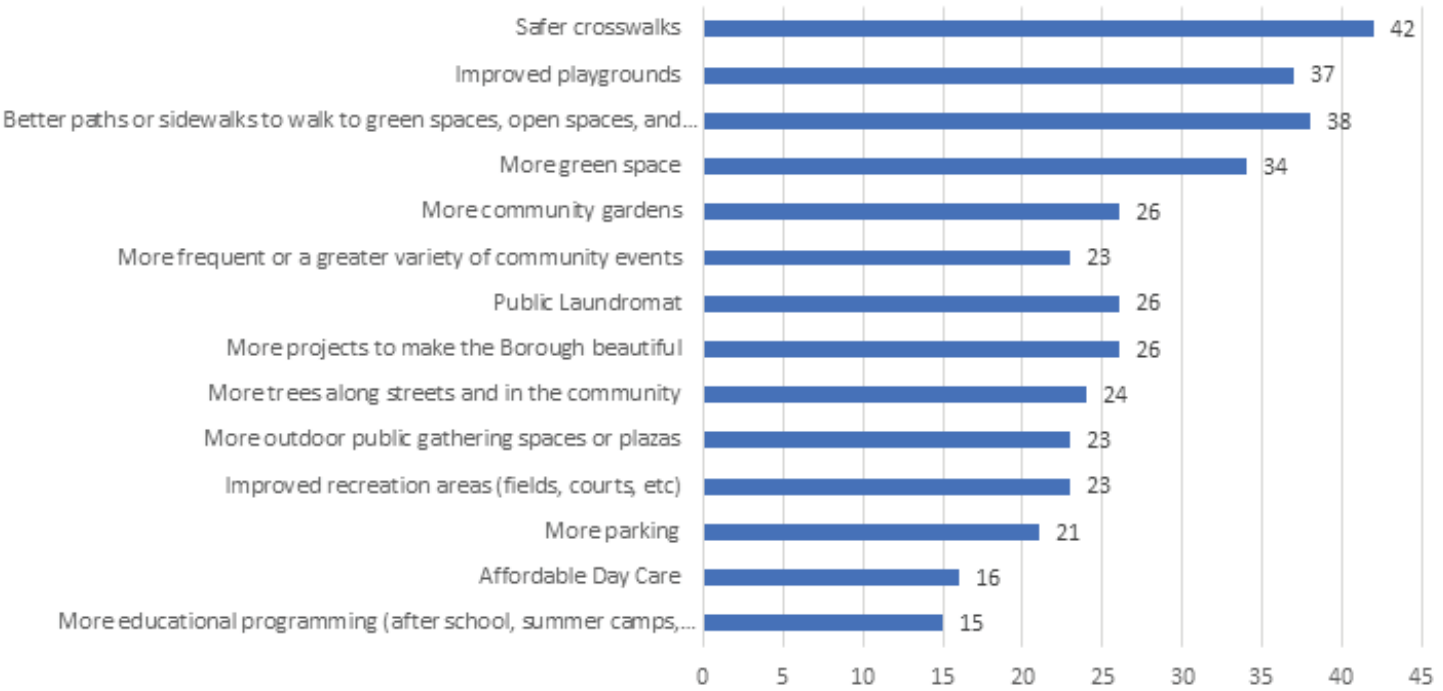


Figure 6: Survey Responses to Survey Question 22 (Future Changes to Avondale)

SECTION 3: GREEN STORMWATER INFRASTRUCTURE OPPORTUNITY ANALYSIS

THE WATER CYCLE AND GREEN STORMWATER INFRASTRUCTURE

The natural water cycle (before human development occurs) is shown in Figure 7. In the natural water cycle, rainfall infiltrates into the ground, vegetation transfers rainfall back into the atmosphere through evapotranspiration, and some rain flows over the ground surface as runoff. Human development has changed some of the earth's pervious land cover (vegetation) to impervious (pavement, roofs, etc.). The altered water cycle, shown in Figure 8, represents the movement of rainfall after human development has occurred. In the altered water cycle, less water moves through infiltration and evapotranspiration processes and more flows over the surface as runoff. The increase in surface runoff can cause increased downstream flooding and can also impact water quality as sediment and other pollutants are carried from the ground surface directly into surface waters.

Green Stormwater Infrastructure, which can include natural (e.g. plants, soil) or manmade (e.g. permeable pavement) systems, are implemented to mimic the natural water cycle. GSI focuses on capturing and holding runoff from small, frequent rainfall events, and manages runoff close to its source. GSI is a shift away from the stormwater management approach that uses hardened systems, such as underground pipes and hardened channels, to move water quickly away from developed areas and towards outfalls into adjacent surface waters. The goal of GSI is to reduce stormwater runoff volumes and increase infiltration into the soil.

GSI OPPORTUNITY ANALYSIS PROCESS

The following process was used to determine potential GSI implementation opportunities in Avondale Borough:

Step 1: Develop Watershed Understanding

First, the Avondale watershed drainage areas, storm sewer network, creek outlets, soils and land cover were reviewed. to determine the flow direction of stormwater runoff and potential for capture in GSI. The existing storm sewer system is shown on Figure 9. The following key observations were made:

- Storm Sewer Network: Avondale has a limited storm sewer network (shown on Figure 9) and majority of the Borough is drained by overland flow.
- Soils: The soils are primarily classified as urban land by the United States Natural Resources Conservation Service. Because of the limited storm sewer network, many of the subsurface GSI opportunities identified will not be able to discharge to the storm sewer network and will need to infiltrate into the soils. The infiltration capacity of the soils at specific GSI will need to be evaluated to confirm feasibility.

Step 2: Identify areas of Limited Opportunity

Next, areas to be eliminated from the analysis were identified; these areas include:

- FEMA floodway and floodplain: the floodway and floodplain were eliminated from the analysis due to potential GSI design and maintenance issues. These areas are shown on Figures 3 and 9.
- PennDOT Roadways: Pennsylvania Avenue (Rt 41) and Third Street are both state roads. Implementation of GSI within the PennDOT Right-of-Way (ROW) can be challenging due to coordination and PennDOT limitations on improvements, therefore these areas were eliminated from the analysis. These areas are shown in Figure 9. It should be noted that GSI opportunities adjacent to PennDOT roads have been included in this plan and could be partnered with PennDOT improvements.

Step 3: Visit Site to Determine GSI Opportunities

As noted in Section I, Meliora toured Avondale on May 18, 2022. Potential GSI areas of opportunity were identified and site conditions were observed. One location in Pomeroy Park was identified as an opportunity for a bioretention

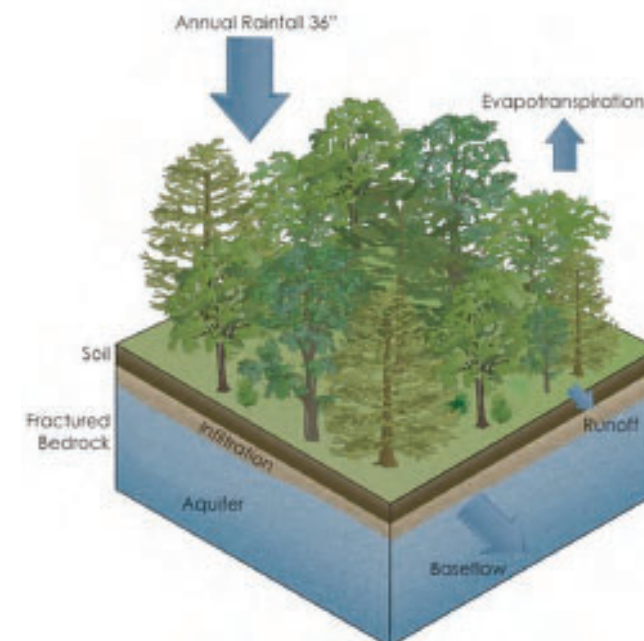


Figure 7: Natural Water Cycle

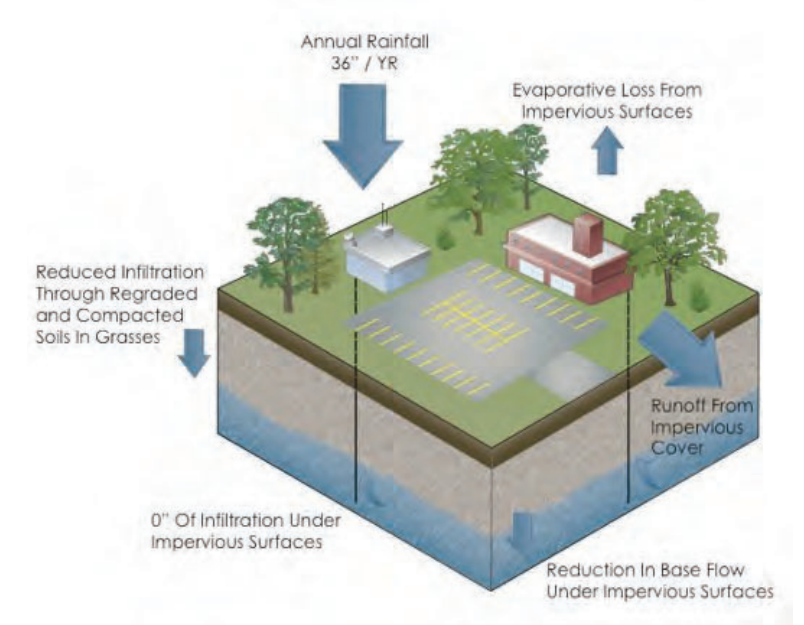


Figure 8: Altered Water Cycle

system; a concept was developed and submitted for a Growing Greener Grant which was awarded. This site was selected because the site is: 1) publicly owned, 2) can capture a moderate drainage area, 3) can be connected to an existing outfall, and 4) overlaps with the community desire for improved parks. The remaining identified areas of opportunity were evaluated for feasibility and additional areas were added as part of the desktop analysis.

Step 4: Perform Desktop Analysis

Drainage areas were delineated based on the initially field-identified locations and additional locations with the potential to capture a significant drainage area. The desktop analysis is an iterative process that includes the following sequence:

- a. Delineate drainage area to potential GSI locations.
- b. Determine initial GSI area size (footprint) based on an appropriate ratio of impervious drainage area to GSI footprint. A target loading ratio of 1:1 was used in this analysis.
- c. Identify locations that capture a feasible drainage area and evaluate the following site conditions:
 - Does the practice avoid FEMA Floodplain & State Roads
 - Is there any Borough owned property that can accommodate a practice?
 - Is the ROW wide enough between the existing road and existing property lines to accommodate potential GSI Practices. (a 5' set back from property lines was used)
 - Do the available online aerial maps show any utility conflicts?

YES to the items under (c) above = project is an ideal candidate for further design consideration.

NO, GSI may still be feasible but potential project cost should be weighed against limitations to capture stormwater. Project cost should be assessed on a dollar amount and per "greened" acre amount.

Note: Street "Greening" measures and landscape changes may still be feasible even when GSI is not. For example, the required GSI measure may have a limited footprint, but for other reasons (aesthetic, traffic calming, etc.) additional pavement may be removed, trees planted, etc.

TYPES OF GSI IN THE AVONDALE GREENING PLAN

The following practices have been identified in the Avondale GSI plan. While there are other types of GSI practices, the options described below have been selected based on the opportunity to provide additional community benefits such as increased tree cover and improved vegetation.

BIORETENTION

Bioretention areas are vegetated, shallow surface depressions that use the interaction of plants, soil, and microorganisms to store, treat, reduce runoff volume, and reduce the flow rate of stormwater runoff. Bioretention systems are highly effective in reducing small storm runoff volume and improving water quality.



Woodlawn Library in Wilmington, DE in both dry and wet conditions

TREE TRENCH

A stormwater tree trench is a series of street trees planted in a continuously connected subsurface infiltration system. On the surface, a stormwater tree trench looks just like a series of street trees, typically within the ROW. In addition to providing stormwater management, tree trenches provide a much healthier soil system for urban trees by allowing the roots to expand laterally along the trench. Lack of soil volume in tree pits often limits urban tree size, health and longevity. This can be improved with tree trenches.



POROUS PAVEMENT

Porous pavement consists of a porous surface typically composed of asphalt, concrete, or pavers overlain on a sub-surface, open-graded stone storage/infiltration bed. Stormwater drains through the surface, is temporarily held in the voids of the stone bed, and then slowly drains into the underlying, uncompacted soils.



VEGETATED SWALE

A vegetated swale is an uncompacted, densely vegetated, earthen channel that is generally shallow. Its objective is to reduce stormwater flow velocity and volume, as well as improve water quality, with vegetation and possibly infiltration.



Vegetated Swale at the Trolley Station ACME in Wilmington, DE

GREEN ALLEYS

Alleys are often underutilized by traffic and utility companies, making them better candidates for GI than some busy streets. Greening an alley is comprised of either porous paving or at the very least some type of subsurface infiltration/slow release. Chicago, IL has published a Green Alley Handbook, which provides more detailed information on this concept.



<http://www.tc.gc.ca/eng/programs/environment-utsp-greeninglocaltransportation-237.htm>

RETENTIVE GRADING

Retentive grading are gentle berms that can be used on sites where steep overall slopes exist between the stormwater runoff source and the final outfall. Infiltration berms act as tools to create variation in the topography that will decrease runoff velocities, provide filtering of runoff pollutants, and potentially allow for infiltration. This has limited applicability in urban areas, but should be considered where there is more open space than typical vegetated areas within the ROW.



ADDITIONAL PRACTICES FOR STORMWATER AND WATER QUALITY IMPROVEMENT

There are additional practices, outside of green stormwater infrastructure, that can reduce stormwater runoff and improve downstream water quality. While not the focus of the analysis in this plan, these practices can be implemented in Avondale at a relatively low cost and can provide stormwater, aesthetic and educational value.

PAVEMENT REMOVAL

Removing pavement (i.e. asphalt, concrete) can be a cost-effective method for improving water quality and aesthetics of neighborhood. While pavement removal may not manage runoff from other impervious areas, it is inexpensive and can have significant benefits when applied throughout a drainage area.

RIPARIAN BUFFERS

Riparian buffers are vegetated areas surrounding a stream (or lake) that contain trees, shrubs or other perennials. Riparian buffers help to stabilize soil subsequently reducing erosion. Riparian buffers can also increase the local biodiversity and provide habitat.

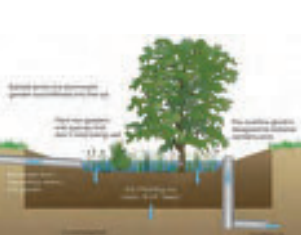
HOME-SCALE PRACTICES

Home-scale rain gardens and rain barrels can capture, store, infiltrate and can even provide for stormwater reuse. While these practices do not typically provide a significant stormwater impact they can have a large impact on community education.

RAIN GARDENS



Image: <https://www.epa.gov/soakuptherain/soak-rain-rain-gardens>



RAIN BARREL

GSI OPPORTUNITY ANALYSIS DISCUSSION

The Avondale GSI opportunities identified are summarized in Table I and shown in Figure 9. Table I summarizes each of the GSI types, drainage area characteristics, potential water quality improvements, planning level costs, cost per impervious square foot managed and potential overlap with climate, equity and community issues.

Sixteen potential GSI practices have been identified; the Pomeroy Park Bioretention project (DA 5) has already received a PADEP Growing Greener grant award and will be designed in 2023. The concept plan for this project is provided in Appendix B. The GSI opportunities are also noted as to their location on public property (Avondale Borough owned land), right-of-way (ROW) (streets and adjacent sidewalks) or private land. Of the sixteen (16) potential projects, eight (8) are in the ROW, four (4) are on public land, and four (4) are on private land.

The **public property projects** identified, in addition to the Pomeroy Park Bioretention system, include: 1) bioretention systems on the public works property (DA7 & DA10), and 2) subsurface system below the borough hall parking (DA 8). The public property projects could collectively manage 5.8 total acres, which includes 1.5 acres of impervious public land.

The **ROW projects** are primarily tree trenches due to the limited width of the available area with the exception of DA 2 which is a porous pavement alley. The tree trenches in the ROW are intended to be below the grass median

and under the sidewalk; sidewalk improvement (or installation) is provided with the installation of a tree trench. If the areas identified could be expanded into the street, any tree trench project could become a bump-out. Bump-outs can expand the GSI capacity and can provide traffic calming in addition to improved vegetation.

The **private land projects** include: 1) bioretention system at the northwest corner of the Pennsylvania Ave and West State Street intersection (1st Avenue), (DA 3A) 2) bioretention system in the grass area uphill of the storm inlet on the northeast corner of Pomeroy Avenue and West State Street (DA 3B), 3) tree trench at the Youth Center (DA 3C) and 4) retentive grading at the industrial/commerical building on the west side of the train tracks and north of West State Street (DA 9). Private land projects were identified in areas that would maximize capture of water from private impervious area while minimizing impact to existing land usage. Private land projects would require additional coordination and cooperation with land owners.

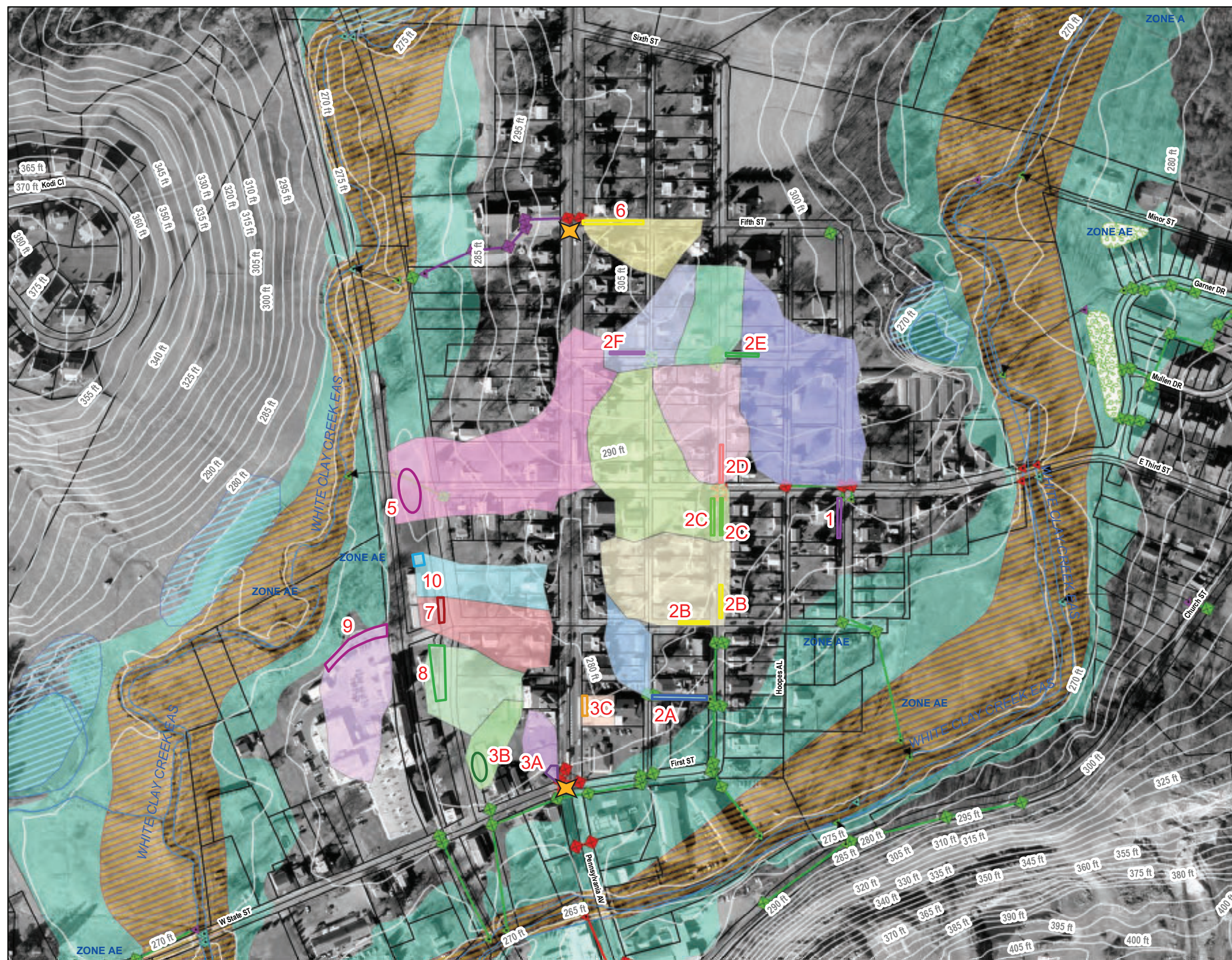
The projects identified are out of the FEMA floodway and floodplain and outside of the PennDOT ROW. While each of the projects are feasible from a planning level, additional utility locations, soil testing and evaluation of overlapping community infrastructure needs (sidewalk, street trees, traffic calming bump-outs) should be evaluated to determine the most feasible and cost effective projects to pursue.

Section 5 of this plan provides a prioritized list of the projects and incorporates the community led research results (Greening Plan Section 2) and the potential fundings sources (Greening Plan Section 4).

Table I: Green Stormwater Infrastructure Opportunities Summary

DRAINAGE AREA (DA)	GSI TYPE	GSI FOOTPRINT (SF)		DRAINAGE AREA (ACRES)			WATER QUALITY METRICS ¹			PLANNING LEVEL COSTS			Public/ROW/ Private	NOTES
				TOTAL	IMPERVIOUS	PERVIOUS	Sediment Reduction (lb/yr)	Phosphorus Reduction (lb/yr)	Nitrogen Reduction (lb/yr)	\$/SF GSI FOOTPRINT	TOTAL COST	\$/Impervious SF Managed		
DA 1	TREE TRENCH	899		2.90	0.38	2.52	1,163.20	2.54	18.32	\$ 150.00	\$ 134,850.00	\$ 8.14	ROW	New Street
DA 2A	POROUS PAVEMENT	1338		0.52	0.18	0.35	352.99	0.59	3.37	\$ 125.00	\$ 167,250.00	\$ 21.82	ROW (Alley)	Pervious Pavers
DA 2B	TREE TRENCH	482	638	1.59	0.25	1.34	689.99	1.44	10.07	\$ 150.00	\$ 168,000.00	\$ 15.57	ROW	2nd Street and Chatham Tree Trench
DA 2C	TREE TRENCH	803	591	2.22	0.48	1.74	1,140.84	2.17	14.15	\$ 150.00	\$ 209,100.00	\$ 10.03	ROW	3rd Street and Chatham Tree Trench (South)
DA 2D	TREE TRENCH	778		1.31	0.19	1.11	549.65	1.17	8.25	\$ 150.00	\$ 116,700.00	\$ 14.02	ROW	3rd Street and Chatham Tree Trench (North)
DA 2E	TREE TRENCH	646		0.78	0.19	0.59	427.83	0.79	4.97	\$ 150.00	\$ 96,900.00	\$ 11.79	ROW	4th Street and Chatham Tree Trench
DA 2F	TREE TRENCH	516		0.84	0.17	0.67	419.21	0.81	5.33	\$ 150.00	\$ 77,400.00	\$ 10.32	ROW	4th Street and Morris Tree Trench
DA 3A	BIORETENTION	842		0.28	0.28	-	430.33	0.53	1.90	\$ 75.00	\$ 63,150.00	\$ 5.27	Private	Private Parking Lot Conversion
DA 3B	BIORETENTION	2021		0.42	0.29	0.13	480.72	0.65	2.79	\$ 75.00	\$ 151,575.00	\$ 12.03	Private	Parking Lot Rain Garden
DA 3C	TREE TRENCH	646		0.15	0.15	0.00	241.20	0.30	1.07	\$ 150.00	\$ 96,900.00	\$ 14.42	Private	Youth Center
DA 5	BIORETENTION	4679		3.08	0.76	2.32	1,711.06	3.13	19.66	\$ 75.00	\$ 350,925.00	\$ 10.59	Public	Rain Garden Pomeroy Park South
DA 6	TREE TRENCH	1316		0.72	0.17	0.55	391.18	0.72	4.59	\$ 150.00	\$ 197,400.00	\$ 26.47	ROW	5th Street and Morris Tree Trench, Potential for Improved Cross-Walk
DA 7	BIORETENTION	942		1.01	0.29	0.72	612.84	1.07	6.47	\$ 75.00	\$ 70,650.00	\$ 5.62	Public	Rain Garden Public Works South
DA 8	POROUS PAVEMENT	4568		0.92	0.29	0.63	601.86	1.02	5.93	\$ 125.00	\$ 571,000.00	\$ 44.46	Public	Underground Structure (Borough Hall)
DA 9	RETENTIVE GRADING	4230		1.25	1.14	0.11	1,276.59	1.35	11.43	\$ 40.00	\$ 169,200.00	\$ 3.40	Private	Private Infiltration Berm
DA 10	BIORETENTION	811		0.80	0.16	0.64	393.80	0.77	5.09	\$ 75.00	\$ 60,825.00	\$ 8.76	Public	Rain Garden Public Works North

1: PA DEP Developed Land Loading Rates for PA Counties (All other counties), lb/acre			
Land Cover	TSS	TP	Nitrogen
Impervious	1839	2.28	23.06
Pervious	264.96	0.84	20.72
GSI Removal Rates from PADEP Stormwater BMP Manual:			
GSI	TSS	TP	NO3
Bioretention	85%	85%	30%
Tree Trench	85%	85%	30%
Porous Pavement	85%	85%	30%
Retentive Grading	60%	50%	40%



Avondale GI Plan Basemap

Legend

- Roads
- Streams
- Wetlands
- Existing BMPs
- Parcels
- FEMA Flood Hazards**
 - AE, FLOODWAY
 - A, 100-YR FLOODPLAIN
 - AE, 100-YR FLOODPLAIN
 - AO, 100-YR FLOODPLAIN
 - X/0.2 PCT ANNUAL CHANCE FLOOD HAZARD

Outfalls

- Municipal
- Private
- Road
- State

Storm Inlets

- Municipal
- Private
- State

Storm Lines

- Municipal
- Private
- State

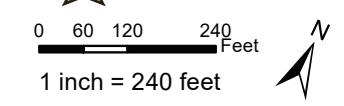
Drainage Areas

- DA1
- DA10
- DA2A
- DA2B
- DA2C
- DA2D
- DA2E
- DA2F
- DA3A
- DA3B
- DA3C
- DA5
- DA6
- DA7
- DA8
- DA9

GI Footprints

- 1
- 10
- 2A
- 2B
- 2C
- 2D
- 2E
- 2F
- 3A
- 3B
- 3C
- 5
- 6
- 7
- 8
- 9

★ Potential PennDOT crossing improvement



1 inch = 240 feet



Figure 9: Green Stormwater Infrastructure Opportunities Plan

SECTION 4: ADDITIONAL NEEDS, POTENTIAL SUPPORTING ORGANIZATIONS & POTENTIAL FUNDING OPPORTUNITIES

ADDITIONAL COMMUNITY NEEDS

The development of this Greening Plan, and the associated community-led research results, uncovered additional community needs in Avondale beyond GSI. The identified needs include:

- Floodplain buyout and/or housing relocation
- Flood hazard warning plan
- Flood hazard temporary housing
- Transportation connectivity plan (focused on walking and biking)
- Improved crossing over Route 41.
- Affordable Housing
- Resiliency and Environmental Justice Plan

POTENTIAL PARTNERSHIPS

The following local organizations have been identified as potential partners in the implementation of the Community Greening Plan and exploration of opportunities to provide the future needs listed above:

- Chester County Planning Commission
- The Garage Community Organization
- Boy Scouts
- Additional County, State and National Partners listed in table below.

POTENTIAL FUNDING OPPORTUNITIES

This greening plan and the additional future needs were discussed with Rachael Griffith, Sustainability Director at the Chester County Planning Commission. Rachael directed Meliora and the WCWA to resources for supporting organizations and funding sources. These needs and potential opportunities are summarized in Table 2.

Table 2: Needs, Potential Partnerships & Funding Opportunities Summary

AVONDALE BOROUGH NEED	POTENTIAL SUPPORTING ORANIZATIONS	POTENTIAL FUNDING SOURCES
Improved Tree Cover	Chester County Conservation District, White Clay Watershed Association	Keystone 10 Million Trees program, TreeVitalize program
		PA DCNR Rivers Conservation, Community and Watershed Forestry Grants
		FHWA Healthy Streets Program (has not yet been announced)
		National Fish and Wildlife Foundations' Delaware Watershed Conservation Fund
		PA DEP- Growing Greener Plus program PECO Green Region grant program
Improved Parks	Natural Lands, Brandywine Conservancy	Many of the above funding sources can also support park improvements
		Chester County Preservation Partnership Program
		PA DCNR Community Conservation Partnership Program
		PA DCED Greenways, Trails and Recreation Program
Improved Stormwater Drainage + GSI Infrastructure	Chester County Dept. of Community Development, White Clay Waterhsed Association Chester County Water Resources Authority,	ChesCo DCD Community Revitalization Fund
		PA H2O grants- funding for larger storm sewer and flood control projects
		PA Small Water and Sewer progam- includes storm sewer and flood control projects
		Transportation Alternatives Set-Aside Program
		US DOT's Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (Bipartisan Infrastructure Law)
		PA Redevelopment Capital Assistance Program PA DEP Growing Greener Plus program
Affordable Housing	Chester County Dept. of Community Development	Discuss with ChesCo Dept. of Community Development
Improved Pedestrian Crossing Over Route 41	PennDOT, Chester County Planning Commission	Transportation Alternatives Set-Aside Program
		PennDOT Multi-Modal Transportation Program
		PA DCED Multi-Modal Transportation Program
		Competitive Congestion Mitigation and Air Quality Improvement (CMAQ) Program- DVRPC
Pedestrian / Bicycle Connectivity to Route 1	PennDOT, Chester County Planning Commission	Transportation Alternatives Set-Aside Program
		PennDOT Multi-Modal Transportation Program
		PA DCED Multi-Modal Transportation Program
		Competitive Congestion Mitigation and Air Quality Improvement (CMAQ) Program- DVRPC



SECTION 5: PROJECT PRIORITIZATION

This section provides a prioritized list of projects that the Borough and WCWA can consider implementing in the future. Each GSI project was evaluated against the factors listed in Table 3 and ranked according to the rating system below the table.

Neighborhood beautification, impervious area managed and implementation simplicity were given highest priority due to the goal of the greening plan to manage stormwater while improving Avondale. Cost effectiveness was considered next and weighed against the other factors, including adjacent to potential cross walk improvements and improved sidewalks. This prioritized list of GSI projects should be considered alongside other goals and capital improvement projects in Avondale.

Table 3: GSI Project Evaluation and Prioritization

GIS NO.	GSI DESCRIPTION	COMMUNITY-LED RESEARCH FACTORS			STORMWATER AND IMPLEMENTATION FACTORS		
		COMMUNITY BEAUTIFICATION	IMPROVED SIDEWALKS	ADJACENT TO POTENTIAL CROSS WALK IMPROVEMENTS	IMPERVIOUS AREA MANAGED (ACRES)	IMPLEMENTATION SIMPLICITY (PUBLIC, ROW, PRIVATE)	COST EFFECTIVENESS (\$/IMPERVIOUS MANAGED)
1	POMEROY PARK RAIN GARDEN						
2	NEW STREET TREE TRENCH						
3	PUBLIC WORKS SOUTH RAIN GARDEN						
4	PUBLIC WORKS NORTH RAIN GARDEN						
5	5TH & MORRIS TREE TRENCH						
6	1ST STREET BIORETENTION						
7	3RD & CHATHAM TREE TRENCH (SOUTH)						
8	2ND & CHATHAM TREE TRENCH						
9	3RD & CHATHAM TREE TRENCH (NORTH)						
10	4TH & CHATHAM TREE TRENCH						
11	4TH & MORRIS TREE TRENCH						
12	YOUTH CENTER TREE TRENCH						
13	POMEROY BIORETENTION						
14	PRIVATE PROPERTY RETENTIVE GRADING						
15	BOROUGH HALL POROUS PAVEMENT						
16	2ND ST ALLEY POROUS PAVEMENT						

RATING SYSTEM	
HIGH	
MEDIUM	
LOW	

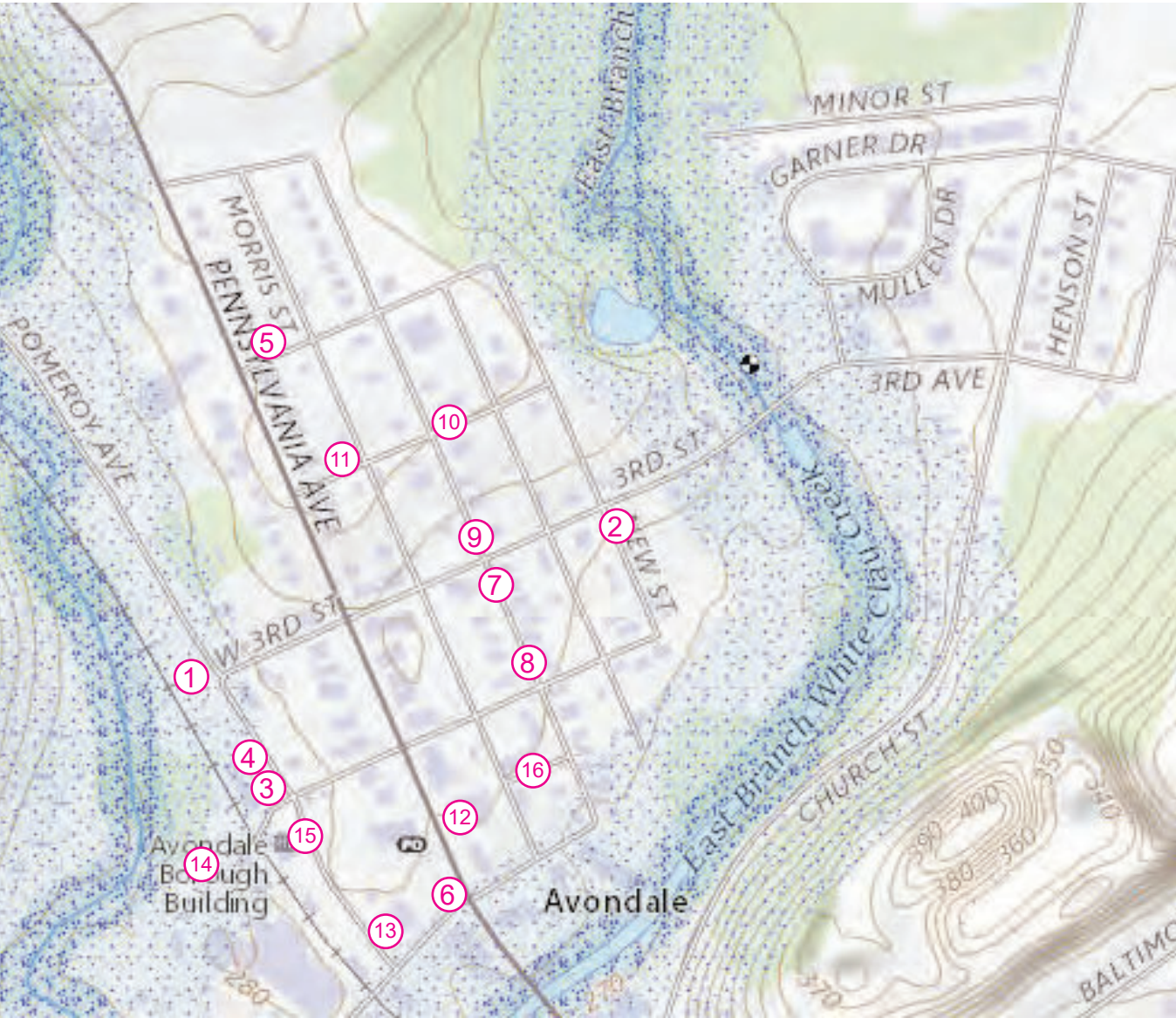


Figure 10: GSI Project Prioritization Map

APPENDIX A: COMMUNITY LED RESEARCH SUMMARY

Developing an Equitable Community Greening Plan for Avondale Borough Using Community Led Research.

An environmental justice community with a large Hispanic population (73%), Avondale Borough experiences frequent and intense flooding at the confluence of the east and west forks of White Clay Creek, a federally designated Wild and Scenic River. As a result, a significant number of borough residents have experienced evacuations from their homes on multiple occasions in recent years, sometimes being displaced for weeks and months at a time. As part of an effort to develop a community green infrastructure plan to mitigate flooding, the White Clay Watershed Association (WCWA) employed Community Led Research methods to better understand flooding impacts in the borough and other related needs and priorities of the community. The responses to the survey are guiding the green infrastructure plan, as well as informing local advocacy on several related issues like safe pedestrian corridors, improved emergency services, and additional affordable housing options outside of the flood zone.

Community-Led Research Details:

Utilizing the Community Led Research Toolkit and technical support from River Network, the White Clay Watershed Association created a team of advisors comprised of the Mayor and nonprofit leaders who either live or work within this community. Those partners includes representatives of The Garage Youth Center, Mighty Writers El Futuro, and Casa Guanajuato. Each advisor signed a contract and was provided a stipend for their time. The team met regularly from February through September of 2022 to develop a community outreach plan and survey, administer the survey, analyze the results, and develop a community engagement task list. Specifically, the team determined what information to collect from the community around flooding impacts on those who live and work in the Borough. The local knowledge and perspective provided by the advisory team members was invaluable in particularly in the interpretation and communication of the survey.

The final survey (Attachments A and B) was translated in both English and Spanish and incentives were offered to participants (\$15 gift cards) who completed the survey in person, which took about 20-30 minutes of their time. The survey was administered at various locations and community events such as vaccine clinics, food distribution lines, a youth center open house, and by canvassing the borough on weekends and evenings throughout the month of May. Most of these interactions were conducted person-to-person. The 'Data Collectors' (or canvassers) largely comprised of the 4 advisory team members, the watershed coordinator, and staff and students from The Garage. The Data Collectors were provided some training before administering the survey to participants. They also acted as interpreters when needed due to different dialects of Spanish spoken within the community. At the end of the canvassing period, the data collectors were provided visa gift cards for their time. Our goal was 100 responses, and by the end of May we had 104.

Data from the survey was analyzed using primary language as a proxy for ethnicity and informed our Community Greening Plan so that community needs and desires could be layered into the overall strategy (Attachment C). Additionally, the preliminary data was used to locate a greening demonstration project to be constructed in 2023. Finally, a Community Task List was included to address future advocacy efforts outside of the scope of this project. This task list highlights the key messages learned from the community surrounding flooding, housing, pedestrian safety, emergency

services, and other desired changes for the Borough by identifying key stakeholders, funding sources, and next steps.

ATTACHMENTS:

- A. Borough Map (used when administering the survey)
- B. Avondale Community Survey (English Version) and Data

ATTACHMENT A: Avondale Borough Map (used when conducting the survey)



Attachment B: Avondale Borough Community Survey and Data

Project Goals:

The goal of this project is to address the recurring flooding issues that are caused by stormwater in Avondale Borough. An important part of this work is to understand what is important to those who live and work in the community directly experiencing the impacts of flooding so that their needs and priorities can help guide the overall 'greening' plan (i.e. green stormwater infrastructure plan) that the White Clay Watershed Association (WCWA) will develop for the Avondale Borough. As a strategy, community-led research taps into the leadership, knowledge, and experience of the community to resolve the community challenges and maximize benefits to community members.

Section 1: Demographics/Housing Questions

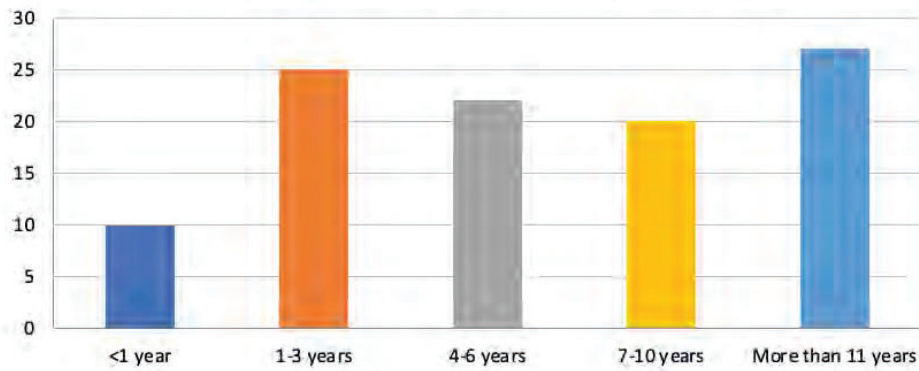
1. Do you live in or run a business in Avondale Borough?
 - a. Yes, I live there
 - b. Yes, I run a business
 - c. No (If no, thank you for your time, but you do not need to fill out this survey) **[skip to end of survey]**

2. If you live or operate a business in Avondale, which section of town do you live or work in? (Use the map to select section)
 - a. Section A
 - b. Section B
 - c. Section C
 - d. Section D

■ Section A ■ Section B ■ Section C ■ Section D

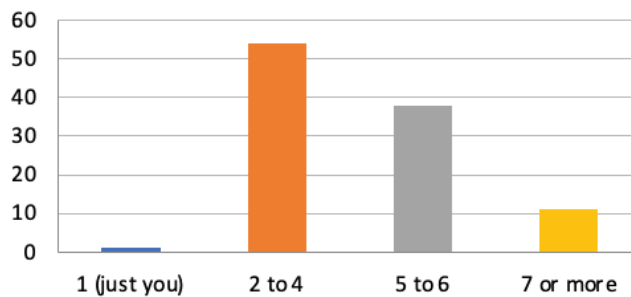


3. How long have you lived or operated a business in Avondale?
 - a. Less than a year
 - b. 1-3 years
 - c. 4-6 years
 - d. 7-10 years
 - e. More than 11 years



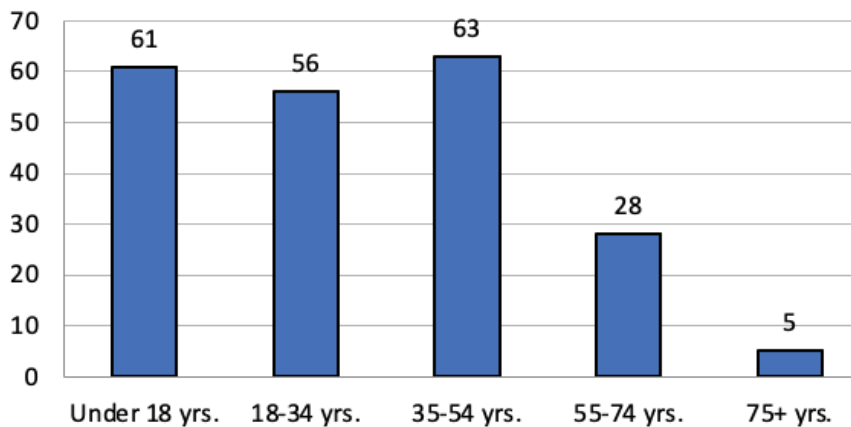
4. How many people live in your household?

- a. 1 (just you)
- b. 2-4
- c. 5-6
- d. 7 or more



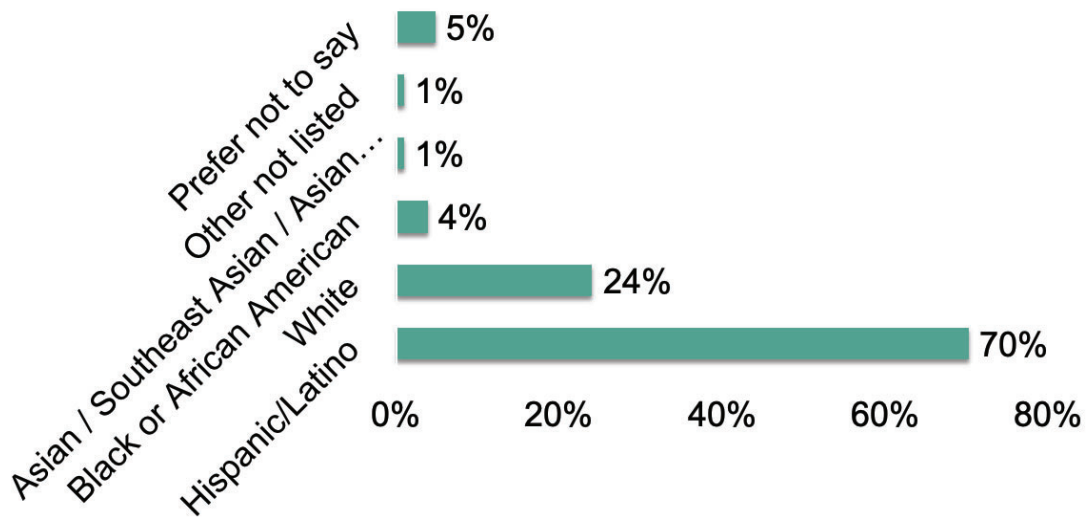
5. What are the ages of the people in your household? (check all that apply)

- a. Under 18 years old
- b. 18-34 years old
- c. 35-54 years old
- d. 55-74 years old
- e. 75+ years old



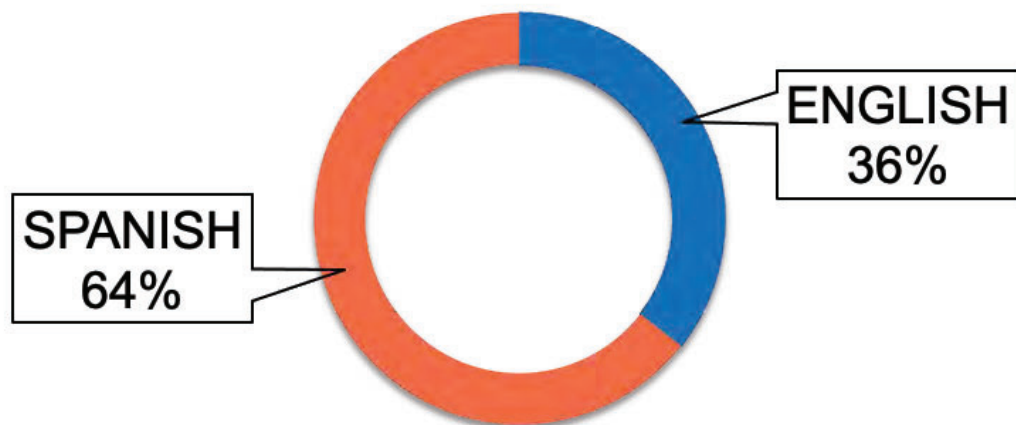
6. Which best describes your race or ethnicity? (check all that apply)

- a. Asian / Southeast Asian / Asian American
- b. Black or African American
- c. Hispanic/Latino
- d. White
- e. Other not listed
- f. Prefer not to say



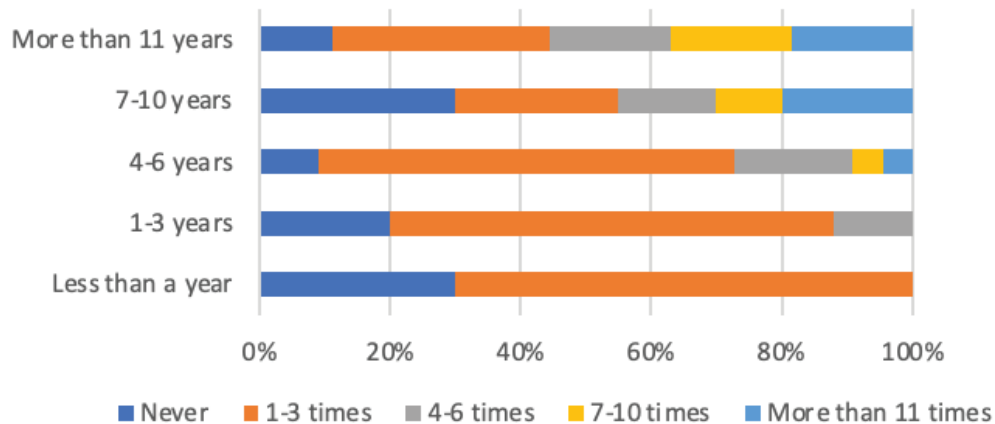
7. What is your primary language?

- a. English
- b. Spanish
- c. Other: _____



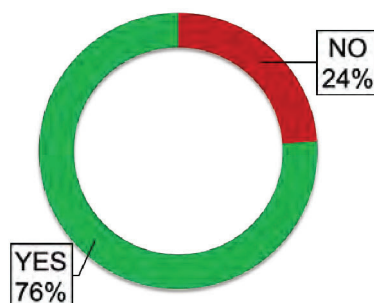
Section 2: Flooding Experience/Impacts

8. Since you have lived or operated a business in Avondale, how many times have you experienced flooding? (e.g. water ponding in the street, water entering homes, etc.)
- Never **[skip to Question #13]**
 - 1-3 times
 - 4-6 times
 - 7-10 times
 - More than 11 times



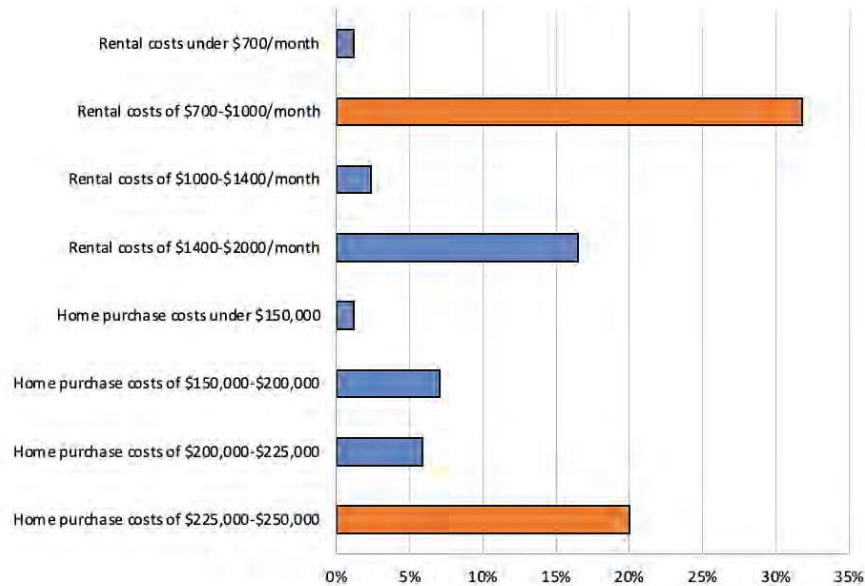
9. If you OWN your home, would you consider participating in a program that purchases your home so you may avoid flooding in the future?
- Yes
 - No
 - I need more information on this
 - Not applicable
10. If you RENT your home, would you consider relocating to another location to avoid future flooding?
- Yes
 - No
 - Maybe, it depends
 - Not applicable

(Combined Pie Chart for Q9&10 below)



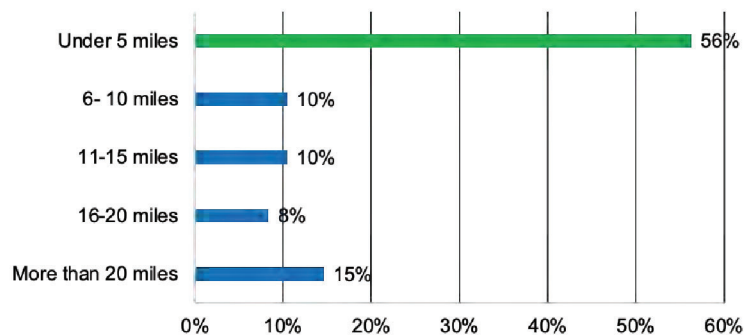
11. If you would consider relocating from your home to avoid future flooding, what housing costs would be affordable to your household? (check all that apply)

- a. Rental costs under \$700/month
- b. Rental costs of \$700-\$1000/month
- c. Rental costs of \$1000-\$1400/month
- d. Rental costs of \$1400-\$2000/month
- e. Home purchase costs under \$150,000
- f. Home purchase costs of \$150,000-\$200,000
- g. Home purchase costs of \$200,000-\$225,000
- h. Home purchase costs of \$225,000-\$250,000



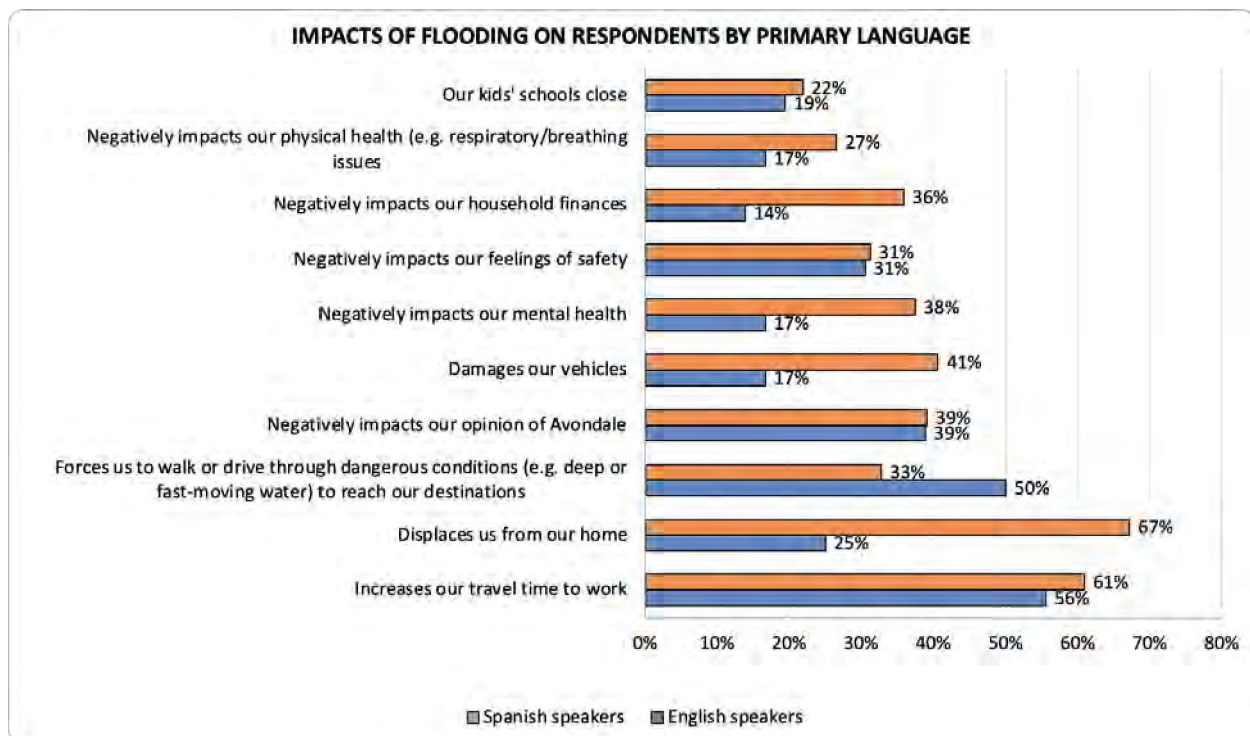
12. If you would consider relocating from your home to avoid future flooding, what is the furthest distance from Avondale Borough that you would be willing to consider? (check ONE)

- a. I would not consider relocating from Avondale
- b. Under 5 miles
- c. 6-10 miles
- d. 11-15 miles
- e. 16-20 miles
- f. More than 20 mi

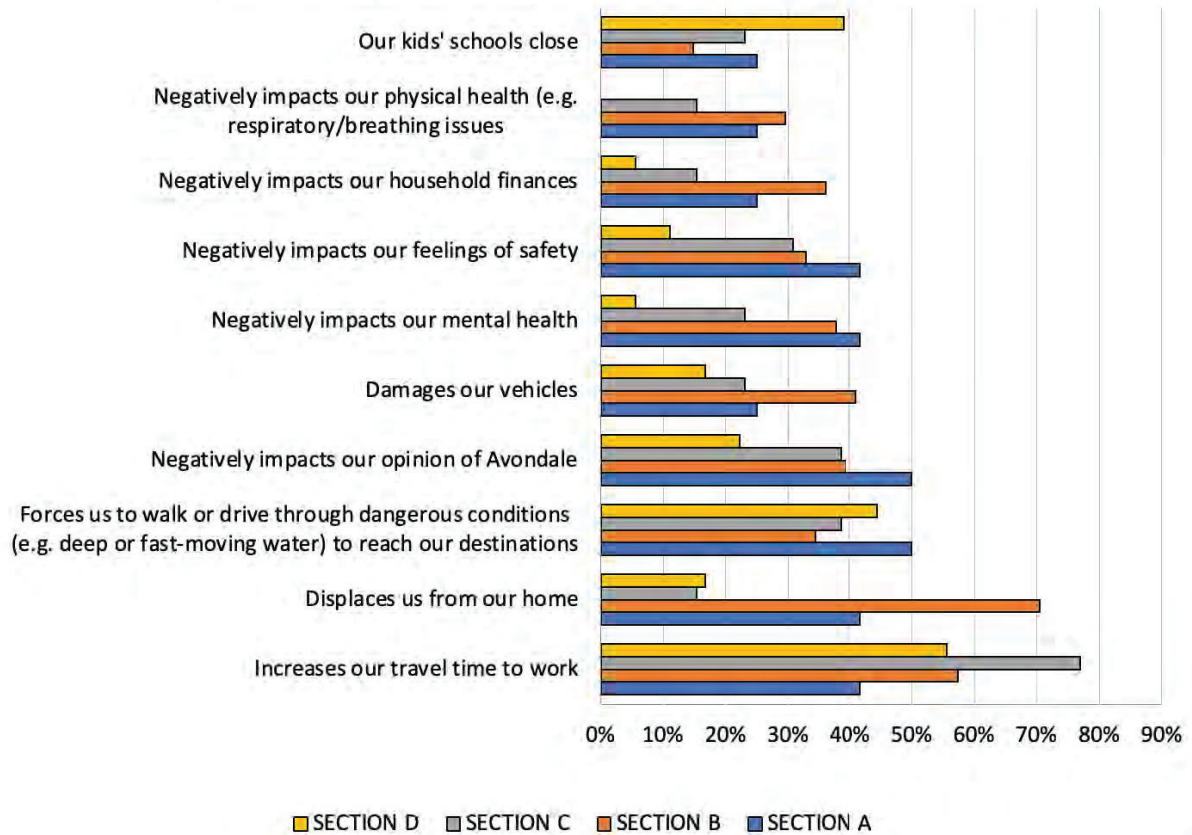


13. When Avondale floods, how does that affect you and members of your household? (check all that apply)

- a. Displaces us from our home
- b. Increases our travel time to work
- c. Our kids' schools close
- d. Forces us to walk or drive through dangerous conditions (e.g. deep or fast-moving water) to reach our destinations
- e. Damages our vehicles
- f. Negatively impacts our physical health (e.g. respiratory/breathing issues, other)
- g. Negatively impacts our mental health
- h. Negatively impacts our feelings of safety
- i. Negatively impacts our opinion of Avondale
- j. Negatively impacts our household finances

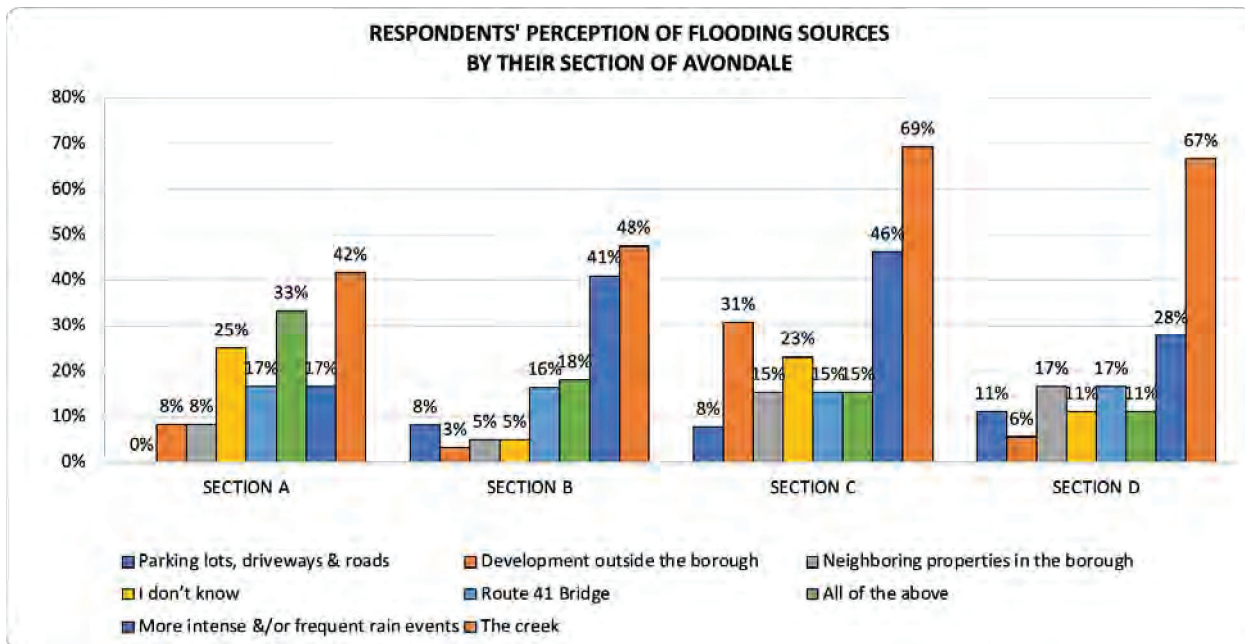
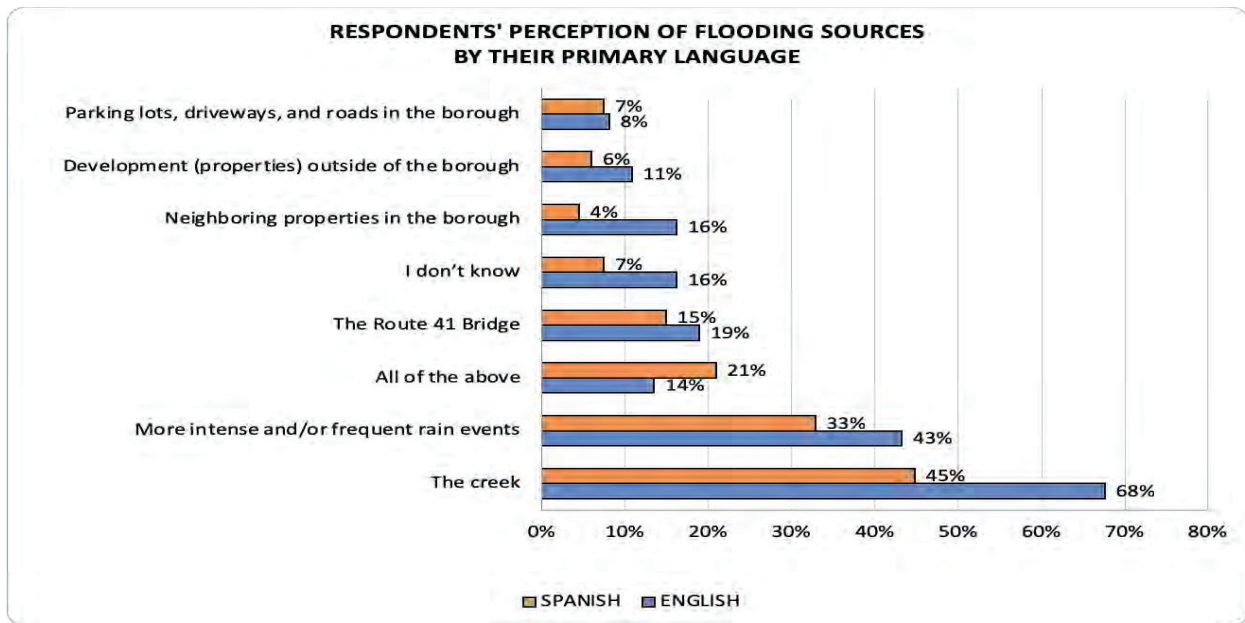


IMPACTS OF FLOODING ON RESPONDENTS BY SECTION OF AVONDALE



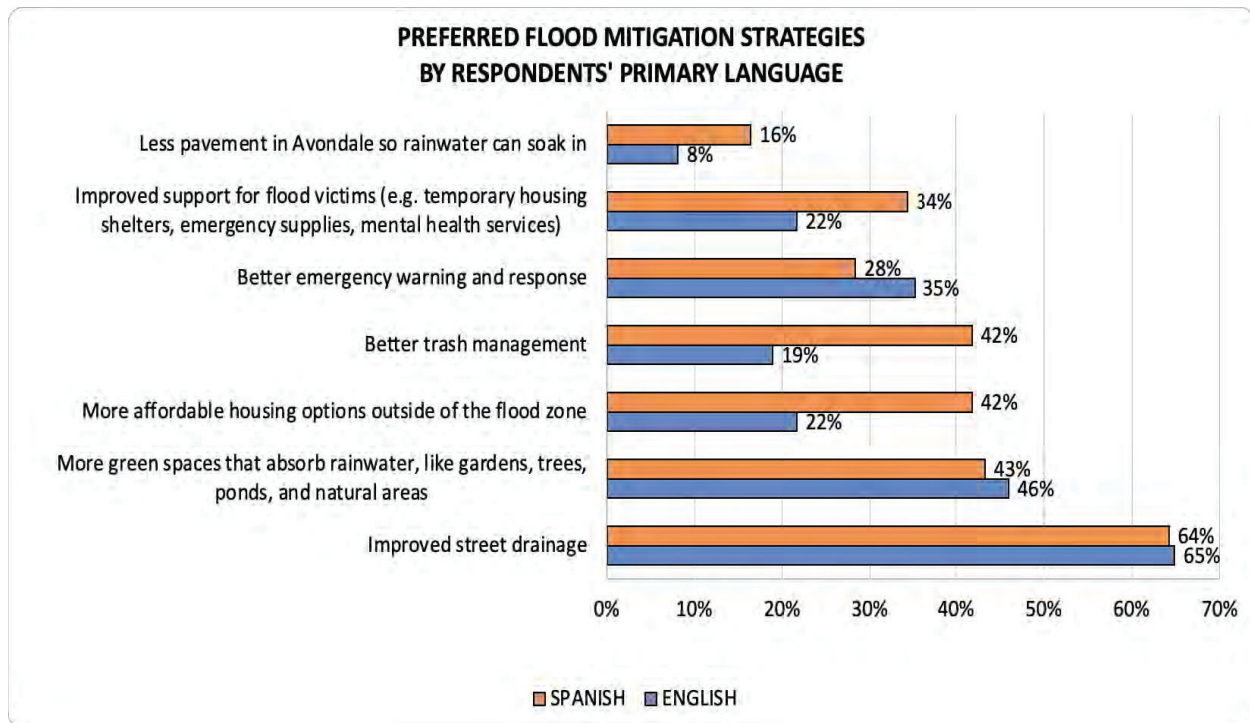
14. When Avondale floods, where do you think the water is coming from? (check all that apply)

- a. Parking lots, driveways, and roads in the borough
- b. Neighboring properties in the borough
- c. Development (properties) outside of the borough
- d. The creek
- e. More intense and/or frequent rain events
- f. The Route 41 Bridge
- g. All of the above
- h. I don't know
- i. Other: _____



15. What strategies would you most like to see used to reduce the impacts of flooding in your neighborhood? (check top 3)
- Improved street drainage
 - More green spaces that absorb rainwater, like gardens, trees, ponds, and natural areas
 - Better trash management
 - Less pavement in Avondale so rainwater can soak in
 - Better emergency warning and response
 - Improved support for flood victims (e.g. temporary housing shelters, emergency supplies, mental health services)

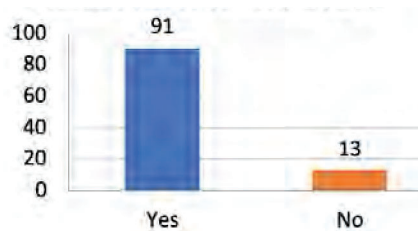
- g. More affordable housing options outside of the flood zone
- h. Other: _____



Section 3: Avondale Improvements

16. Do you have reasonable access to outdoor space in the community?

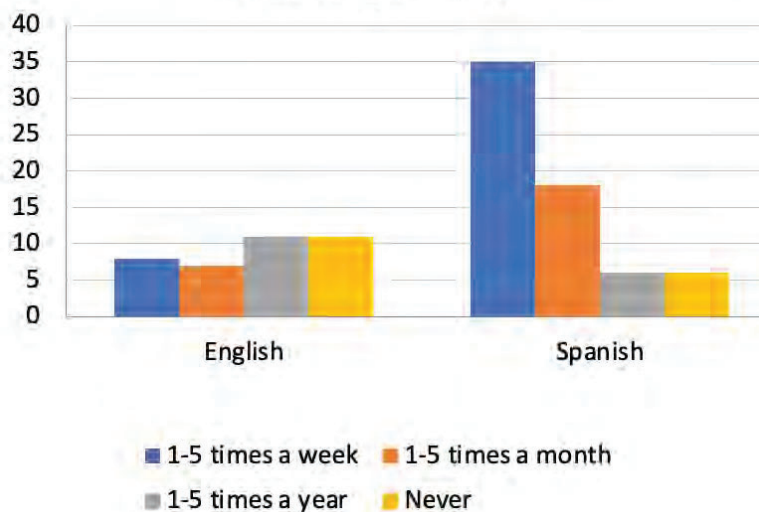
- a. Yes
- b. No



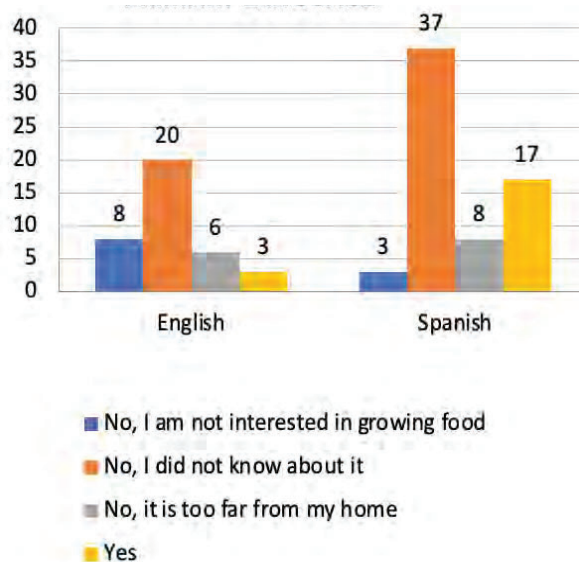
17. How frequently do you or other members of your household use the parks in Avondale?

- a. Never
- b. 1-5 times a week
- c. 1-5 times a month
- d. 1-5 times a year

**FREQUENCY OF PARK USE BY
PRIMARY LANGUAGE**

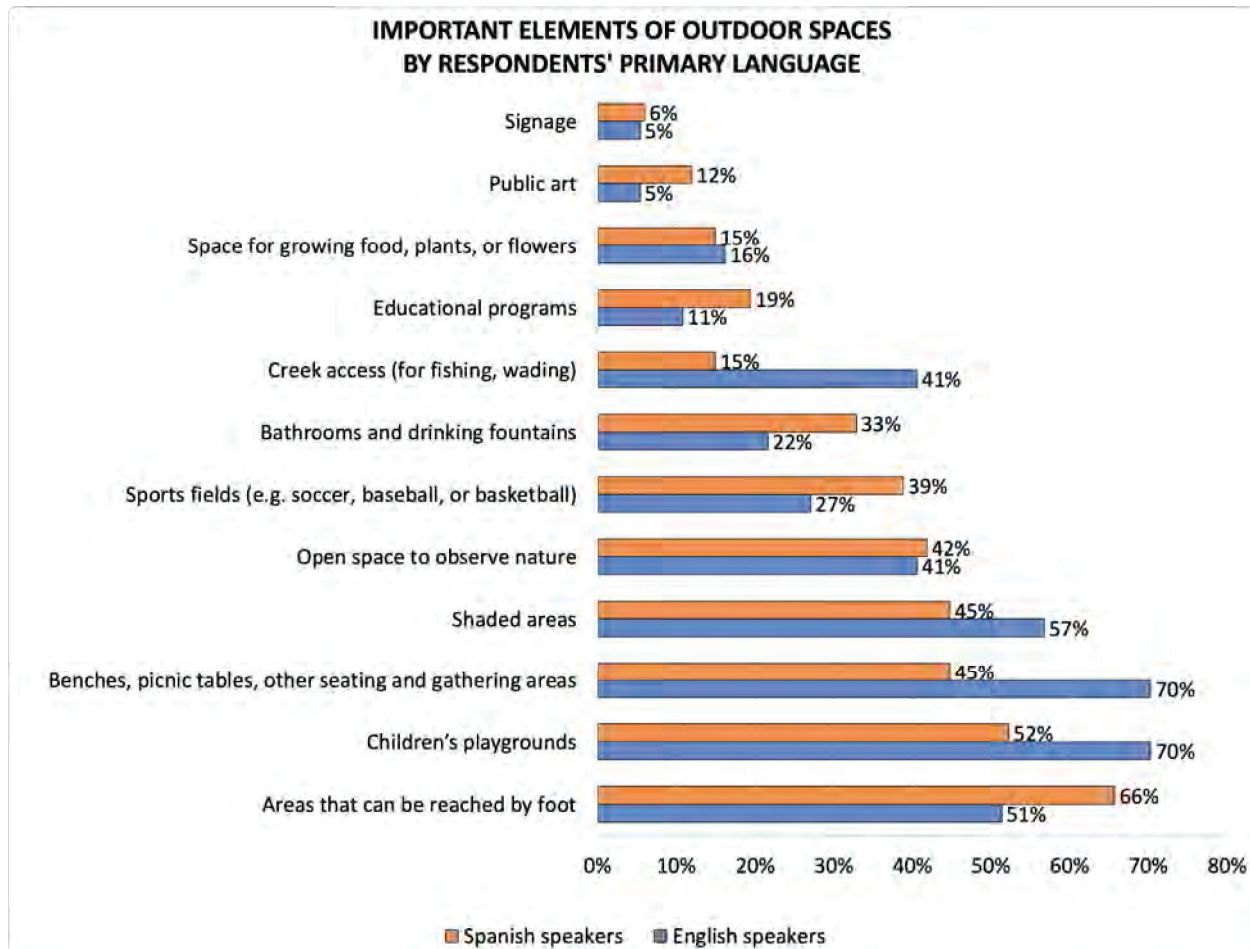


18. Do you utilize the community garden located on Pomeroy Avenue to grow food?
- Yes
 - No, it is too far from my home
 - No, I did not know about it
 - No, I am not interested in growing food

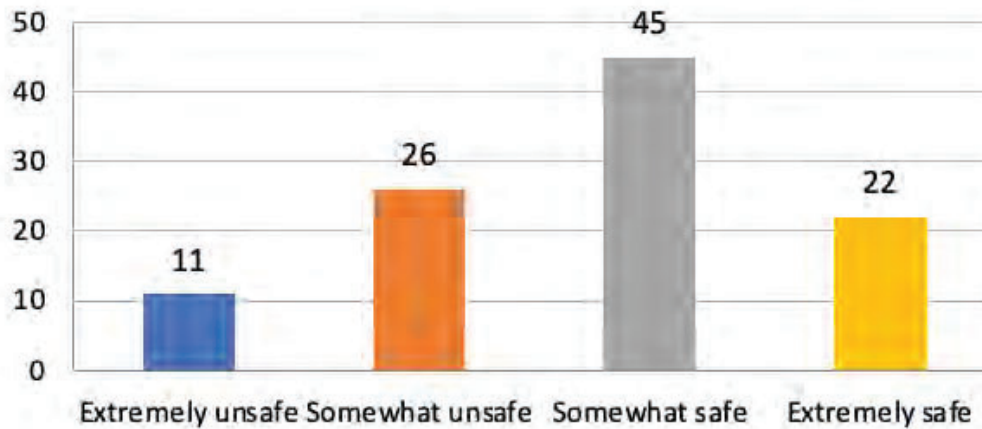


19. What is important to you in a park or an outdoor space? (Select top five choices)
- Areas that can be reached by foot
 - Benches, picnic tables, other seating and gathering areas
 - Children's playgrounds
 - Shaded areas
 - Open space to observe nature

- f. Creek access (for fishing, wading)
- g. Educational programs
- h. Signage
- i. Bathrooms and drinking fountains
- j. Space for growing food, plants, or flowers
- k. Public art
- l. Sports fields (e.g. soccer, baseball, or basketball)
- m. Other_____

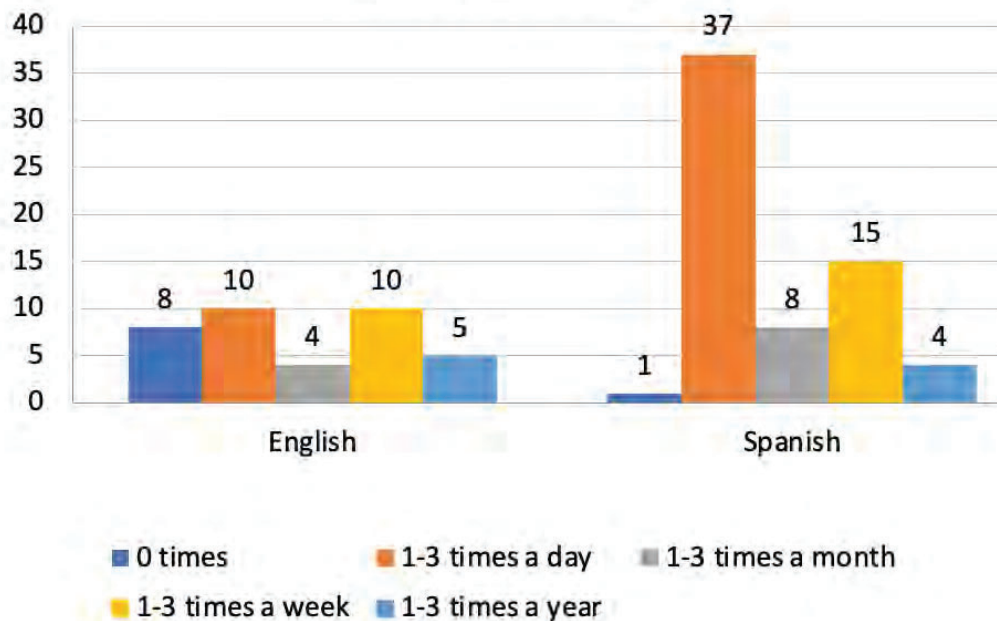


20. How safe do you feel when walking in Avondale considering current traffic levels and patterns?
- a. Extremely safe
 - b. Somewhat safe
 - c. Somewhat unsafe
 - d. Extremely unsafe



21. How often do you cross Route 41?

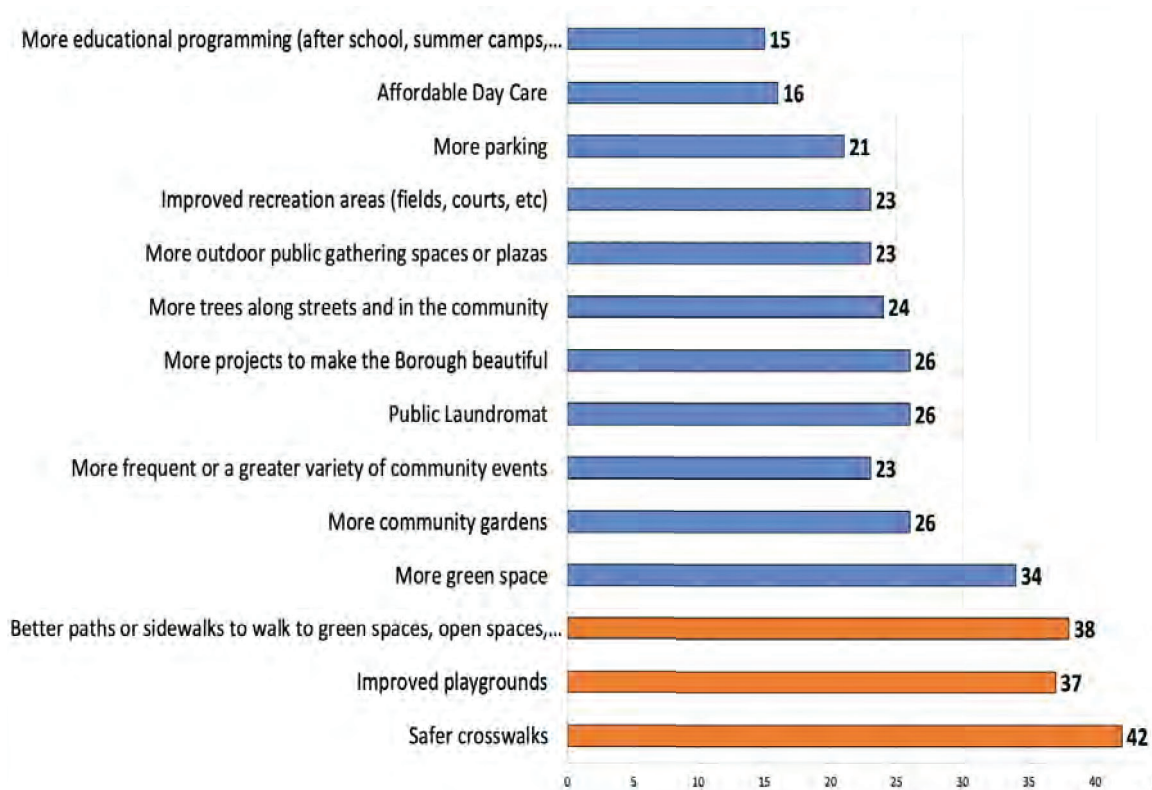
- a. 1-3 times a day
- b. 1-3 times a week
- c. 1-3 times a month
- d. 1-3 times a year
- e. Never



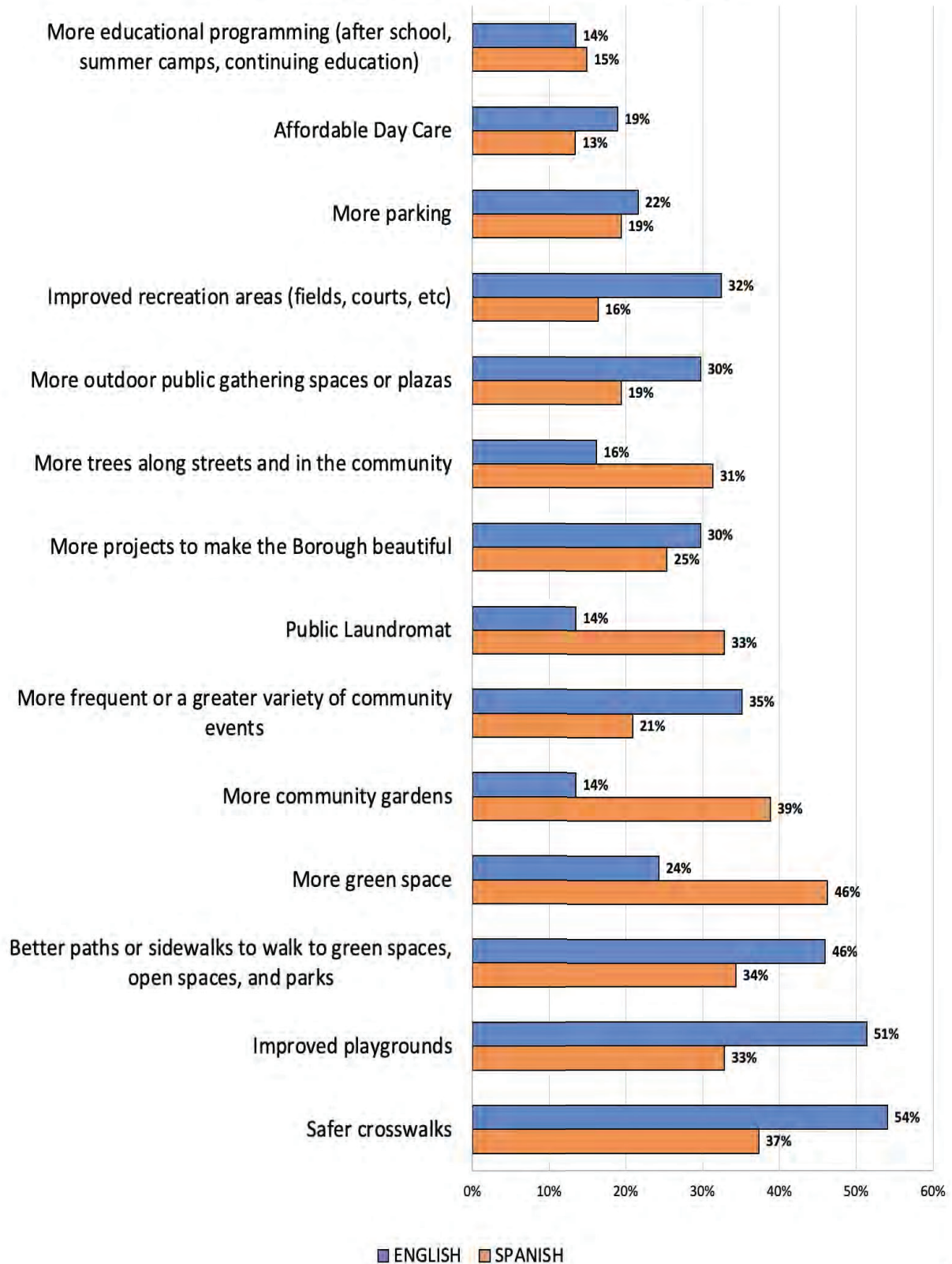
22. In what ways would you like to see Avondale change in the future? (Select top five choices)

- a. More green space
- b. More trees along streets and in the community
- c. More community gardens
- d. More projects to make the Borough beautiful
- e. Safer crosswalks
- f. More outdoor public gathering spaces or plazas
- g. More parking

- h. Better paths or sidewalks to walk to green spaces, open spaces, and parks
- i. More frequent or a greater variety of community events
- j. More educational programming (after school, summer camps, continuing education)
- k. Improved playgrounds
- l. Improved recreation areas (fields, courts, etc)
- m. Affordable Day Care
- n. Public Laundromat
- o. Other: _____

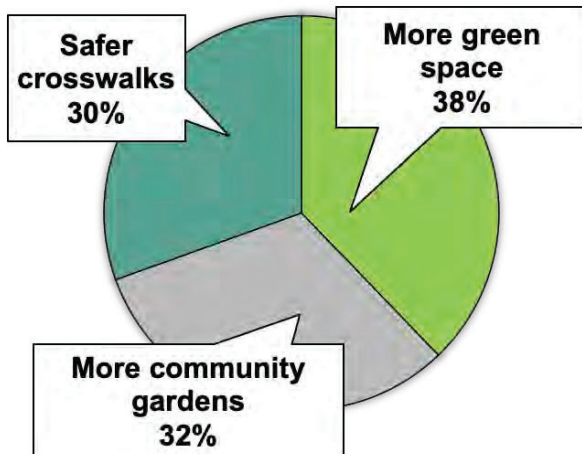


DESIRED CHANGES FOR AVONDALE BY PRIMARY LANGUAGE

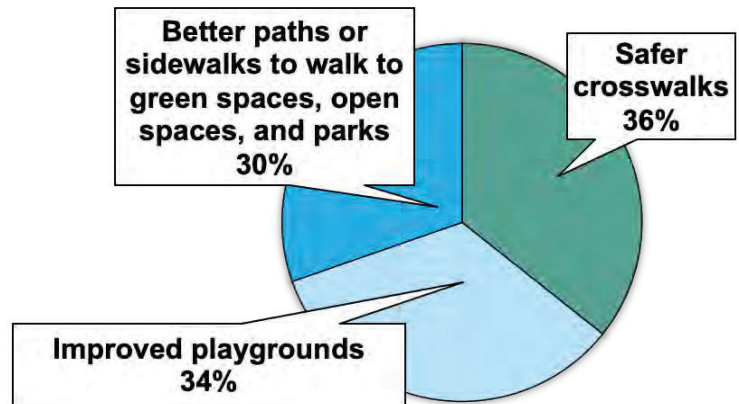


TOP THREE DESIRED CHANGES FOR AVONDALE BY PRIMARY LANGUAGE

SPANISH



ENGLISH



23. Do you have anything else you would like to share about Avondale? (please write in space below)

Section 4: Follow Up Information

24. If you want to participate in discussions about making Avondale Borough a safer and better place to live, would you be willing to be contacted by: (check all that apply)

- ☐ White Clay Watershed Association, for the results of this survey or to discuss ways to address flooding in our community and on your property
- ☐ Other organizations that work on housing or emergency services

25. If you'd like to be contacted, please share your contact information below:

a. Name: _____

b. Best way to contact you (choose one or both):

i. Cell Phone: _____

☐ Check if you are willing to receive text messages

ii. Email : _____

APPENDIX B: POMEROY RAIN GARDEN CONCEPT PLAN

Avondale GSI Plan Demonstration Project

Project Description:

The Borough of Avondale in Chester County, Pennsylvania, is a small, environmental justice community that experiences frequent flooding and has limited community space. The White Clay Watershed Association (WCWA) Wild and Scenic Program is underdevelopment of a Greening Plan, which includes design and installation of a demonstration green stormwater infrastructure (GSI) project, to improve stormwater management within the White Clay Watershed.

Pomeroy Park, is an open, lawn space that is a localized low point with a small playground and volleyball area owned by the Borough is proposed to serve as the GSI demonstration project. A rain garden is proposed by an existing outfall and will receive runoff from a 3.2 acre watershed of residential lots and right-of-way through surface runoff and daylighting an existing storm sewer. The watershed is 35% impervious, and the rain garden can provide both stormwater management and pollutant load reductions.

The WCWA conducted a community-led research project to understand community needs and priorities and identify how this Greening Plan can provide environmental and community benefits. This demonstration project is an opportunity to retrofit an existing unused open space into a community gathering space with improved landscaping with tree cover and stormwater management through a rain garden.



Along Pomeroy Ave, looking towards the outfall



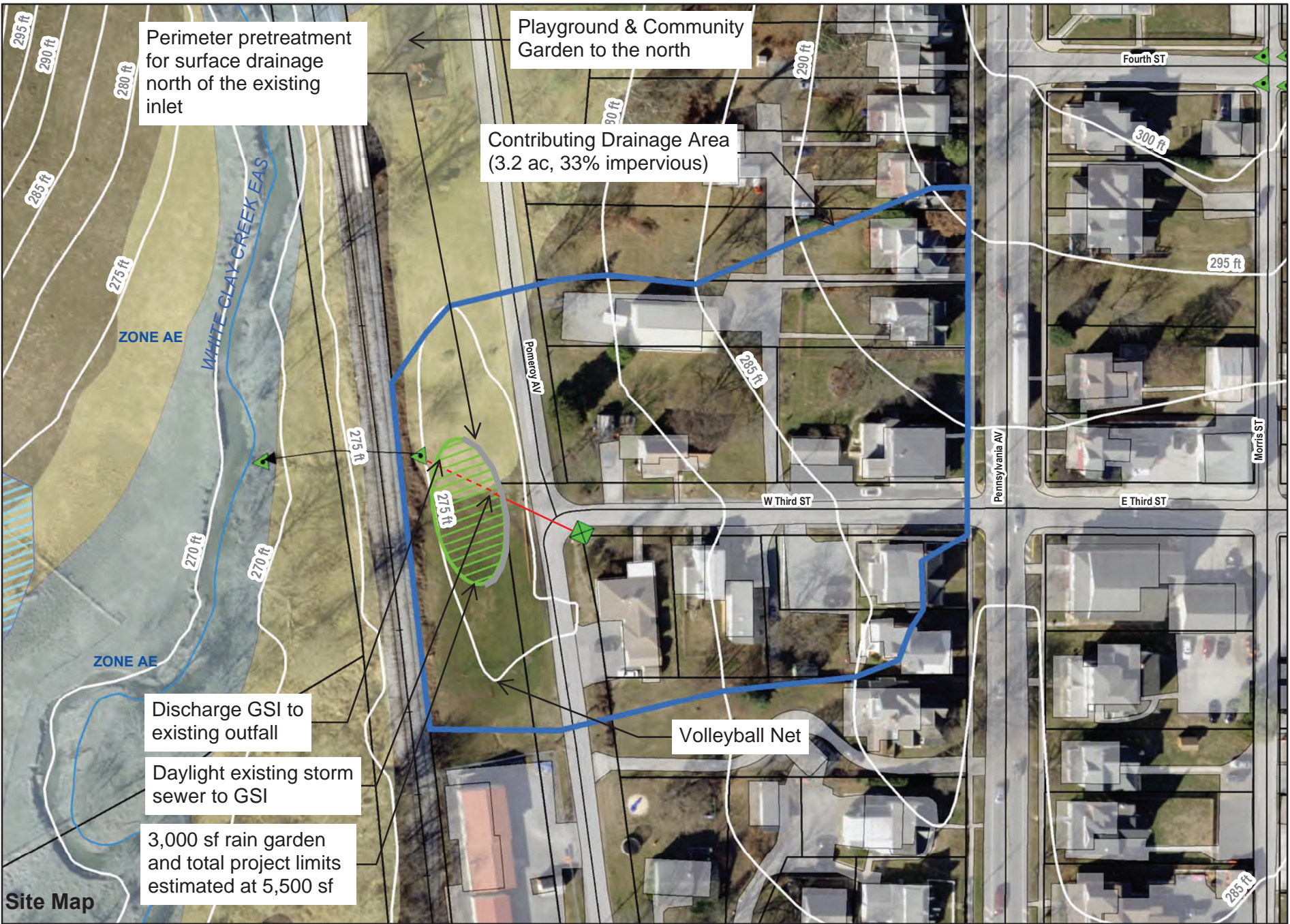
Proposed rain garden area, looking south



Proposed rain garden area, looking north



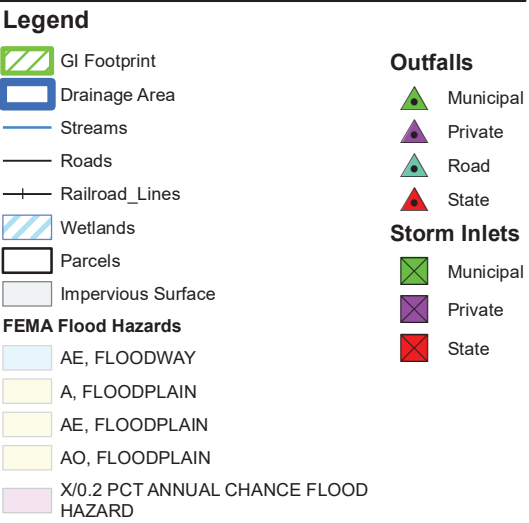
Playground north of the proposed rain garden area



0 50 100 200 Feet
1 inch = 100 feet

Project Benefits

- ✓ Stormwater Volume Management
- ✓ Stormwater Pollutant Load Reduction
- ✓ Community Gathering Space
- ✓ Educational Outreach
- ✓ Tree Plantings



Community Engagement:

- Avondale Borough Community surveyed during May
- Goals included understanding what is important to those who live and work in the community directly experiencing impacts from flooding to influence Greening Plan
- Received 104 responses (goal was 100)
- Data currently in progress of being analyzed in June 2022

Preliminary Survey Responses:

Survey Question #15:

What strategies would you most like to see used to reduce the impacts of flooding in your neighborhood?

Top 3 Responses:

1. Improved street drainage
2. More green spaces that absorb water
3. More affordable housing options

Survey Question #17:

What is important to you in a park or outdoor space?

Top 5 Responses:

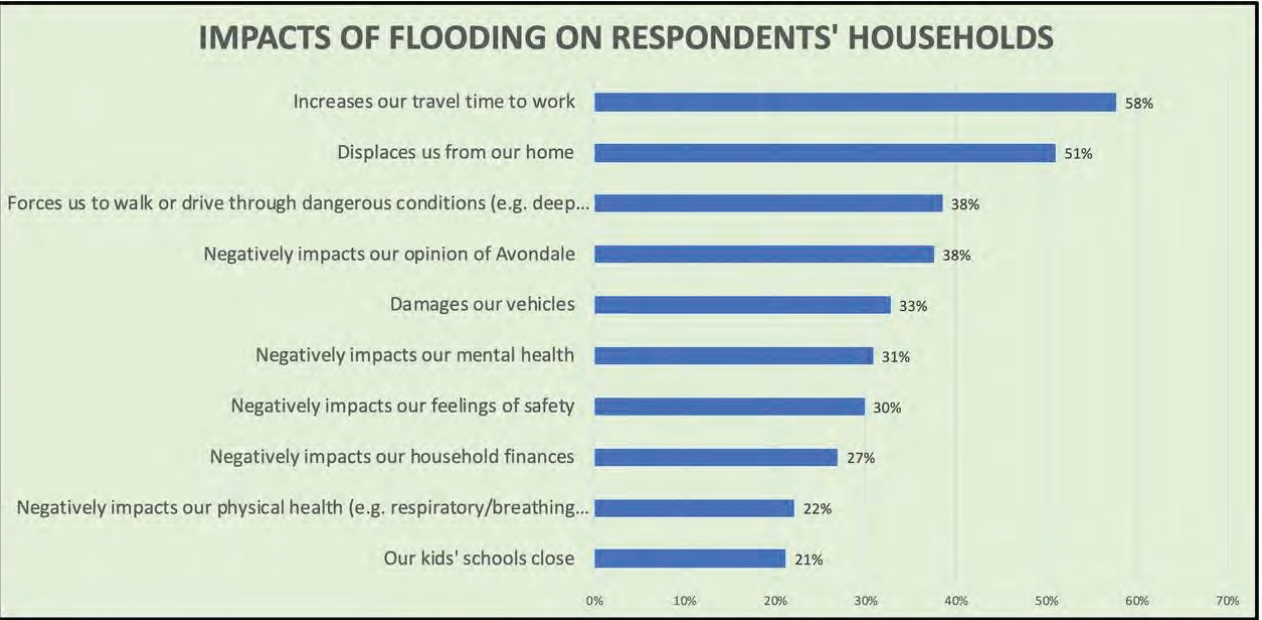
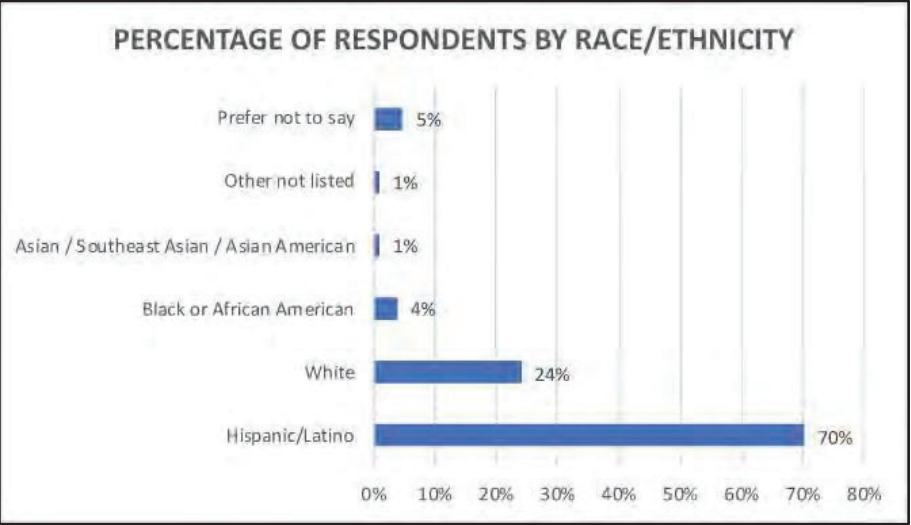
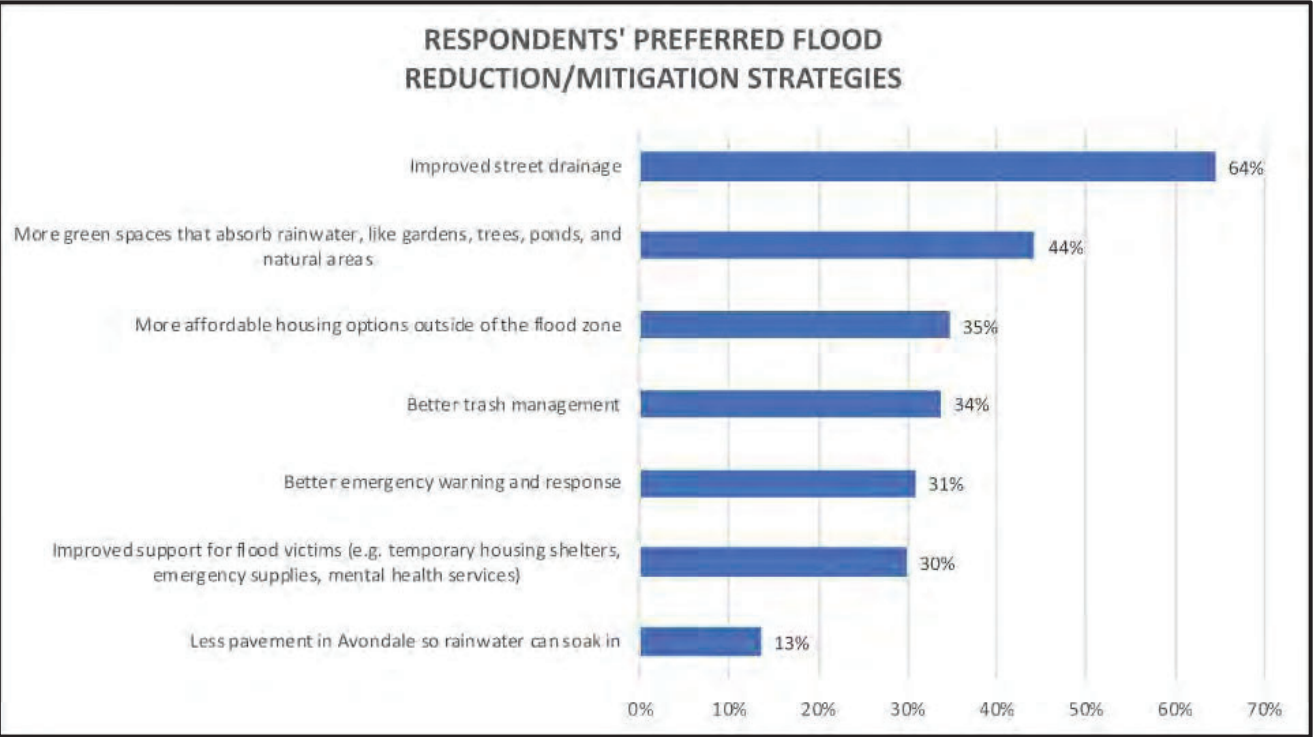
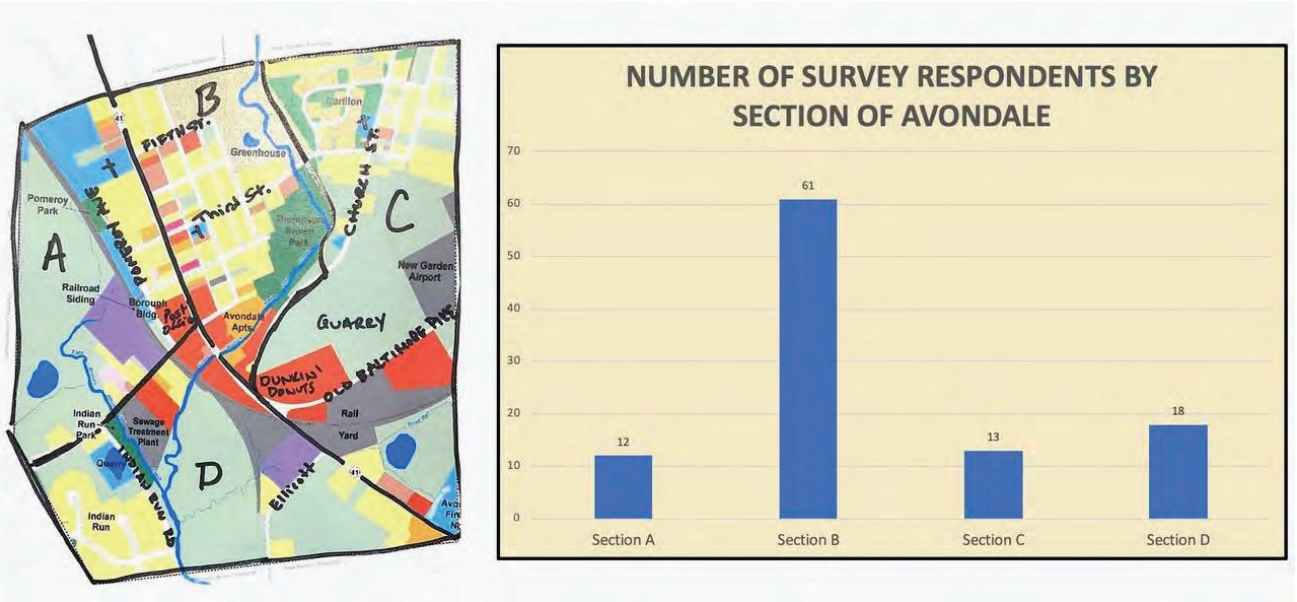
1. Areas that can be reached by foot
2. Children's playgrounds
3. benches, picnic areas, other gathering spots
4. Shaded areas
5. Open space to observe nature

Survey Question #22:

In what ways would you like to see Avondale change in the future?

Top 5 Responses:

1. Safer Crosswalks
2. Improved Playgrounds
3. More green space (tie)
4. Better paths and sidewalks (tie)
5. Improved recreation areas (fields)



Proposed Stormwater Benefits:

Table 1: Sizing estimate and volume reduction of proposed GSI

GSI Type	Area (SF)	Depth (FT)	Capture Volume (CF)	Imp. Drainage Area (SF)	Imp. Drainage Area (AC)	1" Imp. DA Volume (CF)
Rain Garden	---	---	---	48,962	1.12	4,981
Surface Storage	3,000	0.5	1,500			
Soil Storage	3,000	2	1,200			
Stone Storage	3,000	0.5	1,425			
Total		3	4,125			

Table 2: Sediment and nutrient reduction provided by proposed GSI

Existing Pollutant Load and Projected Reduction			
	Impervious	Pervious	Total
Drainage Area to Rain Garden (ac)	1.12	2.08	3.21
Drainage Area to Rain Garden(%)	35%	65%	
Sediment Load to Rain Garden (lb/yr)*	2,067	552	2,619
Sediment Load Managed by Rain Garden (lb/yr)**	1,137	303	1,571
Phosphorus Load to Rain Garden (lb/yr)*	2.56	1.75	4.31
Phosphorus Load Managed - Rain Garden (lb/yr)**	1.15	0.79	1.94
Nitrogen Load to Rain Garden (lb/yr)*	25.92	43.14	69.06
Nitrogen Load Managed - Rain Garden (lb/yr)**	6.48	10.79	17.27
*Based on PA DEP Developed Land Loading Rates for PA Counties (All other counties) TSS: 1,839 lb/ac/yr impervious; 264.96 lb/ac/yr pervious TP: 2.28 lb/ac/yr impervious; 0.84 lb/ac/yr pervious TN: 23.06 lb/ac/yr impervious; 20.72 lb/ac/yr pervious ** Based on Total Suspended Sediment removal rate from DEP PA Stormwater BMP Manual, 55% TSS, 45% TP, 25% NO3 removal for rain garden in C/D soils with underdrain			

Opinion of Cost for Conceptual Plan

		Description	qnt	unit	Total
1	Design & Permitting				
	1	Survey - Provide site survey by professional surveyor	1	ls	
	2	Geotechnical - Provide geotechnical services	1	ls	
	3	Landscape Architecture Allowance - Provide landscape plans by registered landscape architect	1	ls	
	4	Civil Engineering Allowance- Provide civil engineering plans and details by licensed civil engineer	1	ls	
	5	Permit Allowance - Allowance for permitting	1	ls	
	6	Site Layout - Provide site layout of design	1	ls	
		Design & Permitting Total			\$ 62,000.00
2	Mobilization & Site Protection Allowances				
	1	Mobilization Allowance - One mobilization and one demobilization. Cost assumes that all elements are built concurrently in one phase of construction.	1	ls	
	2	Site Protection Fence Allowance - Allowance to furnish and install ±440 lf of 4'-0" tall construction fence	1	ls	
	3	Tree Protection Allowance - Allowance to furnish and install tree orange protection fence	1	ls	
	4	Erosion & Sediment Control Allowance - Allowance to furnish and install ±200 lf of 8" silt sock	1	ls	
	5	Construction Entrance - Furnish, install, and remove stone construction entrance	1	ls	
		Mobilization & Site Protection Allowances Total			\$ 17,700.00
3	Invasives Removal Allowance				
	1	Invasives Removal Allowance - Allowance to provide labor, equipment and materials to selectively remove invasive vegetation. Spray treatment TBD	1	ls	
		Invasives Removal Allowance Total			\$ 8,750.00
		Description	qnt	unit	Total
4	Site Grading & Excavation				
	1	Clearing and Grubbing - Provide labor and equipment to clear and grub site	1	ls	
	2	Site Grading Allowance - Allowance to provide labor and equipment to grade site	1	ls	
	3	Rain Garden Excavation - Provide labor and equipment to excavate for rain garden, assumes 2'-6" of excavation	360	cy	
	4	Soil Disposal and Hauling - Provide labor and equipment to haul and dispose of excavated soils	360	cy	
	5	Pipe Removal Allowance- Provide labor and equipment to remove ±60 lf of existing pipe connecting municipal inlet to the municipal outfall. Depth of pipe to be confirmed	1	ls	
		Site Grading & Excavation Total			\$ 61,730.00

		Description	qnt	unit	Total
5	Outlet Control Structure Allowance				
	1	Outlet Control Structure Allowance - Allowance to furnish and install outlet control structure with weir and orifice	1	ls	
		Outlet Control Structure Allowance Total			\$ 8,500.00
6	Rain Garden Soils				
	1	Soil Testing Allowance - Allowance for soil testing	1	ls	
	2	Rain Garden Soil - Furnish and install rain garden soils to depth of 2'-0"	288	cy	
	3	Coconut Fiber Matting - Furnish and install coconut fiber matting along side slopes of basin	3,000	sf	
	4	Stone Perimeter - Furnish and install 3"-5" river stone set on 6" 3/4" clean gravel and filter fabric along edge of rain garden	10	ton	
		Rain Garden Soils Total			\$ 45,420.00
7	Rain Garden Planting				
	1	Trees - Furnish and install 6'-8' tall multi-stemmed trees	15	ea	
	2	Shrubs - Furnish and install 24"-30" assorted flowering shrubs	50	ea	
	3	Perennials - Furnish and install assorted DP50 flowering perennials and grasses at 15" o.c.	2,800	ea	
	4	Seeding & Matting - Provide labor, equipment, and materials to seed and mat disturbed areas	2,000	sf	
		Meadow Restoration Total			\$ 34,600.00
8	Site Furnishings & Signage Allowance				
	1	Bench Allowance - Furnish and install benches. Design/manufacturer TBD.	1	ls	
	1	Signage Allowance - Allowance to furnish and install	1	ls	
		Site Furnishings & Signage Allowance Total			\$ 5,000.00
9	Construction Contingency				
	1	10% Construction Contingency	1	ls	
		Construction Contingency Total			\$ 18,170.00
		Construction Total			\$ 199,870.00
		Project Total			\$261,870.00