2018 ANNUAL REPORT

September 27, 2018

City of Phoenix




PHX WATER SMART

Prepared by
AECOM

City of Phoenix
WATER SERVICES DEPARTMENT
ENVIRONMENTAL SERVICES DIVISION
Quality Reliability Value

September 28, 2018

Mr. Christopher M. Henninger, Manager
Stormwater and General Permits Unit, Surface Water Section
Arizona Department of Environmental Quality
Mail Code: 5415A-1
1110 West Washington Street
Phoenix, Arizona 85007

Re: ANNUAL REPORT FOR AZPDES PERMIT NO. AZS000003, MUNICIPAL SEPARATE STORM SEWER SYSTEM

Dear Mr. Henninger:

We are pleased to submit the 2017-2018 Annual Report for the City's Municipal Separate Storm Sewer System (MS4) Permit No. AZS000003, issued on February 3, 2009. This report covers the reporting period beginning July 1, 2017 and ending on June 30, 2018. This document includes the information specified in Section 8.1.1 for All Annual Reports.

We appreciate this opportunity to provide you with information about our stormwater management program. Please direct any questions you may have regarding this report to Linda Palumbo at 602-534-2916.

Sincerely,

Kathryn Sorensen

SH Kathryn Sorensen
Water Services Director

Enclosure

cc: Alexis Strauss, Region IX, Environmental Protection Agency (with attachment)
Brandy Kelso (Water Services Department)
Kini Knudsen (Street Transportation Department)
Alan Stephenson (Planning and Development Services Department)
Tamie Fisher (Public Works Department)
Nancy Allen (Office of Environmental Programs)

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ANNUAL REPORT FORM

For Phase I MS4s – Due September 30th each year

PART 1: GENERAL INFORMATION

A. Name of Permittee: City of Phoenix, Arizona

B. Permit Number: AZS000003

C. Reporting Period: July 1, 2017 – June 30, 2018

D. Name of Stormwater Mgt. Program Contact: Linda Palumbo

Title: Environmental Programs Coordinator

Mailing Address: 2474 South 22nd Avenue, Building #31

City: Phoenix Zip: 85009 Phone: (602) 534-2916

Fax Number: (602) 534-7151 Email Address: linda.palumbo@phoenix.gov

E. Name of Certifying Official: Kathryn Sorensen, PhD
(Sections 9.2 and 9.12 of the permit)

Title: Water Services Director

Mailing Address: 200 West Washington Street, 9th Floor

City: Phoenix Zip: 85003 Phone: (602) 262-6627

Fax Number: (602) 534-1090 Email Address: kathryn.sorensen@phoenix.gov

PART 2: ANNUAL REPORT CERTIFICATION

The Annual Report Form must be signed and certified by either a principal executive officer or ranking elected official; or by a "duly authorized representative" of that person in accordance with Sections 9.2 and 9.12 of the permit.

I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

______________________________ ____________________
Signature of Certifying Official Date

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PART 3: NARRATIVE SUMMARY OF STORMWATER MANAGEMENT PROGRAM ACTIVITIES

Attach a status summary addressing each of the following in the approximate order referenced below. Briefly describe implementation, progress, and challenges in each area during the reporting year. Also, explain any significant developments or changes to the number or type of activities, frequency or schedule of activities, or the priorities or procedures for specific management practices.

A. Summarize public awareness activities including outreach

- **Report outreach events, topics, number of people reached, number and type of materials distributed and the Target groups.**

<u>Stormwater Outreach</u>
The City of Phoenix conducted a variety of stormwater-related public awareness activities throughout the 2017/18 reporting year, including outreach focused on illicit discharges and proper management of non-stormwater discharges and long-term maintenance for permanent stormwater controls. In addition, reporting illicit discharges and understanding post-construction measures to prevent pollution in urban runoff were covered in articles and at events with the general public. The City implemented a stormwater-related arts project at the Rio Salado Habitat Restoration Area, where images were sandblasted into existing concrete. Locations were chosen based on proximity to a stormwater outfall, and include reminders to the public that *Clean Water Starts with You* and *Only Rain in the Storm Drain*. This messaging is illustrated in English and Spanish. It is anticipated that the artwork will engage passersby to understand the impact of urban pollutants to the environment.

ONLY RAIN in the STORM DRAIN!

Rio Salado Habitat Restoration Area (Pedestrian Trail – Central Avenue to 12th Avenue)

Major accomplishments include the following:

- Community education events at the Arizona Outdoor Expo, Chinese Cultural and Cooking Festival, Arizona March for Science, South Mountain Environmental Education Center, Phoenix College Earth Day, and Tres Rios Earth Festival reached over 4,000 people.

- Two rain garden conservation workshops taught the general public methods to maintain landscape and use stormwater onsite. More than 40 people attended these events.

- A monsoon preparation postcard was sent to 116 homeowner associations (HOAs) to encourage cleaning of HOA culverts, drainage grates and catch basins, to clear drainage channels and retention basins and to check drywells for proper functioning.

Dear Home Owners' Association,

Monsoon season is here. During this time, thunderstorms with rain and wind can be more frequent or intense than at other times of the year causing damage and flooding.

In preparation for these storms, it is important that you check your storm water management system in your subdivision to ensure that it will perform as designed. Ensure that:

- **Culverts, catch basins and drainage grates within your subdivision are free of trash, overgrown vegetation or other debris that can restrict flow during a storm.**
- **Drainage channels and retention basins are not filled with plant material, trash or silt that will prevent them from conveying and retaining water.**
- **Drywells are functioning properly so that storm water will properly dissipate after an event to prevent mosquitoes. Drywells are typically at the bottom of retention areas and designed to slowly let water flow to the groundwater table. If not maintained they will back-up in multiple storm events and could cause flooding problems.**

Taking these steps will help storm water get to its intended location without causing excessive erosion, flooding or other damage to your home or nearby properties.

If you are experiencing excessive maintenance or damage, hiring a licensed professional engineer to perform an assessment of the drainage system may be a way to identify improvements. The city has a webpage that contains information on a variety of storm water topics, please visit our page at:

phoenix.gov/pdd/stormwatermaintenance

A summary of the stormwater outreach activities for 2017/18 is included in Table 3-1.

Table 3-1 Summary of Outreach Activities

Date(s)	Event / Activity	Audience	Message	Handouts
7/22/2017	Back to School @ Gateway	Children (300)	Pollution Prevention	Storm Drain Dan (SDD) coloring books (900) Stormwater in the Desert (SWID) books (200) Pet Waste Bags (38) Frisbees (50) Bookmarks (300) Hopper Magnets (100) Hoppers (50)
10/21/2017	GAIN Event @ Deer Valley	Children (45)	Pollution Prevention	SDD coloring books (50)
10/21/2017	GAIN Event @ Eastlake Park (Phx Food Day)	Children (50)	Pollution Prevention	SDD coloring books (50)
10/21/2017	GAIN Event @ Golden Gate Community Center	Children (50)	Pollution Prevention	SDD coloring books (50)
10/26/2017	Roosevelt Water Festival (4th Graders)	Children and Teachers (814)	Pollution Prevention	None (hands on demo)
10/26/2017	Rain Garden Workshop	Residents (15)	Stormwater Awareness	None (hands on demo)
10/27/2017	GAIN Event @ John Jacobs Elementary	Children (50)	Pollution Prevention	SDD coloring books (50)
11/4/2017	Water Use It Wisely @ Hance Park	General Public (50)	Pollution Prevention	SDD coloring books (50)
11/26/2017	Silent Sunday Bark Rangers @ South Mountain Park	Pet Owners, General Public (50)	Pet Pollution	Pet Waste Bags (22) Cups (6) Hopper Stickers (5) SWID Book (5) Pencils (10) Totes (8)
11/28/2017	Presentation to Elementary School	Children (50)	Stormwater Awareness	SDD coloring books (50)
11/29/2017	Stormwater Compliance Academy	Industrial Facilities (45)	Stormwater Compliance Ch32C	Pet Waste Bags (28) Chapter 32C (45)
2/2/2018	Demonstration of Storm Drain Equipment (Cool Vehicle Day @ Preschool)	Children (184)	Pollution Prevention	SDD coloring books (160)
2/2/2018	Night of the Open Door @ ASU Downtown	General Public (300)	Pollution Prevention	Hopper Magnets (50) Hoppers (20)
2/16-2/18 2018	Phoenix Chinese Week @ Hance Park	General Public (900)	Pollution Prevention	SDD coloring books (90) Pet Waste Bags (32) Frisbees (109) Cups (105) Totes (20) Pencils (174) SWID (129) Pens (109)

Date(s)	Event / Activity	Audience	Message	Handouts
				Hoppers (20) Hopper Magnets (58) Pet Waste Bags (60)
2/23/2018	Osborn Water Festival (4th Graders)	Children (350)	Stormwater Awareness	None (hands on demo)
2/25/2018	Silent Sunday @ South Mountain Park	General Public (13)	Stormwater Awareness	Cups (6) Totes (8) Pencils (10) SWID (5) Hopper Stickers (5)
3/3-3/4 2018	Tres Rios Nature Festival	General Public (783)	Pollution Prevention	SDD coloring books (120) Pet Waste Bags (32) Frisbees (109) Cups (40) Totes (20) Pencils (115) SWID (38) Pens (87) Hoppers (46) Hopper Magnets (128)
3/24-3/25 2018	Outdoor Expo	General Public (1000 children) (1000 adults)	Stormwater Awareness	SDD coloring books (450) Pet Waste Bags (100) Frisbees (150) Cups (400) SWID (247) Hopper Stickers (121) Book Marks (240) Stress Balls (100) Jar Openers (100) Pens (100) Pencils (200)
4/14/2018	March for Science	General Public (100) Children (150)	Pollution Prevention	Cups (30) Pencils (20)
4/18/2018	Earth Day @ Phoenix College	General Public (70)	Pollution Prevention and Chapter 32C	Pet Waste Bags (17) Cups (11) Pencils (9) Hopper Magnets (5)
4/21/2018	Slope Fest - Tour de Slope	Residents (150)	Pollution Prevention	SDD coloring books (30) Totes (30) Pencils (80) SWID (15) Hopper Stickers (20)
5/12/2018	Rain Garden Workshop	Residents (26)	Stormwater Awareness	None (hands on demo)
6/25/2018	Sandblasting Project	General Public	General Awareness	None

Web and social media returned:

- 650 visits to the stormwater program webpage
- 10 Twitter posts (5,982 impressions with 72 engagements)
- 16 Facebook posts (19,276 impressions with 1,886 engagements).

Three (3) articles were posted on ABC15 and included *Four Ways to be a Good Neighbor* (July 11-13), *Three Ways to Prevent Stormwater Pollution* (October 23-25), and *What is Green Infrastructure* (January 8-10). Examples from the effort are included in the attachments.

The City continues to actively participate in Stormwater Outreach for Regional Municipalities (STORM), which coordinates stormwater outreach throughout the Phoenix metropolitan area. STORM developed three common videos for pools, pets, and lawns, providing each municipality with content for hosting online or at events. STORM managed three public outreach events, a conservation expo at the dolphinarium, and two construction-related seminars at two separate member-city venues. Overall statistics for STORM events are included in the attachments section under STORM's Annual Report.

B. Summarize public involvement activities including outreach

- **Identify activities, number of people involved, number and type of materials distributed if applicable.**

  <u>Household Hazardous Waste Collection</u>
  The Public Works Department (PWD) provided Phoenix residential customers with nine (9) Household Hazardous Waste (HHW) collection events in 2017/18. Over 6,206 customers participated in the HHW events.

  The following materials were collected, and recycled or reused, where feasible:

  - Close to 44,000 pounds of oil based paint and related materials
  - 10,000 pounds of flammable liquids
  - Over 3,000 gallons of used oil
  - Close to four (4) tons of lead acid and rechargeable batteries
  - Close to 23,000 gallons of latex paint.

Other items collected and properly disposed included: antifreeze, pesticides, herbicides, and other hazardous and toxic materials. Non-hazardous materials brought to HHW events were sorted out and disposed of as Municipal Solid Waste, such as shampoo, lotions, alkaline batteries and quart-sized latex paint.

- **Describe MS4 system for public reporting of spills, dumping, discharges, and related stormwater issues.**
- The City continues to offer a Stormwater Hotline (602-256-3190) in English and Spanish, as well as an email address (ask.water@phoenix.gov) for anyone who wishes to report a complaint concerning illicit discharges or releases to the storm drain system. The contact information is distributed with outreach materials and is available on the stormwater website (www.phoenix.gov/stormwater). The City received 317 complaints during the year.

C. Summarize Illicit Discharge, Detection and Elimination (IDDE) program activities. Include:

- **Illicit discharge prevention activities.**

The City discourages discharges to the storm drain system through the placement of Pollution Awareness Markers (PAMs) on existing catch basins. This year 897 PAMs were added to existing catch basins and more than 20,000 PAMs have been installed since the program started.

The City standard for managing hazardous waste and hazardous materials at municipal facilities is the Hazardous Materials Management Program (HMMP) Manual. The manual is available to City employees online through the City's intranet. HMMP procedures apply to all City departments unless stated otherwise and were developed to ensure the City operations are in compliance with federal, state, and local environmental and safety regulations. The HMMP Manual directs personnel to locate storage areas as far away as possible from washes, drains, and drywells and requires that they be protected from weather. Requirements are provided for secondary containment, security, air quality permitting, safety and spill response equipment, proper signs, and labeling. Container storage requirements such as aisle spacing, limitations on drum stacking, segregation of incompatible materials, and types and condition of containers are also provided.

The HMMP Manual contains a comprehensive stormwater management procedure, which, also serves as the facility stormwater management plan required by Phoenix City Code Chapter 32C. The procedure applies to all city facilities with the potential to impact stormwater and addresses permit applicability including the Multi-Sector General Permit (MSGP) and De Minimis General Permit (DMGP), training and inspection requirements, and BMPs for solid waste/litter control, parking lots and building washing, scrap metal and equipment, bulk material piles, vehicle and equipment washing and fueling, and maintenance of stormwater management devices.

The HMMP Manual is maintained by the Office of Environmental Programs (OEP). Each HMMP procedure is reviewed at least once every two years and revised as necessary. Revisions may be made more frequently if regulatory requirements change.

During reporting year 2017/18, five of the ten HMMP procedures were reviewed. Two documents were updated (Pesticide Management Program and Hazardous Materials Purchasing Program), based on input from 14 operating departments and staff with stormwater expertise, including Environmental Quality Specialists and Environmental Program Coordinators. One HMMP for Spill Prevention, Response and Reporting had only minor updates. One additional HMMP for Management of Hazardous Building Materials at City of Phoenix Facilities was reviewed but did not require any updates. The HMMP for Stormwater Management was reviewed, but update of this HMMP was delayed pending issuance of the ADEQ new Construction General Permit and ADEQ Pesticide General Permit.

- **Training dates and topics:**

Stormwater training covering IDDE is accomplished through training offered by various departments, including WSD, PWD, Parks and Recreation, and OEP. Municipal employee stormwater training is coordinated by the OEP P2 Program.

The Phoenix MS4 permit requires IDDE training for two major groups of employees: (1) field staff without direct stormwater program responsibilities; and (2) employees with direct stormwater program responsibilities (Stormwater Field Staff). In addition, the training is divided into three (3) frequencies:

- Annual (for select field staff with "no direct stormwater responsibility" only)
- New Employee Training (for Stormwater Field Staff – offered twice a year)
- Refresher Training (for Stormwater Field Staff – offered every two years).

Other specific training requirements include municipal, industrial, and construction site inspections, hazardous materials handling, spill management, street maintenance and repair and water/sewer maintenance and is limited to employees working in functions with the potential to impact stormwater. Affected employees are identified in the stormwater training plan in the City's Stormwater Management Plan (SWMP). The training is offered by various departments and is divided into two frequencies:

- New Employee Training (conducted twice per year)
- Refresher Training (conducted once every two years).

- **Annual Training**

Stormwater Awareness Training. Awareness training covering IDDE is provided to select field staff with no direct stormwater responsibilities. Topics taken from the City MS4 stormwater permit requirements include identification of harmful/prohibited practices (illegal dumping or spills) into the City's stormwater system and proper management procedures (reporting to the Stormwater Management Section). Twelve sessions were held and 232 people were trained, including 13 new City employees in PWD.

Date	Number Attended
January 8, 2018	6
January 9, 2018	43
January 10, 2018	10
January 11, 2018	25
January 12, 2018	10
January 15, 2018	5
January 18, 2018	38
January 23, 2018	39
January 26, 2018	16
January 31, 2018	17
April 10, 2018	10
May 11, 2018	13

- **New Employee Training and Biennial Refreshers**

IDDE for Stormwater Inspection Staff. Topics covered include MS4 permit requirements, Phoenix City Code, detecting and identifying illicit discharges, De Minimis and other sources of non-stormwater discharges, outfall inspections, sampling, and field screening. Three sessions were held and 55 people attended, including four new WSD employees.

Date	Number Attended
December 13, 2017	8
April 17, 2018	26
April 25, 2018	21

Street Repair and Road Improvement for Street Maintenance Staff. Training is provided to all field staff in the Street Maintenance Division of the Street Transportation Department (STR). Training covers IDDE awareness, pollution prevention, and BMPs to minimize discharges to storm drains. Specific topics include BMPs for hazardous material use and storage, street sweeping, painting and striping, sediment pile management, paving, vehicle maintenance and washing, handling spills, solid waste, and concrete washout areas. Biennial refresher training was completed in reporting year 2016/17. One employee was trained on December 11, 2017.

Spill Prevention and Management Practices – non-Fire Department. Training covers site-specific spill prevention and response procedures/responsibilities and spill management practices to prevent or minimize discharges to the storm sewer system and drywells. Seventeen sessions were held and 497 people were trained. This included one new City employee in WSD, three new employees in PWD, and 19 new City employees in PRD.

Date	Number Attended
October 31, 2017	13
November 14, 2017	17
December 5, 2017	13
January 12, 2018	16
January 23, 2018	13 (PWD)
January 23, 2018	13 (WSD)
February 20, 2018	13
February 26, 2018	6
March 6, 2018	16
April 24, 2018	18
May 1, 2018	15
May 9, 2018	78
May 16, 2018	58
May 17, 2018	56
May 22, 2018	64
May 23, 2018	50
May 24, 2018	38

Spill Prevention and Management Practices – Fire Department. Training is delivered through an online video and training module, which was created specifically for the Phoenix Fire Department. The training covers stormwater awareness, specific spill prevention and response procedures/responsibilities for use during emergency responses, including protection of storm drains and drywells, and BMPs for Fire Department facilities. There were 34 individual computer sessions for 34 employees; these 34 employees were required to complete the training because they were not able to complete the training in reporting year 2016/17. The rosters showing the actual Fire Department training are available upon request. Although the City training plan specifies that the training needs to be completed for “Company Officers (Fire Captains)” and “Command Officers”, the Fire Department had all field employees that were not able to complete the training in reporting year 2016/17 complete the training this year to cover the potential for employees to act in an “out of class” position. This includes an additional 168 employees which are not counted in Part 4 of this Annual Report.

Hazardous Material Handling. Training covers responsibilities for spill prevention and reporting, compliance with regulatory and City hazardous materials management procedures (proper handling, storage, transportation, and disposal) to prevent contamination of stormwater runoff. Refresher training was provided and sessions for new employees are included in these totals. Nineteen sessions were held and 503 people were trained. This included one new City employee in WSD, three new employees in PWD, and nine new City employees in PRD.

Date	Number Attended
October 10, 2017	2
October 31, 2017	13
November 14, 2017	17
December 5, 2017	13
January 12, 2018	16
January 23, 2018	13 (PWD)
January 23, 2018	13 (WSD)
February 20, 2018	13
February 26, 2018	6
February 27, 2018	4
March 6, 2018	16
April 24, 2018	18
May 1, 2017	15
May 9, 2018	78
May 16, 2018	58
May 17, 2018	56
May 22, 2018	64
May 23, 2018	50
May 24, 2018	38

Water/Sewer Maintenance. Training is provided to field staff in Water Distribution and Wastewater Collection and includes protocols to minimize discharges including those found in the WSD Stormwater Pollution Prevention Plan, Emergency Response Plan and Field Incident Response Plan. Thirteen sessions were held and 174 people were trained, including three new City WSD employees.

Date	Number Attended
October 31, 2017	15
November 14, 2017	14
December 5, 2017	13
January 23, 2018	12
February 20, 2018	15
February 26, 2018	10
March 6, 2018	14
April 3, 2018	18
April 10, 2018	8
April 24, 2018	15
May 1, 2018	8
May 8, 2018	12
May 22, 2018	20

Municipal Stormwater Inspections. Training topics include federal and local regulatory requirements, applicable permits and codes, stormwater BMPs, municipal facility inspection procedures, illicit discharges and De Minimis discharges. Biennial inspector training was not required this reporting period, and there were no new OEP employees.

Industrial Stormwater Inspections. Training is provided to all inspectors in the WSD Environmental Services Division. Topics include applicable permits and codes, stormwater pollution prevention policies, structural and non-structural BMPs, and inspection and enforcement procedures. Three sessions were held and 55 people were trained, including four new WSD City employees.

Date	Number Attended
December 13, 2017	8
April 17, 2018	23
April 25, 2018	24

Construction Sites Plan Review and Inspection Training. The Planning and Development Department (PDD) provided on-the-job training (OJT) for stormwater plan review and inspections. Biennial training was also conducted this reporting period. There were two sessions held for 26 employees, including eight new PDD employees. OEP provides biennial training for OEP inspectors that conduct inspections of municipal stormwater projects. Training includes municipal ordinances related to stormwater and construction, erosion and sediment controls, and structural and non-structural BMPs. OEP biennial inspector training was not required this reporting period, and there were no new OEP employees.

Date	Number Attended
June 22, 2018	16
June 28, 2018	10

Other training not included or counted in Part 4 of this Annual Report includes: On February 21, 2018, 49 PDD General Inspectors received training on Residential Single Lot and Subdivision Stormwater Management Training. Three stormwater inspectors, the Chief Water Quality Inspector, one Aviation Department Environmental Quality Specialist, and one OEP Environmental Quality Specialist attended a one-day Stormwater Construction Workshop covering stormwater construction site BMPs, site inspections and enforcement, and recordkeeping. The Aviation Department Environmental Quality Specialist also presented at the training.

➢ **IDDE screening program and investigations – including an overview of industrial facility inspections, identified sources, and any significant corrective or enforcement actions.**

The IDDE program continues to track illicit flows discovered in the storm drain system to identify their sources. Dry-weather flows are investigated by opening manholes and following the flow upstream. Flow changes (typically volume) are observed by the IDDE crew when the manholes are opened. Once the suspected illicit tap is determined to be nearby, the video system is then inserted in the storm drain pipe to track the flow directly to its source. By using the video system the City can then determine where the illicit connection or tap is located and then conduct the appropriate inspection. Occasionally, dye testing or a similar procedure is used to verify the source of the connection.

IDDE investigations are also initiated as a result of complaints, reported spills, or emergency response activities. During the report period, the following non-stormwater discharges were investigated:

- August 8, 2017: A dry weather flow was observed from 7th Street and Willetta Street. IDDE staff found two sources of the flow: Water Distribution main break at 713 Whitton Avenue and irrigation at 7th Street and Camelback Road. The main break was referred to the Water Distribution Division for repair. Irrigation water is an allowable non-stormwater discharge.

- August 9, 2017: A dry weather flow was observed at 12th Street and McDowell Road. IDDE staff found the sources to be irrigation water from 12th and Camelback and 12th Street and Maryland; plus, an apartment building located at 12th and Devonshire. These are allowable discharges.

- August 10, 2017: A possible illicit connection was identified at the U.S. Post Office, 2901 East Greenway Road; upon further investigation, no connection to the storm drain system was identified.

- August 25, 2017: A dry weather flow into a catch basin along Air Lane between 24th and 40th Streets was observed. A water main replacement project was ongoing. A follow-up inspection conducted on September 7, 2017 did not identify any water flowing into the catch basins.

- September 4, 2017: Approximately two gallons of herbicide entered the storm drain during firefighting efforts at 19th Avenue and Grand Avenue. IDDE staff checked outfall SR006 and two manholes downstream of the spill. There were no signs of a spill at the outfall or in the manholes. ADEQ was notified.

- September 25, 2017: A potential illicit connection was identified at Truelite Glass and Aluminum Solutions, 1825 South 43rd Avenue, Suite 1. IDDE staff conducted a video inspection and could not determine a direct connection to the storm drain system.

- October 3, 2017: Staff received a referral of a potential illicit discharge at Brake Masters located at 17209 North Cave Creek Road. IDDE staff conducted a thorough inspection and there were no signs of illegal dumping in the immediate vicinity.

- October 6, 2017: A dry weather flow from IB027 was observed on two consecutive days. The IDDE investigation identified two residential water service lines that were leaking. IDDE staff referred the issue to the Water Distribution Division for repair.

- October 17, 2017: A dry weather flow in the area of 23rd Avenue and Georgia Avenue was observed. The IDDE investigation confirmed the source as irrigation water, which is an allowable discharge.

- October 27, 2017: A dry weather flow was identified at SR035 on two consecutive days. The sources were identified as a water distribution main near 841 East Roeser Road and a residential service line located 5207 South 12th Way. IDDE staff referred the issue to the Water Distribution Division for repair.

- December 5, 2017: A box truck leaked diesel fuel and caught on fire in the vicinity of 51st Avenue and McDowell Road. Approximately 150 gallons of diesel fuel was released or consumed in the fire. The City's contractor responded to the incident and applied a mixture of water and microblaze to remediate any diesel in the storm drain. IDDE staff inspected the storm drain downstream of the spill. Water with a sheen and odor was observed in the storm drain at the scene; however, there was no evidence the spill reached the outfall at Papago Diversion Channel (PD005).

- December 5, 2017: A release of water with an oily sheen was observed in Piestewa Peak Park. The non-stormwater flow was associated with the installation of a potable water line and the sheen was likely a result of recent street repair with new asphalt. No further action was taken.

- March 7, 2018: A dry weather flow was observed at SR003 for two consecutive days. Multiple sources were identified as allowable discharges, including irrigation water from a junction box at 35th Avenue and Durango, Sun Valley, Palm Tree Nursery, Beth Israel Cemetery, and Roosevelt Irrigation District.

- March 9, 2018: A dry weather flow was observed at SR001 for two consecutive days. The source was identified as the ADOT MS4.

- March 9, 2018: A dry weather flow was observed at SR002 for two consecutive days. Multiple sources were identified, including a leaking fire hydrant and flood irrigation lots. The former was reported to Water Distribution and the latter is an allowable discharge.

- March 14, 2018: A spill of yellow-green fluid was observed in the parking lot at 4717 East Hilton Avenue. The spill was cleaned-up and IDDE staff did not observe any sign of this spill/discharge reaching the MS4. No further action taken.

- March 21, 2018: A consultant was hired to investigate the sources of dry weather flow at SR010. The consultant found various sources including, air conditioning condensate, sidewalk cleaning, and possible direct connection to storm drain system. Follow-up investigation is ongoing.

- March 21, 2018: A dry weather flow was observed at SR015 on two consecutive days. IDDE staff identified the sources as flood irrigation, which is an allowable discharge.

- March 21, 2018: A dry weather flow was observed at SR083 on two consecutive days. IDDE staff identified the source as flood irrigation, which is an allowable discharge.

- March 28, 2018: A dry weather flow was observed at SR061 for two consecutive days. IDDE staff identified multiple sources, including flood irrigation, air condition condensate (Desert Island Health Systems), and leaking flood irrigation gate. These are allowable discharges.

- March 28, 2018: A dry weather flow was observed at SR020 for two consecutive days. Follow-up investigation on day two did not encounter flow. IDDE staff performed a neighborhood survey and noted irrigation in a nearby industrial complex.

- May 9, 2018: A potential illicit discharge was reported coming from 20 East Thomas Road to the City storm drain system. IDDE staff investigated the complaint and reviewed approved building plans. It was determined the discharge was stormwater being discharged as a result of on-going repairs to a stormwater holding tank and associated pump system, which is connected to the storm drain system. No further action taken.

- May 11, 2018: A potential illicit discharge was reported in the area of 63rd Street and King Avenue. Upon investigation it was determined that the source was irrigation water, which is an allowable discharge.

D. Municipal Facilities

➢ **Status of identification and inventory of these facilities.**

The Municipal Facility Inventory (MFI) is maintained in a facility assessment database that tracks inspection activities, compliance findings and pollution prevention recommendations. The inventory includes facilities owned and operated by City staff that store or use hazardous chemicals in containers greater than five (5) gallons, or which otherwise have the potential to pollute stormwater. Chemicals stored onsite at each facility are tracked through an online citywide Safety Data Sheet Management System. There were 294 municipal facilities on the inventory as of June 30, 2018. OEP's inspection facility assessment schedule targets 98 facilities each year. Several facilities were removed from the inventory because they no longer have chemical storage or were closed/consolidated with other facilities by City departments.

Information maintained in the inventory includes: address, latitude and longitude, chemicals stored or used and their safety data sheets, operational status (operational or closed), Standard Industrial Classification (SIC) codes, date of last assessment, brief description of operations, facility contact, as well as other compliance-related information. The number of facilities may change based on new facilities becoming operational or existing facilities undergoing a change/cessation of operations. Such changes to the MFI are tracked through the facility assessment database.

High-Risk Facilities Identification and Prioritization:

The high-risk facility identification and prioritization was completed on June 30, 2011. The high risk identification process considered each of the following: (1) quantity of chemicals stored onsite (based on Tier II Reports), (2) potential for exposure of such chemicals to stormwater based on storage location, (3) likelihood of a spill or release to occur and discharge offsite based on structural BMPs and site drainage characteristics, (4) potential severity of impact on surface waters for a worst-case scenario release, and (5) MSGP coverage. Storage of and potential for release of other pollutants at the site were also considered as an additional risk factor.

Numeric ranking criteria are used to evaluate all city facilities that had submitted Tier II Reports. The criteria indicate which facilities are “higher risk” and also the overall risk of facilities relative to one another. Whenever these sites are physically assessed, the risk factors are reviewed and adjusted, if necessary. As of June 30, 2018 there were 44 facilities on the high-risk municipal facility inventory.

Of the 44 facilities categorized as high-risk, five facilities (service centers) were determined to be highest risk and were required to develop and implement facility-specific stormwater pollution prevention plans (SWPPP) and to conduct routine quarterly inspections by site staff and annual comprehensive stormwater inspections by OEP. For the 39 others currently classified as high-risk facilities—mainly unstaffed, remote locations associated with sanitary sewer system lift stations and odor control stations, or fire stations with double-walled (aboveground storage tank) ASTs containing diesel fuel—an increase in inspection frequency was not deemed necessary, but a comprehensive stormwater facility assessment is targeted at least once every three years.

- **Overview of inspection findings (i.e., number inspected, number with follow-up actions needed, significant findings).**

The OEP conducts Environmental Facility Assessments (EFAs) of City owned and operated facilities to acquire baseline information, ensure compliance with select environmental compliance requirements, including spill preparedness and response procedures, hazardous materials storage, and identification of opportunities to reduce hazardous material use and hazardous waste generation. The EFA inspection checklist includes a section on stormwater BMPs, the facility’s SWMP, and a targeted review of high-risk facilities; this checklist is used to meet the Facility Assessment Measurable Goal at Appendix A Section III.B.(1) and the Municipal Facility Inspection Measurable Goal at Appendix A Section IV.C.(2).

OEP’s target schedule is to conduct EFA’s at 98 (of 294) facilities each year. The highest-risk facility service centers (5), which have facility specific SWPPPs, are inspected by site staff quarterly and receive a comprehensive stormwater inspection by OEP at least annually. Thirty-nine other high risk facilities are targeted to receive a comprehensive facility stormwater inspection once every two to three years.

In 2017/18, EFAs were completed at 119 of the facilities on the MFI. There were 85 facilities with zero corrective action findings as a result of the assessment. Thirty-four facilities had a total of 68 findings; recommended corrective action items are summarized in the next section. The annual service center SWPPP inspections are not included in this finding count, but are addressed below under high-risk facilities. In addition, beginning in reporting year 2016/17, "Safety Data Sheet (SDS)" database update findings are referred to Department and Human Resources Safety Division and are no longer specified as EFA findings.

In 2017/18, 24 of the 44 high-risk facilities were assessed, including annual SWPPP inspections at all five of the highest-risk service centers with SWPPPs. The five high risk service centers are also assessed quarterly by site staff. Nine facilities, including the five service centers, had findings, seven of which had some corrective actions related to stormwater which required improved stormwater BMPs. These are summarized in the following section.

- **Activities needed and performed in response to inspections (EFAs)**

The OEP records and tracks all activities needed as a result of an EFA until resolution. As applicable, facility status updates identifying any uncorrected findings are regularly provided to Department Directors. The text below summarizes the primary stormwater-related corrective action activities performed during 2017/18.

<u>2017/18 Corrective Actions Implemented (EFAs)</u>

- Spill response BMPs
    - Ensured spill response kits are adequately stocked and accessible
    - Installed or updated emergency contact poster in areas where hazardous materials are used or stored, including pesticide storage sign requirements
    - Ensured departments have updated and distributed Facility Spill Response Plans.

- Structural BMPs (to minimize exposure to stormwater and prevent spills)
    - Ensured facilities only store containers of hazardous materials under weather-protective cover or inside
    - Ensured secondary containment for hazardous material containers and used oil, etc., are adequate and in good repair with minimal standing free liquids
    - Ensured repair/cleaning of existing secondary containment structures, including repair of two secondary containment structures at one PRD pool facility
    - Ensured facilities provide sediment control (e.g., straw wattles, fiber rolls) for material or soil stockpiles
    - Ensured facilities do not store scrap metals, oily leaking equipment and waste materials that may migrate into the MS4 or block stormwater drainage directly on the ground
    - Ensured clean-up of outside storage area by one PRD facility and at two Police Department facilities
    - Ensured original chemical storage containers are in good repair and kept closed with proper lids, and any spilled materials are cleaned and disposed of properly.

- Non-structural BMPs (practices and procedures)
    - Ensured container closure and labeling standards are followed for chemical containers and universal wastes

- Improved housekeeping and general site, parking lot, and outdoor equipment and material storage practices, including review of parking lot sweeping frequency
- Ensured storage amounts are kept to a minimum
- Ensured all hazardous materials and hazardous building materials are handled properly, and waste determinations/profiles have been completed for materials
- Assisted PRD with ADEQ drywell registration at one site
- Working with WSD to ensure ADEQ drywell registrations are completed at one remote site
- Ensured Spill Prevention Control and Countermeasure Plan in place at on WSD facility.

<u>2017/18 High-Risk Facilities – Improved Stormwater Controls and Practices Implemented</u>

- Monitored maintenance of retention basins to ensure they are maintained free of trash and debris
- Ensured proper storage practices for scrap metal as required by HMMP
- Ensured proper storage requirements for pesticides as required by HHMP
- Ensured vehicle repair parts with greasy/oily fluid residue (e.g., engines, cylinders) are stored under tarps or other overhead protection
- Ensured compliance with HMMP storage practices for hazardous materials—store indoors, or under other weather protections, in properly closed containers in good repair, with appropriate secondary containment; ensured prompt clean-up of small spills
- Noted oil accumulation on top of aboveground oil storage tank at one PWD Fleet Services Division site due to malfunctioning pump; ensured that this pump was repaired, and oil accumulation removed from top of tank
- Ensured proper housekeeping/litter collection and general site, parking lot, and outdoor equipment and material storage practices, including refuse storage, solid waste bin collection areas, and monitoring parking lot sweeping frequency
- Facilitated clean-up of water line repair spoils from one WSD service center bulk bin storage area; monitored use of bulk bin storage areas at other service centers to ensure that materials remain within bins and areas outside bins are swept regularly
- Facilitated coordination between two departments at one service center to ensure that trackout from department storage area was monitored and swept on a regular basis
- Ensured secondary containment structures are maintained clean and dry with minimal standing free liquids
- Verified facility spill plans and/or posted spill contact info and spill response procedures, including pesticide storage sign requirements
- Implemented cleanup of small fluid releases from equipment and vehicle drips, and ensured that drip pans or other methods are used to control small fluid releases; such as, oil-absorbent mats

- Ensured all containers are labeled and with proper secondary containment
- Inspected spill kits and verified spill kits are available in needed areas
- Ensured vehicle washing areas are well maintained, including clean-up of sediments and maintenance of sewer interceptors
- Facilitated coordination between three departments at one service center to ensure that vehicle washing area is used appropriately to prevent build-up of sediments and clogging of the wash rack; the PWD Facilities Management Division also removed accumulated sediments from the east side of the washing area, painted and cleaned the area, and is monitoring site usage
- Verified there are no illicit discharges to the MS4 from routine facility practices
- Ensured all hazardous materials are handled properly, and hazardous waste determinations have been completed
- Facilitated clean-up and proper disposal of sediments, debris, material containers and spent litter at one WSD service center outdoor covered materials storage area

<u>2017/18 Other Stormwater-Related Improvement Projects</u>

The following projects were identified in response to OEP inspection findings in reporting year 2016/17, and completed in 2017/18:

- Glenrosa Covered Storage – Following the fourth quarter of 2016 annual OEP SWPPP inspection, it was noted that the Glenrosa Service Center, PWD Fleet Services Division was in need of additional covered storage. Funding for design and construction was encumbered in the second quarter of 2017. Additional internal soft costs occurred in reporting year 2017/18. The covered storage was completed in January 2018. The covered storage is used by site staff to store greasy/oily vehicle parts and other potentially leaking material in a location that is not exposed to stormwater.

- Okemah Bulk Material Storage Bins – Following the fourth quarter 2015 and 2016 annual OEP SWPPP inspections, it was noted that the Okemah Service Center, STR Department was in need of modifications to the bulk material storage bins, and additional bins. Funding was encumbered in the second quarter of 2017 to build two new bulk material storage bins to contain concrete debris and spoils. Additional internal soft costs occurred in reporting year 2017/18. The bins were completed in January 2018. Use of the new bins also allows one of the existing bins to be used for excess storage.

The following capital improvement projects were identified in response to OEP inspection findings in 2017/18:

- 22nd Avenue and Union Hills Service Centers, Parts Canopies – During the fourth quarter of 2017 OEP SWPPP inspection, it was noted that the parts pick-up storage areas at these locations were lacking covered storage for lead-acid batteries and hydraulic cylinders waiting for repair. Funding was approved and encumbered to construct 10 foot x 20 foot x 14 foot canopies at the request of the PWD Fleet Services Division. The canopies will be used for storage of lead-acid batteries to be recycled and hydraulic cylinders waiting repair.

The following project was identified in response to WSD outfall inspection findings in 2017/18. OEP also noted minor erosion during a fourth quarter 2016 inspection near two outfalls, and erosion near all three outfalls during a fourth quarter 2017 inspection:

- Okemah Service Center Erosion/Drainage Study – The Okemah service center is a 13.5-acre City service center property managed by the PWD Facilities Management Division, and includes operations by PWD Solid Waste Division, PWD Fleet Services Division, and STR Maintenance. Erosion has been noted on the east, west, and north fencelines, including the three north outfalls. Funding was encumbered to conduct a drainage and grading study/hydraulic analysis report of the property including retention basins, drywells and outfalls. This study will address the erosion and drainage issues, and provide suggested resolution. Depending on study results, it is anticipated that the PWD Facilities Management Division will request stormwater funding for site improvements once the study is completed.

In addition to improvements made in response to inspection findings, the following capital improvement projects which included stormwater improvements also had activity in 2017/18:

<u>Aviation Department</u>

- The reconstruction of the T3 Transition Apron and Taxiway Project removed and replaced a large portion of storm drain lines which were beginning to show signs of deterioration.
- The Terminal 4 North Apron Reconstruction project includes a complete redesign. Trench drains are being installed in place of the current manholes, which are limited in number. This project will take place over several fiscal years.

<u>Street Transportation Department</u>

- Paradise Lane Detention Basin – This project consisted of deepening the existing detention basin at Paradise Lane Park to accommodate stormwater run-on from the north, increasing capacity of the existing southern catch basin, and installing a new catch basin on the east side of the park.

- Baseline Road, 51st Avenue to 59th Avenue – This project, which widened Baseline Road from two lanes to four lanes with center raised median, included installation of several new catch basins and expanding/modifying existing catch basins to improve stormwater drainage.

- **Identification and tracking of municipal owned and operated facilities subject to permitting under the MSGP.**
  - Table 3-2 contains a listing of the eleven (11) City-owned and operated facilities subject to permitting under the MSGP, based on their industry sector and/or SIC code.

Table 3-2 City Owned/Operated Facilities Subject to MSGP

Department	Facility	Address	POC	Authorization #	Comments
Public Works	Skunk Creek Landfill	3165 W Happy Valley Road Phoenix, AZ 85027	Environmental Quality Specialist Joy Bell 602-256-5605	AZMSG-61708	
	27th Avenue Solid Waste Management Facility	3060 S 27th Avenue Phoenix, AZ 85009		AZMSG-62581	
	SR 85	28361 W Patterson Road Buckeye, AZ 85326		AZMSG-14391	
	North Gateway Transfer Station	30205 N Black Canyon Hwy, Phoenix, AZ 85085		AZMSG-61710	
Aviation	Sky Harbor International Airport	3400 E Sky Harbor Blvd, Ste 3300 Phoenix, AZ 85034	Environmental Quality Specialist Lisa Farinas 602-273-2787	AZMSG-66063	
	Deer Valley Airport	702 W Deer Valley Road Phoenix, AZ 85027		AZMSG-66017	
	Phoenix/Goodyear Airport	1658 S Litchfield Road Goodyear, AZ 85338		AZMSG-61934	
Water Services	91st Avenue Wastewater Treatment Plant	5616 S 91st Avenue Tolleson, AZ 85353	Environmental Quality Specialist Doug Taylor 602-534-5081	AZMSG-61871	
	23rd Avenue Wastewater Treatment Plant	2470 S 22nd Avenue Phoenix, AZ 85009		AZMSG-61896	
	Cave Creek Water Reclamation Plant	22841 N Cave Creek Road Phoenix, AZ 85024		AZMSG-61713	
City Clerk	Customer Service Center (Print Shop)	2640 S 22nd Avenue Phoenix, AZ	Environmental Quality Specialist Hilary Hartline 602-534-1778	AZRNED-670	No Exposure Certification September 2015

Note: The City previously submitted Sector L Closure Certifications for 15 city properties located on closed landfill sites (three of which were previously owned/operated by the City), which are not covered under the MSGP.

On June 12, 2018 ADEQ conducted an MSGP inspection at Phoenix Sky Harbor Airport which included City operations and nine co-permittees (tenants). No follow up issues were noted by ADEQ concerning the inspection.

- **Status of all inventories, maps, and map studies required by the permit to be developed including completion dates.**

  The stormwater GIS database conversion project has been completed. The Stormwater GIS team is reviewing the data in each quarter section and adding new infrastructure. The data is being shared as a web service that is hosted on the Enterprise ArcGIS Server and shared for all city staff to access.

  The field inventory of stormwater infrastructure in the Ahwatukee area of Phoenix (located south of South Mountain Park and west of Interstate 10) has been completed and the GIS data has been updated.

  The City considers the storm drains to be protected critical infrastructure. As such, the City has not provided a copy of the GIS maps as an attachment. However, the maps are available for review by ADEQ upon request.

- **For the Outfall inspection program, describe the status of:**
  - Staff training
    Outfall inspection training is described in Section H.

- Outfall inventory
  The outfall inventory is described in Section H.
- Inspection tracking system
  The outfall inspection tracking system is described in Section H.
- Overview of Inspection and screening procedures, and any significant findings
  Inspection and screening procedures and findings are discussed in Section H.

E. Industrial Facilities

- **Status of identification and inventory of these facilities.**

In April 2017, WSD migrated to a new database application for tracking facilities and inspections. As part of the data migration, WSD has been reviewing and updating the facility inventory.

The City currently manages an inventory of 4,332 active stormwater facilities, which includes approximately 1,800 industrial (potential MSGP) facilities as well as commercial businesses, such as restaurants and auto service stations. Inspectors also focus on facilities that submit federal Toxic Release Inventory reports, facilities that generate Resource Conservation and Recovery Act (RCRA) hazardous waste, treatment storage and disposal facilities (TSDFs), and non-municipal solid waste facilities throughout the City.

Because lead and copper have been identified in wet-weather samples in quantities exceeding surface surface water quality standards (SWQS), facilities that use or store lead or copper have been identified for priority inspections.

In addition to the industrial inspections, the City has incorporated a stormwater assessment into many of the inspections conducted by the Commercial Section. Stormwater assessments are conducted at commercial businesses including restaurants, car washes, and service stations. When significant stormwater issues are noted, the Commercial Inspector forwards the information to the Stormwater Section for follow-up. Stormwater assessments are also conducted by IPP inspectors when they do their annual inspection for permit compliance. Facilities are referred to the stormwater section for follow-up when necessary.

- **An overview of inspection findings and note significant findings.**

In reporting year 2017/18, the City conducted 688 industrial stormwater inspections, 1,256 commercial stormwater assessments, and 137 IPP screening. A total of 172 informal (i.e., level one action, or inspection with requirements) and 30 formal enforcement letters were issued for stormwater-related violations.

The most common violation identified was the lack of secondary containment, and other container management issues. Most stormwater issues noted during commercial (e.g., restaurant) inspections involved housekeeping related issues that were easily corrected (e.g., spills around tallow bins and open dumpsters).

- **Corrective and enforcement actions needed and taken in response to inspections.**

Informal enforcement actions included 191 inspection letters where requirements were made. Formal enforcement actions included NOVs (13), Field NOVs (16), one (1) Show Cause, and two (2) Civil Citations. Most enforcement actions were resolved quickly, with over 96 percent of all industrial inspections closed within one year of the initial inspection. The following cases went into escalated enforcement:

Primera New Home Interiors: On February 12, 2018, Primera New Home Interiors, LLC (Primera) located at 1035 East Riverview Drive discharged several thousand gallons of granite cutting water and slurry directly into the Salt River at the Rio Salado Habitat Restoration Area. An NOV was issued requiring that the business cease and desist from this activity. A Show Cause Meeting was held on May 9, 2018. Primera was required to enter into a Stormwater Settlement Agreement with the City to eliminate non-stormwater flows into the City storm drain system and nearby wetlands, and to pay a $3,600 fine.

Cartz Partz: On November 15, 2017, Cartz Partz, LLC located at 14634 North Cave Creek Road discharged contaminated wash water from a weep hole on their property into a public alleyway. An NOV was issued requiring that the business cease and desist from this activity. On November 29, 2017 Cartz Partz LLC attended a Compliance Status Review Meeting with the City and was required to eliminate non-stormwater flows off of the property. All work on the property was completed by March 20, 2018.

Union Pochteca, LLC: On July 14, 2017 Union Pochteca, LLC located at 118 North 27th Avenue discharged grease and grey water into the City storm drain that discharges into the Salt River. An NOV was issued to cease and desist from this activity. Union Pochteca, LLC attended a Compliance Review Meeting in November 2017, and was required to eliminate non-stormwater flows into the City storm drain system. All work was performed and a closure letter issued.

Mazzeo Limousine: From late November 2017 to late December 2017, Mazzeo Limousine, LLC was observed (by security cameras) routinely stopping in front of a business near 1400 South 5th Street. The security video showed the buses stopping at a catch-basin then moving on for less than one minute during night time hours. Surveillance cameras later installed by the City showed the buses were stopping at this catch basin to drain their toilet water. On May 30, 2018, Mazzeo Limousine, LLC was issued two civil citations, one for each incident caught on video. The case is scheduled in City Civil Court in September 2018.

F. Construction Program Activities

The *City of Phoenix Stormwater Policies and Standards Manual* requires retention areas for buildings to account for drainage collected from the roof tops, parking lots, and other drainage areas. When the PDD reviews grading plans, staff ensure that the site retention volume is adequate to prevent runoff for the required storm event. If inspectors find that the plans are not being followed, they may stop work on the project. If the problem continues, court-ordered injunctions may be served or civil penalties assessed.

Chapter 32A, the City’s Grading and Drainage Ordinance, establishes minimum requirements for regulating grading and drainage and establishes implementation and enforcement procedures. Grading and Drainage Permits are issued to applicants who fulfill the application requirements, including the submittal of a SWMP, when applicable. Activities regulated by the Grading and Drainage Ordinance are subject to inspection and enforcement action. Enforcement steps begin with a verbal warning, and may lead to a written warning, halting project inspections on the building, and/or a civil citation. The PDD Civil and Site Inspection team includes 25 members tasked with enforcing the ordinance.

Staff from PDD hold pre-construction meetings with private developers to discuss many issues, including on-site retention of stormwater, controlling erosion, and the installation of other BMPs. Communications with developers occur during periodic observations by inspection staff and during formal inspections.

An overview of the PDD process for stormwater related submittals is provided below:

- The customer submits grading/drainage and stormwater plans for review
- PDD provides red lines on plans
- The customer addresses the red lines
- Plans are approved for construction by PDD
- The customer applies for required permits
- Permits are created by PDD, including Civil Grading and Drainage and Civil Stormwater
- PDD office staff request a copy of the Arizona Pollutant Discharge Elimination System (AZPDES) Construction General Permit authorization number, which comes from submitting a Notice of Intent (NOI) before the customer can purchase permits
- The customer schedules a Pre-Construction Meeting prior to beginning work
- BMPs are implemented by the customer prior to the start of construction
- Inspector verifies that trackout and BMPs are properly maintained during each inspection
- The customer submits an Notice of Termination (NOT) when the project is completed
- Warranty inspection is performed by PDD, one-year after completion.

➢ **Status of inventory/plan review of these facilities.**

The PDD database contains a comprehensive inventory of developments for which permits have been issued, plans have been reviewed, and inspections have been conducted. The permits are categorized in the database according to the type of work requested to be performed. In reporting year 2017/18, 735 Construction/Grading Plans were reviewed.

➢ **An overview of Inspection findings and significant findings.**

Inspection findings are documented in the PDD database. During reporting year 2017/18, a total of 493 construction sites were inspected for stormwater. There were 46 permits with noted deficiencies where corrective action was requested at least one time, along with three that required multiple requests to achieve compliance. The counts specific to the four types of deficiencies listed below are:

- 12 – Stormwater controls missing, not per plan, or started work without notification
- 9 – Trackout control not working
- 11 – Failure to maintain stormwater controls
- 14 – Paperwork or other administrative correction cleared.

Some linear and utility municipal construction projects are not subject to PDD’s stormwater permitting process and are inspected by either OEP or WSD staff to ensure BMPs and compliance with the local stormwater ordinance. There were 24 documented deficiencies at 14 of the 21 municipal projects inspected, including:

- Administrative violations
- Insufficient or failing inlet protection

- Housekeeping and signage at concrete washouts
- Refuse/litter control/storage, scrap metal and material storage
- Sanitary facility location/staking
- Missing or insufficient sediment or erosion controls, such as around perimeter of material stockpiles not actively being worked and at discharge points
- Observed trackout.

➢ **Corrective and enforcement actions needed and taken in response to inspections.**

Most documented deficiencies were corrected by the next day. One written notice was issued. No other escalated enforcement was required to bring projects into compliance (i.e., suspension of work), and most violations were corrected upon first request.

For municipal projects, inspection reports showing the specific deficiencies are sent to project managers who work with the contractor to correct the problem and send follow-up documentation that deficiencies have been corrected. For 12 of the municipal projects with findings in 2017/18, deficiencies were corrected promptly and additional enforcement steps were not necessary. Two projects required further follow-up with the project manager to address administrative issues, but no additional enforcement steps were necessary.

PDD requires that the developer provide a “letter of explanation” when they cannot obtain a NOT at the end of the project. These are forwarded to ADEQ twice a year. In reporting year 2017/18, PDD had 19 projects that did not obtain an NOI/NOT.

Staff Training: The PDD Municipal Stormwater Inspection Training for Construction Inspectors trains plan review and inspection staff on administrative procedures (NOI and SWPPP), compliance, and appropriate BMPs to reduce pollution from construction activities.

Details on training dates and number of attendees are included in Section C.

G. Post Construction Controls

➢ **Summary of any new post-construction controls for municipal projects.**

22nd Avenue Service Center: The PWD 22nd Avenue Service Center is classified as a high-risk facility that discharges stormwater directly to the MS4. Funding from Fiscal Year 2016 was provided by OEP and PWD to locate and design a stormwater pretreatment device to prevent oil and grease from entering the MS4 at three existing storm drain inlets, and to provide a drainage design report for the site. In Fiscal Year 2017, OEP provided additional funding to expand the scope of this project to include additional device options/requirements. The expanded scope also changed the placement for one of the treatment devices from an interior storm drain catch basin to a storm drain catch basin that leads to 22nd Avenue to capture more potential pollutants. The design and evaluations options phase was completed in reporting year 2017/18, and it is anticipated that this project will transition to a capital improvement project in reporting year 2018/19. In addition, City staff at the 22nd Avenue Service Center have also improved internal processes at the facility, including vehicle storage locations and re-use of repair vehicle parts to minimize discharge of pollutants to the MS4.

Sky Harbor Airport:

- The Aviation Department Sky Harbor Airport Terminal 3 Modernization project (currently ongoing) includes installation of three Stormceptor stormwater pretreatment devices in the Terminal 3 taxiways.

- The Aviation Department Sky Harbor Airport Turf Improvement Project, which consists of replacing turf with decomposed granite for water conservation, consists of curb cuts to drain asphalt roadways.

South Transit Facility: The Public Transit Department South Transit Facility refurbishment project included installation of an ABTECH Smart-Vault stormwater pretreatment device.

Low Impact Development (LID) / Green Infrastructure (GI) Studies/Activities:

- The City conducted a triple bottom line (economic, social, and environmental) cost benefit analysis of various LID/GI features. The report is included in the attachment section.

- The City initiated a study to evaluate the effectiveness of several existing GI features installed in the City over the past few years. The study is ongoing.

- The City is working with the Sustainable Cities Network and the City of Scottsdale on a GI specification manual.

➢ **An overview of the City's post-construction inspection program.**

PDD inspectors conduct a one-year warranty inspection on each construction project within their jurisdiction. This inspection provides an opportunity to identify corrective action to be implemented by the developer or responsible sub-contractor for a variety of items, including stormwater and grading and drainage controls.

For municipal projects not subject to PDD's stormwater permit program, OEP or WSD staff conducts post-construction stormwater inspections within one year of the project completion.

During reporting year 2017/18, post-construction stormwater inspections were conducted by PDD at 168 private construction projects and by OEP or WSD at 13 municipal construction projects.

➢ **Corrective and enforcement actions needed and taken in response to post-construction inspections.**

The PDD database contains directives for items identified for follow-up during the warranty inspection. In addition, three of the municipal post-construction inspections had six total findings, which include BMP removal, removal of construction yard and materials from yard including trackout, removal of sediment stockpiles and other materials from the project area, removal of grass and sediments from on-site dry well, and establishment of final stabilization.

➢ **Summary of any new or revised post-construction requirements related to permits the City issues.**

No new or revised post-construction requirements were identified by PDD personnel.

H. Outfall inspection program; describe the status of

➢ **Staff training.**

Stormwater staff members are trained on sampling procedures and techniques when they are assigned to the Outfall Inspection rotation, typically within the first year of employment. As part of this, they are required to familiarize themselves with the applicable Code of Federal Regulations at 40 CFR 122 and 40 CFR 136 and the Standard Operating Procedures (SOPs) concerning sampling and Quality Assurance/Quality Control (QA/QC). Refresher training is provided informally throughout the year and formally at least once every two years.

Details on training dates and number of attendees are included in Section C.

- **Outfall inventory.**

  The City maintains a database to document stormwater outfalls. At the time of this report, the inventory includes approximately 904 total outfalls with 437 of these designated as "Major" outfalls according to Environmental Protection Agency (EPA) guidelines. Thirteen outfalls are designated as "priority," either due to observed flow within the past five years, or because they received an illicit discharge in the past five years. The City no longer has outfalls that discharge to an impaired water, because the Salt River, from the 23rd Avenue Wastewater Treatment Plant to the Gila River has been delisted. Other priority outfalls have been removed because we found (and eliminated) the source of an illicit discharge.

  In 2018, the City began to re-evaluate each outfall's designation, using the drainage area from the recently completed GIS upgrade, This effort, which will continue for the next four years has resulted in a significant decrease in the total number of major outfalls. The outfall inventory is included as an attachment to this report.

- **Inspection tracking system.**

  Each outfall inspection is conducted by a trained team of inspectors who use a form specifically designed to capture the data as they are observed. Once the inspection is completed and the inspectors return to the office, all data are entered into a database. Entered data include the documentation and tracking of all (both major and minor) outfall inspections. All items required in 40 CFR 122 are found on the form including both visual and field screening activities.

- **Inspection and screening procedures and significant findings.**

  The inspection crew visits each "priority" outfall annually and the remaining major outfalls at least once every five years. The inspection begins with an overall visual observation of the outfall structure and surrounding area. Visual items are noted such as residue, staining, dead animals, and differences in plant life near the outfall. If a flow (greater than 0.03 gallons per minute) is observed, a sample is collected for field screening, which includes pH, temperature, total chlorine, sulfide, ammonia, phenol, detergent, lead, and copper. All observations are recorded on a standard inspection checklist.

  In reporting year 2017/18, staff inspected major outfalls along the Arizona Canal Diversion Channel, Agua Fria, Arizona Canal, Cave Creek Wash, Charter Oak, East Fork of the Cave Creek, Grand Canal, Indian Bend Wash, Laveen Area Conveyance Channel, Moon Valley Wash, Old Cross Cut, Papago Diversion Channel, Paradise Valley, Skunk Creek Wash, Salt River, Sweetwater Tributary, Scatter Wash, Tempe Drainage Channel, Tenth Street Wash, and Emile Zola Tributary. All priority outfalls were inspected, regardless of location.

  Eight outfalls had two days of consecutive dry-weather flow, which triggered the field screening process at those locations. Eight IDDE investigations were initiated based upon the results of those field screening activities and flow amounts.

I. Description of any new or revised ordinances, rules or policies related to stormwater management or control, if applicable.

- **Complete Streets Design Manual and Policy –** Per City Ordinance adopted by City Council, during 2014/15, a Complete Streets Advisory Board, consisting of community stakeholders appointed by each Council District and the Mayor's office worked to accomplish several goals, including development of a draft Complete Streets Design Manual. The draft Design Manual includes a chapter providing guidance on use of green infrastructure and low-impact development principles in the right of way for stormwater management. The guidance was primarily adopted from, with permission, Watershed Management Group's *Green Infrastructure for Southwestern Neighborhoods (2012).* Other design principles in the manual include improvement of pedestrian and bicycle safety and access and incorporation of street amenities like street furniture and shade accommodation. The Complete Streets Policy was approved by the Phoenix City Council on June 28, 2017. The Complete Streets design guidelines and performance measures are still in development, and are anticipated to be presented to City Council for approval in calendar year 2018. Green infrastructure and low impact development continues to be a component of the design guidelines for City projects within the right-of-way.

J. Fiscal Expenditures; provide a brief report on expenditures related to implementation of the City's stormwater program for the previous fiscal year.

The City collects a stormwater fee to defray the costs of operating the stormwater management program.

Stormwater program charges from STR, WSD, and OEP are paid out of the Stormwater Fund. The fee does not cover the costs for most maintenance of the drainage system or infrastructure improvements, nor does it cover ancillary stormwater activities, such as street sweeping or the HHW program. Stormwater program costs for PDD are funded by construction inspection fees.

<u>Water Services Department</u>
WSD coordinates the City's Stormwater Program. In addition to overall program administration, WSD conducts stormwater outreach, complaint investigations, outfall inspections and IDDE investigations, industrial inspections, wet-weather monitoring, and reporting. Expenditures totaled $1.8M in reporting year 2017/18.

<u>Street Transportation Department</u>
STR conducts storm drain maintenance and inspections, wash maintenance, and is responsible for the stormwater GIS. The stormwater budget for STR was $2,919,870 in reporting year 2017/18. The budget included more than $2,213,324 for wash maintenance and approximately $706,546 for the stormwater GIS.

<u>Office of Environmental Programs</u>
OEP conducts environmental assessments of municipal facilities and operations and oversees the stormwater training plan. OEP also advises city departments on regulatory compliance issues. OEP also conducts stormwater inspections for those municipal construction and post-construction projects that did not go through the PDD permit process. The stormwater operating expenditures for OEP was $147,219 in reporting year 2017/18. An additional $99,276 was spent on capital improvement program projects, and an additional $23,400 was carried-over from 2017/18 to 2018/19 for additional capital improvement project costs.

Planning and Development Department

PDD conducts grading and drainage plan reviews and inspections. PDD costs are covered by construction permit fees, and their budget may vary significantly depending on the number of permitted construction projects. The grading and draining budget for PDD in reporting year 2017/18 was over $1.4M with stormwater expenditures at $400,000.

Table 3-3 Stormwater Management Program Fiscal Expenditures

City of Phoenix Department	Reporting Year 2017/18 Actual	Reporting Year 2018/19 Projected
Water Services Department		
Stormwater Program Support	$1,792,484	$2,206,652
Street Transportation Department		
Wash Maintenance	$2,213,324	$1,849,049
Geographic Information System	$706,546	$740,386
Planning and Development Department		
Grading and Drainage – Plan Review	$1,069412	$1,170,000
Grading and Drainage – Inspections	$377,410	$415,000
Office of Environmental Programs		
Stormwater Program Support	$147,219	$167,674
Capital Improvement Projects	$99,276	$273,400*
*This includes carry-over of $23,400 from fiscal year 2017/18		

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PART 4: SUMMARY OF STORMWATER MANAGEMENT PROGRAM ACTIVITIES (NUMERIC)

Provide a summary of stormwater management practices and activities performed each year as indicated in the Table below.

	REPORTING YEAR (July 1-June 30)						
STORMWATER MANAGEMENT PRACTICE OR ACTIVITY	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**
Illicit Discharge Detection and Elimination Program							
1. Municipal Employee Training							
Number of training sessions (on non-stormwater discharges and the IDDE program)	**37**	**34**	**20**	**9**	**17**	**10**	**15**
Number of employees attending training	**754**	**726**	**515**	**302**	**527**	**357**	**287**
2. Spill Prevention							
Number of municipal facilities identified with hazardous materials	**326**	**307**	**303**	**301**	**298**	**313**	**294**
Number of spills at municipal facilities with hazardous materials, that occurred in outside areas	**0**	**2**	**2**	**1**	**1**	**13**	**2**
Number of Facility Assessments completed* *(*identify any issues found requiring follow-up in narrative and summarize new practices to minimize exposure)*	**98**	**120**	**107**	**112**	**111**	**143**	**119**
Date of last review of HMMP* (*Identify committee participant with stormwater expertise in narrative)	**06/2012**	**06/2013**	**06/2014**	**05/2015**	**05/2016**	**06/2017**	**06/2018**
3. Outfall Inspections							
Total Number inspected* *(*attach or forward electronic copy of inventory or map of major out falls and priority outfalls)*	**185**	**202**	**170**	**214**	**307**	**251**	**169**
Number of 'Priority Outfalls' identified to date* *(*summarize findings and follow-up actions in narrative)*	**38**	**38**	**31**	**27**	**31**	**13**	**13**
Number of 'Priority outfalls' inspected* *(*summarize findings and follow-up actions in narrative)*	**38**	**38**	**31**	**27**	**30**	**13**	**13**
Number of dry weather flows detected	**14**	**18**	**10**	**15**	**24**	**14**	**10**
Number of dry weather flows investigated	**11**	**18**	**10**	**15**	**24**	**14**	**9**
Number of major outfalls sampled	**14**	**18**	**10**	**15**	**24**	**14**	**9**
Number of illicit discharges identified	**7**	**4**	**1**	**6**	**7**	**5**	**8**
Number of illicit discharges eliminated	**3**[b]	**3**[b]	**1**	**2**	**7**	**5**	**7**
Amount of storm drain inspected (length)	**0.17 miles**	**0.61 miles**	**.076**[d]	**3.8 miles**	**4.04 miles**	**5.76 miles**	**0.41 miles**
Number of storm drain cross connection investigations	**0**	**0**	**0**	**1**	**1**	**0**	**5**
Number of illicit connections detected	**3**	**0**	**1**	**1**	**1**	**1**	**2**

	REPORTING YEAR (July 1-June 30)						
STORMWATER MANAGEMENT PRACTICE OR ACTIVITY	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**
Number of illicit connections eliminated	**1**	**2**	**1**	**0**	**1**	**1**	**2**
Number of corrective or enforcement actions initiated within 60 days of identification	**2**	**1**	**1**	**1**	**2**	**5**	**2**
Percent of cases resolved within 1 calendar year of original Level One action*	**N/A[c]**	**100**	**90%**	**100%**	**100%**	**80%**	**100%**
Number of illicit discharge reports received from public	**224**	**236**	**213**	**195**	**186**	**188**	**286**
Percent of illicit discharge reports responded to	**100%**	**99%**	**100%**	**100%**	**98%**	**100%**	**100%**
Percent of responses initiated within 15 days of receipt	**100%**	**100%**	**100%**	**98%**	**100%**	**100%**	**100%**
Municipal Facilities							
1. Employee Training							
Number of training events* *(*dates and topics to be included in narrative)*	**86**	**77**	**48**	**484**	**37**	**61**	**40**
Number of staff trained	**1509**	**2416**	**1208**	**1354**	**753**	**1989**	**1056**
2. Inventory/Map/Database of MS4 Owned and Operated Facilities							
Total number of facilities on inventory	**326**	**307**	**303**	**301**	**298**	**313**	**294**
Date identification of "high risk" facilities completed	**06/30/2011**	**6/30/2011**	**6/30/2011**	**6/30/2011**	**6/30/2011**	**6/30/2011**	**6/30/2011**
Date prioritization of municipal facilities completed	**06/30/2011**	**6/30/2011**	**6/30/2011**	**6/30/2011**	**6/30/2011**	**6/30/2011**	**6/30/2011**
3. Inspections							
Miles of MS4 drainage system prioritized for inspection	**0[a]**	**0[a]**	**0[a]**	**0[a]**	**0[a]**	**0[a]**	**0[a]**
Miles visually inspected	**0.17**	**0.61 (city) 12.66 (contractor)**	**9.55**	**14.08**	**10.06**	**18.72**	**20.24**
Number of 'high risk' municipal facilities inspected	**23**	**38**	**12**	**24**	**18**	**19**	**24**
Number of 'high risk' municipal facilities found needing improved stormwater controls	**4**	**11**	**6**	**8**	**5**	**6**	**7**
4. System Maintenance							
Linear miles of drainage system cleaned each year* (*City to maintain records documenting specific street cleaning events)	**150,087**	**116,413**	**176,970**	**146,315**	**191,318**	**205,299**	**209,992**
Record amount of waste collected from street and lot sweeping (reported in tons)	**12,970**	**14,198**	**12,386**	**16,120**	**18,509**	**14,628**	**17,286**
Total number of catch basins	**16,000**	**18,641**	**18,943**	**19,648**	**20,644**	**21,015**	**33,829**
Number of catch basins cleaned	**7,894**	**4,613**	**5,674**	**10,552**	**6,682**	**4,441**	**3,402**

STORMWATER MANAGEMENT PRACTICE OR ACTIVITY	REPORTING YEAR (July 1-June 30)						
	2011/12	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**
Industrial Sites Not Owned by the MS4							
Number of training events for MS4 staff	**3**	**2**	**2**	**1**	**2**	**1**	**3**
Number of municipal staff trained	**41**	**12**	**46**	**13**	**45**	**9**	**55**
Number of industrial facilities on Part V.B. Inventory inspected	**638**	**686**	**540**	**780**	**636**	**567**	**688**
Number of corrective or enforcement actions initiated on industrial facilities	**232**	**285**	**281**	**171**	**101**	**97**	**223**
Percent of cases resolved within 1 calendar year of original Level One action	**95%**	**>95%**	**95%**	**99%**	**99%**	**99%**	**96**
Construction Program Activities							
Number of training events for MS4 staff* (*include topics in narrative summary)	**2**	**1**	**2**	**7**	**3**	**3**	**2**
Number of municipal staff trained	**36**	**4**	**20**	**28**	**41**	**15**	**26**
Number of construction/grading plans submitted for review	**90**	**153**	**164**	**335**	**634**	**481**	**735**
Number of construction/grading plans reviewed	**90**	**153**	**164**	**335**	**634**	**481**	**735**
Number of construction sites inspected	**320** **22** **(municipal)**	**334** **14** **(municipal)**	**344** **19** **(municipal)**	**353** **10** **(municipal)**	**390** **9** **(municipal)**	**533** **16** **(municipal)**	**354** **21** **(municipal)**
Number of corrective or enforcement actions initiated on construction facilities* (*identify the type of actions in narrative summary)	**44** **8** **(municipal)**	**36** **17** **(municipal)**	**34** **9** **(municipal)**	**118** **12** **(municipal)**	**83** **19** **(municipal)**	**51** **23** **(municipal)**	**46** **24** **(municipal)**
Post Construction Program Activities							
Number of post-construction inspections completed	**96** **28** **(municipal)**	**82** **12** **(municipal)**	**91** **14** **(municipal)**	**130** **6** **(municipal)**	**121** **3** **(municipal)**	**176** **15** **(municipal)**	**168** **13** **(municipal)**
Number of corrective or enforcement actions initiated for post-construction activities * (*identify the type of actions in narrative summary)	**0** **0** **(municipal)**	**0** **4** **(municipal)**	**0** **2** **(municipal)**	**0** **0** **(municipal)**	**0** **0** **(municipal)**	**0** **1** **(municipal)**	**0** **6** **(municipal)**

(a) The City does not measure linear miles of drainage system prioritized for inspection. Rather, these areas are listed by location. The lists are included in the SWMP and updated annually.
(b) Some of the illicit discharges investigated were found to be allowable under City Code and thus not eliminated.
(c) Not applicable for 2011-2012. The cases have not been open for a full year from the initial corrective action date.
(d) 400 feet of televised line was inspected under contract by Pro Pipe. The City did not have the ability to televise storm drain lines due to inoperative camera equipment.

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PART 5: EVALUATION OF THE STORMWATER MANAGEMENT PROGRAM

In accordance with Section 5.4 of the permit, provide an evaluation of the progress and success of the stormwater management program each year, including an assessment of the effectiveness of stormwater management practices in reducing the discharge of pollutants to and from the municipal storm sewer system.

Program Management

The Stormwater Working Group (Working Group), which includes representatives from WSD, STR, OEP, PDD, PWD, and Law, continues to meet on a monthly basis. The Working Group discusses ongoing issues, such as IDDE investigations, municipal stormwater projects, the GIS database, and stormwater training. An Executive Committee composed of Management from the five key departments meets quarterly to discuss the stormwater budget and any ongoing issues that require management decisions.

Monthly Working Group and quarterly Executive Committee meetings are an efficient and effective way to communicate program requirements. It is anticipated that this meeting structure will greatly benefit the City of Phoenix during the Phase I MS4 General Permit stakeholder process.

Public Education and Outreach

WSD has developed a new division that is focused on community education and outreach (CEO). Staff from other WSD divisions support CEO, which continues to include stormwater messaging to school-aged children and citizens at City-sponsored or attended events. The City continues to utilize multi-media efforts, such as print advertisement, mailers, and surveys, as well as actively participating in AZSTORM on a monthly basis. The Stormwater Management Section has expanded the number of public outreach events attended and works cooperatively with other City departments and divisions within WSD to distribute stormwater program materials during other outreach events.

This reporting year more than 1,000 storm drain awareness surveys were completed. A majority of the respondents answered the 16-question survey online via Survey Monkey distributed via NextDoor. The City uses Survey Monkey to track analytics over time and help determine whether awareness is increasing.

In summary:

This year 49% answered that runoff goes to a treatment plant or sewer system (less than 1% decrease over last year), and 29% chose wash or river (also less than 1% decrease over last year.)

87% believe there is a problem in the Valley with pollution entering storm drains; and this did not change this year.

Nearly all responses *deny* that they dispose of household chemicals, pesticides, automotive fluids, yard waste, and pet waste in storm drains; same as last year’s measurements.

Seventy-nine percent (79%) of respondents do not have young children; same as last year.

While most indicate that they would seek information on these topics by going to the City, ADEQ, or internet, more than 35% were not sure where to go when observing someone dumping pollutants into the storm drain; (statistic is unchanged from last year)

Demographic questions were added to the survey (rather than gathered separately) to assist in narrowing down information on the audience. These questions are:

- What is your gender: Female (62%), Male (36%), Other (<1%)
- What is your age group: Under 25 (<1%), 25-35 (7%), 35-55 (28%), 56+ (64%); generally, more mature audiences took this year's survey than last.
- What is your zip code: these were not queriable this year; we will evaluate the relevance of the demographic and determine whether to prioritize collection of this information in the future.

Last, we added a question about how they heard about us, which may be used in the future to direct our method of contact:

> 73% compared to last year's 87% indicated NextDoor; 24% said email (up from last year's 9%); a few said Facebook and Other, with minimal hits coming from events and print advertisement.

The survey response summary is included in the attachments section of this annual report.

Pollutant Load

Annual and seasonal pollutant load estimates have been calculated for pollutants identified in Section 7.4 of the City's AZPDES Permit. Total pollutant load estimates for all watershed basins within the Phoenix MS4 are presented in Part 11 of this report.

As included in the 2013 MS4 Permit renewal application, City GIS staff acquired County land-use spatial data and combined them with sub-watershed boundaries developed by the Flood Control District of Maricopa County (FCDMC 2013). These sub-watershed boundaries are very similar to the Watershed Boundary Dataset 10-digit Hydrologic Unit Code (HUC), with exceptions made for local flood control and other man-made diversions (for example, White Tanks A Basin). Clipping these data to the City permit boundaries produced a watershed-based land-use map that was used to define 12 new areas, now sub-watersheds, used in the pollutant load estimate. Data from reporting years 2012/13, through 2016/17 are presented for comparison to the reporting year 2017/18 pollutant load analysis.

Pollutant load analysis does not offer much insight to BMP effectiveness as there appears to be a direct correlation between pollutant loading and quantity of flow, not necessarily program implementation measures.

PART 6: STORMWATER MANAGEMENT PROGRAM MODIFICATIONS

In accordance with Section 5.5 of the permit, provide a description of modifications, if applicable, to the stormwater management program each year as follows:

1. **Addition of New BMPs: Summarize the development and implementation of any new stormwater management practices or pollution controls each year.**

   No BMPs were added during this reporting year.

2. **Addition of Temporary BMPs: Specify the occasions when these controls were initiated and terminated, and the perceived success of these temporary BMPs.**

   No temporary BMPs were added this reporting year.

3. **Increase of Existing BMPs: Summarize modifications to existing stormwater management practices that increase the number of activities, increase the frequency of activities, or other increases in the level of implementation.**

   No existing BMPs were increased during this reporting year.

4. **Replacement of Existing BMPs: Briefly summarize any replacements made with prior approval of ADEQ per section 5.5(4) of the permit.**

   No existing BMPs were replaced this reporting year.

Programmatic Changes

Environmental Services Division migrated to a new database application, which came online in April 2017. The transition included moving data from an access database to a proprietary system that was in use by other sections within the division. The project required months of testing functionality and process control to ensure that reports would provide necessary results to include in regulatory compliance reports, such as this annual report. Though the data has been migrated, and the new application is being utilized, work on the reports is ongoing.

Note: Modifications to reduce number of stormwater management practices or activities, frequencies, time frames, level of implementation, or any other program standard specified in Appendix A of the permit requires permit modification (refer to Section 5.6 of the permit).

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PART 7: MONITORING LOCATIONS

For the year one Annual Report**,** provide a brief description of each stormwater monitoring location (outfall), including the following information. For subsequent Annual Reports, advise if any of the information has changed or is updated.

No changes to the stormwater monitoring locations were made in reporting year 2017/18.

The monitoring sites are described on the following pages. The information for each site corresponds to the requirements in Part 7 of Appendix B of the Permit. Latitude and longitude coordinates have been revised for some outfalls. Land-use data and catchment area information are approximate values based on a review of the available data and best engineering judgment. Maps of the drainage areas are included as an attachment to this report.

It should be noted that SR049 catchment area will change as a result of the 202 Connect Project.

Note: Modifications to monitoring locations shall not be implemented without permit modification.

Name and Description of Receiving Water

Arizona Canal Diversion Channel (ACDC)

Outfall Identification Number

AC033

Address/Physical Location of the Site

Dunlap and 7th Avenue just south of Hatcher

Latitude/Longitude

33° 34' 8.016 "

-112° 4' 58.348"

Discharge Structure

60-inch box outlet

Size (acres) of Drainage Area

1084 acres

Land Uses

Industrial	0.5%
Commercial	9.9%
Open Land	17.9%
Institutional	4.2%
Residential	49.8%
Heavy Residential	2.1%
Pavement	13.1%
Miscellaneous	2.5%

Type of Monitoring Equipment

Automated composite sampler (Isco Environmental model 6712), an Isco rain gauge, and an Isco flow meter for depth and flow measurement. Installed solar panels to augment battery performance.

Name and Description of Receiving Water

Indian Bend Wash

Outfall Identification Number

IB008

Address/Physical Location of the Site

12499 North 40th Street

Latitude/Longitude

33° 35' 58.218 "

-111° 59' 44.292"

Discharge Structure

66-inch round inlet pipe (original) discharging to two 30-inch outlet pipes

48-inch round inlet pipe (new in 2005) discharging to one 48-inch outlet pipe

Size (acres) of Drainage Area

804.5 acres

Land Uses

Industrial	0.6%
Commercial	5.3%
Open Land	1.8%
Institutional	6.0%
Residential	63.0%
Heavy Residential	3.3%
Utilities	0.7%
Pavement	13.1%
Miscellaneous	6.2%

Type of Monitoring Equipment

Automated composite sampler (Isco Environmental model 6712), an Isco rain gauge, and an Isco flow meter for depth and flow measurement. Installed solar panels to augment battery performance. Adjusted flow meter device within the pipe, Winter 2017/18.

Name and Description of Receiving Water

Salt River

Outfall Identification Number

SR003

Address/Physical Location of the Site

3501 West Elwood Street

Latitude/Longitude

33° 24' 43.025"

-112° 8' 5.004"

Discharge Structure

75-inch round pipe

Size (acres) of Drainage Area

1886 acres

Land Uses

Industrial	7.5%
Commercial	16.1%
Transportation	1.0%
Open Land	9.8%
Institutional	18.1%
Residential	26.1%
Heavy Residential	2.6%
Utilities	0.5%
Pavement	9.1%
Miscellaneous	9.3%

Type of Monitoring Equipment

Automated composite sampler (Isco Environmental model 6712), an Isco rain gauge, and an Isco flow meter for depth and flow measurement. Installed solar panels to augment battery performance.

Name and Description of Receiving Water

Salt River

Outfall Identification Number

SR030

Address/Physical Location of the Site

27th Avenue at the Salt River (south bank)

Latitude/Longitude

33° 24' 31.447"

-112° 06' 59.142"

Discharge Structure

108-inch round pipe

Size (acres) of Drainage Area

1620 acres

Land Uses

Industrial	9.58%
Commercial	22.33%
Open Land	21.72%
Institutional	2.03%
Residential	30.28%
Heavy Residential	0.24%
Pavement	6.33%
Miscellaneous	7.47%

Type of Monitoring Equipment

Automated composite sampler (Isco Environmental model 6712), an Isco rain gauge, and an Isco flow meter for depth and flow measurement. Installed solar panels to augment battery performance. Relocated sampler to upland location (2016/17), out of flow path.

Name and Description of Receiving Water

Salt River

Outfall Identification Number

SR045

Address/Physical Location of the Site

2401 South 40th Street

Latitude/Longitude

33° 25' 34.082"

-111° 59' 44. 274"

Discharge Structure

54-inch round pipe

Size (acres) of Drainage Area

879.7 acres

Land Uses

Industrial	42.6%
Commercial	30.5%
Transportation	3.0%
Open Land	8.4%
Institutional	10.5%
Residential	0.2%
Heavy Residential	0.0%
Utilities	0.9%
Pavement	7.2%
Miscellaneous	7.2%

Type of Monitoring Equipment

Automated composite sampler (Isco Environmental model 6712), an Isco rain gauge, and an Isco flow meter for depth and flow measurement. Installed solar panels to augment battery performance.

Name and Description of Receiving Water

Salt River

Outfall Identification Number

SR049

Address/Physical Location of the Site

5400 South 67th Avenue

Latitude/Longitude

33° 24' 0.510"

-112° 12' 15.095"

Discharge Structure

96-inch round pipe

Size (acres) of Drainage Area

4761.9 acres

Land Uses

Industrial	24.3%
Commercial	11.1%
Transportation	0.6%
Open Land	20.8%
Institutional	3.2%
Residential	20.9%
Heavy Residential	1.0%
Utilities	0.6%
Pavement	6.4%
Miscellaneous	11.2%

Type of Monitoring Equipment

Automated composite sampler (Isco Environmental model 6712), an Isco rain gauge, and an Isco flow meter for depth and flow measurement. Installed solar panels to augment battery performance.

Note: The drainage area for this outfall is anticipated to change significantly as part of the Connect 202 Project.

Name and Description of Receiving Water

Skunk Creek Wash (Tributary to New River)

Outfall Identification Number

SC046

Address/Physical Location of the Site

35206 North 27th Avenue

Latitude/Longitude

33° 48' 11.171"

-112° 7' 7.380"

Discharge Structure

Three 36-inch round pipes

Size (acres) of Drainage Area

46 acres

Land Uses

Industrial	0.0%
Commercial	0.0%
Transportation	0.0%
Open Land	2.8%
Residential	86.9%
Heavy Residential	0.0%
Pavement	10.4%

Type of Monitoring Equipment

Automated composite sampler (Isco Environmental model 6712), an Isco rain gauge, and an Isco flow meter for depth and flow measurement. Installed solar panels to augment battery performance.

PART 8: STORM EVENT RECORDS

For each outfall identified in Part 7.0, Table 1.0 of the permit, summarize all measurable storm events (greater than 0.1-inch rainfall) occurring in the drainage area of each outfall within the winter and summer wet seasons, respectively, until samples have been collected for the outfall. Include the date of each event, the amount of precipitation (inches) for each event, and whether a sample was collected, or if not collected, information on the conditions that prevented sampling. (Note: If unable to collect stormwater samples due to adverse climatic conditions, provide, in lieu of sampling data, a description of the conditions that prevented sampling. Adverse climatic conditions which may prevent the collection of samples include weather conditions that create dangerous conditions for personnel, such as local flooding, high winds, electrical storms, etc.).

In accordance with 40 CFR Part 122.21(g) (7), the City AZPDES Permit Section 7.3.1 defines a representative storm as rainfall in the amount of 0.2 inches or more. The section further directs that "Stormwater samples shall be collected from discharges resulting from a storm event producing 0.2 inches or more of rainfall and at least 72 hours after the previously measured storm event (greater than 0.1-inch rainfall)." The definition of a representative storm event was modified in the 2009 permit so that more stormwater monitoring data might be collected during the new 5-year permit term. Rainfall totals and sample collection information by outfall are provided in Table 8-1 in this section.

Summer Wet Season Sampling Summary

July 16-17, 2017: Grab and composite samples were collected from SR045, SC046, IB008, and AC033.

July 24, 2017: Grab and composite samples were collected from SR003, SR030, and SR049.

Winter Wet Season Sampling Summary

December 17, 2017: Grab and composite samples were collected at IB008.

January 9-10, 2018: Grab and composite samples were collected from SR049, SR030, SR003, SC046, and AC033.

February 14, 2018: Grab and composite samples were collected from SR045.

All reported data were validated by the USGS to ensure that the data quality objectives of the AZPDES program have been met. The data validation was reviewed by AECOM to determine whether the data and associated quality assurance and quality control (QAQC) information appear to be complete. Based on the QAQC presented, the analytical results appear to be generally usable for their intended purpose.

The following procedures were used in validating the data:

- Analytical methods used in the monitoring program were reviewed to assess the appropriateness of sample collection, transport methods, and holding times.
- Original laboratory reports and the corresponding chain of custody forms were reviewed to determine if quality assurance/quality control requirements were met. Evaluation criteria including holding times, duplicate results, field blank results, method blank results, matrix spike results, equipment calibration information, and sample collection and transport information (to the extent practical.)

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Table 8-1 Storm Event Data for Reporting Year 2017/18

Season	Date	Outfall IB008	Rainfall inches	Outfall SR049	Rainfall inches	Outfall SR045	Rainfall inches	Outfall SR003	Rainfall inches	Outfall SR030	Rainfall inches	Outfall AC033	Rainfall inches	Outfall SC046	Rainfall inches
Summer (Jun 1 – Oct 31)	7/15/17	-	-	-	-	-	-	NR	0.18	-	-	-	-	-	-
	7/16/17	SC	0.78	-	-	SC	0.37	-	-	-	-	SC	0.34	SC	0.24
	7/20/17	-	-	EM	0.37	-	-	-	-	-	-	-	-	-	-
	7/24/17	-	-	SC	0.50	-	-	SC	0.32	SC	0.41	-	-	-	-
Winter (Nov 1 – May 31)	12/17/17	SC	0.35	-	-	-	-	SC	0.21	SC	0.24	SC	0.51	SC	0.45
	1/9/18	-	-	SC	0.27	NR	0.18	-	-	-	-	-	-	-	-
	2/14/18	-	-	-	-	SC	0.22	-	-	-	-	-	-	-	-

SC – Sample Collected; NR – Not Representative; EM – Equipment Malfunction

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PART 9: SUMMARY OF MONITORING DATA (BY LOCATION)

Use a separate table for each outfall monitoring location. Provide the outfall identification number, the receiving water designated uses, and the lowest surface water quality standards applicable to the receiving water. Enter the analytical results for the stormwater samples collected for each season of the reporting period for each year. Enter subsequent monitoring data for each location on the same form. Include, as an attachment, the laboratory reports for stormwater samples.

OUTFALL ID: IB008 **RECEIVING WATER: Indian Bend Wash** **DESIGNATED USES: PBC and A&We**	**MONITORING SEASONS** Summer: June 1 – October 31 Winter: November 1 – May 31																			
	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16		Summer 2016		Winter 2016/17		Summer 2017		Winter 2017/18	
SAMPLING DATE(S):	SWQS	7/19/13	SWQS	11/22/13	SWQS	8/2/14	SWQS	12/4/14	SWQS	6/29/15	SWQS	1/04/16	SWQS	8/5/16	SWQS	12/22/16	SWQS	7/16/17	SWQS	12/17/17
MONITORING PARAMETERS [1, 2]																				
Conventional Parameters																				
Flow [3] (cfs)	NS	1.223	NS	12.34	NS	9.4	NS	0.212	NS	5.341	NS	2.296	NS	19.830	NS	59.094	NS	156.6	NS	6.33
pH	6.5-9	7.18	6.5-9	8.38	6.5-9	7.46	6.5-9	7.49	6.5-9	7.3	6.5-9	7.51	6.5-9	7.14	6.5-9	6.83	6.5-9	7.25	6.5-9	7.56
Temperature (ºC)	Varies	31.0	Varies	15.5	Varies	30.5	Varies	17.0	Varies	29.0	Varies	14.1	Varies	25.0	Varies	16.5	Varies	28.9	Varies	14.5
Hardness (mg/L)	400	224	400	60.8	400	39.9	400	16.6	400	91.2	400	25.1	400	27.6	400	27.3	400	82.1	400	71.4
Total Dissolved Solids (TDS) (mg/L) [2]	NS	674	NS	182	NS	92	NS	56	NS	274	NS	60	NS	86	NS	60	NS	320	NS	216
Total Suspended Solids (TSS) (mg/L) [2]	NS	279	NS	192	NS	212	NS	71.0	NS	252	NS	76.0	NS	458	NS	55	NS	804	NS	40
Biochemical Oxygen Demand (BOD) (mg/L) [2]	NS	123	NS	41	NS	17	NS	7	NS	67	NS	10	NS	23	NS	7	NS	108	NS	46
Chemical Oxygen Demand (COD) (mg/L) [2]	NS	600	NS	250	NS	110	NS	<50	NS	300	NS	90	NS	190	NS	<50	NS	560	NS	200

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Inorganics																				
Cyanide, total (µg/L) [2]	84	<50	84	<5	84	<5	84	<5	84	<5	84	<5	84	<5	84	<5	84	<5	84	<5
Nutrients (mg/L) [2]																				
Nitrate + Nitrite as N	NS	6.9	NS	1.3	NS	1.4	NS	0.4	NS	2.1	NS	0.5	NS	1.1	NS	0.4	NS	2.3	NS	1.8
Ammonia as N	NS	3.7	NS	1.7	NS	1.7	NS	0.61	NS	2.7	NS	0.45	NS	1.5	NS	0.35	NS	3.1	NS	1.9

NOTES:
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Footnotes
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3 Report the average flow rate for the sampling period (no more than 6 hours).
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Total Kjeldahl Nitrogen (TKN)	NS	15	NS	4.5	NS	3.1	NS	1.4	NS	7.7	NS	1.4	NS	4.7	NS	1.3	NS	11	NS	5.8
Total Phosphorus as P	NS	0.83	NS	0.64	NS	0.44	NS	0.35	NS	0.82	NS	0.44	NS	3.3	NS	0.24	NS	0.48	NS	0.64
Ortho-Phosphorus as P	NS	0.9	NS	0.3	NS	0.1	NS	0.1	NS	0.3	NS	0.1	NS	0.2	NS	0.1	NS	0.7	NS	0.4
Microbiological																				
Escherichia coli (*E. coli*) (CFU/100 mg or MPN/100 mL) [2]	575	**>2,419.6**	575	**>2,419.6**	575	**>2,419.6**	575	**>2,419.6**	575	**2,419.6**	575	**2,650.0**	575	**1,986.3**	575	**2,419.6**	575	**1,986.3**	575	**20,350**
Total Metals (µg/L) [2]																				
Antimony	747 T	3.7 T 1.9 D	747 T	1.7 T 0.8 D	747 T	1.5 T 1.1 D	747 T	1.2 T 0.4 D	747 T	2 T <5 D	747 T	1.4 T <5.0 D	747 T	2.3 T >5 D	747 T	0.69T <5 D	747 T	4.3 T <5 D	747 T	2.1 T <5 D
Arsenic	280 T 440 D	5.9 T 2.8 D	280 T 440 D	2.0 T 1.0 D	280 T 440 D	2.5 T 1.2 D	280 T 440 D	1.6 T 0.5 D	280 T 440 D	3.3 T <5 D	280 T 440 D	2.0 T <5.0 D	280 T 440 D	6.2 T <5 D	280 T 440 D	1.7 T <5 D	280 T 440 D	7.8 T <5 D	280 T 440 D	2.3 T <5 D
Barium	98,000 T	225 T 90 D	98,000 T	86 T 26 D	98,000 T	55 T 22 D	98,000 T	40 T 8 D	98,000 T	106 T 50 D	98,000 T	58 T 12 D	98,000 T	176 T 19 D	98,000 T	42 T 12 D	98,000 T	271 T 58 D	98,000 T	74 T 33 D
Beryllium	1,867 T	0.46 T <0.15 D	1,867 T	<0.15 T <0.06 D	1,867 T	0.15 T <0.06 D	1,867 T	0.12 T <0.06 D	1,867 T	0.22 T <5 D	1,867 T	0.10 T <5.0 D	1,867 T	0.53 T <5 D	1,867 T	<0.25 T <5 D	1,867 T	0.73 T <5 D	1,867 T	<0.15 T <5 D
Cadmium	700 T 49.92 D	0.6 T <0.25 D	700 T 14.05 D	0.3 T <0.10 D	700 T 9.33 D	<0.30 T <0.12 D	700 T 3.67 D	<0.12 T <0.12 D	700 T 20.85 D	0.2 T <5 D	700 T 5.93 D	0.2 T <5.0	700 T 15.98 D	0.3 T <0.25 D	700 T 15.79 D	<0.25 T <0.25 D	700 T 52.16 D	0.8 T <0.2 D	700 T 44.83 D	<0.20 T <0.2
Chromium	NS	20.1 T 3.3 D	NS	5.9 T 1.0 D	NS	5 T 1 D	NS	3.7 T 0.4 D	NS	6.8 T <5 D	NS	5.1 T <5.0 D	NS	17.2 T <5 D	NS	3.8 T <5 D	NS	20.7 T <5 D	NS	5 T <5 D
Copper	1,300 T 49.73 D	147 T **75.5 D**	1,300 T 14.55 D	51.2 T **20.8 D**	1,300 T 9.79 D	25.2 T **13.7 D**	1,300 T 4.28 D	16.0 T **5.8** D	1,300 T 21.32 D	62.5 T **40.6 D**	1,300 T 6.32 D	40.0 T **14.8 D**	1,300 T 2.98 D	61.3 T **12.8 D**	1,300 T 6.85 D	12 T 5.5 D	1,300 T 19.32 D	156 T **34.5 D**	1,300 T 16.93 D	46.5 T **28.4 D**
Lead	15 T 323.97 D	**27.8 T** 2.4 D	15 T 78.97 D	11.0 T 0.5 D	15 T 49.48 D	7.3 T 0.7 D	15 T 18.45 D	7.6 T 0.3 D	15 T 123.27 D	10.4 T < 5 D	15 T 29.43 D	10.7 T <5.0 D	15 T 32.75 D	**24.3 T** 0.7 D	15 T 32.35 D	5.2 T <0.55 D	15 T 109.89 D	**41.5 T** 3.4 D	15 T 94.27 D	8 T 0.7 D
Mercury	280 T 5 D	0.06 T 0.037 D	280 T 5 D	<0.020 T <0.020D	280 T 5 D	<0.092 T <0.2 D	280 T 5 D	<0.092 T <0.092 D	280 T 5 D	<0.2 T <0.2 D	280 T 5 D	<0.062 T <0.2 D	280 T 5 D	<0.068 T <0.068 D	280 T 5 D	<0.068 T <0.2D	280 T 5 D	0.132 T <0.2 D	280 T 5 D	<0.066 T <0.2 D
Nickel	28,000 T 8,227 D	34.0 T 18.0 D	28,000 T 2,729.4 D	10.0 T 4.6 D	28,000 T 1,911 D	5.7 T 2.7 D	28,000 T 910.2 D	3.5 T 0.7 D	28,000 T 3,846 D	11.7 T 6.3 D	28,000 T 1,291 D	5.1 T <5.0 D	28,000 T 1,399 D	16.6 T <5 D	280,000 T 1,386 D	3.6 T <5 D	280,000 T 3519.29 D	25.7 T 8.4 D	280,000 T 3127.15 D	7 T <5 D
Selenium	33 T	1.5 T 1.3 D	33 T	<0.60 T 0.3 D	33 T	0.64 T 0.4 D	33 T	0.25 T 0.1 D	33 T	0.99 T <5 D	33 T	<0.40 T <5.0 D	33T	1.6 T <5 D	33T	0.51 T <5 D	33T	1.2 T <5.0 D	33T	0.71 T <5 D
Silver	4,667 T 12.88 D	0.4 T <0.15 D	4,667 T 1.364 D	<0.15 T <0.15 D	4,667 T 0.667D	<0.20 T <0.20 D	4,667 T 0.146 D	<0.08 T <0.08 D	4,667 T 2.75 D	<0.25 T *<5 D*	4,667 T 0.30 D	<0.25 T *<5.0 D*	4,667 T 0.35 D	<0.45 T <5 D	4,667 T 0.34 D	<0.45 T *<5 D*	4,667 T 2.29 D	0.5 T *<5.0 D*	4,667 T 1.80 D	<0.10 T *<5.0 D*
Thallium	75 T	<0.20 T <0.20 D	75 T	<0.20 T <0.08 D	75 T	0.12 T <0.04 D	75 T	0.07 T <0.04 D	75 T	0.4 T <5 D	75 T	<0.15 T <5.0 D	75 T	0.26 T <5 D	75 T	0.34 T <5 D	75 T	0.35 T <5 D	75 T	<0.10 T <5.0 D
Zinc	280,000 T 2,202 D	362 T 109 D	280,000 T 729.8 D	211 T 61.6 D	280,000 T 510.9 D	77 T 19.2 D	280,000 T 242.8 D	63.3 T 8.4 D	280,000 T 1,029 D	209 T 70 D	280,000 T 345 D	141 T 12.0 D	280,000 T 374 D	261 T 15.4 D	280,000 T 370 D	42.5 T <8	280,000 T 940.87 D	476 T 90.5 D	280,000 T 835.88 D	151 T 53.2 D

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Organic Toxic Pollutants																				
Total Petroleum Hydrocarbons (TPH) (mg/L) [2]	NS	<11	NS	<11	NS	<10	NS	<12	NS	<11	NS	<5.7	NS	<5.6	NS	<4.5	NS	<7.1	NS	<7.0
Total Oil and Grease (mg/L) [2]	NS	<5.6	NS	<5.7	NS	<5.0	NS	<6.0	NS	<5.6	NS	<5.7	NS	<5.6	NS	<4.5	NS	<5.9	NS	<5.9
VOCs, Semi-VOCs, and Pesticides (µg/L) [2]																				
Acrolein	467	<2.0	467	<0.20	467	<2.00	467	<0.40	467	<3.90	467	<0.78	467	<0.41	467	<0.41	467	<3.95	467	<0.79
Acrylonitrile	37,333	<1.6	37,333	<0.16	37,333	<0.70	37,333	<0.14	37,333	<2.65	37,333	<0.53	37,333	<0.42	37,333	<0.42	37,333	<2.95	37,333	<0.59
Benzene	3,733	<1.20	3,733	<0.24	3,733	<1.20	3,733	<0.13	3,733	<0.65	3,733	<0.46	3,733	<0.29	3,733	<0.29	3,733	<1.30	3,733	<0.26
Bromoform	18,667	<2.35	18,667	<0.47	18,667	<2.35	18,667	<0.28	18,667	<1.40	18,667	<0.68	18,667	<0.33	18,667	<0.33	18,667	<1.05	18,667	<0.21
Carbon tetrachloride	1,307	<1.30	1,307	<0.26	1,307	<1.30	1,307	<0.23	1,307	<1.15	1,307	<0.31	1,307	<0.20	1,307	<0.20	1,307	<1.50	1,307	<0.30
Chlorobenzene	18,667	<0.80	18,667	<0.16	18,667	<0.80	18,667	<0.13	18,667	<0.65	18,667	<0.50	18,667	<0.33	18,667	<0.33	18,667	<1.15	18,667	<0.23
Chlorodibromomethane	18,667	<0.90	18,667	<0.18	18,667	<0.90	18,667	<0.24	18,667	<1.20	18,667	<0.61	18,667	<0.32	18,667	<0.32	18,667	<1.20	18,667	<0.24
Chloroethane (ethyl chloride)	NS	<1.10	NS	<0.22	NS	<1.10	NS	<0.19	NS	<0.95	NS	<0.40	NS	<0.33	NS	<0.33	NS	<1.40	NS	<0.28
2-chloroethylvinyl ether	NS	<2.2	NS	<0.22	NS	<0.95	NS	<0.19	NS	<2.65	NS	<0.53	NS	<0.43	NS	<0.43	NS	<3.25	NS	<0.65
Chloroform	9,333	<1.15	9,333	<0.23	9,333	<1.15	9,333	<0.14	9,333	<0.70	9,333	<0.49	9,333	<0.32	9,333	<0.32	9,333	<1.20	9,333	<0.24
Dichlorobromomethane	18,667	<1.15	18,667	<0.23	18,667	<1.15	18,667	<0.15	18,667	<0.75	18,667	<0.49	18,667	<0.29	18,667	<0.29	18,667	<1.30	18,667	<0.26
1,1-dichloroethane	NS	<1.30	NS	<0.26	NS	<1.30	NS	<0.19	NS	<0.95	NS	<0.42	NS	<0.29	NS	<0.29	NS	<1.35	NS	<0.27
1,2-dichloroethane	186,667	<1.25	186,667	<0.25	186,667	<1.25	186,667	<0.11	186,667	<0.55	186,667	<0.51	186,667	<0.35	186,667	<0.35	186,667	<1.35	186,667	<0.27
1,1-dichloroethylene	46,667	<1.40	46,667	<0.28	46,667	<1.40	46,667	<0.27	46,667	<1.35	46,667	<0.34	46,667	<0.19	46,667	<0.19	46,667	<1.60	46,667	<0.32
1,2-dichloropropane	84,000	<1.25	84,000	<0.25	84,000	<1.25	84,000	<0.18	84,000	<0.90	84,000	<0.49	84,000	<0.32	84,000	<0.32	84,000	<1.60	84,000	<0.32
1,3-dichloropropylene[8]	28,000	cis <1.20 trans <1.10	28,000	cis <0.24 trans <0.22	28,000	cis <1.20 trans <1.10	28,000	cis <0.13 trans <0.13	28,000	cis <0.65 trans <0.65	28,000	cis <0.51 trans <0.50	28,000	<0.28	28,000	<0.28	28,000	<1.05	28,000	<0.21
Ethylbenzene	93,333	<0.65	93,333	<0.13	93,333	<0.65	93,333	<0.15	93,333	<0.75	93,333	<0.46	93,333	<0.29	93,333	<0.29	93,333	<1.15	93,333	<0.23
Methyl bromide	1,307	<0.95	1,307	<0.19	1,307	<0.95	1,307	<0.18	1,307	<0.90	1,307	<0.46	1,307	<0.28	1,307	<0.28	1,307	<1.15	1,307	<0.23
Methyl chloride	NS	<1.40	NS	<0.28	NS	<01.40	NS	<0.23	NS	<1.15	NS	<0.46	NS	<0.28	NS	<0.28	NS	<1.85	NS	<0.37
Methylene chloride	56,000	<1.00	56,000	<0.20	56,000	<1.00	56,000	<0.20	56,000	<1.00	56,000	<0.81	56,000	<0.31	56,000	<0.31	56,000	<4.00	56,000	<0.80
1,1,2,2-tetrachloroethane	93,333	<2.00	93,333	<0.40	93,333	<2.00	93,333	<0.35	93,333	<1.75	93,333	<0.80	93,333	<0.33	93,333	<0.33	93,333	<1.55	93,333	<0.31
Tetrachloroethylene	9,333	<1.05	9,333	<0.21	9,333	<1.05	9,333	<0.13	9,333	<0.65	9,333	<0.35	9,333	<0.23	9,333	<0.23	9,333	<1.45	9,333	<0.29
Toluene	373,333	<0.95	373,333	<0.19	373,333	<0.95	373,333	<0.11	373,333	<0.55	373,333	<0.43	373,333	<0.28	373,333	<0.28	373,333	<1.25	373,333	<0.25
1,2-trans-dichloroethylene	18,667	<1.25	18,667	<0.25	18,667	<1.25	18,667	<0.18	18,667	<0.90	18,667	<0.38	18,667	<0.24	18,667	<0.24	18,667	<1.25	18,667	<0.25
1,1,1-trichloroethane	$1.867 \times 10^{+6}$	<1.00	$1.867 \times 10^{+6}$	<0.20	$1.867 \times 10^{+6}$	<1.00	$1.867 \times 10^{+6}$	<0.14	$1.867 \times 10^{+6}$	<0.70	$1.867 \times 10^{+6}$	<0.34	$1.867 \times 10^{+6}$	<0.23	$1.867 \times 10^{+6}$	<0.23	$1.867 \times 10^{+6}$	<1.40	$1.867 \times 10^{+6}$	<0.28
1,1,2-trichloroethane	3,733	<0.75	3,733	<0.15	3,733	<0.75	3,733	<0.13	3,733	<0.65	3,733	<0.60	3,733	<0.29	3,733	<0.29	3,733	<1.50	3,733	<0.30
Trichloroethylene	280	<0.75	280	<0.15	280	<0.75	280	<0.22	280	<1.10	280	<0.48	280	<0.28	280	0.28	280	<1.80	280	<0.36

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1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene	NS	<5.0 <5.0	NS	<1.0 <1.0	NS	<5.0 <5.0	NS	<1.0 <1.0	NS	<5.0 <5.0	NS	<1.0 <1.0	NS	<1.0 <1.0	NS	<1.0 <1.0	NS	<5.0 <5.0	NS	<1.0 <1.0
Vinyl chloride	2,800	<1.00	2,800	<0.20	2,800	<1.00	2,800	<0.22	2,800	<1.10	2,800	<0.35	2,800	<0.24	2,800	<0.24	2,800	<2.10	2,800	<0.42
Xylenes, Total	186,667	<1.50	186,667	<0.30	186,667	<1.50	186,667	<0.13	186,667	<0.65	186,667	<0.52	186,667	<0.32	186,667	<0.32	186,667	<1.15	186,667	<0.23
Acid Compounds (µg/L) [2]																				
2-chlorophenol	4,667	<214.5	4,667	<90.1	4,667	<29.6	4,667	<1.48	4,667	<3.13	4,667	<3.10	4,667	<2.92	4,667	<2.92	4,667	<42.3	4,667	<84.6
2,4-dichlorophenol	2,800	<211.0	2,800	<88.6	2,800	<33.0	2,800	<1.65	2,800	<2.84	2,800	<2.81	2,800	<3.21	2,800	<3.21	2,800	<48.2	2,800	<96.4
2,4-dimethylphenol	18,667	<114.0	18,667	<47.9	18,667	<44.0	18,667	<2.20	18,667	<2.67	18,667	<2.64	18,667	<1.32	18,667	<1.32	18,667	<70.7	18,667	<141.4
4,6-dinitro-o-cresol	3,733	<149.0	3,733	<62.6	3,733	<24.4	3,733	<1.22	3,733	<1.50	3,733	<1.49	3,733	<2.27	3,733	<2.27	3,733	<46.9	3,733	<93.8
2,4-dinitrophenol	1,867	<129.5	1,867	<54.4	1,867	<22.6	1,867	<1.13	1,867	<2.23	1,867	<2.21	1,867	<2.64	1,867	<2.64	1,867	<51.1	1,867	<102.2
2-nitrophenol	NS	<205.5	NS	<86.3	NS	<31.4	NS	<1.57	NS	<2.87	NS	<2.84	NS	<2.61	NS	<2.61	NS	<78.3	NS	<156.6
4-nitrophenol	NS	<233.5	NS	<98.1	NS	<22.8	NS	<1.14	NS	<3.01	NS	<2.98	NS	<2.03	NS	<2.03	NS	<40.3	NS	<80.6
p-chloro-m-cresol	48,000	<220.5	48,000	<92.6	48,000	<33.0	48,000	<1.65	48,000	<1.89	48,000	<1.87	48,000	<3.10	48,000	<3.10	48,000	<40.5	48,000	<81.0
Pentachlorophenol	44.084	*<168.0*	147.244	<70.6	58.434	<27.8	60.177	<1.39	46.695	<1.48	61.40	<1.47	61.40	<3.44	61.40	<3.44	47.26	*<73.6*	64.53	*<147.2*
Phenol	180,000	<177.5	180,000	<74.6	180,000	<26.8	180,000	<1.34	180,000	<2.32	180,000	<2.30	180,000	2.8	180,000	<1.84	180,000	<39.9	180,000	<79.8
2,4,6-trichlorophenol	130	*<239.5*	130	<100.6	130	<37.8	130	<1.89	130	<2.63	130	<2.60	130	<3.28	130	<3.28	130	<47.4	130	<94.8
Bases/Neutrals (µg/L) [2]																				
Acenaphthene	56,000	<67.0	56,000	<28.1	56,000	<20.6	56,000	<1.03	56,000	<0.35	56,000	<0.35	56,000	<1.02	56,000	<1.02	56,000	<18.8	56,000	<37.6
Acenaphthylene	NS	<86.5	NS	<36.3	NS	<20.0	NS	<1.00	NS	<1.24	NS	<1.23	NS	<6.10	NS	<6.10	NS	<17.5	NS	<35.0
Anthracene	280,000	<86.5	280,000	<36.3	280,000	<57.6	280,000	<2.88	280,000	<0.44	280,000	<0.44	280,000	<1.96	280,000	<1.96	280,000	<26.2	280,000	<52.4
Benzo(a)anthracene	0.2	*<86.5*	0.2	*<36.3*	0.2	*<21.6*	0.2	*<1.08*	0.2	*<0.38*	0.2	*<0.38*	0.2	*<1.57*	0.2	*<1.57*	0.2	*<19.6*	0.2	*<39.2*
Benzo(a)pyrene	0.2	*<93.5*	0.2	*<39.3*	0.2	*<75.4*	0.2	*<3.77*	0.2	*<1.42*	0.2	*<1.41*	0.2	*<3.12*	0.2	*<3.12*	0.2	*<37.7*	0.2	*<75.4*
Benzo(b)fluoranthene	NS	<121.5	NS	<51.0	NS	<29.2	NS	<1.46	NS	<1.07	NS	<1.06	NS	<1.28	NS	<1.28	NS	<21.7	NS	<43.4
Benzo(g,h,i)perylene	NS	<86.5	NS	<36.3	NS	<25.8	NS	<1.29	NS	<0.73	NS	<0.72	NS	<2.83	NS	<2.83	NS	<25.1	NS	<50.2
Benzo(k)fluoranthene	1.9	*<70.0*	1.9	*<29.4*	1.9	*<20.8*	1.9	<1.04	1.9	<0.35	1.9	<0.35	1.9	<1.76	1.9	<1.76	1.9	*<23.3*	1.9	*<46.6*
Chrysene	19	*<74.0*	19	*<31.1*	19	*<28.2*	19	<1.41	19	<0.46	19	<0.46	19	<1.08	19	<1.08	19	*<19.6*	19	*<39.2*
Dibenz(a,h)anthracene	1.9	*<99.0*	1.9	*<41.6*	1.9	*<24.8*	1.9	<1.24	1.9	<0.47	1.9	<0.47	1.9	<1.93	1.9	<1.93	1.9	*<60.4*	1.9	*<120.8*
1,2-dichlorobenzene	5,900	<13.5	5,900	<5.7	5,900	<35.2	5,900	<1.76	5,900	<1.05	5,900	<1.04	5,900	<0.58	5,900	<0.58	5,900	<1.50	5,900	<0.30
1,3-dichlorobenzene	NS	<56.5	NS	<23.7	NS	<34.8	NS	<1.74	NS	<0.47	NS	<0.47	NS	<0.52	NS	<0.52	NS	<1.25	NS	<0.25
1,4-dichlorobenzene	6,500	<52.5	6,500	<22.0	6,500	<31.2	6,500	<1.56	6,500	<1.29	6,500	<1.28	6,500	<0.50	6,500	<0.50	6,500	<1.45	6,500	<0.29
3,3-dichlorobenzidine	3	*<1363.5*	3	*<572.7*	3	*<121.2*	3	*<6.06*	3	*<11.72*	3	*<11.60*	3	*<23.45*	3	*<23.45*	3	*<254.3*	3	*<508.6*
Diethyl phthalate	746,667	<95.0	746,667	<39.9	746,667	<47.4	746,667	<2.37	746,667	<0.36	746,667	<0.36	746,667	<1.07	746,667	<1.07	746,667	<19.9	746,667	<39.8
Dimethyl phthalate	NS	<89.5	NS	<37.6	NS	<48.4	NS	<2.42	NS	<0.47	NS	<0.47	NS	<0.58	NS	<0.58	NS	<19.1	NS	<38.2
Di-n-butyl phthalate	1,100	<111.5	1,100	<46.8	1,100	<37.0	1,100	<1.85	1,100	<0.31	1,100	<0.31	1,100	<1.37	1,100	<1.37	1,100	<23.5	1,100	<47.0

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2 Analytical results shall be reported in the units specified for each category or parameter.
3 Report the average flow rate for the sampling period (no more than 6 hours).
4 Standard for total PCBs of 11 µg/L A&We and 19 µg/L PBC.
5 The sample was lost during extraction at the laboratory due to the glassware breaking.
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IB008	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16		Summer 2016		Winter 2016/17		Summer 2017		Winter 2017/18	
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2,4-dinitrotoluene	1,867	<102.5	1,867	<43.0	1,867	<42.4	1,867	<2.12	1,867	<0.26	1,867	<0.26	1,867	<1.30	1,867	<1.30	1,867	<31.0	1,867	<62.0
2,6-dinitrotoluene	3,733	<126.0	3,733	<52.9	3,733	<22.4	3,733	<1.12	3,733	<0.38	3,733	<0.38	3,733	<1.39	3,733	<1.39	3,733	<28.9	3,733	<57.8
Di-n-octyl phthalate	373,333	<144.0	373,333	<60.5	373,333	<22.0	373,333	<1.10	373,333	<1.29	373,333	<1.28	373,333	<1.67	373,333	<1.67	373,333	<55.0	373,333	<110.0
1,2-diphenylhydrazine (as azobenzene)	NS	<116.5	NS	<48.9	NS	<134.0	NS	<6.70	NS	<1.07	NS	<1.06	NS	<7.46	NS	<7.46	NS	<21.5	NS	<43.0
Fluoranthene	37,333	<89.5	37,333	<37.6	37,333	<27.0	37,333	<1.35	37,333	<0.27	37,333	<0.27	37,333	<1.06	37,333	<1.06	37,333	<30.8	37,333	<61.6
Fluorene	37,333	<77.0	37,333	<32.3	37,333	<96.2	37,333	<4.81	37,333	<0.29	37,333	<0.29	37,333	<0.51	37,333	<0.51	37,333	<28.7	37,333	<57.4
Hexachlorobenzene	747	<69.5	747	<29.2	747	<24.6	747	<1.23	747	<0.34	747	<0.34	747	<0.47	747	<0.47	747	<15.7	747	<31.4
Hexachlorobutadiene	187	<16.5	187	<6.9	187	<36.4	187	<1.82	187	<1.69	187	<1.67	187	<0.41	187	<0.41	187	<10.0	187	<20.0
Hexachlorocyclopentadiene	11,200	<113.5	11,200	<47.7	11,200	<24.6	11,200	<1.23	11,200	<1.55	11,200	<1.53	11,200	<2.16	11,200	<2.16	11,200	<61.0	11,200	<122.0
Hexachloroethane	850	<20.0	850	<8.4	850	<32.4	850	<1.62	850	<1.24	850	<1.23	850	<0.54	850	<0.54	850	<14.9	850	<29.8
Indeno(1,2,3-cd)pyrene	1.9	*<101.5*	1.9	*<42.6*	1.9	*<27.8*	1.9	<1.39	1.9	<0.63	1.9	<0.62	1.9	*<2.38*	1.9	*<2.38*	1.9	*<61.1*	1.9	*<122.2*
Isophorone	186,667	<70.5	186,667	<29.6	186,667	<42.8	186,667	<2.14	186,667	<0.37	186,667	<0.37	186,667	<0.51	186,667	<0.51	186,667	<17.7	186,667	<35.4
Naphthalene	18,667	<60.0	18,667	<25.2	18,667	<36.6	18,667	<1.83	18,667	<0.36	18,667	<0.36	18,667	<0.49	18,667	<0.49	18,667	<15.4	18,667	<30.8
Nitrobenzene	467	<61.5	467	<25.8	467	<42.0	467	<2.10	467	<1.27	467	<1.26	467	<0.44	467	<0.44	467	<18.0	467	<36.0
N-nitrosodimethylamine	0.03	*<60.0*	0.03	*<25.2*	0.03	*<20.0*	0.03	*<1.00*	0.03	*<1.14*	0.03	*<1.13*	0.03	*<0.54*	0.03	*<0.54*	0.03	*<16.2*	0.03	*<32.4*
N-nitrosodi-n-propylamine	88,667	<75.5	88,667	<31.7	88,667	<23.0	88,667	<1.15	88,667	<1.18	88,667	<1.17	88,667	<1.02	88,667	<1.02	88,667	<16.5	88,667	<33.0
N-nitrosodiphenylamine	290	<152.0	290	<63.8	290	<71.4	290	<3.57	290	<1.16	290	<1.15	290	<1.67	290	<1.67	290	<31.3	290	<62.6
Phenanthrene	NS	<81.5	NS	<34.2	NS	<27.8	NS	<1.39	NS	<0.31	NS	<0.31	NS	<0.49	NS	<0.49	NS	<30.2	NS	<60.4
Pyrene	28,000	<82.0	28,000	<34.4	28,000	<77.2	28,000	<3.86	28,000	<0.68	28,000	<0.67	28,000	<3.21	28,000	<3.21	28,000	<33.8	28,000	<67.6
1,2,4-trichlorobenzene	9,333	<16.0	9,333	<6.7	9,333	<33.8	9,333	<1.69	9,333	<1.05	9,333	<1.04	9,333	<0.55	9,333	<0.55	9,333	<12.1	9,333	<24.2
Pesticides (µg/L) [2]																				
Aldrin	4.5	<0.047	4.5	0.043	4.5	<0.027	4.5	<0.027	4.5	<0.012	4.5	0.078	4.5	<0.019	4.5	<0.019	4.5	<0.013	4.5	<0.013
Alpha-BHC	1,600	<0.039	1,600	<0.017	1,600	<0.021	1,600	<0.021	1,600	<0.058	1,600	<0.058	1,600	<0.010	1,600	<0.010	1,600	<0.015	1,600	0.065
Beta-BHC	560	<0.098	560	<0.092	560	<0.072	560	<0.072	560	<0.063	560	<0.063	560	<0.049	560	<0.049	560	<0.083	560	<0.083
Gamma-BHC	11	<0.034	11	<0.023	11	<0.034	11	<0.034	11	<0.058	11	<0.058	11	<0.019	11	<0.019	11	<0.020	11	<0.020
Delta-BHC	1,600	<0.033	1,600	<0.018	1,600	<0.021	1,600	<0.021	1,600	<0.066	1,600	<0.066	1,600	<0.035	1,600	<0.035	1,600	<0.012	1,600	<0.012
Chlordane	3.2	<0.16	3.2	<0.020	3.2	<0.14	3.2	<0.14	3.2	<0.36	3.2	<0.36	3.2	<0.61	3.2	<0.61	3.2	<0.29	3.2	<0.29
4,4'-DDT	1.1	<0.030	1.1	<0.016	1.1	<0.025	1.1	<0.025	1.1	<0.017	1.1	<0.017	1.1	<0.011	1.1	<0.011	1.1	<0.020	1.1	<0.020
4,4'-DDE	1.1	<0.035	1.1	<0.018	1.1	<0.010	1.1	<0.010	1.1	<0.013	1.1	<0.013	1.1	<0.020	1.1	<0.020	1.1	<0.019	1.1	<0.019
4,4'-DDD	1.1	<0.024	1.1	<0.014	1.1	<0.031	1.1	<0.031	1.1	<0.021	1.1	<0.021	1.1	<0.021	1.1	<0.021	1.1	<0.023	1.1	<0.023
Dieldrin	4	<0.029	4	<0.022	4	<0.030	4	<0.030	4	<0.060	4	<0.060	4	<0.019	4	<0.019	4	<0.015	4	<0.015
Alpha-endosulfan	3 T	0.090	3 T	<0.018	3 T	0.054	3 T	0.061	3 T	<0.072	3 T	<0.072	3 T	0.083	3 T	0.061	3 T	<0.015	3 T	0.077
Beta-endosulfan	3 T	<0.035	3 T	<0.013	3 T	<0.032	3 T	<0.032	3 T	<0.019	3 T	<0.019	3 T	<0.021	3 T	<0.021	3 T	<0.014	3 T	<0.014

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Endosulfan sulfate	3	<0.026	3	<0.014	3	<0.008	3	<0.008	3	<0.016	3	<0.016	3	<0.022	3	<0.022	3	<0.019	3	<0.019
Endrin	0.7	<0.036	0.7	<0.016	0.7	<0.017	0.7	<0.017	0.7	<0.023	0.7	<0.023	0.7	<0.042	0.7	<0.042	0.7	<0.040	0.7	<0.040
Endrin aldehyde	0.7	<0.039	0.7	<0.023	0.7	<0.032	0.7	<0.032	0.7	<0.026	0.7	<0.026	0.7	<0.024	0.7	<0.024	0.7	<0.034	0.7	<0.034
Heptachlor	0.9	<0.036	0.9	<0.018	0.9	<0.027	0.9	<0.027	0.9	<0.035	0.9	<0.035	0.9	<0.023	0.9	<0.023	0.9	<0.019	0.9	<0.019
Heptachlor epoxide	0.9	<0.033	0.9	<0.020	0.9	<0.008	0.9	<0.008	0.9	<0.062	0.9	<0.062	0.9	<0.020	0.9	<0.020	0.9	<0.016	0.9	<0.016
PCB-1242	[4]	<0.42	[4]	<0.55	[4]	<0.37	[4]	<0.37	[4]	<0.14	[4]	<0.14	[4]	<0.72	[4]	<0.72	[4]	<0.33	[4]	<0.33
PCB-1254	[4]	<0.21	[4]	<0.28	[4]	<0.23	[4]	<0.23	[4]	<0.20	[4]	<0.20	[4]	<0.22	[4]	<0.22	[4]	<0.17	[4]	<0.17
PCB-1221	[4]	<0.70	[4]	<0.85	[4]	<0.22	[4]	<0.22	[4]	<0.64	[4]	<0.64	[4]	<0.46	[4]	<0.46	[4]	<0.36	[4]	<0.36
PCB-1232	[4]	<0.68	[4]	<0.34	[4]	<0.55	[4]	<0.55	[4]	<0.37	[4]	<0.37	[4]	<0.90	[4]	<0.90	[4]	<0.40	[4]	<0.40
PCB-1248	[4]	<0.80	[4]	<0.27	[4]	<0.19	[4]	<0.19	[4]	<0.22	[4]	<0.22	[4]	<0.24	[4]	<0.24	[4]	<0.21	[4]	<0.21
PCB-1260	[4]	<0.22	[4]	<0.23	[4]	<0.32	[4]	<0.32	[4]	<0.59	[4]	<0.59	[4]	<0.26	[4]	<0.26	[4]	<0.34	[4]	<0.34
PCB-1016	[4]	<0.37	[4]	<0.33	[4]	<0.18	[4]	<0.18	[4]	<0.55	[4]	<0.55	[4]	<0.29	[4]	<0.29	[4]	<0.33	[4]	<0.33
Toxaphene	11	<0.55	11	<0.34	11	<0.22	11	<0.22	11	<0.60	11	<0.60	11	<0.48	11	<0.48	11	<0.47	11	<0.47

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OUTFALL ID: SC046 **RECEIVING WATER: Skunk Creek Wash** **DESIGNATED USES: A&We, PBC**	**MONITORING SEASONS** Summer: June 1 – October 31 Winter: November 1 – May 31																			
	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16		Summer 2016		Winter 2016/17		Summer 2017		Winter 2017/18	
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MONITORING PARAMETERS [1, 2]																				
Conventional Parameters																				
Flow [3] (cfs)	NS	0.996	NS	0.16	NS	0.245	NS	0.088	NS	4.852	NS	3.363	NS	6.367	NS	2.519	NS	10.266	NS	8.01
pH	6.5-9	8.00	6.5-9	8.01	6.5-9	7.06	6.5-9	7.26	6.5-9	7.51	6.5-9	6.87	6.5-9	6.96	6.5-9	7.54	6.5-9	6.8	6.5-9	6.5
Temperature (ºC)	Varies	27.5	Varies	14.5	Varies	28.5	Varies	16.0	Varies	20.5	Varies	19.2	Varies	25.5	Varies	19.5	Varies	29.1	Varies	13.7
Hardness (mg/L)	400	23.7	400	17.4	400	176	400	24.6	400	23.8	400	43.0	400	29.6	400	35.3	400	63.2	400	81.4
Total Dissolved Solids (TDS) (mg/L) [2]	NS	88	NS	48	NS	534	NS	56	NS	118	NS	178	NS	50	NS	96	NS	262	NS	190
Total Suspended Solids (TSS) (mg/L) [2]	NS	291	NS	57.2	NS	72	NS	14.7	NS	2,490	NS	133	NS	77	NS	226	NS	168	NS	324
Biochemical Oxygen Demand (BOD) (mg/L) [2]	NS	21	NS	8	NS	167	NS	8	NS	15	NS	100	NS	16	NS	29	NS	115	NS	42
Chemical Oxygen Demand (COD) (mg/L)[2]	NS	150	NS	<50	NS	620	NS	<50	NS	310	NS	300	NS	90	NS	190	NS	420	NS	270

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Inorganics																				
Cyanide, total (µg/L) [2]	84	<5	84	<5	84	<5	84	<5	84	<5	84	<5	84	<5	84	<5	84	<5	84	<5
Nutrients (mg/L) [2]																				
Nitrate + Nitrite as N	NS	1.2	NS	0.5	NS	<0.1	NS	0.6	NS	1.1	NS	0.7	NS	0.7	NS	0.8	NS	2.2	NS	1
Ammonia as N	NS	1.3	NS	0.30	NS	3.7	NS	0.29	NS	0.50	NS	1.2	NS	0.77	NS	0.96	NS	2.7	NS	1.7
Total Kjeldahl Nitrogen (TKN)	NS	3.1	NS	0.98	NS	17	NS	0.75	NS	5.6	NS	10	NS	1.8	NS	3.1	NS	9.9	NS	4.2
Total Phosphorus as P	NS	0.90	NS	0.26	NS	1.5	NS	0.19	NS	5.3	NS	0.86	NS	.34	NS	0.42	NS	0.56	NS	0.33
Ortho-Phosphorus as P	NS	0.2	NS	0.1	NS	0.5	NS	<0.1	NS	0.2	NS	0.7	NS	0.2	NS	0.2	NS	0.7	NS	0.2
Microbiological																				
Escherichia coli (*E. coli*) (CFU/100 mg or MPN) [2]	575	61.6	575	**>2,419.6**	575	**>2,419.6**	575	**1,413.6**	575	**1,046.2**	575	**1,732.9**	575	27.5	575	**1,986.3**	575	**1,553.1**	575	461.1

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Total Metals (µg/L) 2																				
Antimony	747 T	0.71 T 0.3 D	747 T	0.27 T 0.2 D	747 T	2.8 T 1 D	747 T	0.24 T 0.2 D	747 T	0.38 T <5.0 D	747 T	0.70 T <5.0 D	747 T	0.3 T <5 D	747 T	1.1 T <5 D	747 T	1.2 T <5 D	747 T	1.2 T <5 D
Arsenic	280 T 440 D	3.2 T 0.8 D	280 T 440 D	<1.0 T 0.5 T	280 T 440 D	4.4 T 3.6 D	280 T 440 D	1.0 T 0.6 D	280 T 440 D	13.4 T <5.0 D	280 T 440 D	1.9 T <5.0 D	280 T 440 D	2.2 T <5 D	280 T 440 D	3.3 T <5 D	280 T 440 D	3.4 T <5 D	280 T 440 D	3.9 T <5 D
Barium	98,000 T	119 T 12 D	98,000 T	21 T 5 T	98,000 T	113 T 94 D	98,000 T	12 T 7 D	98,000 T	831 T 14 D	98,000 T	64 T 19 D	98,000 T	34 T 13 D	98,000 T	113 T 14 D	98,000 T	102 T 36 D	98,000 T	140 T 28 D
Beryllium	1,867 T	0.36 T <0.06 D	1,867 T	<0.15 T <0.06 D	1,867 T	<0.15 T <0.06 D	1,867 T	<0.06 T <0.06 D	1,867 T	3.5 T <5.0 D	1,867 T	0.15 T <5.0 D	1,867 T	<0.25 T <5 D	1,867 T	0.33 T <5 D	1,867 T	0.3 T <5.0 D	1,867 T	0.43 T <5.0 D
Cadmium	700 T 5.61 D	<0.25 T <0.10 D	700 T 4.15 D	<0.25 T <0.10 D	700 T 39.50 D	<0.30 T <0.12 D	700 T 5.82 D	0.2 T <0.12 D	700 T 5.63 D	1.2 T <5.0 D	700 T 10.03 D	<0.15 T <5.0 D	700 T 17.24 D	<0.25 T <5 D	700 T 20.87 D	<0.25 T <0.25 D	700 T 39.27 D	<0.20 T <0.2 D	700 T 51.67 D	<0.20 T <0.5 D
Chromium	NS	9.4 T <0.80 D	NS	<2.00 T <0.80 D	NS	3.2 T 1 D	NS	1.2 T <0.36 D	NS	36.4 T <5.0 D	NS	6.0 T <5.0 D	NS	2.6 T <5 D	NS	9.2 T <5 D	NS	7.8 T <5.0 D	NS	11.2 T <5.0 D
Copper	1,300 T 5.99 D	35.7 T **7.1 D**	1,300 T 4.48 D	14.0 T **5.6 D**	1,300 T 39.62 D	33.3 T 24.1 D	1,300 T 6.20 D	6.6 T 5.2 D	1,300 T 6.01 D	88.5 T **8.9 D**	1,300 T 10.50 D	33.5 T **32.1 D**	1,300 T 7.39 D	11.3 T **21.3 D**	1,300 T 8.72 D	39.8 T **10 D**	1,300 T 15.10 D	44.0 T **31.6 D**	1,300 T 19.16 D	38.9 T 9 D
Lead	15 T 27.59 D	9.4 T 0.2 D	15 T 19.45 D	1.8 T <0.18 D	15 T 250.76 D	4.1 T 1.7 D	15 T 27.77 D	0.7 T 0.1 D	15 T 27.72 D	**140 T** <5.0 D	15 T 53.78 D	14.1 T <5.0 D	15 T 35.42 D	3.1 T <5 D	15 T 43.15 D	11 T <0.55 D	15 T 82.42 D	8.3 T 1.3 D	15 T 108.86 D	11.7 T 0.2 D
Mercury	280 T 5 D	0.09 T 0.047 D	280 T 5 D	<0.020 T <0.020 D	280 T 5 D	<0.092 T <0.2 D	280 T 5 D	<0.092 T <0.092 D	280 T 5 D	0.12 T <0.2 D	280 T 5 D	<0.062 T <0.2 D	280 T 5 D	<0.068 T <0.2 D	280 T 5 D	<0.068 T <0.2 D	280 T 5 D	0.116 T <0.2 D	280 T 5 D	<0.066 T <0.2 D
Nickel	28,000 T 1,229.8 D	11.3 T 1.4 D	28,000 T 947.4 D	2.0 T 0.7 D	28,000 T 6,708 D	7.5 T 6.1 D	28,000 T 1,269.4 D	1.2 T 0.7 D	28,000 T 1,234.2 D	42.9 T <5.0 D	28,000 T 2,036 D	6.4 T <5.0 D	28,000 T 14.85 D	3.1 T <5 D	280,000 T 1723 D	10.8 T <5 D	280,000 T 2820.51 D	11.6 T 5.4 D	280,000 T 3493.88 D	12.2 T <5.0 D
Selenium	33 T	<0.60 T 0.3 D	33 T	<0.60 T <0.24 D	33 T	1 T 0.7 D	33 T	0.19 T 0.1 D	33 T	2.2 T <5.0 D	33 T	0.45 T <5.0 D	33T	2.5 T <5 D	33T	<0.4 T <5 D	33T	0.97 T <5.0 D	33T	0.56 T <5.0 D
Silver	4,667 T 0.274 D	<0.15 T <0.15 D	4,667 T 0.158 D	<0.15 T <0.15 D	4,667 T 8.51 D	<0.20 T <0.20 D	4,667 T 0.292 D	0.2 T <0.08 D	4,667 T 0.28 D	0.4 T *<5.0 D*	4,667 T 0.75 D	<0.25 T *<5.0 D*	4,667 T 0.40 D	<0.45 T *<5 D*	4,667 T 0.54 D	<0.45 T *<5 D*	4,667 T 1.46 D	0.1 T *<5.0 D*	4,667 T 2.26 D	0.1 T *<5.0 D*
Thallium	75 T	<0.20 T <0.08 D	75 T	<0.20 T <0.08 D	75 T	<0.10 T <0.04 D	75 T	<0.04 T <0.04 D	75 T	0.46 T <5.0 D	75 T	0.19 T <5.0 D	75 T	<0.2 T <5 D	75 T	<0.2 T <5 D	75 T	<0.10 T <5.0 D	75 T	<0.10 T <5.0 D
Zinc	280,000 T 328.4 D	193 T 31.7 D	280,000 T 252.8 D	50.1 T 17.1 D	280,000 T 1,795 D	174 T 128 D	280,000 T 339.2 D	30.5 T 17.6 D	280,000 T 329.6 D	566 T 7.3 D	280,000 T 544 D	178 T 93.6 D	280,000 T 396.4 D	73.5 T <50 D	280,000 T 460.2 D	176 T 33.8 D	280,000 T 753.79 D	195 T 104 D	280,000 T 934.06 D	179 T 29.3 D
Organic Toxic Pollutants																				
Total Petroleum Hydrocarbons (TPH) (mg/L) 2	NS	<11	NS	<11	NS	<10	NS	<10	NS	<5.4	NS	<5.9	NS	<5.7	NS	<4.5	NS	<6.7	NS	<7.1
Total Oil and Grease (mg/L) 2	NS	<5.4	NS	<5.7	NS	<5.0	NS	<5.0	NS	<5.4	NS	<5.9	NS	<5.7	NS	<4.5	NS	<5.6	NS	<5.9
VOCs, Semi-VOCs, and Pesticides (µg/L) 2																				
Acrolein	467	<0.20	467	<0.20	467	<2.00	467	<0.40	467	<0.78	467	<0.41	467	<0.41	467	<0.41	467	<3.95	467	<0.79
Acrylonitrile	37,333	<0.16	37,333	<0.16	37,333	<0.70	37,333	<0.14	37,333	<0.53	37,333	<0.42	37,333	<0.42	37,333	<0.42	37,333	<2.95	37,333	<0.59
Benzene	3,733	<1.20	3,733	<0.24	3,733	<1.20	3,733	<0.13	3,733	<2.30	3,733	<2.30	3,733	<0.29	3,733	<0.29	3,733	<1.30	3,733	<0.26
Bromoform	18,667	<2.35	18,667	<0.47	18,667	<2.35	18,667	<0.28	18,667	<3.40	18,667	<3.40	18,667	<0.33	18,667	<0.33	18,667	<1.05	18,667	<0.21
Carbon tetrachloride	1,307	<1.30	1,307	<0.26	1,307	<1.30	1,307	<0.23	1,307	<1.55	1,307	<1.55	1,307	<0.20	1,307	<0.20	1,307	<1.50	1,307	<0.30

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Chlorobenzene	18,667	<0.80	18,667	<0.16	18,667	<0.80	18,667	<0.13	18,667	<2.50	18,667	<2.50	18,667	<0.33	18,667	<0.33	18,667	<1.15	18,667	<0.23
Chlorodibromomethane	18,667	<0.90	18,667	<0.18	18,667	<0.90	18,667	<0.24	18,667	<3.05	18,667	<3.05	18,667	<0.32	18,667	<0.32	18,667	<1.20	18,667	<0.24
Chloroethane (ethyl chloride)	NS	<1.10	NS	<0.22	NS	<1.10	NS	<0.19	NS	<2.00	NS	<2.00	NS	<0.33	NS	<0.33	NS	<1.40	NS	<0.28
2-chloroethylvinyl ether	NS	<0.22	NS	<0.22	NS	<0.95	NS	<0.19	NS	<0.53	NS	<0.43	NS	<0.43	NS	<0.43	NS	<3.25	NS	<0.65
Chloroform	9,333	<1.15	9,333	<0.23	9,333	<1.15	9,333	<0.14	9,333	<2.45	9,333	<2.45	9,333	<0.32	9,333	<0.32	9,333	<1.20	9,333	<0.24
Dichlorobromomethane	18,667	<1.15	18,667	<0.23	18,667	<1.15	18,667	<0.15	18,667	<2.45	18,667	<2.45	18,667	<0.29	18,667	<0.29	18,667	<1.30	18,667	<0.26
1,1-dichloroethane	NS	<1.30	NS	<0.26	NS	<1.30	NS	<0.19	NS	<2.10	NS	<2.10	NS	<0.29	NS	<0.29	NS	<1.35	NS	<0.27
1,2-dichloroethane	186,667	<1.25	186,667	<0.25	186,667	<1.25	186,667	<0.11	186,667	<2.55	186,667	<2.55	186,667	<0.35	186,667	<0.35	186,667	<1.30	186,667	<0.26
1,1-dichloroethylene	46,667	<1.40	46,667	<0.28	46,667	<1.40	46,667	<0.27	46,667	<1.70	46,667	<1.70	46,667	<0.19	46,667	<0.19	46,667	<1.60	46,667	<0.32
1,2-dichloropropane	84,000	<1.25	84,000	<0.25	84,000	<1.25	84,000	<0.18	84,000	<2.45	84,000	<2.45	84,000	<0.32	84,000	<0.32	84,000	<1.60	84,000	<0.32
1,3-dichloropropylene[8]	28,000	<1.20	28,000	<0.24	28,000	<1.20	28,000	<0.13	28,000	cis <2.55 trans <2.50	28,000	cis <2.55 trans <2.50	28,000	<0.28	28,000	<0.28	28,000	<1.05	28,000	<0.21
Ethylbenzene	93,333	<0.65	93,333	<0.13	93,333	<0.65	93,333	<0.15	93,333	<2.30	93,333	<2.30	93,333	<0.29	93,333	<0.29	93,333	<1.15	93,333	<0.23
Methyl bromide	1,307	<0.95	1,307	<0.19	1,307	<0.95	1,307	<0.18	1,307	<2.30	1,307	<2.30	1,307	<0.28	1,307	<0.28	1,307	<1.15	1,307	<0.23
Methyl chloride	NS	<1.40	NS	<0.28	NS	<1.40	NS	<0.23	NS	<2.30	NS	<2.30	NS	<0.28	NS	<0.28	NS	<1.85	NS	<0.37
Methylene chloride	56,000	<1.00	56,000	<0.20	56,000	<1.00	56,000	<0.20	56,000	<4.05	56,000	<4.05	56,000	<0.31	56,000	<0.31	56,000	<4.00	56,000	<0.80
1,1,2,2-tetrachloroethane	93,333	<2.00	93,333	<0.40	93,333	<2.00	93,333	<0.35	93,333	<4.00	93,333	<4.00	93,333	<0.33	93,333	<0.33	93,333	<1.55	93,333	<0.31
Tetrachloroethylene	9,333	<1.05	9,333	<0.21	9,333	<1.05	9,333	<0.13	9,333	<1.75	9,333	<1.75	9,333	<0.23	9,333	<0.23	9,333	<1.45	9,333	<0.29
Toluene	373,333	<0.95	373,333	<0.19	373,333	<0.95	373,333	<0.11	373,333	<2.15	373,333	<2.15	373,333	<0.28	373,333	<0.28	373,333	<1.25	373,333	<0.25
1,2-trans-dichloroethylene	18,667	<1.25	18,667	<0.25	18,667	<1.25	18,667	<0.18	18,667	<1.90	18,667	<1.90	18,667	<0.24	18,667	<0.24	18,667	<1.25	18,667	<0.25
1,1,1-trichloroethane	1.867x 10^{+6}	<1.00	1.867x 10^{+6}	<0.20	1.867x 10^{+6}	<1.00	1.867x 10^{+6}	<0.14	1.867x 10^{+6}	<1.70	1.867x 10^{+6}	<1.70	1.867x 10^{+6}	<0.23	1.867x 10^{+6}	<0.23	1.867x 10^{+6}	<1.40	1.867x 10^{+6}	<0.28
1,1,2-trichloroethane	3,733	<0.75	3,733	<0.15	3,733	<0.75	3,733	<0.13	3,733	<3.00	3,733	<3.00	3,733	<0.29	3,733	<0.29	3,733	<1.50	3,733	<0.30
Trichloroethylene	280	<0.75	280	<0.15	280	<0.75	280	<0.22	280	<2.40	280	<2.40	280	<0.28	280	<0.28	280	<1.80	280	<0.36
1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene	NS	<5.0 <5.0	NS	<1.0 <1.0	NS	<5.0 <5.0	NS	<1.0 <1.0	NS	<5.0 <5.0	NS	<5.0 <5.0	NS	<1.0 <1.0	NS	<1.0 <1.0	NS	<5.0 <1.0	NS	<5.0 <1.0
Vinyl chloride	2,800	<1.00	2,800	<0.20	2,800	<1.00	2,800	<0.22	2,800	<1.75	2,800	<1.75	2,800	<0.24	2,800	<0.24	2,800	<2.10	2,800	<0.42
Xylenes, Total	186,667	<1.50	186,667	<0.30	186,667	<1.50	186,667	<0.13	186,667	<2.60	186,667	<2.60	186,667	<0.32	186,667	<0.32	186,667	<1.15	186,667	<0.23
Acid Compounds (µg/L) [2]																				
2-chlorophenol	4,667	<85.8	4,667	<42.9	4,667	<14.8	4,667	<1.48	4,667	<3.10	4,667	<3.26	4,667	<2.92	4,667	<2.92	4,667	<42.3	4,667	<211.5
2,4-dichlorophenol	2,800	<84.4	2,800	<42.2	2,800	<16.5	2,800	<1.65	2,800	<2.81	2,800	<2.95	2,800	<3.21	2,800	<3.21	2,800	<48.2	2,800	<241.0
2,4-dimethylphenol	18,667	<45.6	18,667	<22.8	18,667	<22.0	18,667	<2.20	18,667	<2.64	18,667	<2.77	18,667	<1.32	18,667	<1.32	18,667	<70.7	18,667	<353.5
4,6-dinitro-o-cresol	3,733	<59.6	3,733	<29.8	3,733	<12.2	3,733	<1.22	3,733	<1.49	3,733	<1.56	3,733	<2.27	3,733	<2.27	3,733	<46.9	3,733	<234.5
2,4-dinitrophenol	1,867	<51.8	1,867	<25.9	1,867	<11.3	1,867	<1.13	1,867	<2.21	1,867	<2.32	1,867	<2.64	1,867	<2.64	1,867	<51.1	1,867	<255.5
2-nitrophenol	NS	<82.2	NS	<41.1	NS	<15.7	NS	<1.57	NS	<2.84	NS	<2.98	NS	<2.61	NS	<2.61	NS	<78.3	NS	<391.5
4-nitrophenol	NS	<93.4	NS	<46.7	NS	<11.4	NS	<1.14	NS	<2.98	NS	<3.13	NS	<2.03	NS	<2.03	NS	<40.3	NS	<201.5
p-chloro-m-cresol	48,000	<88.2	48,000	<44.1	48,000	<16.5	48,000	<1.65	48,000	<1.87	48,000	<1.96	48,000	<3.10	48,000	<3.10	48,000	<40.5	48,000	<202.5

NOTES:
NS = no standard applicable to the designated use
T = Total
D = Dissolved
Bold text indicates a sample result greater than the WQS.
Italicized text indicated a laboratory detection limit higher that the WQS.

Footnotes
1 The Permittee shall report on any additional parameters that were monitored for seasonal stormwater sampling as required by Section 6.0 of this permit (Special Conditions).
2 Analytical results shall be reported in the units specified for each category or parameter.
3 Report the average flow rate for the sampling period (no more than 6 hours).
4 Standard for total PCBs of 11 µg/L A&We and 19 µg/L PBC.
5 The sample was lost during extraction at the laboratory due to the glassware breaking.
6 There were no representative storm events (>0.20 inches) that occurred or no representative events without a measurable rain event in the previous 72 hours.
7 A representative event occurred on 8/2; however, the sampler malfunctioned. Then next event was on 8/5 but due to the 72-hour rule, no sample was taken. Another measurable event on 9/22 did not result in a qualifying rain event. No samples were taken at this outfall during Summer 2016.
8 Prior to FY2016, the lab was reporting cis and trans for 1-3-dichloropropylene; this reporting year, an upgrade has resulted in providing the result as a total.
9 Data flagged due to contamination in the lab reagent blank; therefore, these are not true detections or exceedances.

SC046	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16		Summer 2016		Winter 2016/17		Summer 2017		Winter 2017/18	
SAMPLING DATE(S):	SWQS	8/24/13	SWQS	11/22/13	SWQS	8/2/14	SWQS	12/4/14	SWQS	10/6/15	SWQS	4/8/16	SWQS	8/23/16	SWQS	11/3/16	SWQS	7/16/17	SWQS	1/9/18
Pentachlorophenol	100.424	<67.2	101.486	<33.6	39.092	<13.9	47.794	<1.39	61.40	<1.47	32.29	<1.54	35.31	<3.44	63.25	<3.44	30.07	*<73.6*	22.4	*<368.0*
Phenol	180,000	<71.0	180,000	<35.5	180,000	<13.4	180,000	<1.34	180,000	<2.30	180,000	<2.42	180,000	<1.84	180,000	<1.84	180,000	<39.9	180,000	<199.5
2,4,6-trichlorophenol	130	<95.8	130	<47.9	130	<18.9	130	<1.89	130	<2.60	130	<2.73	130	<3.28	130	<3.28	130	<47.4	130	*<237.0*
Bases/Neutrals (µg/L) [2]																				
Acenaphthene	56,000	<26.8	56,000	<13.4	56,000	<10.3	56,000	<1.03	56,000	<0.35	56,000	<0.37	56,000	<1.02	56,000	<1.02	56,000	<18.8	56,000	<94.0
Acenaphthylene	NS	<34.6	NS	<17.3	NS	<10.0	NS	<1.00	NS	<1.23	NS	<1.29	NS	<6.10	NS	<6.10	NS	<17.5	NS	<87.5
Anthracene	280,000	<34.6	280,000	<17.3	280,000	<28.8	280,000	<2.88	280,000	<0.44	280,000	<0.46	280,000	<1.96	280,000	<1.96	280,000	<26.2	280,000	<131.0
Benz(a)anthracene	0.2	*<34.6*	0.2	*<17.3*	0.2	*<10.8*	0.2	*<1.08*	0.2	*<0.38*	0.2	*<0.40*	0.2	*<1.57*	0.2	*<1.57*	0.2	*<19.6*	0.2	*<98.0*
Benzo(a)pyrene	0.2	*<37.4*	0.2	*<18.7*	0.2	*<37.7*	0.2	*<3.77*	0.2	*<1.41*	0.2	*<1.48*	0.2	*<3.12*	0.2	*<3.12*	0.2	*<37.7*	0.2	*<188.5*
Benzo(b)fluoranthene	NS	<48.6	NS	<24.3	NS	<14.6	NS	<1.46	NS	<1.06	NS	<1.11	NS	<1.28	NS	<1.28	NS	<21.7	NS	<108.5
Benzo(g,h,i)perylene	NS	<34.6	NS	<17.3	NS	<12.9	NS	<1.29	NS	<0.72	NS	<0.76	NS	<2.83	NS	<2.83	NS	<25.1	NS	<125.5
Benzo(k)fluoranthene	1.9	*<28.0*	1.9	*<14.0*	1.9	*<10.4*	1.9	<1.04	1.9	<0.35	1.9	<0.37	1.9	<1.76	1.9	<1.76	1.9	*<23.3*	1.9	*<116.5*
Chrysene	19	*<29.6*	19	<14.8	19	<14.1	19	<1.41	19	<0.46	19	<0.48	19	<1.08	19	<1.08	19	*<19.6*	19	*<98.0*
Dibenz(a,h)anthracene	1.9	*<39.6*	1.9	*<19.8*	1.9	*<12.4*	1.9	<1.24	1.9	<0.47	1.9	<0.49	1.9	<1.93	1.9	<1.93	1.9	*<60.4*	1.9	*<302.0*
1,2-dichlorobenzene	5,900	<5.4	5,900	<2.7	5,900	<17.6	5,900	<1.76	5,900	<1.04	5,900	<1.09	5,900	<0.58	5,900	<0.58	5,900	<1.50	5,900	<0.30
1,3-dichlorobenzene	NS	<22.6	NS	<11.3	NS	<17.4	NS	<1.74	NS	<0.47	NS	<0.49	NS	<0.52	NS	<0.52	NS	<1.25	NS	<0.25
1,4-dichlorobenzene	6,500	<21.0	6,500	<10.5	6,500	<15.6	6,500	<1.56	6,500	<1.28	6,500	<1.34	6,500	<0.50	6,500	<0.50	6,500	<1.45	6,500	<0.29
3,3-dichlorobenzidine	3	*<545.4*	3	*<272.7*	3	*<60.6*	3	*<6.06*	3	*<11.60*	3	*<12.18*	3	*<23.45*	3	*<23.45*	3	*<254.3*	3	*<1271.5*
Diethyl phthalate	746,667	<38.0	746,667	<19.0	746,667	<23.7	746,667	<2.37	746,667	<0.36	746,667	<0.38	746,667	<1.07	746,667	<1.07	746,667	<19.9	746,667	<99.5
Dimethyl phthalate	NS	<35.8	NS	<17.9	NS	<24.2	NS	<2.42	NS	<0.47	NS	<0.49	NS	<0.58	NS	<0.58	NS	<19.1	NS	<95.5
Di-n-butyl phthalate	1,100	<44.6	1,100	<22.3	1,100	<18.5	1,100	<1.85	1,100	<0.31	1,100	<0.33	1,100	<1.37	1,100	<1.37	1,100	<23.5	1,100	<117.5
2,4-dinitrotoluene	1,867	<41.0	1,867	<20.5	1,867	<21.2	1,867	<2.12	1,867	<0.26	1,867	<0.27	1,867	<1.30	1,867	<1.30	1,867	<31.0	1,867	<155.0
2,6-dinitrotoluene	3,733	<50.4	3,733	<25.2	3,733	<11.2	3,733	<1.12	3,733	<0.38	3,733	<0.40	3,733	<1.39	3,733	<1.39	3,733	<28.9	3,733	<144.5
Di-n-octyl phthalate	373,333	<57.6	373,333	<28.8	373,333	<11.0	373,333	<1.10	373,333	<1.28	373,333	<1.34	373,333	<1.67	373,333	<1.67	373,333	<55.0	373,333	<275.0
1,2-diphenylhydrazine (as azobenzene)	NS	<46.6	NS	<23.3	NS	<67.0	NS	<6.70	NS	<1.06	NS	<1.11	NS	<7.46	NS	<7.46	NS	<21.5	NS	<107.5
Fluoranthene	37,333	<35.8	37,333	<17.9	37,333	<13.5	37,333	<1.35	37,333	<0.27	37,333	<0.28	37,333	<1.06	37,333	<1.06	37,333	<30.8	37,333	<154.0
Fluorene	37,333	<30.8	37,333	<15.4	37,333	<48.1	37,333	<4.81	37,333	<0.29	37,333	<0.30	37,333	<0.51	37,333	<0.51	37,333	<28.7	37,333	<143.5
Hexachlorobenzene	747	<27.8	747	<13.9	747	<12.3	747	<1.23	747	<0.34	747	<0.36	747	<0.47	747	<0.47	747	<15.7	747	<78.5
Hexachlorobutadiene	187	<6.6	187	<3.3	187	<18.2	187	<1.82	187	<1.67	187	<1.75	187	<0.41	187	<0.41	187	<10.0	187	<50.0
Hexachlorocyclopentadiene	11,200	<45.4	11,200	<22.7	11,200	<12.3	11,200	<1.23	11,200	<1.53	11,200	<1.61	11,200	<2.16	11,200	<2.16	11,200	<61.0	11,200	<305.0
Hexachloroethane	850	<8.0	850	<4.0	850	<16.2	850	<1.62	850	<1.23	850	<1.29	850	<0.54	850	<0.54	850	<14.9	850	<74.5
Indeno(1,2,3-cd)pyrene	1.9	*<40.6*	1.9	*<20.3*	1.9	*<13.9*	1.9	<1.39	1.9	<0.62	1.9	<0.65	1.9	<2.38	1.9	<2.38	1.9	*<61.1*	1.9	*<305.5*
Isophorone	186,667	<28.2	186,667	<14.1	186,667	<21.4	186,667	<2.14	186,667	<0.37	186,667	<0.39	186,667	<0.51	186,667	<0.51	186,667	<17.7	186,667	<88.5
Naphthalene	18,667	<24.0	18,667	<12.0	18,667	<18.3	18,667	<1.83	18,667	<0.36	18,667	<0.38	18,667	<0.49	18,667	<0.49	18,667	<15.4	18,667	<77.0
Nitrobenzene	467	<24.6	467	<12.3	467	<21.0	467	<2.10	467	<1.26	467	<1.32	467	<0.44	467	<0.44	467	<18.0	467	<90.0
N-nitrosodimethylamine	0.03	*<24.0*	0.03	*<12.0*	0.03	*<10.0*	0.03	*<1.00*	0.03	*<1.13*	0.03	*<1.19*	0.03	*<0.54*	0.03	*<0.54*	0.03	*<16.2*	0.03	*<81.0*

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9 Data flagged due to contamination in the lab reagent blank; therefore, these are not true detections or exceedances.

SC046	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16		Summer 2016		Winter 2016/17		Summer 2017		Winter 2017/18	
SAMPLING DATE(S):	SWQS	8/24/13	SWQS	11/22/13	SWQS	8/2/14	SWQS	12/4/14	SWQS	10/6/15	SWQS	4/8/16	SWQS	8/23/16	SWQS	11/3/16	SWQS	7/16/17	SWQS	1/9/18
N-nitrosodi-n-propylamine	88,667	<30.2	88,667	<15.1	88,667	<11.5	88,667	<1.15	88,667	<1.17	88,667	<1.23	88,667	<1.02	88,667	<1.02	88,667	<16.5	88,667	<82.5
N-nitrosodiphenylamine	290	<60.8	290	<30.4	290	<35.7	290	<3.57	290	<1.15	290	<1.21	290	<1.67	290	<1.67	290	<31.3	290	<156.5
Phenanthrene	NS	<32.6	NS	<16.3	NS	<13.9	NS	<1.39	NS	<0.31	NS	<0.33	NS	<0.49	NS	<0.49	NS	<30.2	NS	<151.0
Pyrene	28,000	<32.8	28,000	<16.4	28,000	<38.6	28,000	<3.86	28,000	<0.67	28,000	<0.70	28,000	<3.21	28,000	<3.21	28,000	<33.8	28,000	<169.0
1,2,4-trichlorobenzene	9,333	<6.4	9,333	<3.2	9,333	<16.9	9,333	<1.69	9,333	<1.04	9,333	<1.09	9,333	<0.55	9,333	<0.55	9,333	<12.1	9,333	<60.5
Pesticides (µg/L) [2]																				
Aldrin	4.5	<0.046	4.5	<0.015	4.5	<0.027	4.5	<0.027	4.5	0.060	4.5	<0.012	4.5	<0.019	4.5	<0.019	4.5	<0.013	4.5	<0.013
Alpha-BHC	1,600	<0.038	1,600	<0.016	1,600	<0.021	1,600	<0.021	1,600	<0.058	1,600	<0.058	1,600	<0.010	1,600	<0.010	1,600	<0.015	1,600	<0.015
Beta-BHC	560	<0.095	560	<0.090	560	<0.072	560	<0.072	560	<0.063	560	<0.063	560	<0.049	560	<0.049	560	<0.083	560	<0.083
Gamma-BHC	11	<0.033	11	<0.022	11	<0.034	11	<0.034	11	<0.058	11	<0.058	11	<0.019	11	<0.019	11	<0.020	11	<0.020
Delta-BHC	1,600	<0.032	1,600	0.041	1,600	<0.021	1,600	<0.021	1,600	<0.066	1,600	<0.066	1,600	<0.035	1,600	<0.035	1,600	<0.012	1,600	<0.012
Chlordane	3.2	<0.16	3.2	<0.19	3.2	<0.14	3.2	<0.14	3.2	<0.36	3.2	<0.36	3.2	<0.61	3.2	<0.61	3.2	<0.29	3.2	<0.29
4,4'-DDT	1.1	<0.029	1.1	<0.015	1.1	<0.025	1.1	<0.025	1.1	<0.017	1.1	<0.017	1.1	<0.011	1.1	<0.011	1.1	<0.020	1.1	<0.020
4,4'-DDE	1.1	<0.034	1.1	<0.017	1.1	<0.010	1.1	<0.010	1.1	<0.013	1.1	<0.013	1.1	<0.020	1.1	<0.020	1.1	<0.019	1.1	<0.019
4,4'-DDD	1.1	<0.023	1.1	<0.013	1.1	<0.031	1.1	<0.031	1.1	<0.021	1.1	<0.021	1.1	<0.021	1.1	<0.021	1.1	<0.023	1.1	<0.023
Dieldrin	4	<0.028	4	<0.021	4	<0.030	4	<0.030	4	<0.060	4	<0.060	4	<0.019	4	<0.019	4	<0.015	4	0.026
Alpha-endosulfan	3 T	<0.034	3 T	<0.017	3 T	<0.018	3 T	0.019	3 T	<0.072	3 T	<0.072	3 T	0.037	3 T	<0.018	3 T	<0.015	3 T	<0.015
Beta-endosulfan	3 T	<0.034	3 T	<0.012	3 T	<0.032	3 T	<0.032	3 T	<0.019	3 T	<0.019	3 T	<0.021	3 T	<0.021	3 T	<0.014	3 T	<0.014
Endosulfan sulfate	3	<0.025	3	<0.013	3	<0.008	3	<0.008	3	<0.016	3	<0.016	3	<0.022	3	<0.022	3	<0.019	3	<0.019
Endrin	0.7	<0.035	0.7	<0.015	0.7	<0.017	0.7	<0.017	0.7	<0.023	0.7	<0.023	0.7	<0.042	0.7	<0.042	0.7	<0.040	0.7	<0.040
Endrin aldehyde	0.7	<0.038	0.7	<0.022	0.7	<0.032	0.7	<0.032	0.7	<0.026	0.7	<0.026	0.7	<0.024	0.7	<0.024	0.7	<0.034	0.7	<0.034
Heptachlor	0.9	<0.035	0.9	<0.017	0.9	<0.027	0.9	<0.027	0.9	<0.035	0.9	<0.035	0.9	<0.023	0.9	<0.023	0.9	<0.019	0.9	<0.019
Heptachlor epoxide	0.9	<0.032	0.9	<0.019	0.9	<0.008	0.9	<0.008	0.9	<0.062	0.9	<0.062	0.9	<0.020	0.9	<0.020	0.9	<0.016	0.9	<0.016
PCB-1242	[4]	<0.41	[4]	<0.53	[4]	<0.37	[4]	<0.37	[4]	<0.14	[4]	<0.14	[4]	<0.72	[4]	<0.72	[4]	<0.33	[4]	<0.33
PCB-1254	[4]	<0.20	[4]	<0.28	[4]	<0.23	[4]	<0.23	[4]	<0.20	[4]	<0.20	[4]	<0.22	[4]	<0.22	[4]	<0.17	[4]	<0.17
PCB-1221	[4]	<0.68	[4]	<0.83	[4]	<0.22	[4]	<0.22	[4]	<0.64	[4]	<0.64	[4]	<0.46	[4]	<0.46	[4]	<0.36	[4]	<0.36
PCB-1232	[4]	<0.66	[4]	<0.33	[4]	<0.55	[4]	<0.55	[4]	<0.37	[4]	<0.37	[4]	<0.90	[4]	<0.90	[4]	<0.40	[4]	<0.40
PCB-1248	[4]	<0.78	[4]	<0.27	[4]	<0.19	[4]	<0.19	[4]	<0.22	[4]	<0.22	[4]	<0.24	[4]	<0.24	[4]	<0.21	[4]	<0.21
PCB-1260	[4]	<0.21	[4]	<0.22	[4]	<0.32	[4]	<0.32	[4]	<0.59	[4]	<0.59	[4]	<0.26	[4]	<0.26	[4]	<0.34	[4]	<0.34
PCB-1016	[4]	<0.36	[4]	<0.32	[4]	<0.18	[4]	<0.18	[4]	<0.55	[4]	<0.55	[4]	<0.29	[4]	<0.29	[4]	<0.33	[4]	<0.33
Toxaphene	11	<0.53	11	<0.33	11	<0.22	11	<0.22	11	<0.60	11	<0.60	11	<0.48	11	<0.48	11	<0.47	11	<0.47

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OUTFALL ID: AC033 RECEIVING WATER: Arizona Canal Diversion Canal DESIGNATED USES: A&We, PBC[10]	MONITORING SEASONS Summer: June 1 – October 31 Winter: November 1 – May 31																			
	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16		Summer 2016		Winter 2016/17		Summer 2017		Winter 2017/18	
SAMPLING DATE(S):	SWQS	07/20/13	SWQS	11/22/13	SWQS	8/12/14	SWQS	12/4/14	SWQS	10/6/15	SWQS	1/4/16	SWQS	8/22/16	SWQS	11/3/16	SWQS	7/16/17	SWQS	1/9/18
MONITORING PARAMETERS [1, 2]																				
Conventional Parameters																				
Flow [3] (cfs)	NS	4.788	NS	2.00	NS	2.7	NS	0.364	NS	3.01	NS	1.466	NS	1.548	NS	0.582	NS	6.094	NS	6.59
pH	4.5-9.0	8.36	4.5-9.0	8.11	4.5-9.0	8.52	4.5-9.0	7.45	4.5-9.0	7.39	4.5-9.0	7.73	4.5-9.0	7.53	4.5-9.0	7.32	6.5-9	7.21	6.5-9	7.19
Temperature (ºC)	Varies	28.5	Varies	16.5	Varies	24.8	Varies	17.0	Varies	24.0	Varies	14.0	Varies	31.0	Varies	22.0	Varies	29.6	Varies	15.6
Hardness (mg/L)	400	56.6	400	25.7	400	33.9	400	19.4	400	34.0	400	16.9	400	49.8	400	46.3	400	64.6	400	28.9
Total Dissolved Solids (TDS) (mg/L) [2]	NS	182	NS	72	NS	104	NS	42	NS	88	NS	46	NS	120	NS	144	NS	276	NS	96
Total Suspended Solids (TSS) (mg/L) [2]	NS	573	NS	242	NS	352	NS	210	NS	182	NS	108	NS	305	NS	182	NS	620	NS	204
Biochemical Oxygen Demand (BOD) (mg/L) [2]	NS	54	NS	18	NS	20	NS	12	NS	13	NS	10	NS	16	NS	50	NS	113	NS	31
Chemical Oxygen Demand (COD) (mg/L) [2]	NS	370	NS	140	NS	180	NS	140	NS	140	NS	120	NS	160	NS	350	NS	570	NS	200

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Inorganics																				
Cyanide, total (µg/L) [2]	200 T	<50	200 T	<5	200 T	<5	200 T	<5	200 T	<5	200 T	<5	200 T	<5	200 T	<5	84	<5	84	<5
Nutrients (mg/L) [2]																				
Nitrate + Nitrite as N	NS	1.7	NS	0.6	NS	1.2	NS	0.5	NS	0.8	NS	0.5	NS	2.1	NS	1.2	NS	1.8	NS	1
Ammonia as N	NS	1.9	NS	0.86	NS	1.4	NS	0.85	NS	0.58	NS	0.52	NS	1.5	NS	2	NS	2.5	NS	1.6
Total Kjeldahl Nitrogen (TKN)	NS	7.2	NS	2.2	NS	3.2	NS	2.0	NS	2.2	NS	1.3	NS	4.5	NS	5.3	NS	10	NS	4.6
Total Phosphorus as P	NS	0.48	NS	0.80	NS	1.0	NS	0.38	NS	0.67	NS	0.48	NS	1.3	NS	0.66	NS	0.48	NS	1.3
Ortho-Phosphorus as P	NS	0.5	NS	0.2	NS	0.2	NS	0.1	NS	0.1	NS	0.1	NS	0.3	NS	0.3	NS	0.6	NS	0.3
Microbiological																				
Escherichia coli (*E. coli*) (CFU/100 mg or MPN/100 mL) [2]	NS	2419.6	NS	>2,419.6	NS	727.0	NS	>2,419.6	NS	9,590	NS	1,610.0	NS	6,500	NS	57,940	575	**10,140**	575	**3,310**
Total Metals (µg/L) [2]																				
Antimony	NS	1.9 T 0.9 D	NS	1.1 T 0.5 D	NS	1.6 T 1.0 D	NS	2.3 T 0.6 D	NS	2.1 T <5.0 D	NS	1.6 T <5.0 D	NS	1.7 T <5 D	NS	3.7 T <5 D	747 T	5.3 T <5 D	747 T	3.1 T <5 D
Arsenic	200 T	7.4 T 1.4 D	200 T	2.5 T 0.7 D	200 T	4.1 T 1.4 D	200 T	2.6 T 0.6 D	200 T	3.7 T <5.0 D	200 T	2.1 T <5.0 D	200 T	5.4 T <5 D	200 T	3 T <5 D	280 T 440 D	5 T <5.0 D	280 T 440 D	4.5 T <5.0 D
Barium	NS	283 T 39 D	NS	91 T 11 D	NS	126 T 20 D	NS	104 T 11 D	NS	92 T 18 D	NS	61 T 10 D	NS	176 T 28 D	NS	136 T 29 D	98,000 T	202 T 52 D	98,000 T	131 T 19 D
Beryllium	NS	0.73 T <0.15 D	NS	0.22 T <0.06 D	NS	0.29 T <0.15 D	NS	0.22 T <0.06	NS	0.15 T <5.0 D	NS	<0.10 T <5.0 D	NS	0.49 T <5 D	NS	<0.25 T <5 D	1,867 T	<0.15 T <5.0 D	1,867 T	0.37 T <5.0 D

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Cadmium	50 T	0.7 T <0.25 D	50 T	0.4 T <0.10 D	50 T	0.4 T <0.30 D	50 T	0.3 T <0.12 D	50 T	0.2 T 5.7 D	50 T	0.2 T <5.0 D	50 T	0.5 T <5 D	50 T	0.3 T <0.25 D	700 T 40.22 D	0.6 T <5.0D	700 T 16.80 D	0.2 T <5.0 D
Chromium	NS CrIII CrVI 1,000 T	27.5 T <2.00 D	NS CrIII CrVI 1,000 T	8.1 T <0.80 D	NS CrIII CrVI 1,000 T	14.0 T 0.9 D	NS CrIII CrVI 1,000 T	9.0 T 0.8 D	NS CrIII CrVI 1,000 T	8.7 T <5.0 D	NS CrIII CrVI 1,000 T	5.3 T <5.0 D	NS CrIII CrVI 1,000 T	16.9 T <5 D	NS CrIII CrVI 1,000 T	9 T <5 D	NS	13.8 T <5.0 D	NS	14 T <5.0 D
Copper	500 T	97.0 T 26.9 D	500 T	32.7 T 10.1 D	500 T	49.6 T 13.6 D	500 T	40.2 T 8.0 D	500 T	39.7 T 11.9 D	500 T	28.7 T 10.2 D	500 T	62.2 T 17.9 D	500 T	55.7 T 24.6 D	1,300 T 15.41 D	97.5 T **51.8 D**	1,300 T 7.22 D	51.5 T **16.2 D**
Lead	100 T	71.1 T 3.1 D	100 T	15.3 T 0.4 D	100 T	37.5 T 1.1 D	100 T	25.2 T 0.7 D	100 T	19.7 T <5.0 D	100 T	13.3 T <5.0 D	100 T	43.4 T <5 D	100 T	15.7 T 0.8 D	15 T 84.44 D	**32.2 T** <5.0 D	15 T 34.49 D	**25.2 T** <5.0 D
Mercury	10 T	0.03 T 0.024 D	10 T	<0.020 T <0.020 D	10 T	<0.092 T <0.2 D	10 T	<0.092 T <0.092 D	10 T	<0.062 T <0.2 D	10 T	<0.062 T <0.2 D	10 T	<0.068 T <0.2 D	10 T	<0.068 T <0.2 D	280 T 5 D	0.084 T <0.2 D	280 T 5 D	<0.066 T <0.2 D
Nickel	NS	29.2 T 6.4 D	NS	9.2 T 1.9 D	NS	13.4 T 2.3 D	NS	9.2 T 1.2 D	NS	9.0 T <5.0 D	NS	4.8 T <5.0 D	NS	15.8 T <5 D	NS	11.1 T <5 D	280,000 T 2873.27 D	20.2 T 8.8 D	280,000 T 1454.92 D	12.8 T <5.0 D
Selenium	20 T	<0.60 T <0.60 D	20 T	<0.60 T <0.24 D	20 T	0.3 T <0.25 D	20 T	0.29 T 0.1 D	20 T	0.67 T <5.0 D	20 T	<0.40 T <5.0 D	20 T	1 T <5 D	20 T	<0.4 T <5 D	33T	0.86 T <5.0 D	33T	0.27 T <5.0 D
Silver	NS	0.3 T <0.15 D	NS	<0.15 T <0.15 D	NS	<0.20 T <0.20 D	NS	0.1 T <0.08 D	NS	<0.25 T <5.0 D	NS	<0.25 T <5.0 D	NS	<0.45 T <5 D	NS	<0.45 T <5 D	4,667 T 1.52 D	0.2 T <5.0 D	4,667 T 0.38 D	0.2 T <5.0 D
Thallium	NS	0.34 T <0.20 D	NS	<0.20 T <0.08 D	NS	<0.10 T <0.10 D	NS	0.08 T <0.04 D	NS	<0.15 T <5.0 D	NS	<0.15 T <5.0 D	NS	0.45 T <5 D	NS	<0.2 T <5 D	75 T	0.1 T <5.0 D	75 T	<0.10 T <5.0 D
Zinc	10,000 T	424 T 80.6 D	10,000 T	170 T 32.1 D	10,000 T	197 T 19.8 D	10,000 T	195 T 15.0 D	10,000 T	180 T 26.6 D	10,000 T	173 T 18.0 D	10,000 T	232 T <50 D	10,000 T	284 T 96.8 D	280,000 T 767.92 D	562 T 217 D	280,000 T 388.44 D	211 T 23.8 D
Organic Toxic Pollutants																				
Total Petroleum Hydrocarbons (TPH) (mg/L) [2]	NS	<11	NS	<11	NS	<10.0	NS	<10	NS	<5.6	NS	<5.7	NS	<6.1	NS	<4.5	NS	<6.7	NS	<7.0
Total Oil and Grease (mg/L) [2]	NS	<5.5	NS	6.0	NS	<5.0	NS	<5.0	NS	<5.6	NS	<5.7	NS	<6.1	NS	<4.5	NS	<5.6	NS	<5.8
VOCs, Semi-VOCs, and Pesticides (µg/L) [2]																				
Acrolein	NS	1.1	NS	<0.20	NS	4.1	NS	<0.40	NS	<0.78	NS	<0.78	NS	<0.41	NS	0.74	467	<3.95	467	<0.79
Acrylonitrile	NS	<0.16	NS	<0.16	NS	<0.70	NS	<0.14	NS	<0.53	NS	<0.53	NS	<0.42	NS	<0.42	37,333	<2.95	37,333	<0.59
Benzene	NS	<1.20	NS	<1.20	NS	<0.65	NS	<0.13	NS	<2.30	NS	<0.46	NS	<0.29	NS	<0.29	3,733	<1.30	3,733	<0.26
Bromoform	NS	<2.35	NS	<2.35	NS	<1.40	NS	<0.28	NS	<3.40	NS	<0.68	NS	<0.33	NS	<0.33	18,667	<1.05	18,667	<0.21
Carbon tetrachloride	NS	<1.30	NS	<1.30	NS	<1.15	NS	<0.23	NS	<1.55	NS	<0.31	NS	<0.20	NS	<0.20	1,307	<1.50	1,307	<0.30
Chlorobenzene	NS	<0.80	NS	<0.80	NS	<0.65	NS	<0.13	NS	<2.50	NS	<0.50	NS	<0.33	NS	<0.33	18,667	<1.15	18,667	<0.23
Chlorodibromomethane	NS	<0.90	NS	<0.90	NS	<1.20	NS	<0.24	NS	<3.05	NS	<0.61	NS	<0.32	NS	<0.32	18,667	<1.20	18,667	<0.24
Chloroethane (ethyl chloride)	NS	<1.10	NS	<1.10	NS	<0.95	NS	<0.19	NS	<2.00	NS	<0.40	NS	<0.33	NS	<0.33	NS	<1.40	NS	<0.28
2-chloroethylvinyl ether	NS	<0.22	NS	<0.22	NS	<0.95	NS	<0.19	NS	<0.53	NS	<0.53	NS	<0.43	NS	<0.43	NS	<3.25	NS	<0.65
Chloroform	NS	<1.15	NS	<1.15	NS	<0.70	NS	<0.14	NS	<2.45	NS	<0.49	NS	<0.32	NS	<0.32	9,333	<1.20	9,333	<0.24
Dichlorobromomethane	NS	<1.15	NS	<1.15	NS	<0.75	NS	<0.15	NS	<2.45	NS	<0.49	NS	<0.29	NS	<0.29	18,667	<1.30	18,667	<0.26
1,1-dichloroethane	NS	<1.30	NS	<1.30	NS	<0.95	NS	<0.19	NS	<2.10	NS	<0.42	NS	<0.29	NS	<0.29	NS	<1.35	NS	<0.27
1,2-dichloroethane	NS	<1.25	NS	<1.25	NS	<0.55	NS	<0.11	NS	<2.55	NS	<0.51	NS	<0.35	NS	<0.35	186,667	<1.30	186,667	<0.26
1,1-dichloroethylene	NS	<1.40	NS	<1.40	NS	<1.35	NS	<0.27	NS	<1.70	NS	<0.34	NS	<0.19	NS	<0.19	46,667	<1.60	46,667	<0.32

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1,2-dichloropropane	NS	<1.25	NS	<1.25	NS	<0.90	NS	<0.18	NS	<2.45	NS	<0.49	NS	<0.32	NS	<0.32	84,000	<1.60	84,000	<0.32
1,3-dichloropropylene[8]	NS	<1.10	NS	<1.10	NS	<0.65	NS	<0.13	NS	cis <2.55 trans <2.50	NS	cis <0.51 trans <0.50	NS	<0.28	NS	<0.28	28,000	<1.05	28,000	<0.21
Ethylbenzene	NS	<0.65	NS	<0.65	NS	<0.75	NS	<0.15	NS	<2.30	NS	<0.46	NS	<0.29	NS	<0.29	93,333	<1.15	93,333	<0.23
Methyl bromide	NS	<0.95	NS	<0.95	NS	<0.90	NS	<0.18	NS	<2.30	NS	<0.46	NS	<0.28	NS	<0.28	1,307	<1.15	1,307	<0.32
Methyl chloride	NS	<1.40	NS	<1.40	NS	<1.15	NS	<0.23	NS	<2.30	NS	<0.46	NS	<0.28	NS	<0.28	NS	<1.85	NS	<0.37
Methylene chloride	NS	<1.00	NS	<1.00	NS	<1.00	NS	<0.20	NS	<4.05	NS	<0.81	NS	<0.31	NS	<0.31	56,000	<4.00	56,000	>0.80
1,1,2,2-tetrachloroethane	NS	<2.00	NS	<2.00	NS	<1.75	NS	<0.35	NS	<4.00	NS	<0.80	NS	<0.33	NS	<0.33	93,333	<1.55	93,333	<0.31
Tetrachloroethylene	NS	<1.05	NS	<1.05	NS	<0.65	NS	<0.13	NS	<1.75	NS	<0.35	NS	<0.23	NS	<0.23	9,333	<1.45	9,333	<0.29
Toluene	NS	<0.95	NS	<0.95	NS	<0.55	NS	<0.11	NS	<2.15	NS	<0.43	NS	0.42	NS	<0.28	373,333	<1.25	373,333	<0.25
1,2-trans-dichloroethylene	NS	<1.25	NS	<1.25	NS	<0.90	NS	<0.18	NS	<1.90	NS	<0.38	NS	<0.24	NS	<0.24	18,667	<1.25	18,667	<0.25
1,1,1-trichloroethane	1,000	<1.00	1,000	<1.00	1,000	<0.70	1,000	<0.14	1,000	<1.70	1,000	<0.34	1,000	<0.23	1,000	<0.23	1.867x 10^{+6}	<1.40	1.867x 10^{+6}	<0.28
1,1,2-trichloroethane	NS	<0.75	NS	<0.75	NS	<0.65	NS	<0.13	NS	<3.00	NS	<0.60	NS	<0.29	NS	<0.29	3,733	<1.50	3,733	<0.30
Trichloroethylene	NS	<0.75	NS	<0.75	NS	<1.10	NS	<0.22	NS	<2.40	NS	<0.48	NS	<0.28	NS	<0.28	280	<1.80	280	<0.36
1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene	NS	<5.0 <5.0	NS	<5.0 <5.0	NS	<10.0 <5.0	NS	<1.0 <1.0	NS	<5.0 <5.0	NS	<1.0 <1.0	NS	<1.0 <1.0	NS	<1.0 <1.0	NS	<5.0 <1.0	NS	>5.0 <1.0
Vinyl chloride	NS	<1.00	NS	<1.00	NS	<1.10	NS	<0.22	NS	<1.75	NS	<0.35	NS	<0.24	NS	<0.24	2,800	<2.10	2,800	<0.42
Xylenes, Total	NS	<1.50	NS	<1.50	NS	<1.25	NS	<0.13	NS	<2.60	NS	<0.52	NS	<0.32	NS	<0.32	186,667	<1.15	186,667	<0.23
Acid Compounds (µg/L) [2]																				
2-chlorophenol	NS	<223.1	NS	<90.9	NS	<1.48	NS	<1.48	NS	<3.10	NS	<3.10	NS	<2.92	NS	<2.92	4,667	<42.3	4,667	<211.5
2,4-dichlorophenol	NS	<219.4	NS	<89.5	NS	<1.65	NS	<1.65	NS	<2.81	NS	<2.81	NS	<3.21	NS	<3.21	2,800	<48.2	2,800	<241.0
2,4-dimethylphenol	NS	<118.6	NS	<48.3	NS	<2.20	NS	<2.20	NS	<2.64	NS	<2.64	NS	<1.32	NS	<1.32	18,667	<70.7	18,667	<353.5
4,6-dinitro-o-cresol	NS	<155.0	NS	<63.2	NS	<1.22	NS	<1.22	NS	<1.49	NS	<1.49	NS	<2.27	NS	<2.27	3,733	<46.9	3,733	<234.5
2,4-dinitrophenol	NS	<134.7	NS	<54.9	NS	<1.13	NS	<1.13	NS	<2.21	NS	<2.21	NS	<2.64	NS	<2.64	1,867	<51.1	1,867	<255.5
2-nitrophenol	NS	<213.7	NS	<87.1	NS	<1.57	NS	<1.57	NS	<2.84	NS	<2.84	NS	<2.61	NS	<2.61	NS	<78.3	NS	<391.5
4-nitrophenol	NS	<242.8	NS	<99.0	NS	5.2	NS	2.1	NS	<2.98	NS	<2.98	NS	<2.03	NS	<2.03	NS	<40.3	NS	<201.5
p-chloro-m-cresol	NS	<229.3	NS	<93.5	NS	<1.65	NS	<1.65	NS	<1.87	NS	<1.87	NS	<3.10	NS	<3.10	48,000	<40.5	48,000	<202.5
Pentachlorophenol	NS	<174.7	NS	<71.2	NS	<1.39	NS	<1.39	NS	<1.47	NS	<1.47	NS	<3.44	NS	<3.44	45.40	<73.6	44.49	*<368.0*
Phenol	NS	<184.6	NS	<75.3	NS	1.4	NS	<1.34	NS	<2.30	NS	<2.30	NS	<1.84	NS	1.9	180,000	<39.9	180,000	<199.5
2,4,6-trichlorophenol	NS	<249.1	NS	<101.5	NS	<1.89	NS	<1.89	NS	<2.60	NS	<2.60	NS	<3.28	NS	<3.28	130	<47.4	130	*<237.0*
Bases/Neutrals (µg/L) [2]																				
Acenaphthene	NS	<69.7	NS	<28.4	NS	<1.03	NS	<1.03	NS	<0.35	NS	<0.35	NS	<1.02	NS	<1.02	56,000	<18.8	56,000	<94.0
Acenaphthylene	NS	<90.0	NS	<36.7	NS	<1.00	NS	<1.00	NS	<1.23	NS	<1.23	NS	<6.10	NS	<6.10	NS	<17.5	NS	<87.5
Anthracene	NS	<90.0	NS	<36.7	NS	<2.88	NS	<2.88	NS	<0.44	NS	<0.44	NS	<1.96	NS	<1.96	280,000	<26.2	280,000	<131.0
Benz(a)anthracene	NS	<90.0	NS	<36.7	NS	<1.08	NS	<1.08	NS	<0.38	NS	<0.38	NS	<1.57	NS	<1.57	0.2	*<19.6*	0.2	*<98.0*
Benzo(a)pyrene	NS	<97.2	NS	<39.6	NS	<3.77	NS	<3.77	NS	<1.41	NS	<1.41	NS	<3.12	NS	<3.12	0.2	*<37.7*	0.2	*<188.5*
Benzo(b)fluoranthene	NS	<126.4	NS	<51.5	NS	<1.46	NS	<1.46	NS	<1.06	NS	<1.06	NS	<1.28	NS	<1.28	NS	<21.7	NS	<108.5
Benzo(g,h,i)perylene	NS	<90.0	NS	<36.7	NS	<1.29	NS	<1.29	NS	<0.72	NS	<0.72	NS	<2.83	NS	<2.83	NS	<25.1	NS	<125.5

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8 Prior to FY2016, the lab was reporting cis and trans for 1-3-dichloropropylene; this reporting year, an upgrade has resulted in providing the result as a total.
9 Data flagged due to contamination in the lab reagent blank; therefore, these are not true detections or exceedances.
10 Review of SWQS during triennial review, this site was reclassified as PBC and A&We according to R18-11-105 Tributary; designated uses. From FY2018 forward will have modified SWQS for comparison.

AC033	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16		Summer 2016		Winter 2016/17		Summer 2017		Winter 2017/18	
SAMPLING DATE(S):	SWQS	07/20/13	SWQS	11/22/13	SWQS	8/12/14	SWQS	12/4/14	SWQS	10/6/15	SWQS	1/4/16	SWQS	8/22/16	SWQS	11/3/16	SWQS	7/16/17	SWQS	1/9/18
Benzo(k)fluoranthene	NS	<72.8	NS	<29.7	NS	<1.04	NS	<1.04	NS	<0.35	NS	<0.35	NS	<1.76	NS	<1.76	1.9	*<23.3*	1.9	*<116.5*
Chrysene	NS	<77.0	NS	<31.4	NS	<1.41	NS	<1.41	NS	<0.46	NS	<0.46	NS	<1.08	NS	<1.08	19	*<19.6*	19	*<98.0*
Dibenzo(a,h)anthracene	NS	<103.0	NS	<42.0	NS	<1.24	NS	<1.24	NS	<0.47	NS	<0.47	NS	<1.93	NS	<1.93	1.9	*<60.4*	1.9	*<302.0*
1,2-dichlorobenzene	NS	<14.0	NS	<5.7	NS	<1.76	NS	<1.76	NS	<1.04	NS	<1.04	NS	<0.58	NS	<0.58	5,900	<1.50	5,900	<0.30
1,3-dichlorobenzene	NS	<58.8	NS	<24.0	NS	<1.74	NS	<1.74	NS	<0.47	NS	<0.47	NS	<0.52	NS	<0.52	NS	<1.25	NS	<0.25
1,4-dichlorobenzene	NS	<54.6	NS	<22.3	NS	<1.56	NS	<1.56	NS	<1.28	NS	<1.28	NS	<0.50	NS	<0.50	6,500	<1.45	6,500	<0.29
3,3-dichlorobenzidine	NS	<1418.0	NS	<578.1	NS	<6.06	NS	<6.06	NS	<11.60	NS	<11.60	NS	<23.45	NS	<23.45	3	*<254.3*	3	*<1,271.5*
Diethyl phthalate	NS	<98.8	NS	<40.3	NS	<2.37	NS	<2.37	NS	0.4	NS	0.4	NS	<1.07	NS	<1.07	746,667	<19.9	746,667	<99.5
Dimethyl phthalate	NS	<93.1	NS	<37.9	NS	<2.42	NS	<2.42	NS	<0.47	NS	<0.47	NS	<0.58	NS	<0.58	NS	<19.1	NS	<95.5
Di-n-butyl phthalate	NS	<116.0	NS	<47.3	NS	<1.85	NS	<1.85	NS	<0.31	NS	<0.31	NS	<1.37	NS	<1.37	1,100	<23.5	1,100	<117.5
2,4-dinitrotoluene	NS	<106.6	NS	<43.5	NS	<2.12	NS	<2.12	NS	<0.26	NS	<0.26	NS	<1.30	NS	<1.30	1,867	<31.0	1,867	<155.0
2,6-dinitrotoluene	NS	<131.0	NS	<53.4	NS	<1.12	NS	<1.12	NS	<0.38	NS	<0.38	NS	<1.39	NS	<1.39	3,733	<28.9	3,733	<144.5
Di-n-octyl phthalate	NS	<149.8	NS	<61.1	NS	<1.10	NS	<1.10	NS	<1.28	NS	<1.28	NS	<1.67	NS	<1.67	373,333	<55.0	373,333	<275.0
1,2-diphenylhydrazine (as azobenzene)	NS	<121.2	NS	<49.4	NS	<6.70	NS	<6.70	NS	<1.06	NS	<1.06	NS	<7.46	NS	<7.46	NS	<21.5	NS	<107.5
Fluoranthene	NS	<93.1	NS	<37.9	NS	<1.35	NS	<1.35	NS	<0.27	NS	<0.27	NS	<1.06	NS	<1.06	37,333	<30.8	37,333	<154.0
Fluorene	NS	<80.1	NS	<32.6	NS	<4.81	NS	<4.81	NS	<0.29	NS	<0.29	NS	<0.51	NS	<0.51	37,333	<28.7	37,333	<143.5
Hexachlorobenzene	NS	<72.3	NS	<29.5	NS	<1.23	NS	<1.23	NS	<0.34	NS	<0.34	NS	<0.47	NS	<0.47	747	<15.7	747	<78.5
Hexachlorobutadiene	NS	<17.2	NS	<7.0	NS	<1.82	NS	<1.82	NS	<1.67	NS	<1.67	NS	<0.41	NS	<0.41	187	<10.0	187	<50.0
Hexachlorocyclopentadiene	NS	<118.0	NS	<48.1	NS	<1.23	NS	<1.23	NS	<1.53	NS	<1.53	NS	<2.16	NS	<2.16	11,200	<61.0	11,200	<305.0
Hexachloroethane	NS	<20.8	NS	<8.5	NS	<1.62	NS	<1.62	NS	<1.23	NS	<1.23	NS	<0.54	NS	<0.54	850	<14.9	850	<74.5
Indeno(1,2,3-cd)pyrene	NS	<105.6	NS	<43.0	NS	<1.39	NS	<1.39	NS	<0.62	NS	<0.62	NS	<2.38	NS	**3.9**[9]	1.9	*<61.1*	1.9	*<305.5*
Isophorone	NS	<73.3	NS	<29.9	NS	<2.14	NS	<2.14	NS	<0.37	NS	<0.37	NS	<0.51	NS	<0.51	186,667	<17.7	186,667	<88.5
Naphthalene	NS	<62.4	NS	<25.4	NS	<1.83	NS	<1.83	NS	<0.36	NS	<0.36	NS	<0.49	NS	<0.49	18,667	<15.4	18,667	<77.0
Nitrobenzene	NS	<64.0	NS	<26.1	NS	<2.10	NS	<2.10	NS	<1.26	NS	<1.26	NS	<0.44	NS	<0.44	467	<18.0	467	<90.0
N-nitrosodimethylamine	NS	<62.4	NS	<25.4	NS	<1.00	NS	<1.00	NS	<1.13	NS	<1.13	NS	<0.54	NS	<0.54	0.03	*<16.2*	0.03	*<81.0*
N-nitrosodi-n-propylamine	NS	<78.5	NS	<32.0	NS	<1.15	NS	<1.15	NS	<1.17	NS	<1.17	NS	<1.02	NS	<1.02	88,667	<16.5	88,667	<82.5
N-nitrosodiphenylamine	NS	<158.1	NS	<64.4	NS	<3.57	NS	<3.57	NS	<1.15	NS	<1.15	NS	<1.67	NS	<1.67	290	<31.3	290	<156.5
Phenanthrene	NS	<84.8	NS	<34.6	NS	<1.39	NS	<1.39	NS	<0.31	NS	<0.31	NS	<0.49	NS	<0.49	NS	<30.2	NS	<151.0
Pyrene	NS	<85.3	NS	<34.8	NS	<3.86	NS	<3.86	NS	<0.67	NS	<0.67	NS	<3.21	NS	<3.21	28,000	<33.8	28,000	<169.0
1,2,4-trichlorobenzene	NS	<16.6	NS	<6.8	NS	<1.69	NS	<1.69	NS	<1.04	NS	<1.04	NS	<0.55	NS	<0.55	9,333	<12.0	9,333	<60.5
Pesticides (µg/L) [2]																				
Aldrin	0.003	*<0.048*	0.003	**0.028**	0.003	*<0.027*	0.003	*<0.027*	0.003	*<0.012*	0.003	*<0.012*	0.003	**0.077**	0.003	*<0.019*	4.5	0.071	4.5	<0.013
Alpha-BHC	NS	<0.040	NS	<0.017	NS	<0.021	NS	<0.021	NS	<0.058	NS	<0.058	NS	<0.010	NS	<0.010	1,600	<0.015	1,600	0.019
Beta-BHC	NS	<0.099	NS	<0.094	NS	<0.072	NS	<0.072	NS	0.078	NS	<0.063	NS	<0.049	NS	<0.049	560	<0.083	560	<0.083
Gamma-BHC	NS	0.074	NS	<0.024	NS	<0.034	NS	<0.034	NS	<0.058	NS	<0.058	NS	<0.019	NS	<0.019	11	<0.020	11	<0.020
Delta-BHC	NS	<0.033	NS	<0.018	NS	<0.021	NS	<0.021	NS	<0.066	NS	<0.066	NS	<0.035	NS	<0.035	1,600	<0.012	1,600	<0.012
Chlordane	NS	<0.17	NS	<0.20	NS	<0.14	NS	<0.14	NS	<0.36	NS	<0.36	NS	<0.61	NS	<0.61	3.2	<0.29	3.2	<0.29
4,4'-DDT	0.001	*<0.030*	0.001	*<0.016*	0.001	*<0.025*	0.001	*<0.025*	0.001	*<0.017*	0.001	*<0.017*	0.001	*<0.011*	0.001	*<0.011*	1.1	<0.020	1.1	<0.020

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4,4'-DDE	0.001	*<0.035*	0.001	*<0.018*	0.001	*<0.010*	0.001	*<0.010*	0.001	*<0.013*	0.001	*<0.013*	0.001	*<0.020*	0.001	*<0.020*	1.1	<0.019	1.1	<0.019
4,4'-DDD	0.001	*<0.024*	0.001	*<0.014*	0.001	*<0.031*	0.001	*<0.031*	0.001	*<0.021*	0.001	*<0.021*	0.001	*<0.021*	0.001	*<0.021*	1.1	<0.023	1.1	<0.023
Dieldrin	0.003	*<0.029*	0.003	*<0.022*	0.003	*<0.030*	0.003	*<0.030*	0.003	*<0.060*	0.003	*<0.060*	0.003	**0.035**	0.003	*<0.019*	4	<0.015	4	<0.015
Alpha-endosulfan	NS	<0.035	NS	0.084	NS	0.072	NS	<0.018	NS	<0.072	NS	<0.072	NS	0.089	NS	<0.018	3 T	<0.015	3 T	<0.015
Beta-endosulfan	NS	<0.035	NS	<0.013	NS	<0.032	NS	<0.032	NS	<0.019	NS	<0.019	NS	<0.021	NS	<0.021	3 T	<0.014	3 T	<0.014
Endosulfan sulfate	NS	<0.026	NS	<0.014	NS	<0.008	NS	<0.008	NS	<0.016	NS	<0.016	NS	<0.022	NS	<0.022	3	<0.019	3	<0.019
Endrin	0.004	*<0.036*	0.004	*<0.016*	0.004	*<0.017*	0.004	*<0.017*	0.004	*<0.023*	0.004	*<0.023*	0.004	*<0.042*	0.004	*<0.042*	0.7	<0.040	0.7	<0.040
Endrin aldehyde	NS	<0.040	NS	<0.024	NS	<0.032	NS	<0.032	NS	<0.026	NS	<0.026	NS	<0.024	NS	<0.024	0.7	<0.034	0.7	<0.034
Heptachlor	NS	0.092	NS	<0.018	NS	<0.027	NS	<0.027	NS	<0.035	NS	<0.035	NS	<0.023	NS	<0.023	0.9	<0.019	0.9	<0.019
Heptachlor epoxide	NS	<0.033	NS	<0.020	NS	<0.008	NS	<0.008	NS	<0.062	NS	<0.062	NS	<0.020	NS	<0.020	0.9	<0.016	0.9	<0.016
PCB-1242	0.001	*<0.43*	0.001	<0.56	0.001	*<0.37*	0.001	*<0.37*	0.001	*<0.14*	0.001	*<0.14*	0.001	*<0.72*	0.001	*<0.72*	[4]	<0.33	[4]	<0.33
PCB-1254	0.001	*<0.21*	0.001	<0.29	0.001	*<0.23*	0.001	*<0.23*	0.001	*<0.20*	0.001	*<0.20*	0.001	*<0.22*	0.001	*<0.22*	[4]	<0.17	[4]	<0.17
PCB-1221	0.001	*<0.71*	0.001	<0.87	0.001	*<0.22*	0.001	*<0.22*	0.001	*<0.64*	0.001	*<0.64*	0.001	*<0.46*	0.001	*<0.46*	[4]	<0.36	[4]	<0.36
PCB-1232	0.001	*<0.69*	0.001	<0.34	0.001	*<0.55*	0.001	*<0.55*	0.001	*<0.37*	0.001	*<0.37*	0.001	*<0.90*	0.001	*<0.90*	[4]	<0.40	[4]	<0.40
PCB-1248	0.001	*<0.81*	0.001	<0.28	0.001	*<0.19*	0.001	*<0.19*	0.001	*<0.22*	0.001	*<0.22*	0.001	*<0.24*	0.001	*<0.24*	[4]	<0.21	[4]	<0.21
PCB-1260	0.001	*<0.22*	0.001	<0.24	0.001	*<0.32*	0.001	*<0.32*	0.001	*<0.59*	0.001	*<0.59*	0.001	*<0.26*	0.001	*<0.26*	[4]	<0.34	[4]	<0.34
PCB-1016	0.001	*<0.37*	0.001	<0.33	0.001	*<0.18*	0.001	*<0.18*	0.001	*<0.55*	0.001	*<0.55*	0.001	*<0.29*	0.001	*<0.29*	[4]	<0.33	[4]	<0.33
Toxaphene	0.005	*<0.55*	0.005	<0.34	0.005	*<0.22*	0.005	*<0.22*	0.005	*<0.60*	0.005	*<0.60*	0.005	*<0.48*	0.005	*<0.48*	11	<0.47	11	<0.47

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9 Data flagged due to contamination in the lab reagent blank; therefore, these are not true detections or exceedances.
10 Review of SWQS during triennial review, this site was reclassified as PBC and A&We according to R18-11-105 Tributary; designated uses. From FY2018 forward will have modified SWQS for comparison.

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OUTFALL ID: SR003 **RECEIVING WATER: Salt River** **DESIGNATED USES: A&Wedw, PBC, FC, AgI, AgL**	**MONITORING SEASONS** Summer: June 1 – October 31 Winter: November 1 – May 31																			
	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16		Summer 2016		Winter 2016/17		Summer 2017		Winter 2017/18	
SAMPLING DATE(S):	SWQS	7/21/13	SWQS	11/23/13	SWQS	8/12/14	SWQS	12/4/14	SWQS	7/31/15	SWQS	1/4/16	SWQS	7/29/16	SWQS	11/3/16	SWQS	7/24/17	SWQS	1/9/18
MONITORING PARAMETERS [1, 2]																				
Conventional Parameters																				
Flow [3] (cfs)	NS	2.93	NS	2.23	NS	1.162	NS	1.116	NS	5.167	NS	2.656	NS	2.377	NS	6.224	NS	21.462	NS	18.08
pH	6.5-9	7.78	6.5-9	8.54	6.5-9	7.67	6.5-9	8.47	6.5-9	7.63	6.5-9	7.94	6.5-9	7.62	6.5-9	6.96	6.5-9	7.42	6.5-9	7.62
Temperature (ºC)	Varies	27.5	Varies	20.0	Varies	29.5	Varies	19.5	Varies	30.8	Varies	15.5	Varies	30.5	Varies	21.5	Varies	29	Varies	18
Hardness (mg/L)	400	39.1	400	74.0	400	38.9	400	32.5	400	46.0	400	41.4	400	63.5	400	69.9	400	38.1	400	62.4
Total Dissolved Solids (TDS) (mg/L) [2]	NS	130	NS	186	NS	130	NS	112	NS	172	NS	124	NS	260	NS	212	NS	138	NS	200
Total Suspended Solids (TSS) (mg/L) [2]	NS	178	NS	84.0	NS	314	NS	1,600	NS	684	NS	196	NS	212	NS	192	NS	162	NS	130
Biochemical Oxygen Demand (BOD) (mg/L) [2]	NS	27	NS	10	NS	18	NS	36	NS	30	NS	21	NS	43	NS	33	NS	24	NS	>59.48
Chemical Oxygen Demand (COD) (mg/L) [2]	NS	160	NS	74	NS	200	NS	400	NS	330	NS	200	NS	240	NS	250	NS	200	NS	270

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Inorganics																				
Cyanide, total (µg/L) [2]	41 T	*<50*	41 T	<5	41 T	<5	41 T	<5	41 T	<5	41 T	<5	41T	<5	41T	<5	41T	<5.0	41T	<5.0
Nutrients (mg/L) [2]																				
Nitrate + Nitrite as N	NS	1.6	NS	0.9	NS	0.9	NS	0.7	NS	0.7	NS	0.6	NS	2	NS	1.4	NS	0.8	NS	1.4
Ammonia as N	12.56	1.2	2.98	0.47	10.18	0.98	2.28	1.1	16.2	1.6	9.42	0.78	16.5	2.3	37.3	1.3	22.3	0.98	16.5	2.3
Total Kjeldahl Nitrogen (TKN)	NS	4.0	NS	1.2	NS	2.8	NS	4.2	NS	4.3	NS	2.5	NS	7.3	NS	3.7	NS	3.2	NS	5.5
Total Phosphorus as P	NS	0.79	NS	0.40	NS	1.1	NS	0.37	NS	1.8	NS	0.98	NS	1.4	NS	0.69	NS	0.72	NS	0.43
Ortho-Phosphorus as P	NS	0.4	NS	0.1	NS	0.1	NS	0.2	NS	<0.1	NS	0.1	NS	0.4	NS	0.3	NS	0.2	NS	0.4
Microbiological																				
Escherichia coli (*E. coli*) (CFU/100 mg or MPN/100 mL) [2]	575	**>2,419.6**	575	**2,419.6**	575	**>2419.6**	575	**>2,419.6**	575	**10,710**	575	**8,130.0**	575	**1,986.3**	575	**5,940**	575	**104,620**	575	**4,140**

NOTES:
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D = Dissolved

Bold text indicates a sample result greater than the WQS.
Italicized text indicated a laboratory detection limit higher that the WQS.

<u>Footnotes</u>
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Total Metals (µg/L) 2																				
Antimony	640 T 1,000 D	1.6 T 0.8 D	640 T 1,000 D	1.2 T 0.6 D	640 T 1,000 D	1.8 T 1.0 D	640 T 1,000 D	1.4 T 1.0 D	640 T 1,000 D	2.9 T <5.0 D	640 T 1,000 D	2.6 T <5.0 D	640 T 1,000 D	2.7 T <5 D	640 T 1,000 D	6 T <5 D	640 T 1,000 D	3.7 T <5.0 D	640 T 1,000 D	3.5 T <5.0 D
Arsenic	80 T 340 D	4.6 T 1.4 D	80 T 340 D	3.6 T 2.8 D	80 T 340 D	3.8 T 1.4 D	80 T 340 D	12.2 T 1.2 D	80 T 340 D	8.8 T <5.0 D	80 T 340 D	4.8 T <5.0 D	80 T 340 D	8.4 T <5 D	80 T 340 D	4.9 T <5 D	80 T 340 D	4.2 T <5.0 D	80 T 340 D	4.6 T <5.0 D
Barium	98,000 T	119 T 22 D	98,000 T	67 T 26 D	98,000 T	136 T 21 D	98,000 T	538 T 14 D	98,000 T	293 T 25 D	98,000 T	161 T 18 D	98,000 T	275 T 35 D	98,000 T	187 T 34 D	98,000 T	118 T 23 D	98,000 T	120 T 30 D
Beryllium	84 T	0.48 T <0.15 D	84 T	<0.15 <0.06 D	84 T	0.3 T <0.15 D	84 T	1.7 T <0.06 D	84 T	0.95 T <5.0 D	84 T	0.32 T <5.0 D	84 T	0.87 T <5 D	84 T	0.38 T <5 D	84 T	0.36 T <5.0 D	84 T	0.28 T <5.0 D
Cadmium	50 T 3.158 D	0.6 T <0.25 D	50 T 5.87 D	<0.3 T <0.10 D	50 T 3.14 D	0.8 T <0.30 D	50 T 2.64 D	2.7 T <0.12 D	50 T 3.70 D	1.2 T *<5.0 D*	50 T 3.33 D	1.2 T *<5.0 D*	50 T 2.61 D	1.4 T <0.25 D	50 T 2.89 D	1 T <0.25 D	50 T 1.5 D	0.8 T <0.2 D	50 T 2.56 D	0.3 T *<5.0 D*
Chromium	1,000 T	14.5 T <2.00 D	1,000 T	5.2 T 1.1 D	1,000 T	11.6 T 1.1 D	1,000 T	45.6 T 0.8 D	1,000 T	31.4 T <5.0 D	1,000 T	14.4 T <5.0 D	1,000 T	30.5 T <5 D	1,000 T	16.1 T <5 D	1,000 T	12.7 T <5.0 D	1,000 T	13.1 T <5.0 D
Copper	500 T 5.54 D	49.1 T **16.8 D**	500 T 10.12 D	25.1 T 6.8 D	500 T 5.52 D	78.3 T **9.6 D**	500 T 4.66 D	219 T **10.6 D**	500 T 6.47 D	147 T **16.6 D**	500 T 5.85 D	95.2 T **17.3 D**	500 T 8.76 D	180 T **28.6 D**	500 T 9.59 D	139 T **34.8 D**	500 T 5.41 D	59 T **18 D**	500 T 8.62 D	70.7 T **19.5 D**
Lead	15 T 22.93 D	**34.4 T** 1.5 D	15 T 46.46 D	14.4 T 0.6 D	15 T 22.79 D	**49.6 T** 1.4 D	15 T 18.64 D	**110 T** 0.6 D	15 T 27.47 D	**64.4 T** 1.0 D	15 T 24.43 D	**44.1 T** <5.0 D	15 T 39.26 D	**79 T** 1.8 D	15 T 43.64 D	**58.4 T** 1 D	15 T 22.27 D	**28 T** 1.2 D	15 T 38.51 D	**28.7 T** 1.1 D
Mercury	10 T 2.4 D	0.02 T 0.023 D	10 T 2.4 D	<0.020 T <0.020 D	10 T 2.4 D	<0.092 T <0.2 D	10 T 2.4 D	<0.092 T <0.092 D	10 T 2.4 D	0.08 T <0.2 D	10 T 2.4 D	0.08 T <0.2 D	10 T 2.4 D	0.191 T <0.068 D	10 T 2.4 D	0.101 T <0.2 D	10 T 2.4 D	<0.20 T <0.20 D	10 T 2.4 D	<0.066 T <0.2 D
Nickel	511 T 211.5 D	18.8 T 3.3 D	511 T 363 D	6.1 T 1.3 D	511 T 210.6 D	16.4 T 2.5 D	511 T 181 D	60.6 D 2.2 D	511 T 243 D	36.8 T 3.4 D	511 T 222 D	18.9 T <5.0 D	511 T 318.87 D	38 T 5 D	511 T 345.85 D	19.6 T <5 D	511 T 206.98 D	15.1 T <5.0 D	511 T 314.19 D	16.9 T <5.0 D
Selenium	20 T	<0.60 T <0.60 D	20 T	<0.60 T 0.7 D	20 T	<0.25 T <0.25 D	20 T	0.79 T 0.3 D	20 T	<0.40 T <5.0 D	20 T	<0.40 T <5.0 D	20 T	<0.4 T <5 D	20 T	0.64 T <5 D	20 T	0.79 T <5.0 D	20 T	0.37 T <5.0 D
Silver	4,667 T 0.643 D	0.2 T <0.15 D	4,667 T 1.92 D	<0.15 T <0.15 D	4,667 T 0.637 D	<0.20 T <0.20 D	4,667 T 0.465 D	0.5 T <0.08 D	4,667 T 0.85 D	0.4 T *<5.0 D*	4,667 T 0.70 D	<0.25 T *<5.0 D*	4,667 T 1.47 D	0.5 T *<5 D*	4,667 T 1.74 D	<0.45 T *<5 D*	4,667 T 0.61 D	0.2 T *<5.0 D*	4,667 T 1.43 D	0.2 T *<5.0 D*
Thallium	1 T 700 D	<0.20 T <0.20 D	1 T 700 D	<0.2 T <0.08 D	1 T 700 D	0.13 T <0.10 D	1 T 700 D	0.61 T <0.04 D	1 T 700 D	0.22 T <5.0 D	1 T 700 D	<0.15 T <5.0 D	1 T 700 D	0.5 T <5 D	1 T 700 D	<0.2 T <5 D	1 T 700 D	0.1 T <5.0 D	1 T 700 D	0.13 T <5.0 D
Zinc	5,106 T 52.9 D	213 T 27.4 D	5,106 T 90.8 D	120 T 18.6 D	5,106 T 52.7 D	391 T 30.4 D	5,106 T 45.2 D	919 T 12.9 D	5,106 T 60.7 D	688 T 29.5 D	5,106 T 55.5 D	395 T 27.4 D	5,106 T 79.75 D	858 T **79.8 D**	5,106 T 86.51 D	538 T 62 D	5,106 T 51.73 D	255 T 42.8 D	5,106 T 78.58 D	279 T 52.3 D
Organic Toxic Pollutants																				
Total Petroleum Hydrocarbons (TPH) (mg/L) 2	NS	<11	NS	<11	NS	<13	NS	<10	NS	<12	NS	<5.4	NS	<5.7	NS	<4.4	NS	<7.0	NS	<6.6
Total Oil and Grease (mg/L) 2	NS	<5.5	NS	<5.6	NS	<6.3	NS	5.4	NS	<5.8	NS	<5.4	NS	<5.7	NS	<4.4	NS	<5.8	NS	<5.5
VOCs, Semi-VOCs, and Pesticides (µg/L) 2																				
Acrolein	1.9	<0.20	1.9	<0.20	1.9	<2.00	1.9	<0.40	1.9	<0.78	1.9	<0.78	1.9	<0.41	1.9	1.3	1.9	<3.95	1.9	<0.79
Acrylonitrile	0.2	<0.16	0.2	<0.16	0.2	<0.70	0.2	<0.14	0.2	*<0.53*	0.2	*<0.53*	0.2	*<0.42*	0.2	*<0.42*	0.2	<2.95	0.2	<0.59
Benzene	114	<1.20	114	<0.24	114	<0.65	114	<0.13	114	<0.46	114	<0.46	114	<0.46	114	<0.29	114	<1.30	114	<0.26
Bromoform	133	<2.35	133	<0.47	133	<1.40	133	<0.28	133	<0.68	133	<0.68	133	<0.68	133	<0.33	133	<1.05	133	<0.21

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Carbon tetrachloride	2	<1.30	2	<0.26	2	<1.15	2	<0.23	2	<0.31	2	<0.31	2	<0.31	2	<0.20	2	<1.50	2	<0.30
Chlorobenzene	1,553	<0.80	1,553	<0.16	1,553	<0.65	1,553	<0.13	1,553	<0.50	1,553	<0.50	1,553	<0.50	1,553	<0.33	1,553	<1.15	1,553	<0.23
Chlorodibromomethane	13	<0.90	13	<0.18	13	<1.20	13	<0.24	13	<0.61	13	<0.61	13	<0.61	13	<0.32	13	<1.20	13	<0.24
Chloroethane (ethyl chloride)	NS	<1.10	NS	<0.22	NS	<0.95	NS	<0.19	NS	<0.40	NS	<0.40	NS	<0.40	NS	<0.33	NS	<1.40	NS	<0.28
2-chloroethylvinyl ether	180,000	<0.22	180,000	<0.22	180,000	<0.95	180,000	<0.19	180,000	<0.53	180,000	<0.53	180,000	<0.43	180,000	<0.43	180,000	<3.25	180,000	<0.65
Chloroform	2,133	<1.15	2,133	<0.23	2,133	0.72	2,133	<0.14	2,133	<0.49	2,133	<0.49	2,133	<0.49	2,133	<0.32	2,133	<1.20	2,133	<0.24
Dichlorobromomethane	17	<1.15	17	<0.23	17	<0.75	17	<0.15	17	<0.49	17	<0.49	17	<0.49	17	<0.29	17	<1.20	17	<0.24
1,1-dichloroethane	NS	<1.30	NS	<0.26	NS	<0.95	NS	<0.19	NS	<0.42	NS	<0.42	NS	<0.42	NS	<0.29	NS	<1.35	NS	<0.27
1,2-dichloroethane	37	<1.25	37	<0.25	37	<0.55	37	<0.11	37	<0.51	37	<0.51	37	<0.51	37	<0.35	37	<1.30	37	<0.26
1,1-dichloroethylene	7,143	<1.40	7,143	<0.28	7,143	<1.35	7,143	<0.27	7,143	<0.34	7,143	<0.34	7,143	<0.34	7,143	<0.19	7,143	<1.60	7,143	<0.32
1,2-dichloropropane	17,518	<1.25	17,518	<0.25	17,518	<0.90	17,518	<0.18	17,518	<0.49	17,518	<0.49	17,518	<0.49	17,518	<0.32	17,518	<1.60	17,518	<0.32
1,3-dichloropropylene[8]	42	cis<1.20 trans<1.10	42	cis<0.24 trans<0.22	42	<0.65	42	<0.13	42	cis <0.51 trans <0.50	42	cis <0.51 trans <0.50	42	<0.51	42	<0.28	42	<1.05	42	<0.21
Ethylbenzene	2,133	<0.65	2,133	<0.13	2,133	<0.75	2,133	<0.15	2,133	<0.46	2,133	<0.46	2,133	<0.46	2,133	<0.29	2,133	<1.15	2,133	<0.23
Methyl bromide	299	<0.95	299	<0.19	299	<0.90	299	<0.18	299	<0.46	299	<0.46	299	<0.46	299	<0.28	299	<1.15	299	<0.23
Methyl chloride	270,000	<1.40	270,000	<0.28	270,000	<1.15	270,000	<0.23	270,000	<0.46	270,000	<0.46	270,000	<0.46	270,000	<0.28	270,000	<1.85	270,000	<0.37
Methylene chloride	593	<1.00	593	<0.20	593	<1.00	593	<0.20	593	<0.81	593	<0.81	593	<0.81	593	<0.31	593	<4.00	593	<0.80
1,1,2,2-tetrachloroethane	4	<2.00	4	<0.40	4	<1.75	4	<0.35	4	<0.80	4	<0.80	4	<0.80	4	<0.33	4	<1.55	4	<0.31
Tetrachloroethylene	261	<1.05	261	<0.21	261	<0.65	261	<0.13	261	<0.35	261	<0.35	261	<0.35	261	<0.23	261	<1.45	261	<0.29
Toluene	8,700	<0.95	8,700	<0.19	8,700	<0.55	8,700	<0.11	8,700	<0.43	8,700	<0.43	8,700	<0.43	8,700	<0.28	8,700	<1.25	8,700	<0.25
1,2-trans-dichloroethylene	10,127	<1.25	10,127	<0.25	10,127	<0.90	10,127	<0.18	10,127	<0.38	10,127	<0.38	10,127	<0.38	10,127	<0.24	10,127	<1.25	10,127	<0.25
1,1,1-trichloroethane	1,000	<1.00	1,000	<0.20	1,000	<0.70	1,000	<0.14	1,000	<0.34	1,000	<0.34	1,000	<0.34	1,000	<0.23	1,000	<1.40	1,000	<0.28
1,1,2-trichloroethane	16	<0.75	16	<0.15	16	<0.65	16	<0.13	16	<0.60	16	<0.60	16	<0.60	16	<0.29	16	<1.50	16	<0.30
Trichloroethylene	29	<0.75	29	<0.15	29	<1.10	29	<0.22	29	<0.48	29	<0.48	29	<0.48	29	<0.28	29	<1.80	29	<0.36
1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene	NS	<5.0 <5.0	NS	<1.0 <1.0	NS	<10.00 <5.00	NS	<1.0 <1.0	NS	<1.0 <1.0	NS	<1.0 <1.0	NS	<1.0 <1.0	NS	<1.0 <1.0	NS	<5.0 <5.0	NS	<1.0 <1.0
Vinyl chloride	5	<1.00	5	<0.20	5	<1.10	5	<0.22	5	<0.35	5	<0.35	5	<0.35	5	<0.24	5	<2.10	5	<0.42
Xylenes, Total	186,667	<1.50	186,667	<0.30	186,667	<1.25	186,667	<0.13	186,667	<0.52	186,667	<0.52	186,667	<0.52	186,667	<0.32	186,667	<1.15	186,667	<0.23
Acid Compounds (µg/L) [2]																				
2-chlorophenol	30	*<89.2*	30	*<43.3*	30	<1.48	30	<1.48	30	<3.10	30	<3.10	30	<2.92	30	<2.92	30	<4.23	30	*<84.6*
2,4-dichlorophenol	59	*<87.8*	59	<42.6	59	<1.65	59	<1.65	59	<2.81	59	<2.81	59	<3.21	59	<3.21	59	<4.82	59	*<96.4*
2,4-dimethylphenol	171	<47.4	171	<23.0	171	<2.20	171	<2.20	171	<2.64	171	<2.64	171	<1.32	171	<1.32	171	<7.07	171	<141.4
4,6-dinitro-o-cresol	310	<62.0	310	<30.1	310	<1.22	310	<1.22	310	<1.49	310	<1.49	310	<2.27	310	<2.27	310	<4.69	310	<93.8
2,4-dinitrophenol	110	<53.9	110	<26.2	110	<1.13	110	<1.13	110	<2.21	110	<2.21	110	<2.64	110	<2.64	110	<5.11	110	<102.2
2-nitrophenol	NS	<85.5	NS	<41.5	NS	<1.57	NS	<1.57	NS	<2.84	NS	<2.84	NS	<2.61	NS	<2.61	NS	<7.83	NS	<156.6
4-nitrophenol	4,100	<97.1	4,100	<47.2	4,100	3.0	4,100	3.7	4,100	<2.98	4,100	3.6	4,100	<2.03	4,100	<2.03	4,100	<4.03	4,100	<80.6

NOTES:
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Italicized text indicated a laboratory detection limit higher that the WQS.

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4 Standard for total PCBs of 11 µg/L A&We and 19 µg/L PBC.
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7 A representative event occurred on 8/2; however, the sampler malfunctioned. Then next event was on 8/5 but due to the 72-hour rule, no sample was taken. Another measurable event on 9/22 did not result in a qualifying rain event. No samples were taken at this outfall during Summer 2016.
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9 Data flagged due to contamination in the lab reagent blank; therefore, these are not true detections or exceedances.

SR003	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16		Summer 2016		Winter 2016/17		Summer 2017		Winter 2017/18	
SAMPLING DATE(S):	SWQS	7/21/13	SWQS	11/23/13	SWQS	8/12/14	SWQS	12/4/14	SWQS	7/31/15	SWQS	1/4/16	SWQS	7/29/16	SWQS	11/3/16	SWQS	7/24/17	SWQS	1/9/18
p-chloro-m-cresol	15	*<91.7*	15	*<44.5*	15	<1.65	15	<1.65	15	<1.87	15	<1.87	15	<3.10	15	<3.10	15	<4.05	15	*<81.0*
Pentachlorophenol	19.879	*<69.9*	42.688	<33.9	17.803	<1.39	39.781	<1.39	17.10	6.7	23.36	<1.47	16.91	<3.44	8.71	<3.44	13.83	<7.36	16.91	*<147.2*
Phenol	37	*<73.8*	37	<35.9	37	1.6	37	<1.34	37	<2.30	37	<2.30	37	3.7	37	2.1	37	<3.99	37	*<79.8*
2,4,6-trichlorophenol	2	*<99.6*	2	*<48.4*	2	<1.89	2	<1.89	2	*<2.60*	2	*<2.60*	2	*<3.28*	2	*<3.28*	2	*<4.74*	2	*<94.8*
Bases/Neutrals (µg/L) [2]																				
Acenaphthene	198	<27.9	198	<13.5	198	<1.03	198	<1.03	198	<0.35	198	<0.35	198	<1.02	198	<1.02	198	<1.88	198	<37.6
Acenaphthylene	NS	<36.0	NS	<17.5	NS	<1.00	NS	<1.00	NS	<1.23	NS	<1.23	NS	<6.10	NS	<6.10	NS	<1.75	NS	<35.0
Anthracene	74	<36.0	74	<17.5	74	<2.88	74	<2.88	74	<0.44	74	<0.44	74	<1.96	74	<1.96	74	<2.62	74	<52.4
Benz(a)anthracene	0.02	*<36.0*	0.02	*<17.5*	0.02	*<1.08*	0.02	*<1.08*	0.02	*<0.38*	0.02	*<0.38*	0.02	*<1.57*	0.02	*<1.57*	0.02	*<1.96*	0.02	*<39.2*
Benzo(a)pyrene	0.02	*<38.9*	0.02	*<18.9*	0.02	*<3.77*	0.02	*<3.77*	0.02	*<1.41*	0.02	*<1.41*	0.02	*<3.12*	0.02	*<3.12*	0.02	*<3.77*	0.02	*<75.4*
Benzo(b)fluoranthene	0.02	*<50.5*	0.02	*<24.5*	0.02	*<1.46*	0.02	*<1.46*	0.02	*<1.06*	0.02	*<1.06*	0.02	*<1.28*	0.02	*<1.28*	0.02	*<2.17*	0.02	*<43.4*
Benzo(g,h,i)perylene	NS	<36.0	NS	<17.5	NS	<1.29	NS	<1.29	NS	<0.72	NS	<0.72	NS	<2.83	NS	<2.83	NS	<2.51	NS	<50.2
Benzo(k)fluoranthene	0.02	*<29.1*	0.02	*<14.1*	0.02	*<1.04*	0.02	*<1.04*	0.02	*<0.35*	0.02	*<0.35*	0.02	*<1.76*	0.02	*<1.76*	0.02	*<2.33*	0.02	*<46.6*
Chrysene	0.02	*<30.8*	0.02	*<14.9*	0.02	*<1.41*	0.02	*<1.41*	0.02	*<0.46*	0.02	*<0.46*	0.02	*<1.08*	0.02	*<1.08*	0.02	*<1.96*	0.02	*<39.2*
Dibenz(a,h)anthracene	0.02	*<41.2*	0.02	*<20.0*	0.02	*<1.24*	0.02	*<1.24*	0.02	*<0.47*	0.02	*<0.47*	0.02	*<1.93*	0.02	*<1.93*	0.02	*<6.04*	0.02	*<120.8*
1,2-dichlorobenzene	205	<5.6	205	<2.7	205	<1.76	205	<1.76	205	<1.04	205	<1.04	205	<0.58	205	<0.58	205	<1.33	205	<0.30
1,3-dichlorobenzene	2,500	<23.5	2,500	<11.4	2,500	<1.74	2,500	<1.74	2,500	<0.47	2,500	<0.47	2,500	<0.52	2,500	<0.52	2,500	<1.25	2,500	<0.25
1,4-dichlorobenzene	2,000	<21.8	2,000	<10.6	2,000	<1.56	2,000	<1.56	2,000	<1.28	2,000	<1.28	2,000	<0.50	2,000	<0.50	2,000	<1.25	2,000	<0.29
3,3-dichlorobenzidine	0.03	*<567.2*	0.03	*<275.4*	0.03	*<6.06*	0.03	*<6.06*	0.03	*<11.60*	0.03	*<11.60*	0.03	*<23.45*	0.03	*<23.45*	0.03	*<25.43*	0.03	*<508.6*
Diethyl phthalate	8,767	<39.5	8,767	<19.2	8,767	<2.37	8,767	<2.37	8,767	0.4	8,767	<0.36	8,767	1.1	8,767	<1.07	8,767	<1.99	8,767	<39.8
Dimethyl phthalate	17,000	<37.2	17,000	<18.1	17,000	<2.42	17,000	<2.42	17,000	<0.47	17,000	<0.47	17,000	<0.58	17,000	<0.58	17,000	<1.91	17,000	<38.2
Di-n-butyl phthalate	470	<46.4	470	<22.5	470	<1.85	470	<1.85	470	<0.31	470	<0.31	470	<1.37	470	<1.37	470	<2.35	470	<47.0
2,4-dinitrotoluene	421	<42.6	421	<20.7	421	<2.12	421	<2.12	421	<0.26	421	<0.26	421	<1.30	421	<1.30	421	<3.10	421	<62.0
2,6-dinitrotoluene	3,733	<52.4	3,733	<25.5	3,733	<1.12	3,733	<1.12	3,733	<0.38	3,733	<0.38	3,733	<1.39	3,733	<1.39	3,733	<2.89	3,733	<57.8
Di-n-octyl phthalate	373,333	<59.9	373,333	<29.1	373,333	<1.10	373,333	<1.10	373,333	<1.28	373,333	<1.28	373,333	<1.67	373,333	<1.67	373,333	<5.50	373,333	<110.0
1,2-diphenylhydrazine (as azobenzene)	NS	<48.5	NS	<23.5	NS	<6.70	NS	<6.70	NS	<1.06	NS	<1.06	NS	<7.46	NS	<7.46	NS	<2.15	NS	<43.0
Fluoranthene	28	*<37.2*	28	<18.1	28	<1.35	28	<1.35	28	0.3	28	<0.27	28	<1.06	28	<1.06	28	<3.08	28	*<61.6*
Fluorene	1,067	<32.0	1,067	<15.6	1,067	<4.81	1,067	<4.81	1,067	<0.29	1,067	<0.29	1,067	<0.51	1,067	<0.51	1,067	<2.87	1,067	<57.4
Hexachlorobenzene	0.0003	*<28.9*	0.0003	*<14.0*	0.0003	*<1.23*	0.0003	*<1.23*	0.0003	*<0.34*	0.0003	*<0.34*	0.0003	*<0.47*	0.0003	*<0.47*	0.0003	*<1.57*	0.0003	*<31.4*
Hexachlorobutadiene	18	<6.9	18	<3.3	18	<1.82	18	<1.82	18	<1.67	18	<1.67	18	<0.41	18	<0.41	18	<1.00	18	<20.0
Hexachlorocyclopentadiene	3.5	*<47.2*	3.5	*<22.9*	3.5	<1.23	3.5	<1.23	3.5	<1.53	3.5	<1.53	3.5	<2.16	3.5	<2.16	3.5	*<6.10*	3.5	*<122.0*
Hexachloroethane	3.3	*<8.3*	3.3	*<4.0*	3.3	<1.62	3.3	<1.62	3.3	<1.23	3.3	<1.23	3.3	<0.54	3.3	<0.54	3.3	<1.49	3.3	*<29.8*
Indeno(1,2,3-cd)pyrene	0.2	*<42.2*	0.2	*<20.5*	0.2	*<1.39*	0.2	*<1.39*	0.2	*<0.62*	0.2	*<0.62*	0.2	*<2.38*	0.2	**3.8** [9]	0.2	*<6.11*	0.2	*<122.2*
Isophorone	961	<29.3	961	<14.2	961	<2.14	961	<2.14	961	<0.37	961	<0.37	961	<0.51	961	<0.51	961	<1.77	961	<35.4
Naphthalene	1,524	<25.0	1,524	<12.1	1,524	<1.83	1,524	<1.83	1,524	<0.36	1,524	0.6	1,524	<0.49	1,524	<0.49	1,524	<1.54	1,524	<30.8
Nitrobenzene	138	<25.6	138	<12.4	138	<2.10	138	<2.10	138	<1.26	138	<1.26	138	<0.44	138	<0.44	138	<1.80	138	<36.0

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N-nitrosodimethylamine	0.03	*<25.0*	0.03	*<12.1*	0.03	*<1.00*	0.03	*<1.00*	0.03	*<1.13*	0.03	*<1.13*	0.03	*<0.54*	0.03	*<0.54*	0.03	*<1.62*	0.03	*<32.4*
N-nitrosodi-n-propylamine	0.5	*<31.4*	0.5	*<15.3*	0.5	*<1.15*	0.5	*<1.15*	0.5	*<1.17*	0.5	*<1.17*	0.5	*<1.02*	0.5	*<1.02*	0.5	*<1.65*	0.5	*<33.0*
N-nitrosodiphenylamine	6	*<63.2*	6	*<30.7*	6	<3.57	6	<3.57	6	<1.15	6	<1.15	6	<1.67	6	<1.67	6	<3.13	6	*<62.6*
Phenanthrene	30	*<33.9*	30	<16.5	30	<1.39	30	<1.39	30	<0.31	30	<0.31	30	<0.49	30	<0.49	30	<3.02	30	*<60.4*
Pyrene	800	<34.1	800	<16.6	800	<3.86	800	<3.86	800	<0.67	800	<0.67	800	<3.21	800	<3.21	800	<3.38	800	<67.6
1,2,4-trichlorobenzene	70	<6.7	70	<3.2	70	<1.69	70	<1.69	70	<1.04	70	<1.04	70	<0.55	70	<0.55	70	<1.21	70	<24.2
Pesticides (µg/L) [2]				NOT RUN[5]																
Aldrin	0.00005	*<0.046*	0.00005	-	0.00005	*<0.027*	0.00005	*<0.027*	0.00005	*<0.012*	0.00005	*<0.012*	0.00005	*<0.019*	0.00005	*<0.019*	0.00005	*<0.013*	0.00005	*<0.013*
Alpha-BHC	0.005	*<0.038*	0.005	-	0.005	*<0.021*	0.005	*<0.021*	0.005	*<0.058*	0.005	*<0.058*	0.005	*<0.010*	0.005	*<0.010*	0.005	*<0.015*	0.005	*0.036*
Beta-BHC	0.02	*<0.095*	0.02	-	0.02	*<0.072*	0.02	*<0.072*	0.02	*<0.063*	0.02	*<0.063*	0.02	*<0.049*	0.02	*<0.049*	0.02	*<0.083*	0.02	*<0.083*
Gamma-BHC	1	<0.033	1	-	1	<0.034	1	*<0.034*	1	<0.058	1	<0.058	1	<0.019	1	<0.019	1	<0.020	1	<0.020
Delta-BHC	1,600	<0.032	1,600	-	1,600	<0.021	1,600	<0.021	1,600	<0.066	1,600	<0.066	1,600	<0.035	1,600	<0.035	1,600	0.093	1,600	<0.012
Chlordane	0.0008	*<0.16*	0.0008	-	0.0008	*<0.14*	0.0008	*<0.14*	0.0008	*<0.36*	0.0008	*<0.36*	0.0008	*<0.61*	0.0008	*<0.61*	0.0008	*<0.29*	0.0008	*<0.29*
4,4'-DDT	0.0002	*<0.029*	0.0002	-	0.0002	*<0.025*	0.0002	*<0.025*	0.0002	*<0.017*	0.0002	*<0.017*	0.0002	*<0.011*	0.0002	*<0.011*	0.0002	*<0.020*	0.0002	*<0.020*
4,4'-DDE	0.0002	*<0.034*	0.0002	-	0.0002	*<0.010*	0.0002	*<0.010*	0.0002	*<0.013*	0.0002	*<0.013*	0.0002	*<0.020*	0.0002	*<0.020*	0.0002	*<0.019*	0.0002	*<0.019*
4,4'-DDD	0.0002	*<0.023*	0.0002	-	0.0002	*<0.031*	0.0002	*<0.031*	0.0002	*<0.021*	0.0002	*<0.021*	0.0002	*<0.021*	0.0002	*<0.021*	0.0002	*<0.023*	0.0002	*<0.023*
Dieldrin	0.00005	*<0.028*	0.00005	-	0.00005	*<0.030*	0.00005	*<0.030*	0.00005	*<0.060*	0.00005	*<0.060*	0.00005	*<0.019*	0.00005	*<0.019*	0.00005	*<0.015*	0.00005	*<0.015*
Alpha-endosulfan	0.2	<0.034	0.2	-	0.2	<0.018	0.2	<0.018	0.2	<0.072	0.2	<0.072	0.2	<0.018	0.2	<0.018	0.2	<0.015	0.2	<0.015
Beta-endosulfan	0.2	<0.034	0.2	-	0.2	<0.032	0.2	<0.032	0.2	<0.019	0.2	<0.019	0.2	<0.021	0.2	<0.021	0.2	<0.014	0.2	<0.014
Endosulfan sulfate	0.2	<0.025	0.2	-	0.2	<0.008	0.2	0.078	0.2	<0.016	0.2	0.051	0.2	<0.022	0.2	<0.022	0.2	<0.019	0.2	<0.019
Endrin	0.004	*<0.035*	0.004	-	0.004	*<0.017*	0.004	*<0.017*	0.004	*<0.023*	0.004	*<0.023*	0.004	*<0.042*	0.004	*<0.042*	0.004	*<0.040*	0.004	*<0.040*
Endrin aldehyde	0.09	<0.038	0.09	-	0.09	<0.032	0.09	<0.032	0.09	<0.026	0.09	<0.026	0.09	<0.024	0.09	<0.024	0.09	<0.034	0.09	<0.034
Heptachlor	0.00008	*<0.035*	0.00008	-	0.00008	*<0.027*	0.00008	**0.063**	0.00008	*<0.035*	0.00008	**0.059**	0.00008	**0.073**	0.00008	*<0.023*	0.00008	*<0.019*	0.00008	*<0.019*
Heptachlor epoxide	0.00004	*<0.032*	0.00004	-	0.00004	*<0.008*	0.00004	*<0.008*	0.00004	*<0.062*	0.00004	*<0.062*	0.00004	*<0.020*	0.00004	*<0.020*	0.00004	*<0.016*	0.00004	*<0.016*
PCB-1242	[4]	<0.41	[4]	-	[4]	<0.37	[4]	<0.37	[4]	<0.14	[4]	<0.14	[4]	<0.72	[4]	<0.72	[4]	<0.33	[4]	<0.33
PCB-1254	[4]	<0.20	[4]	-	[4]	<0.23	[4]	<0.23	[4]	<0.20	[4]	<0.20	[4]	<0.22	[4]	<0.22	[4]	<0.17	[4]	<0.17
PCB-1221	[4]	<0.68	[4]	-	[4]	<0.22	[4]	<0.22	[4]	<0.64	[4]	<0.64	[4]	<0.46	[4]	<0.46	[4]	<0.36	[4]	<0.36
PCB-1232	[4]	<0.66	[4]	-	[4]	<0.55	[4]	<0.55	[4]	<0.37	[4]	<0.37	[4]	<0.90	[4]	<0.90	[4]	<0.40	[4]	<0.40
PCB-1248	[4]	<0.78	[4]	-	[4]	<0.19	[4]	<0.19	[4]	<0.22	[4]	<0.22	[4]	<0.24	[4]	<0.24	[4]	<0.21	[4]	<0.21
PCB-1260	[4]	<0.21	[4]	-	[4]	<0.32	[4]	<0.32	[4]	<0.59	[4]	<0.59	[4]	<0.26	[4]	<0.26	[4]	<0.34	[4]	<0.34
PCB-1016	[4]	<0.36	[4]	-	[4]	<0.18	[4]	<0.18	[4]	<0.55	[4]	<0.55	[4]	<0.29	[4]	<0.29	[4]	<0.33	[4]	<0.33
Toxaphene	0.0003	*<0.53*	0.0003	-	0.0003	*<0.22*	0.0003	*<0.22*	0.0003	*<0.60*	0.0003	*<0.60*	0.0003	<0.48	0.0003	*<0.48*	0.0003	*<0.47*	0.0003	*<0.47*

NOTES:

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OUTFALL ID: SR030 **RECEIVING WATER: Salt River** **DESIGNATED USES: A&Wedw, PBC, FC, AgI, and AgL**	**MONITORING SEASONS** Summer: June 1 – October 31 Winter: November 1 – May 31																			
	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16		Summer 2016[6]		Winter 2016/17		Summer 2017		Winter 2017/18	
SAMPLING DATE(S):	SWQS	7/21/13	SWQS	11/22/13	SWQS	8/12/14	SWQS	12/4/14	SWQS	7/31/15	SWQS	1/31/16	-	-	SWQS	11/27/16	SWQS	7/24/17	SWQS	1/9/18
MONITORING PARAMETERS [1, 2]																				
Conventional Parameters																				
Flow [3] (cfs)	NS	40.52	NS	7.51	NS	69.2	NS	3.094	NS	30.58	NS	6.438	-	-	NS	0.387	NS	1.496	NS	1.14
pH	6.5-9	8.14	6.5-9	8.49	6.5-9	8.17	6.5-9	8.15	6.5-9	7.9	6.5-9	8.09	-	-	6.5-9	7.96	6.5-9	6.68	6.5-9	7.59
Temperature (ºC)	Varies	26.5	Varies	18.5	Varies	26.2	Varies	19.0	Varies	30.5	Varies	13.5	-	-	Varies	17.0	Varies	29.8	Varies	17.4
Hardness (mg/L)	400	33.1	400	64.3	400	85.5	400	31.0	400	64.5	400	33.1	-	-	400	38	400	40.5	400	55.6
Total Dissolved Solids (TDS) (mg/L) [2]	NS	120	NS	204	NS	332	NS	96	NS	240	NS	114	-	-	NS	112	NS	134	NS	170
Total Suspended Solids (TSS) (mg/L) [2]	NS	392	NS	355	NS	251	NS	296	NS	124	NS	712	-	-	NS	145	NS	70	NS	528
Biochemical Oxygen Demand (BOD) (mg/L) [2]	NS	17	NS	53	NS	9	NS	14	NS	38	NS	20	-	-	NS	16	NS	15	NS	55
Chemical Oxygen Demand (COD) (mg/L) [2]	NS	140	NS	340	NS	94	NS	160	NS	220	NS	250	-	-	NS	110	NS	120	NS	360

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SR030	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16		Summer 2016[6]		Winter 2016/17		Summer 2017		Winter 2017/18	
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Inorganics																				
Cyanide, total (µg/L) [2]	41 T	*<50*	41 T	<5	41 T	<5	41 T	<5	41 T	<5	41 T	<5	-	-	41 T	<5	41 T	<5.0	41 T	<5.0
Nutrients (mg/L) [2]																				
Nitrate + Nitrite as N	NS	1.2	NS	2.1	NS	1.0	NS	0.8	NS	1.3	NS	1.5	-	-	NS	1	NS	0.8	NS	1.5
Ammonia as N	6.46	1.2	3.27	2.3	4.07	0.56	4.24	0.76	10.1	1.8	7.09	0.87	-	-	9.2	0.69	45.0	0.49	17.4	2.4
Total Kjeldahl Nitrogen (TKN)	NS	4.2	NS	6.3	NS	1.7	NS	2.3	NS	4.2	NS	3.8	-	-	NS	2.6	NS	2	NS	6.4
Total Phosphorus as P	NS	0.46	NS	1.4	NS	0.83	NS	0.39	NS	0.77	NS	1.8	-	-	NS	0.16	NS	0.43	NS	1.7
Ortho-Phosphorus as P	NS	0.4	NS	0.3	NS	0.1	NS	0.2	NS	<0.1	NS	0.2	-	-	NS	0.2	NS	0.1	NS	0.3
Microbiological																				
Escherichia coli (*E. coli*) (CFU/100 mg or MPN/100 mL) [2]	575	**>2419.6**	575	**2419.6**	575	**>2,419.6**	575	**>2,419.6**	575	**1,553.1**	575	**4,320.0**	-	**-**	575	**9,320**	575	**20,140**	575	**1,986.3**
Total Metals (µg/L) [2]																				
Antimony	640 T 1,000 D	1.2 T 0.4 D	640 T 1,000 D	2.4 T 1.2 D	640 T 1,000 D	<25 TandD	640 T 1,000 D	<25 TandD	640 T 1,000 D	3.9 T <5.0 D	640 T 1,000 D	1.9 T <5.0 D	-	-	640 T 1,000 D	2 T <5 D	640 T 1,000 D	2 T <5.0 D	640 T 1,000 D	3.8 T <5.0 D
Arsenic	80 T 340 D	8.0 T 1.2 D	80 T 340 D	4.9 T 1.5 D	80 T 340 D	35 T <10 D	80 T 340 D	<10 TandD	80 T 340 D	4.2 T <5.0 D	80 T 340 D	7.8 T <5.0 D	-	-	80 T 340 D	3.2 T <5 D	80 T 340 D	3 T <5.0 D	80 T 340 D	6.2 T <5.0 D
Barium	98,000 T	236 T 14 D	98,000 T	160 T 28 D	98,000 T	670 T 13 D	98,000 T	206 T 38 D	98,000 T	110 T 33 D	98,000 T	256 T 16 D	-	-	98,000 T	69 T 16 D	98,000 T	58 T 21 D	98,000 T	221 T 28 D

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Beryllium	84 T	0.94 T <0.15 D	84 T	0.45 T <0.06 D	84 T	2.2 T <2.0 D	84 T	<2 TandD	84 T	0.29 T <5.0 D	84 T	0.95 T <5.0 D	-	-	84 T	0.25 T <5 D	84 T	0.19 T <5.0 D	84 T	0.66 T <5.0 D
Cadmium	50 T 2.68 D	0.8 T <0.25 D	50 T 5.12 D	0.5 T <0.10 D	50 T 30.23 D	4.6 T <3.0 D	50 T 13.10 D	<3 TandD	50 T 5.14 D	0.5 T <5.0 D	50 T 2.68 D	0.7 T *<5.0 D*	-	-	50 T 1.49 D	0.3 T <0.25 D	50 T 1.60 D	<0.20 T <0.2 D	50 T 2.26 D	0.6 T <5.0 D
Chromium	1,000 T	23.9 T <2.00 D	1,000 T	13.7 T 1.5 D	1,000 T	57 T <10 D	1,000 T	17.8 T <10 D	1,000 T	11.6 T <5.0 D	1,000 T	24.8 T <5.0 D	-	-	1,000 T	28.1 T <5 D	1,000 T	6.3 T <5.0 D	1,000 T	21 T <5.0 D
Copper	500 T 4.74 D	65.8 T **10.6 D**	500 T 8.87 D	75.2 T **30.9 D**	500 T 49.62 D	210 T 10 D	500 T 22.03 D	75 T 14 D	500 T 8.89 D	58.6 T **33.5 D**	500 T 4.74 D	79.2 T **14.0 D**	-	-	500 T 5.40 D	26.6 T **10.3 D**	500 T 5.73 D	26.1 T **13.4 D**	500 T 7.73 D	87 T **28.5 D**
Lead	15 T 19.03 D	**60.8 T** 1.1 D	15 T 39.80 D	**27.6 T** 0.9 D	15 T 280.85 D	**110 T** <10 D	15 T 113.78 D	**71 T** <10 D	15 T 39.94 D	**38.6 T** 2.4 D	15 T 19.02 D	**45.0 T** <5.0 D	-	-	15 T 22.20 D	11.9 T <0.55 D	15 T 23.84 D	10.8 T 0.5 D	15 T 33.90 D	**49.3 T** 2.1 D
Mercury	10 T 2.4 D	0.04 T <0.020 D	10 T 2.4 D	<0.020 T <0.020 D	10 T 2.4 D	<0.2 TandD	10 T 2.4 D	<0.20 T <0.20 D	10 T 2.4 D	0.08 T <0.2 D	10 T 2.4 D	<0.062 T <0.2 D	-	-	10 T 2.4 D	<0.068 T <0.2 D	10 T 2.4 D	<0.20 T <0.20 D	10 T 2.4 D	<0.066 T <0.2 D
Nickel	511 T 183.5 D	30.6 T 2.1 D	511 T 322.2 D	18.9 T 4.6 D	511 T 1,513 D	110 T <10 D	511 T 730 D	23 T <10 D	511 T 323 D	12.1 T 4.6 D	511 T 184 D	31.4 T <5.0 D	-	-	511 T 205.52 D	9 T <5	511 T 217.96 D	7.3 T <5.0 D	511 T 284.97 D	24.3 T <5.0 D
Selenium	20 T	<0.60 T <0.60 D	20 T	0.66 T 0.4 D	20 T	<2.0 TandD	20 T	<2.00 T <2.00 D	20 T	0.41 T <5.0 D	20 T	0.62 T <5.0 D	-	-	20 T	0.62 T <5 D	20 T	0.49 T <5.0 D	20 T	0.69 T <5.0 D
Silver	4,667 T 0.482 D	0.2 T <0.15 D	4,667 T 1.502 D	0.2 T <0.15 D	4,667 T 34.91 D	<5 TandD	4,667 T 7.93 D	<5 TandD	4,667 T 1.51 D	<0.25 T *<5.0 D*	4,667 T 0.48 D	0.3 T *<5.0 D*	-	-	4,667 T 0.61 D	<0.45 T *<5 D*	4,667 T 0.68 D	<0.10 T *<5.0 D*	4,667 T 1.17 D	0.4 T *<5.0 D*
Thallium	1 T 700 D	0.20 T <0.20 D	1 T 700 D	<0.20 T <0.08 D	1 T 700 D	0.9 T <0.5 D	1 T 700 D	<0.5 TandD	1 T 700 D	0.26 T <5.0 D	1 T 700 D	0.37 T <5.0 D	-	-	1 T 700 D	<0.2 T <5 D	1 T 700 D	<0.10 T <5.0 D	1 T 700 D	0.18 T <5.0 D
Zinc	5,106 T 45.92 D	452 T 13.7 D	5,106 T 80.6 D	302 T 31.4 D	5,106 T 379.3 D	770 T <50 D	5,106 T 182.8 D	397 T <50 D	5,106 T 80.8 D	195 T 38.0 D	5,106 T 45.9 D	390 T 11.0 D	-	-	5,106 T 51.62 D	106 T 11.1 D	5,106 T 54.48 D	127 T 19.9 D	5,106 T 71.26 D	433 T 28.8 D
Organic Toxic Pollutants																				
Total Petroleum Hydrocarbons (TPH) (mg/L) [2]	NS	<11	NS	<11	NS	<10	NS	<10	NS	<12	NS	<5.8	-	-	NS	<4.2	NS	<6.9	NS	<6.6
Total Oil and Grease (mg/L) [2]	NS	<5.7	NS	6.4	NS	<5.0	NS	<5.0	NS	11	NS	<5.8	-	-	NS	<4.2	NS	<5.8	NS	<5.5
VOCs, Semi-VOCs, and Pesticides (µg/L) [2]																				
Acrolein	1.9	<0.20	1.9	<0.20	1.9	*<2.00*	1.9	<0.40	1.9	<0.78	1.9	<0.41	-	-	1.9	0.44	1.9	0.79	1.9	<0.79
Acrylonitrile	0.2	<0.16	0.2	<0.16	0.2	*<0.70*	0.2	<0.14	0.2	*<0.53*	0.2	*<0.42*	-	-	0.2	*<0.42*	0.2	*<0.59*	0.2	*<0.59*
Benzene	114	<1.20	114	<0.24	114	<0.65	114	<0.13	114	<0.46	114	<0.46	-	-	114	<0.29	114	<1.30	114	<0.26
Bromoform	133	<2.35	133	<0.47	133	<1.40	133	<0.28	133	<0.68	133	<0.68	-	-	133	<0.33	133	<1.05	133	<0.21
Carbon tetrachloride	2	<1.30	2	<0.26	2	<1.15	2	<0.23	2	<0.31	2	<0.31	-	-	2	<0.20	2	<1.50	2	<0.30
Chlorobenzene	1,553	<0.80	1,553	<0.16	1,553	<0.65	1,553	<0.13	1,553	<0.50	1,553	<0.50	-	-	1,553	<0.33	1,553	<1.15	1,553	<0.23
Chlorodibromomethane	13	<0.90	13	<0.18	13	2.6	13	<0.24	13	<0.61	13	<0.61	-	-	13	<0.32	13	<1.20	13	<0.24
Chloroethane (ethyl chloride)	NS	<1.10	NS	<0.22	NS	<0.95	NS	<0.19	NS	<0.40	NS	<0.40	-	-	NS	<0.33	NS	<1.40	NS	<0.28
2-chloroethylvinyl ether	180,000	<0.22	180,000	<0.22	180,000	<0.95	180,000	<0.19	180,000	<0.53	180,000	<0.43	-	-	180,000	<0.43	180,000	<0.65	180,000	<0.65
Chloroform	2,133	<1.15	2,133	<0.23	2,133	0.92	2,133	<0.14	2,133	<0.49	2,133	<0.49	-	-	2,133	<0.32	2,133	<1.20	2,133	<0.24
Dichlorobromomethane	17	<1.15	17	<0.23	17	2.2	17	<0.15	17	<0.49	17	<0.49	-	-	17	<0.29	17	<1.30	17	<0.26
1,1-dichloroethane	NS	<1.30	NS	<0.26	NS	<0.95	NS	<0.19	NS	<0.42	NS	<0.42	-	-	NS	<0.29	NS	<1.35	NS	<0.27
1,2-dichloroethane	37	<1.25	37	<0.25	37	<0.55	37	<0.11	37	<0.51	37	<0.51	-	-	37	<0.35	37	<1.30	37	<0.26

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1,1-dichloroethylene	7,143	<1.40	7,143	<0.28	7,143	<1.35	7,143	<0.27	7,143	<0.34	7,143	<0.34	-	-	7,143	<0.19	7,143	<1.60	7,143	<0.32
1,2-dichloropropane	17,518	<1.25	17,518	<0.25	17,518	<0.90	17,518	<0.18	17,518	<0.49	17,518	<0.49	-	-	17,518	<0.32	17,518	<1.60	17,518	<0.32
1,3-dichloropropylene[8]	42	cis<1.20 trans<1.10	42	cis<0.24 trans<0.22	42	<0.65	42	<0.13	42	cis <0.51 trans <0.50	42	cis <0.51 trans <0.50	-	-	42	<0.28	42	<1.05	42	<0.21
Ethylbenzene	2,133	<0.65	2,133	<0.13	2,133	<0.75	2,133	<0.15	2,133	<0.46	2,133	<0.46	-	-	2,133	<0.29	2,133	<1.15	2,133	<0.23
Methyl bromide	299	<0.95	299	<0.19	299	<0.90	299	<0.18	299	<0.46	299	<0.46	-	-	299	<0.28	299	<1.15	299	<0.23
Methyl chloride	270,000	<1.40	270,000	<0.28	270,000	<1.15	270,000	<0.23	270,000	<0.46	270,000	<0.46	-	-	270,000	<0.28	270,000	<1.85	270,000	<0.37
Methylene chloride	593	<1.00	593	<0.20	593	<1.00	593	<0.20	593	<0.81	593	<0.81	-	-	593	<0.31	593	<4.00	593	<0.80
1,1,2,2-tetrachloroethane	4	<2.00	4	<0.40	4	<1.75	4	<0.35	4	<0.80	4	<0.80	-	-	4	<0.33	4	<1.55	4	<0.31
Tetrachloroethylene	261	<1.05	261	<0.21	261	<0.65	261	<0.13	261	<0.35	261	<0.35	-	-	261	<0.23	261	<1.45	261	<0.29
Toluene	8,700	<0.95	8,700	<0.19	8,700	<0.55	8,700	<0.11	8,700	<0.43	8,700	<0.43	-	-	8,700	<0.28	8,700	<1.25	8,700	<0.25
1,2-trans-dichloroethylene	10,127	<1.25	10,127	<0.25	10,127	<0.90	10,127	<0.18	10,127	<0.38	10,127	<0.38	-	-	10,127	<0.24	10,127	<1.25	10,127	<0.25
1,1,1-trichloroethane	1,000	<1.00	1,000	<0.20	1,000	<0.70	1,000	<0.14	1,000	<0.34	1,000	<0.34	-	-	1,000	<0.23	1,000	<1.40	1,000	<0.28
1,1,2-trichloroethane	16	<0.75	16	<0.15	16	<0.65	16	<0.13	16	<0.60	16	<0.60	-	-	16	<0.29	16	<1.50	16	<0.30
Trichloroethylene	29	<0.75	29	<0.15	29	<1.10	29	<0.22	29	<0.48	29	<0.48	-	-	29	<0.28	29	<1.80	29	<0.36
1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene	NS	<5.0 <5.0	NS	<1.0 <1.0	NS	<10.0 <5.0	NS	<1.0 <1.0	NS	<1.0 <1.0	NS	<1.0 <1.0	-	-	NS	<1.0 <1.0	NS	<5.0 <5.0	NS	<1.0 <1.0
Vinyl chloride	5	<1.00	5	<0.20	5	<1.10	5	<0.22	5	<0.35	5	<0.35	-	-	5	<0.24	5	<2.10	5	<0.42
Xylenes, Total	186,667	<1.50	186,667	<0.30	186,667	<1.25	186,667	<0.13	186,667	<0.52	186,667	<0.52	-	-	186,667	<0.32	186,667	<1.15	186,667	<0.23
Acid Compounds (µg/L) [2]																				
2-chlorophenol	30	*<214.5*	30	*<45.5*	30	<1.48	30	<1.48	30	<3.10	30	<3.10	-	-	30	<2.92	30	<4.23	30	*<211.5*
2,4-dichlorophenol	59	*<211.0*	59	*<44.7*	59	<1.65	59	<1.65	59	<2.81	59	<2.81	-	-	59	<3.21	59	<4.82	59	*<241.0*
2,4-dimethylphenol	171	<114.0	171	<24.2	171	<2.20	171	<2.20	171	<2.64	171	<2.64	-	-	171	<1.32	171	<7.07	171	*<353.5*
4,6-dinitro-o-cresol	310	<149.0	310	<31.6	310	<1.22	310	<1.22	310	<1.49	310	<1.49	-	-	310	<2.27	310	<4.69	310	<234.5
2,4-dinitrophenol	110	*<129.5*	110	<27.5	110	<1.13	110	<1.13	110	<2.21	110	<2.21	-	-	110	<2.64	110	<5.11	110	*<255.5*
2-nitrophenol	NS	<205.5	NS	<43.6	NS	<1.57	NS	<1.57	NS	<2.84	NS	<2.84	-	-	NS	<2.61	NS	<7.83	NS	<391.5
4-nitrophenol	4,100	<233.5	4,100	<49.5	4,100	<1.14	4,100	2.6	4,100	<2.98	4,100	<2.98	-	-	4,100	<2.03	4,100	<4.03	4,100	<201.5
p-chloro-m-cresol	15	*<220.5*	15	*<46.7*	15	<1.65	15	<1.65	15	<1.87	15	<1.87	-	-	15	<3.10	15	<4.05	15	*<202.5*
Pentachlorophenol	28.558	<168.0	40.564	<35.6	29.427	<1.39	28.848	<1.39	22.410	7.4	27.137	<1.47	-	-	23.80	<3.44	6.58	*<7.36*	16.41	*<368.0*
Phenol	37	*<177.5*	37	*<37.6*	37	<1.34	37	<1.34	37	<2.30	37	<2.30	-	-	37	2.2	37	<3.99	37	*<199.5*
2,4,6-trichlorophenol	2	*<239.5*	2	*<50.8*	2	<1.89	2	<1.89	2	*<2.60*	2	*<2.60*	-	-	2	<3.28	2	*<4.74*	2	*<237.0*

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SR030	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16		Summer 2016[6]		Winter 2016/17		Summer 2017		Winter 2017/18	
SAMPLING DATE(S):	SWQS	7/21/13	SWQS	11/22/13	SWQS	8/12/14	SWQS	12/4/14	SWQS	7/31/15	SWQS	1/31/16	-	-	SWQS	11/27/16	SWQS	7/24/17	SWQS	1/9/18
Bases/Neutrals (µg/L) [2]																				
Acenaphthene	198	<67.0	198	<14.2	198	<1.03	198	<1.03	198	<0.35	198	<0.35	-	-	198	<1.02	198	<1.88	198	<94.0
Acenaphthylene	NS	<86.5	NS	<18.3	NS	<1.00	NS	<1.00	NS	<1.23	NS	<1.23	-	-	NS	<6.10	NS	<1.75	NS	<87.5
Anthracene	74	*<86.5*	74	<18.3	74	<2.88	74	<2.88	74	<0.44	74	<0.44	-	-	74	<1.96	74	<2.62	74	*<131.0*
Benz(a)anthracene	0.02	*<86.5*	0.02	*<18.3*	0.02	*<1.08*	0.02	*<1.08*	0.02	*<0.38*	0.02	*<0.38*	-	-	0.02	*<1.57*	0.02	*<1.96*	0.02	*<98.0*
Benzo(a)pyrene	0.02	*<93.5*	0.02	*<19.8*	0.02	*<3.77*	0.02	*<3.77*	0.02	*<1.41*	0.02	*<1.41*	-	-	0.02	*<3.12*	0.02	*<3.77*	0.02	*<188.5*
Benzo(b)fluoranthene	0.02	*<121.5*	0.02	*<25.8*	0.02	*<1.46*	0.02	*<1.46*	0.02	*<1.06*	0.02	*<1.06*	-	-	0.02	*<1.28*	0.02	*<2.17*	0.02	*<108.5*
Benzo(g,h,i)perylene	NS	<86.5	NS	<18.3	NS	<1.29	NS	<1.29	NS	<0.72	NS	<0.72	-	-	NS	<2.83	NS	<2.51	NS	<125.5
Benzo(k)fluoranthene	0.02	*<70.0*	0.02	*<14.8*	0.02	*<1.04*	0.02	*<1.04*	0.02	*<0.35*	0.02	*<0.35*	-	-	0.02	*<1.76*	0.02	*<2.33*	0.02	*<116.5*
Chrysene	0.02	*<74.0*	0.02	*<15.7*	0.02	*<1.41*	0.02	*<1.41*	0.02	*<0.46*	0.02	*<0.46*	-	-	0.02	*<1.08*	0.02	*<1.96*	0.02	*<98.0*
Dibenz(a,h)anthracene	0.02	*<99.0*	0.02	*<21.0*	0.02	*<1.24*	0.02	*<1.24*	0.02	*<0.47*	0.02	*<0.47*	-	-	0.02	*<1.93*	0.02	*<6.04*	0.02	*<302.0*
1,2-dichlorobenzene	205	<13.5	205	<2.9	205	<1.76	205	<1.76	205	<1.04	205	<1.04	-	-	205	<0.58	205	<1.33	205	<0.30
1,3-dichlorobenzene	2,500	<56.5	2,500	<12.0	2,500	<1.74	2,500	<1.74	2,500	<0.47	2,500	<0.47	-	-	2,500	<0.52	2,500	<1.25	2,500	<0.25
1,4-dichlorobenzene	2,000	<52.5	2,000	<11.1	2,000	<1.56	2,000	<1.56	2,000	<1.28	2,000	<1.28	-	-	2,000	<0.50	2,000	<1.25	2,000	<0.29
3,3-dichlorobenzidine	0.03	*<1363.5*	0.03	*<289.1*	0.03	*<6.06*	0.03	*<6.06*	0.03	*<11.60*	0.03	*<11.60*	-	-	0.03	*<23.45*	0.03	*<25.43*	0.03	*<1,271.5*
Diethyl phthalate	8,767	<95.0	8,767	<20.1	8,767	<2.37	8,767	<2.37	8,767	0.6	8,767	0.5	-	-	8,767	<1.07	8,767	<1.99	8,767	<99.5
Dimethyl phthalate	17,000	<89.5	17,000	<19.0	17,000	<2.42	17,000	<2.42	17,000	<0.47	17,000	<0.47	-	-	17,000	<0.58	17,000	<1.91	17,000	<95.5
Di-n-butyl phthalate	470	<111.5	470	<23.6	470	<1.85	470	<1.85	470	<0.31	470	<0.31	-	-	470	<1.37	470	<2.35	470	<117.5
2,4-dinitrotoluene	421	<102.5	421	<21.7	421	<2.12	421	<2.12	421	<0.26	421	<0.26	-	-	421	<1.30	421	<3.10	421	<155.0
2,6-dinitrotoluene	3,733	<126.0	3,733	<26.7	3,733	<1.12	3,733	<1.12	3,733	<0.38	3,733	<0.38	-	-	3,733	<1.39	3,733	<2.89	3,733	<144.5
Di-n-octyl phthalate	373,333	<144.0	373,333	<30.5	373,333	<1.10	373,333	<1.10	373,333	<1.28	373,333	<1.28			373,333	<1.67	373,333	<5.50	373,333	<275.0
1,2-diphenylhydrazine (as azobenzene)	NS	<116.5	NS	<24.7	NS	<6.70	NS	<6.70	NS	<1.06	NS	<1.06	-	-	NS	<7.46	NS	<2.15	NS	<107.5
Fluoranthene	28	*<89.5*	28	<19.0	28	<1.35	28	<1.35	28	<0.27	28	<0.27	-	-	28	<1.06	28	<3.08	28	*<154.0*
Fluorene	1,067	<77.0	1,067	<16.3	1,067	<4.81	1,067	<4.81	1,067	<0.29	1,067	<0.29	-	-	1,067	<0.51	1,067	<2.87	1,067	<143.5
Hexachlorobenzene	0.0003	*<69.5*	0.0003	*<14.7*	0.0003	*<1.23*	0.0003	*<1.23*	0.0003	*<0.34*	0.0003	*<0.34*	-	-	0.0003	*<0.47*	0.0003	*<1.57*	0.0003	*<78.5*
Hexachlorobutadiene	18	<16.5	18	<3.5	18	<1.82	18	<1.82	18	<1.67	18	<1.67	-	-	18	<0.41	18	<1.00	18	*<50.0*
Hexachlorocyclopentadiene	3.5	*<113.5*	3.5	*<24.1*	3.5	<1.23	3.5	<1.23	3.5	<1.53	3.5	<1.53	-	-	3.5	<2.16	3.5	*<6.10*	3.5	*<305.0*
Hexachloroethane	3.3	*<20.0*	3.3	*<4.2*	3.3	<1.62	3.3	<1.62	3.3	<1.23	3.3	<1.23	-	-	3.3	<0.54	3.3	<1.49	3.3	*<74.5*
Indeno(1,2,3-cd)pyrene	0.2	*<101.5*	0.2	*<21.5*	0.2	*<1.39*	0.2	*<1.39*	0.2	*<0.62*	0.2	*<0.62*	-	-	0.2	**4.8[9]**	0.2	*<6.11*	0.2	*<305.5*
Isophorone	961	<70.5	961	<14.9	961	<2.14	961	<2.14	961	<0.37	961	<0.37	-	-	961	<0.51	961	<1.77	961	<88.5
Naphthalene	1,524	<60.0	1,524	<12.7	1,524	<1.83	1,524	<1.83	1,524	<0.36	1,524	<0.36	-	-	1,524	<0.49	1,524	<1.54	1,524	<77.0
Nitrobenzene	138	<61.5	138	<13.0	138	<2.10	138	<2.10	138	<1.26	138	<1.26	-	-	138	<0.44	138	<1.80	138	<90.0
N-nitrosodimethylamine	0.03	*<60.0*	0.03	*<12.7*	0.03	*<1.00*	0.03	*<1.00*	0.03	*<1.13*	0.03	*<1.13*	-	-	0.03	*<0.54*	0.03	*<1.62*	0.03	*<81.0*
N-nitrosodi-n-propylamine	0.5	*<75.5*	0.5	*<16.0*	0.5	*<1.15*	0.5	*<1.15*	0.5	*<1.17*	0.5	*<1.17*	-	-	0.5	*<1.02*	0.5	*<1.65*	0.5	*<82.5*
N-nitrosodiphenylamine	6	*<152.0*	6	<32.2	6	<3.57	6	<3.57	6	<1.15	6	<1.15	-	-	6	<1.67	6	<3.13	6	*<156.5*
Phenanthrene	30	*<81.5*	30	<17.3	30	<1.39	30	<1.39	30	<0.31	30	<0.31	-	-	30	<0.49	30	<3.02	30	*<151.0*
Pyrene	800	<82.0	800	<17.4	800	<3.86	800	<3.86	800	<0.67	800	<0.67	-	-	800	<3.21	800	<3.38	800	<169.0

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SR030	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16		Summer 2016[6]		Winter 2016/17		Summer 2017		Winter 2017/18	
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1,2,4-trichlorobenzene	70	<16.0	70	<3.4	70	<1.69	70	<1.69	70	<1.04	70	<1.04	-	-	70	<0.55	70	<1.21	70	<60.5
Pesticides (µg/L) [2]																				
Aldrin	0.00005	*<0.046*	0.00005	*<0.016*	0.00005	*<0.027*	0.00005	*<0.027*	0.00005	*<0.012*	0.00005	*<0.012*	-	-	0.00005	*<0.019*	0.00005	*<0.013*	0.00005	*<0.013*
Alpha-BHC	0.005	*<0.038*	0.005	*<0.017*	0.005	*<0.021*	0.005	*<0.021*	0.005	*<0.058*	0.005	*<0.058*	-	-	0.005	*<0.010*	0.005	*<0.015*	0.005	**0.036**
Beta-BHC	0.02	*<0.095*	0.02	*<0.092*	0.02	*<0.072*	0.02	*<0.072*	0.02	*<0.063*	0.02	*<0.063*	-	-	0.02	*<0.049*	0.02	*<0.083*	0.02	*<0.083*
Gamma-BHC	1	<0.033	1	<0.023	1	<0.034	1	<0.034	1	<0.058	1	<0.058	-	-	1	<0.019	1	<0.020	1	<0.020
Delta-BHC	1,600	<0.032	1,600	<0.018	1,600	<0.021	1,600	<0.021	1,600	<0.066	1,600	<0.066	-	-	1,600	<0.035	1,600	<0.012	1,600	<0.012
Chlordane	0.0008	*<0.16*	0.0008	*<0.020*	0.0008	*<0.14*	0.0008	*<0.14*	0.0008	*<0.36*	0.0008	*<0.36*	-	-	0.0008	*<0.61*	0.0008	*<0.29*	0.0008	*<0.29*
4,4'-DDT	0.0002	*<0.029*	0.0002	*<0.016*	0.0002	*<0.025*	0.0002	*<0.025*	0.0002	*<0.017*	0.0002	*<0.017*	-	-	0.0002	*<0.011*	0.0002	*<0.020*	0.0002	*<0.020*
4,4'-DDE	0.0002	**0.037**	0.0002	*<0.018*	0.0002	*<0.010*	0.0002	**0.027**	0.0002	*<0.013*	0.0002	*<0.013*	-	-	0.0002	<0.020	0.0002	*<0.019*	0.0002	**0.076**
4,4'-DDD	0.0002	*<0.023*	0.0002	*<0.014*	0.0002	*<0.031*	0.0002	*<0.031*	0.0002	*<0.021*	0.0002	*<0.021*	-	-	0.0002	*<0.021*	0.0002	*<0.023*	0.0002	*<0.023*
Dieldrin	0.00005	*<0.028*	0.00005	*<0.022*	0.00005	*<0.030*	0.00005	*<0.030*	0.00005	*<0.060*	0.00005	*<0.060*	-	-	0.00005	*<0.019*	0.00005	*<0.015*	0.00005	*<0.015*
Alpha-endosulfan	0.2	<0.034	0.2	<0.018	0.2	<0.018	0.2	<0.018	0.2	<0.072	0.2	<0.072	-	-	0.2	<0.018	0.2	<0.015	0.2	0.085
Beta-endosulfan	0.2	<0.034	0.2	<0.013	0.2	<0.032	0.2	<0.032	0.2	<0.019	0.2	<0.019	-	-	0.2	<0.021	0.2	<0.014	0.2	<0.014
Endosulfan sulfate	0.2	<0.025	0.2	<0.014	0.2	<0.008	0.2	0.028	0.2	<0.016	0.2	<0.016	-	-	0.2	<0.022	0.2	<0.019	0.2	<0.019
Endrin	0.004	*<0.035*	0.004	*<0.016*	0.004	*<0.017*	0.004	*<0.017*	0.004	*<0.023*	0.004	*<0.023*			0.004	*<0.042*	0.004	*<0.040*	0.004	*<0.040*
Endrin aldehyde	0.09	<0.038	0.09	<0.023	0.09	<0.032	0.09	<0.032	0.09	<0.026	0.09	<0.026	-	-	0.09	<0.024	0.09	<0.034	0.09	<0.034
Heptachlor	0.00008	*<0.035*	0.00008	*<0.018*	0.00008	*<0.027*	0.00008	*<0.027*	0.00008	*<0.035*	0.00008	*<0.035*	-	-	0.00008	**0.04**	0.00008	*0.031*	0.00008	*<0.019*
Heptachlor epoxide	0.00004	*<0.032*	0.00004	*<0.020*	0.00004	*<0.008*	0.00004	*<0.008*	0.00004	*<0.062*	0.00004	*<0.062*	-	-	0.00004	*<0.020*	0.00004	*<0.016*	0.00004	*<0.016*
PCB-1242	[4]	<0.41	[4]	<0.55	[4]	<0.37	[4]	<0.37	[4]	<0.14	[4]	<0.14	-	-	[4]	<0.72	[4]	<0.33	[4]	<0.33
PCB-1254	[4]	<0.20	[4]	<0.28	[4]	<0.23	[4]	<0.23	[4]	<0.20	[4]	<0.20	-	-	[4]	<0.22	[4]	<0.17	[4]	<0.17
PCB-1221	[4]	<0.68	[4]	<0.85	[4]	<0.22	[4]	<0.22	[4]	<0.64	[4]	<0.64	-	-	[4]	<0.46	[4]	<0.36	[4]	<0.36
PCB-1232	[4]	<0.66	[4]	<0.34	[4]	<0.55	[4]	<0.55	[4]	<0.37	[4]	<0.37	-	-	[4]	<0.90	[4]	<0.40	[4]	<0.40
PCB-1248	[4]	<0.78	[4]	<0.27	[4]	<0.19	[4]	<0.19	[4]	<0.22	[4]	<0.22	-	-	[4]	<0.24	[4]	<0.21	[4]	<0.21
PCB-1260	[4]	<0.21	[4]	<0.23	[4]	<0.32	[4]	<0.32	[4]	<0.59	[4]	<0.59	-	-	[4]	<0.26	[4]	<0.34	[4]	<0.34
PCB-1016	[4]	<0.36	[4]	<0.33	[4]	<0.18	[4]	<0.18	[4]	<0.55	[4]	<0.55	-	-	[4]	<0.29	[4]	<0.33	[4]	<0.33
Toxaphene	0.0003	*<0.53*	0.0003	*<0.34*	0.0003	*<0.22*	0.0003	*<0.22*	0.0003	*<0.60*	0.0003	*<0.60*	-	-	0.0003	*<0.48*	0.0003	*<0.47*	0.0003	*<0.47*

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OUTFALL ID: SR045
RECEIVING WATER: Salt River
DESIGNATED USES: A&We, PBC

MONITORING SEASONS
Summer: June 1 – October 31
Winter: November 1 – May 31

	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16[6]		Summer 2016		Winter 2016/17		Summer 2017		Winter 2017/18	
SAMPLING DATE(S):	SWQS	7/21/13	SWQS	11/22/13	SWQS	8/12/14	SWQS	12/4/14	SWQS	7/31/15	-	-	SWQS	7/29/16	SWQS	11/3/16	SWQS	7/16/17	SWQS	2/14/18
MONITORING PARAMETERS [1, 2]																				
Conventional Parameters																				
Flow [3] (cfs)	NS	8.88	NS	1.01	NS	0.725	NS	1.371	NS	1.898	-	-	NS	7.105	NS	1.251	NS	11.503	NS	1.38
pH	6.5-9	8.24	6.5-9	8.30	6.5-9	7.94	6.5-9	7.73	6.5-9	7.62	-	-	6.5-9	7.09	6.5-9	**6.34**	6.5-9	7.36	6.5-9	7.82
Temperature (ºC)	Varies	28.0	Varies	19.5	Varies	30.1	Varies	19.0	Varies	30.5	-	-	Varies	30.0	Varies	21.0	Varies	30.3	Varies	17.8
Hardness (mg/L)	400	40.1	400	31.2	400	96.1	400	42.2	400	42.4	-	-	400	45.4	400	87.8	400	102	400	152
Total Dissolved Solids (TDS) (mg/L) [2]	NS	98	NS	82	NS	340	NS	124	NS	126	-	-	NS	166	NS	302	NS	408	NS	514
Total Suspended Solids (TSS) (mg/L) [2]	NS	60.0	NS	420	NS	192	NS	1070	NS	126	-	-	NS	80	NS	162	NS	668	NS	486
Biochemical Oxygen Demand (BOD) (mg/L) [2]	NS	13	NS	56	NS	45	NS	175	NS	25	-	-	NS	35	NS	127	NS	141	NS	388
Chemical Oxygen Demand (COD) (mg/L) [2]	NS	100	NS	540	NS	280	NS	950	NS	160	-	-	NS	150	NS	410	NS	700	NS	1100

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Inorganics																				
Cyanide, total (µg/L) [2]	84	<50	84	<5	84	<5	84	<5	84	<5	-	-	84	<5	84	<5	84	<5	84	<5
Nutrients (mg/L) [2]																				
Nitrate + Nitrite as N	NS	0.8	NS	0.6	NS	1.7	NS	0.5	NS	1.2	-	-	NS	1.4	NS	1.4	NS	1.9	NS	1.6
Ammonia as N	NS	0.64	NS	0.42	NS	1.4	NS	0.51	NS	1.4	-	-	NS	1.3	NS	1.1	NS	1.4	NS	1.6
Total Kjeldahl Nitrogen (TKN)	NS	3.3	NS	6.9	NS	4.5	NS	14	NS	2.9	-	-	NS	3.9	NS	6.8	NS	9.3	NS	15
Total Phosphorus as P	NS	0.41	NS	1.5	NS	0.91	NS	0.58	NS	0.55	-	-	NS	1.3	NS	0.89	NS	0.46	NS	1.1
Ortho-Phosphorus as P	NS	<0.1	NS	0.2	NS	0.2	NS	0.1	NS	<0.1	-	-	NS	0.2	NS	0.3	NS	0.2	NS	0.7
Microbiological																				
Escherichia coli (*E. coli*) (CFU/100 mg or MPN/100 mL) [2]	575	**2419.6**	575	**>2419.6**	575	**>2,419.6**	575	**>2,419.6**	575	**34,480**	-	-	575	**5,040**	575	**2,419.6**	575	**17,230**	575	**14,390**

NOTES:
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Italicized text indicated a laboratory detection limit higher that the WQS.

Footnotes
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4 Standard for total PCBs of 11 µg/L A&We and 19 µg/L PBC.
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Total Metals (µg/L) [2]																				
Antimony	747 T	1.8 T 0.9 D	747 T	2.6 T 0.6 D	747 T	3.5 T 3.1 D	747 T	4.8 T 1.0 D	747 T	3.2 T <5.0 D	-	-	747 T	1.8 T <5 D	747 T	3.7 T <5 D	747 T	4.7 T <5 D	747 T	7.1 T <5 D
Arsenic	280 T 440 D	2.6 T 1.0 D	280 T 440 D	8.1 T 1.1 D	280 T 440 D	5.0 T 3.2 D	280 T 440 D	10.5 T 1.2 D	280 T 440 D	3.5 T <5.0 D	-	-	280 T 440 D	2.5 T <5 D	280 T 440 D	3.8 T <5 D	280 T 440 D	7.2 T <5.0 D	280 T 440 D	8.1 T <5 D
Barium	98,000 T	86 T 22 D	98,000 T	344 T 8 D	98,000 T	98 T 39 D	98,000 T	599 T 11 D	98,000 T	120 T 19 D	-	-	98,000 T	62 T 18 D	98,000 T	160 T 25 D	98,000 T	241 T 7 D	98,000 T	255 T 22 D
Beryllium	1,867 T	0.22 T <0.15 D	1,867 T	0.53 T <0.06 D	1,867 T	<0.15 T <0.15 D	1,867 T	0.75 T <0.06 D	1,867 T	0.21 T <5.0 D	-	-	1,867 T	<0.25 T <5 D	1,867 T	<0.25 T <5 D	1,867 T	0.53 T <5 D	1,867 T	0.44 T <5 D
Cadmium	700 T 9.37 D	0.4 T <0.25 D	700 T 7.34 D	2.1 T <0.10 D	700 T 21.94 D	<0.30 T <0.30 D	700 T 9.85 D	2.2 T <0.12 D	700 T 9.89 D	0.4 T <5.0 D	-	-	700 T 27.43 D	0.3 T <0.25 D	700 T 56.09 D	0.4 T <0.25	700 T 65.99 D	0.9 T <0.2 D	700 T 101.65 D	1.3 T <0.2 D
Chromium	NS	7.3 T <2.00 D	NS	23.8 T 0.8 D	NS	7.7 T 2.5 D	NS	34.6 T 1.9 D	NS	10.4 T <5.0 D	-	-	NS	6.5 T <5 D	NS	10.4 T <5 D	NS	21.1 T <5 D	NS	26.4 T 6.2 D
Copper	1,300 T 9.83 D	72.0 T **23.8 D**	1,300 T 7.77 D	206 T **12.2 D**	1,300 T 22.40 D	60.6 T **32.7 D**	1,300 T 10.32 D	263 T **16.7** D	1,300 T 10.36 D	66.6 T **21.6 D**	-	-	1,300 T 11.05 D	44.4 T **30.9 D**	1,300 T 20.58 D	76.2 T **38.4 D**	1,300 T 23.70 D	150 T 11.3 D	1,300 T 34.51 D	178 T **70.6 D**
Lead	15 T 49.76 D	**21.4 T** 1.2 D	15 T 37.58 D	**75.3 T** 0.6 D	15 T 130.52 D	14.3 T 1.4 D	15 T 52.67 D	**97.9 T** 0.6 D	15 T 52.95 D	**19.4 T** <0.8 D	-	-	15 T 57.13 D	10.9 T 0.9 D	15 T 118.26 D	**17.3 T** 0.9 D	15 T 139.27 D	**50.4 T** 0.2 D	15 T 214.34 D	**50 T** 2 D
Mercury	280 T 5 D	0.02 T <0.020 D	280 T 5 D	0.20 T 0.026 D	280 T 5 D	<0.092 T <0.2 D	280 T 5 D	0.30 T <0.092 D	280 T 5 D	0.08 T <0.2 D	-	-	280 T 5 D	0.094 T <0.068 D	280 T 5 D	0.095 T <0.2 D	280 T 5 D	0.134 T <0.2 D	280 T 5 D	0.26 T <0.20 D
Nickel	28,000 T 1,919 D	10.3 T 3.5 D	28,000 T 1,552 D	32.3 T 1.7 D	28,000 T 4021 D	14.6 T 8.4 D	28,000 T 2004 D	37.9 T 2.1 D	28,000 T 2,012 D	11.2 T 2.7 D	-	-	28,000 T 2,132 D	7.9 T <5 D	28,000 T 3725 D	13.4 T 6.9 D	28,000 T 4,229 D	28.1 T <5 D	28,000 T 5,926 D	29 T 13.2 D
Selenium	33 T	<0.60 T <0.60 D	33 T	0.69 T <0.24 D	33 T	0.76 T 0.5 D	33 T	0.87 T 0.4 D	33 T	0.51 T <5.0 D	-	-	33 T	0.96 T <5 D	33 T	0.87 T <5 D	33 T	1.3 T <5 D	33 T	1.3 T <5 D
Silver	4,667 T 0.672 D	0.2 T <0.15 D	4,667 T 0.434 D	0.5 T <0.15 D	4,667 T 3.005 D	<0.20 T <0.20 D	4,667 T 0.726 D	0.8 T <0.08 D	4,667 T 0.73 D	0.3 T *<5.0 D*	-	-	4,667 T 0.83 D	<0.45 T *<5 D*	4,667 T 2.57 D	<0.45 T *<5 D*	4,667 T 3.33 D	0.4 T *<5 D*	4,667 T 6.61 D	0.8 T <5 D
Thallium	75 T	<0.20 T <0.20 D	75 T	<0.20 T <0.08 D	75 T	<0.10 T <0.10 D	75 T	0.25 T <0.04 D	75 T	<0.15 T <5.0 D	-	-	75 T	0.32 T <5 D	75 T	<0.2 T <5 D	75 T	0.23 T <5 D	75 T	0.18 T <5 D
Zinc	280,000 T 513 D	207 T 63.2 D	280,000 T 414 D	1020 T 23.0 D	280,000 T 1075 D	192 T 66.4 D	280,000 T 535.2 D	1,410 T 32.8 D	280,000 T 537 D	288 T 50.9 D	-	-	280,000 T 570 D	202 T 58.2 D	280,000 T 996 D	274 T 82.4 D	280,000 T 1,131 D	633 T 22.3 D	280,000 T 1,586 D	662 T 109 D
Organic Toxic Pollutants											-	-								
Total Petroleum Hydrocarbons (TPH) (mg/L) [2]	NS	<11	NS	15	NS	<10	NS	<10	NS	<11	-	-	NS	<5.7	NS	<4.3	NS	<7.3	NS	<7.1
Total Oil and Grease (mg/L) [2]	NS	<5.7	NS	42	NS	<5.0	NS	6.0	NS	5.8	-	-	NS	<5.7	NS	<4.3	NS	7.8	NS	7.6
VOCs, Semi-VOCs, and Pesticides (µg/L) [2]											-	-								
Acrolein	467	<0.20	467	<0.20	467	2.7	467	<0,40	467	<0.78	-	-	467	<0.41	467	1.3	467	<3.95	467	<0.79
Acrylonitrile	37,333	<0.16	37,333	<0.16	37,333	<0.70	37,333	<0.14	37,333	<0.53	-	-	37,333	<0.42	37,333	<0.42	37,333	<2.95	37,333	<0.59
Benzene	3,733	<0.15	3,733	<1.20	3,733	<0.65	3,733	<0.13	3,733	<0.46	-	-	3,733	<0.46	3,733	<0.29	3,733	<1.30	3,733	<0.26
Bromoform	18,667	<0.43	18,667	<2.35	18,667	<1.40	18,667	<0.28	18,667	<0.68	-	-	18,667	<0.68	18,667	<0.33	18,667	<1.05	18,667	<0.21
Carbon tetrachloride	1,307	<0.33	1,307	<1.30	1,307	<1.15	1,307	<0.23	1,307	<0.31	-	-	1,307	<0.31	1,307	<0.20	1,307	<1.50	1,307	<0.30
Chlorobenzene	18,667	<0.28	18,667	<0.80	18,667	<0.65	18,667	<0.13	18,667	<0.50	-	-	18,667	<0.50	18,667	<0.33	18,667	<1.15	18,667	<0.23

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Chlorodibromomethane	18,667	<0.26	18,667	<0.90	18,667	<1.20	18,667	<0.24	18,667	<0.61	-	-	18,667	<0.61	18,667	<0.32	18,667	<1.20	18,667	<0.24
Chloroethane (ethyl chloride)	NS	<0.27	NS	<1.10	NS	<0.95	NS	<0.19	NS	<0.40	-	-	NS	<0.40	NS	<0.33	NS	<1.40	NS	<0.28
2-chloroethylvinyl ether	NS	<0.22	NS	<0.22	NS	<0.95	NS	<0.19	NS	<0.53	-	-	NS	<0.43	NS	<0.43	NS	<3.25	NS	<0.65
Chloroform	9,333	<0.21	9,333	<1.15	9,333	<0.70	9,333	<0.14	9,333	<0.49	-	-	9,333	<0.49	9,333	<0.32	9,333	<1.20	9,333	<0.24
Dichlorobromomethane	18,667	<0.15	18,667	<1.15	18,667	<0.75	18,667	<0.15	18,667	<0.49	-	-	18,667	<0.49	18,667	<0.29	18,667	<1.30	18,667	<0.26
1,1-dichloroethane	NS	<0.13	NS	<1.30	NS	<0.95	NS	<0.19	NS	<0.42	-	-	NS	<0.42	NS	<0.29	NS	<1.35	NS	<0.27
1,2-dichloroethane	186,667	<0.16	186,667	<1.25	186,667	<0.55	186,667	<0.11	186,667	<0.51	-	-	186,667	<0.51	186,667	<0.35	186,667	<1.30	186,667	<0.26
1,1-dichloroethylene	46,667	<0.37	46,667	<1.40	46,667	<1.35	46,667	<0.27	46,667	<0.34	-	-	46,667	<0.34	46,667	<0.19	46,667	<1.60	46,667	<0.32
1,2-dichloropropane	84,000	<0.15	84,000	<1.25	84,000	<0.90	84,000	<0.18	84,000	<0.49	-	-	84,000	<0.49	84,000	<0.32	84,000	<1.60	84,000	<0.32
1,3-dichloropropylene[8]	28,000	cis<0.10 trans<0.15	28,000	cis<1.20 trans<1.10	28,000	<0.65	28,000	<0.13	28,000	cis <0.51 trans <0.50	-	-	28,000	cis <0.51 trans <0.50	28,000	<0.28	28,000	<1.45	28,000	<0.21
Ethylbenzene	93,333	<0.29	93,333	<0.65	93,333	<0.75	93,333	<0.15	93,333	<0.46	-	-	93,333	<0.46	93,333	<0.29	93,333	<1.15	93,333	<0.23
Methyl bromide	1,307	<0.19	1,307	<0.95	1,307	<0.90	1,307	<0.18	1,307	<0.46	-	-	1,307	<0.46	1,307	<0.28	1,307	<1.15	1,307	<0.23
Methyl chloride	NS	<0.37	NS	<1.40	NS	<1.15	NS	<0.23	NS	<0.46	-	-	NS	<0.46	NS	<0.28	NS	<1.85	NS	<0.37
Methylene chloride	56,000	<0.28	56,000	<1.00	56,000	<1.00	56,000	<0.20	56,000	<0.81	-	-	56,000	<0.81	56,000	<0.31	56,000	<4.00	56,000	<0.80
1,1,2,2-tetrachloroethane	93,333	<0.49	93,333	<2.00	93,333	<1.75	93,333	<0.35	93,333	<0.80	-	-	93,333	<0.80	93,333	<0.33	93,333	<1.55	93,333	<0.31
Tetrachloroethylene	9,333	<0.23	9,333	<1.05	9,333	<0.65	9,333	<0.13	9,333	<0.35	-	-	9,333	<0.35	9,333	<0.23	9,333	<1.45	9,333	<0.29
Toluene	373,333	<0.12	373,333	<0.95	373,333	<0.55	373,333	<0.11	373,333	<0.43	-	-	373,333	<0.43	373,333	<0.28	373,333	<1.25	373,333	<0.25
1,2-trans-dichloroethylene	18,667	<0.17	18,667	<1.25	18,667	<0.90	18,667	<0.18	18,667	<0.38	-	-	18,667	<0.38	18,667	<0.24	18,667	<1.25	18,667	<0.25
1,1,1-trichloroethane	1,866,66 7	<0.23	1,866,667	<1.00	1,866,667	<0.70	1,866,667	<0.14	1,866,667	<0.34	-	-	1,866,667	<0.34	1,866,667	<0.23	1,866,667	<1.40	1,866,667	<0.28
1,1,2-trichloroethane	3,733	<0.24	3,733	<0.75	3,733	<0.65	3,733	<0.13	3,733	<0.60	-	-	3,733	<0.60	3,733	<0.29	3,733	<1.50	3,733	<0.30
Trichloroethylene	280	<0.24	280	<0.75	280	<1.10	280	<0.22	280	<0.48	-	-	280	<0.48	280	<0.28	280	<1.80	280	<0.36
1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene	NS	<1.0 <1.0	NS	<5.0 <5.0	NS	<10.00 <5.00	NS	<1.0 <1.0	NS	<1.0 <1.0	-	-	NS	<1.0 <1.0	NS	<1.0 <1.0	NS	<5.0 <5.0	NS	<1.0 <1.0
Vinyl chloride	2,800	<0.50	2,800	<1.00	2,800	<1.10	2,800	<0.22	2,800	<0.35	-	-	2,800	<0.35	2,800	<0.24	2,800	<2.10	2,800	<0.42
Xylenes, Total	186,667	<0.58	186,667	<1.50	186,667	<1.25	186,667	<0.13	186,667	<0.52	-	-	186,667	<0.52	186,667	<0.32	186,667	<1.15	186,667	<0.23
Acid Compounds (µg/L) [2]																				
2-chlorophenol	4,667	<85.8	4,667	<214.5	4,667	<1.48	4,667	<1.48	4,667	<3.10	-	-	4,667	<2.92	4,667	<2.92	4,667	<42.3	4,667	<84.6
2,4-dichlorophenol	2,800	<84.4	2,800	<211.0	2,800	<1.65	2,800	<1.65	2,800	<2.81	-	-	2,800	<3.21	2,800	<3.21	2,800	<48.2	2,800	<96.4
2,4-dimethylphenol	18,667	<45.6	18,667	<114.0	18,667	<2.20	18,667	<2.20	18,667	<2.64	-	-	18,667	<1.32	18,667	<1.32	18,667	<70.7	18,667	<141.4
4,6-dinitro-o-cresol	3,733	<59.6	3,733	<149.0	3,733	<1.22	3,733	<1.22	3,733	<1.49	-	-	3,733	<2.27	3,733	<2.27	3,733	<46.9	3,733	<93.8
2,4-dinitrophenol	1,867	<51.8	1,867	<129.5	1,867	<1.13	1,867	<1.13	1,867	<2.21	-	-	1,867	<2.64	1,867	<2.64	1,867	<51.1	1,867	<102.2
2-nitrophenol	NS	<82.2	NS	<205.5	NS	<1.57	NS	<1.57	NS	<2.84	-	-	NS	<2.61	NS	<2.61	NS	<78.3	NS	<156.6
4-nitrophenol	NS	<93.4	NS	<233.5	NS	<1.14	NS	3.1	NS	<2.98	-	-	NS	<2.03	NS	<2.03	NS	<40.3	NS	<80.6
p-chloro-m-cresol	48,000	<88.2	48,000	<220.5	48,000	<1.65	48,000	<1.65	48,000	<1.87	-	-	48,000	<3.10	48,000	<3.10	48,000	<40.5	48,000	<81.0
Pentachlorophenol	127.97	<67.2	135.76	*<168.0*	94.663	<1.39	76.64	<1.39	68.60	6.6	-	-	40.24	3.8	18.94	<3.44	52.78	*<73.6*	83.81	*<147.2*
Phenol	180,000	<71.0	180,000	<177.5	180,000	2.8	180,000	1.9	180,000	<2.30	-	-	180,000	2.7	180,000	2.4	180,000	<39.9	180,000	<79.8

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SR045	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16[6]		Summer 2016		Winter 2016/17		Summer 2017		Winter 2017/18	
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2,4,6-trichlorophenol	130	<95.8	130	*<239.5*	130	<1.89	130	<1.89	130	<2.60	-	-	130	<3.28	130	<3.28	130	<47.4	130	<94.8
Bases/Neutrals (µg/L) [2]																				
Acenaphthene	56,000	<26.8	56,000	<67.0	56,000	<1.03	56,000	<1.03	56,000	<0.35	-	-	56,000	<1.02	56,000	<1.02	56,000	<18.8	56,000	<37.6
Acenaphthylene	NS	<34.6	NS	<86.5	NS	<1.00	NS	<1.00	NS	<1.23	-	-	NS	<6.10	NS	<6.10	NS	<17.5	NS	<35.0
Anthracene	280,000	<34.6	280,000	<86.5	280,000	<2.88	280,000	<2.88	280,000	<0.44	-	-	280,000	<1.96	280,000	<1.96	280,000	<26.2	280,000	<52.4
Benz(a)anthracene	0.2	*<34.6*	0.2	*<86.5*	0.2	*<1.08*	0.2	*<1.08*	0.2	*<0.38*	-	-	0.2	*<1.57*	0.2	*<1.57*	0.2	*<19.6*	0.2	*<39.2*
Benzo(a)pyrene	0.2	*<37.4*	0.2	*<93.5*	0.2	*<3.77*	0.2	*<3.77*	0.2	*<1.41*	-	-	0.2	*<3.12*	0.2	*<3.12*	0.2	*<37.7*	0.2	*<75.4*
Benzo(b)fluoranthene	1.9	*<48.6*	1.9	*<121.5*	1.9	<1.46	1.9	<1.46	1.9	<1.06	-	-	1.9	<1.28	1.9	<1.28	1.9	*<21.7*	1.9	*<43.4*
Benzo(g,h,i)perylene	NS	<34.6	NS	<86.5	NS	<1.29	NS	<1.29	NS	<0.72	-	-	NS	<2.83	NS	<2.83	NS	<25.1	NS	<50.2
Benzo(k)fluoranthene	1.9	*<28.0*	1.9	*<70.0*	1.9	<1.04	1.9	<1.04	1.9	<0.35	-	-	1.9	<1.76	1.9	<1.76	1.9	*<23.3*	1.9	*<46.6*
Chrysene	19	*<29.6*	19	*<74.0*	19	<1.41	19	<1.41	19	<0.46	-	-	19	<1.08	19	<1.08	19	*<19.6*	19	*<39.2*
Dibenz(a,h)anthracene	1.9	*<39.6*	1.9	*<99.0*	1.9	<1.24	1.9	<1.24	1.9	<0.47	-	-	1.9	<1.93	1.9	<1.93	1.9	*<60.4*	1.9	*<120.8*
1,2-dichlorobenzene	5,900	<5.4	5,900	<13.5	5,900	<1.76	5,900	<1.76	5,900	<1.04	-	-	5,900	<0.58	5,900	<0.58	5,900	<1.50	5,900	<0.30
1,3-dichlorobenzene	NS	<22.6	NS	<56.5	NS	<1.74	NS	<1.74	NS	<0.47	-	-	NS	<0.52	NS	<0.52	NS	<1.25	NS	<0.25
1,4-dichlorobenzene	6,500	<21.0	6,500	<52.5	6,500	<1.56	6,500	<1.56	6,500	<1.28	-	-	6,500	<0.50	6,500	<0.50	6,500	<1.25	6,500	<0.29
3,3-dichlorobenzidine	3	*<545.4*	3	*<1363.5*	3	*<6.06*	3	*<6.06*	3	*<11.60*	-	-	3	*<23.45*	3	*<23.45*	3	*<254.3*	3	*<508.6*
Diethyl phthalate	746,667	<38.0	746,667	<95.0	746,667	<2.37	746,667	<2.37	746,667	0.7	-	-	746,667	<1.07	746,667	<1.07	746,667	<19.9	746,667	<39.8
Dimethyl phthalate	NS	<35.8	NS	<89.5	NS	<2.42	NS	<2.42	NS	<0.47	-	-	NS	<0.58	NS	<0.58	NS	<19.1	NS	<39.2
Di-n-butyl phthalate	1,100	<44.6	1,100	<111.5	1,100	<1.85	1,100	<1.85	1,100	<0.31	-	-	1,100	<1.37	1,100	<1.37	1,100	<23.5	1,100	<47.0
2,4-dinitrotoluene	1,867	<41.0	1,867	<102.5	1,867	<2.12	1,867	<2.12	1,867	<0.26	-	-	1,867	<1.30	1,867	<1.30	1,867	<31.0	1,867	<62.0
2,6-dinitrotoluene	3,733	<50.4	3,733	<126.0	3,733	<1.12	3,733	<1.12	3,733	<0.38	-	-	3,733	<1.39	3,733	<1.39	3,733	<28.9	3,733	<57.8
Di-n-octyl phthalate	373,333	<57.6	373,333	<144.0	373,333	<1.10	373,333	<1.10	373,333	<1.28	-	-	373,333	<1.67	373,333	<1.67	373,333	<55.0	373,333	<110.0
1,2-diphenylhydrazine (as azobenzene)	NS	<46.6	NS	<116.5	NS	<6.70	NS	<6.70	NS	<1.06	-	-	NS	<7.46	NS	<7.46	NS	<21.5	NS	<43.0
Fluoranthene	37,333	<35.8	37,333	<89.5	37,333	<1.35	37,333	<1.35	37,333	<0.27	-	-	37,333	<1.06	37,333	<1.06	37,333	<30.8	37,333	<61.6
Fluorene	37,333	<30.8	37,333	<77.0	37,333	<4.81	37,333	<4.81	37,333	<0.29	-	-	37,333	<0.51	37,333	<0.51	37,333	<28.7	37,333	<57.4
Hexachlorobenzene	747	<27.8	747	<69.5	747	<1.23	747	<1.23	747	<0.34	-	-	747	<0.47	747	<0.47	747	<15.7	747	<31.4
Hexachlorobutadiene	187	<6.6	187	<16.5	187	<1.82	187	<1.82	187	<1.67	-	-	187	<0.41	187	<0.41	187	<10.0	187	<20.0
Hexachlorocyclopentadiene	11,200	<45.4	11,200	<113.5	11,200	<1.23	11,200	<1.23	11,200	<1.53	-	-	11,200	<2.16	11,200	<2.16	11,200	<61.0	11,200	<122.0
Hexachloroethane	850	<8.0	850	<20.0	850	<1.62	850	<1.62	850	<1.23	-	-	850	<0.54	850	<0.54	850	<14.9	850	<29.8
Indeno(1,2,3-cd)pyrene	1.9	*<40.6*	1.9	*<101.5*	1.9	<1.39	1.9	<1.39	1.9	<0.62	-	-	1.9	<2.38	1.9	**3.8**[9]	1.9	*<61.1*	1.9	*<122.2*
Isophorone	186,667	<28.2	186,667	<70.5	186,667	<2.14	186,667	<2.14	186,667	<0.37	-	-	186,667	<0.51	186,667	<0.51	186,667	<17.7	186,667	<35.4
Naphthalene	18,667	<24.0	18,667	<60.0	18,667	<1.83	18,667	<1.83	18,667	<0.36	-	-	18,667	<0.49	18,667	<0.49	18,667	<15.4	18,667	<30.8
Nitrobenzene	467	<24.6	467	<61.5	467	<2.10	467	<2.10	467	<1.26	-	-	467	<0.44	467	<0.44	467	<18.0	467	<36.0
N-nitrosodimethylamine	0.03	*<24.0*	0.03	*<60.0*	0.03	*<1.00*	0.03	*<1.00*	0.03	*<1.13*	-	-	0.03	*<0.54*	0.03	*<0.54*	0.03	*<16.2*	0.03	*<32.4*
N-nitrosodi-n-propylamine	86,667	<30.2	86,667	<75.5	86,667	<1.15	86,667	<1.15	86,667	<1.17	-	-	86,667	<1.02	86,667	<1.02	86,667	<16.5	86,667	<33.0
N-nitrosodiphenylamine	290	<60.8	290	<152.0	290	<3.57	290	<3.57	290	<1.15	-	-	290	<1.67	290	<1.67	290	<31.3	290	<62.6

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Phenanthrene	NS	<32.6	NS	<81.5	NS	<1.39	NS	<1.39	NS	<0.31	-	-	NS	<0.49	NS	<0.49	NS	<30.2	NS	<60.4
Pyrene	28,000	<32.8	28,000	<82.0	28,000	<3.86	28,000	<3.86	28,000	<0.67	-	-	28,000	<3.21	28,000	<3.21	28,000	<33.8	28,000	<67.6
1,2,4-trichlorobenzene	9,333	<6.4	9,333	<16.0	9,333	<1.69	9,333	<1.69	9,333	<1.04	-	-	9,333	<0.55	9,333	<0.55	9,333	<12.1	9,333	<24.2
Pesticides (µg/L) [2]																				
Aldrin	4.5	<0.048	4.5	<0.015	4.5	<0.027	4.5	<0.027	4.5	<0.012	-	-	4.5	<0.019	4.5	<0.019	4.5	<0.013	4.5	<0.014
Alpha-BHC	1,600	<0.040	1,600	<0.016	1,600	<0.021	1,600	<0.021	1,600	<0.058	-	-	1,600	<0.010	1,600	<0.010	1,600	<0.015	1,600	<0.016
Beta-BHC	560	<0.100	560	<0.088	560	<0.072	560	<0.072	560	<0.063	-	-	560	<0.049	560	<0.049	560	<0.083	560	<0.086
Gamma-BHC	11	0.052	11	<0.022	11	<0.034	11	<0.034	11	<0.058	-	-	11	<0.019	11	<0.019	11	<0.020	11	<0.021
Delta-BHC	1,600	<0.034	1,600	<0.017	1,600	<0.021	1,600	<0.021	1,600	<0.066	-	-	1,600	<0.035	1,600	<0.035	1,600	<0.012	1,600	<0.012
Chlordane	3.2	<0.17	3.2	<0.19	3.2	<0.14	3.2	<0.14	3.2	<0.36	-	-	3.2	<0.61	3.2	<0.61	3.2	<0.029	3.2	<0.030
4,4'-DDT	1.1	<0.030	1.1	<0.015	1.1	<0.025	1.1	<0.025	1.1	<0.017	-	-	1.1	<0.011	1.1	<0.011	1.1	<0.020	1.1	<0.021
4,4'-DDE	1.1	<0.036	1.1	<0.017	1.1	<0.010	1.1	<0.010	1.1	<0.013	-	-	1.1	<0.020	1.1	<0.020	1.1	<0.019	1.1	<0.020
4,4'-DDD	1.1	<0.024	1.1	<0.013	1.1	<0.031	1.1	<0.031	1.1	<0.021	-	-	1.1	<0.021	1.1	<0.021	1.1	<0.023	1.1	<0.024
Dieldrin	4	<0.029	4	0.070	4	<0.030	4	<0.030	4	<0.060	-	-	4	<0.019	4	<0.019	4	<0.015	4	<0.041
Alpha-endosulfan	3 T	0.089	3 T	<0.017	3 T	<0.018	3 T	<0.018	3 T	<0.072	-	-	3 T	<0.018	3 T	<0.018	3 T	<0.015	3 T	<0.016
Beta-endosulfan	3 T	<0.036	3 T	<0.012	3 T	<0.032	3 T	<0.032	3 T	<0.019	-	-	3 T	<0.021	3 T	<0.021	3 T	<0.014	3 T	<0.015
Endosulfan sulfate	3	<0.026	3	<0.013	3	<0.008	3	<0.008	3	0.028	-	-	3	<0.022	3	<0.022	3	<0.019	3	<0.020
Endrin	0.7	<0.037	0.7	<0.015	0.7	<0.017	0.7	<0.017	0.7	<0.023	-	-	0.7	<0.042	0.7	<0.042	0.7	<0.040	0.7	<0.042
Endrin aldehyde	0.7	<0.040	0.7	<0.022	0.7	<0.032	0.7	<0.032	0.7	<0.026	-	-	0.7	<0.024	0.7	<0.024	0.7	<0.034	0.7	<0.035
Heptachlor	0.9	<0.037	0.9	<0.017	0.9	<0.027	0.9	0.045	0.9	<0.035	-	-	0.9	<0.023	0.9	<0.023	0.9	<0.019	0.9	<0.020
Heptachlor epoxide	0.9	<0.034	0.9	<0.019	0.9	<0.008	0.9	<0.008	0.9	<0.062	-	-	0.9	<0.020	0.9	<0.020	0.9	<0.016	0.9	<0.017
PCB-1242	[4]	<0.43	[4]	<0.52	[4]	<0.37	[4]	<0.37	[4]	<0.14	-	-	[4]	<0.72	[4]	<0.72	[4]	<0.33	[4]	<0.34
PCB-1254	[4]	<0.21	[4]	<0.27	[4]	<0.23	[4]	<0.23	[4]	<0.20	-	-	[4]	<0.22	[4]	<0.22	[4]	<0.17	[4]	<0.18
PCB-1221	[4]	<0.71	[4]	<0.81	[4]	<0.22	[4]	<0.22	[4]	<0.64	-	-	[4]	<0.46	[4]	<0.46	[4]	<0.36	[4]	<0.37
PCB-1232	[4]	<0.69	[4]	<0.32	[4]	<0.55	[4]	<0.55	[4]	<0.37	-	-	[4]	<0.90	[4]	<0.90	[4]	<0.40	[4]	<0.42
PCB-1248	[4]	<0.82	[4]	<0.26	[4]	<0.19	[4]	<0.19	[4]	<0.22	-	-	[4]	<0.24	[4]	<0.24	[4]	<0.21	[4]	<0.22
PCB-1260	[4]	<0.22	[4]	<0.22	[4]	<0.32	[4]	<0.32	[4]	<0.59	-	-	[4]	<0.26	[4]	<0.26	[4]	<0.34	[4]	<0.35
PCB-1016	[4]	<0.38	[4]	<0.31	[4]	<0.18	[4]	<0.18	[4]	<0.55	-	-	[4]	<0.29	[4]	<0.29	[4]	<0.33	[4]	<0.34
Toxaphene	11	<0.56	11	<0.32	11	<0.22	11	<0.22	11	<0.60	-	-	11	<0.48	11	<0.48	11	<0.47	11	<0.49

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OUTFALL ID: SR049

RECEIVING WATER: Salt River

DESIGNATED USES: A&Wedw, PBC, FC, AgI, and AgL

MONITORING SEASONS
Summer: June 1 – October 31
Winter: November 1 – May 31

	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16		Summer 2016[7]		Winter 2016/17		Summer 2017		Winter 2017/18	
SAMPLING DATE(S):	SWQS	7/21/13	SWQS	11/22/13	SWQS	8/1/14	SWQS	12/4/14	SWQS	7/31/15	SWQS	1/4/16	-	-	SWQS	11/3/16	SWQS	7/14/17	SWQS	1/9/18
MONITORING PARAMETERS [1, 2]																				
Conventional Parameters																				
Flow [3] (cfs)	NS	18.84	NS	13.48	NS	10.791	NS	10.166	NS	24.5	NS	22.997	-	-	NS	55.936	NS	101.82	NS	13.82
pH	6.5-9	8.03	6.5-9	8.54	6.5-9	7.64	6.5-9	8.01	6.5-9	7.5	6.5-9	7.73	-	-	6.5-9	7.16	6.5-9	7.29	6.5-9	7.95
Temperature (ºC)	Varies	28.6	Varies	17.0	Varies	28.5	Varies	18.0	Varies	30.8	Varies	16.5	-	-	Varies	21.5	Varies	27.8	Varies	18.3
Hardness (mg/L)	400	39.9	400	32.8	400	74.8	400	142	400	66.8	400	48.9	-	-	400	171	400	57.3	400	68.9
Total Dissolved Solids (TDS) (mg/L) [2]	NS	134	NS	100	NS	290	NS	362	NS	270	NS	146	-	-	NS	486	NS	190	NS	216
Total Suspended Solids (TSS) (mg/L) [2]	NS	440	NS	420	NS	508	NS	200	NS	2,290	NS	420	-	-	NS	256	NS	295	NS	488
Biochemical Oxygen Demand (BOD) (mg/L) [2]	NS	35	NS	22	NS	66	NS	33	NS	61	NS	25	-	-	NS	35	NS	26	NS	45
Chemical Oxygen Demand (COD) (mg/L) [2]	NS	270	NS	200	NS	440	NS	210	NS	750	NS	280	-	-	NS	260	NS	230	NS	310

SR049	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16		Summer 2016[7]		Winter 2016/17		Summer 2017		Winter 2017/18	
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Inorganics																				
Cyanide, total (µg/L) [2]	41 T	<50	41 T	<5	41 T	<5	41 T	<5	41 T	<5	41 T	<5	-	-	41 T	<5	41 T	<5	41 T	<5
Nutrients (mg/L) [2]																				
Nitrate + Nitrite as N	NS	1.2	NS	0.8	NS	2.8	NS	1.9	NS	1.3	NS	1.0	-	-	NS	1.5	NS	1.2	NS	1.4
Ammonia as N	5.33	1.3	1.99	1.1	10.7	2.8	5.52	1.4	19.9	2.5	13.7	1.2	-	-	30.9	2	26.5	0.9	9.2	2.5
Total Kjeldahl Nitrogen (TKN)	NS	5.3	NS	3.8	NS	8.0	NS	4.7	NS	5.2	NS	3.9	-	-	NS	5.3	NS	3.6	NS	6.3
Total Phosphorus as P	NS	0.46	NS	1.5	NS	2.1	NS	0.35	NS	3.5	NS	1.4	-	-	NS	0.6	NS	0.83	NS	1.6
Ortho-Phosphorus as P	NS	0.3	NS	0.2	NS	0.6	NS	0.1	NS	<0.1	NS	0.2	-	-	NS	0.3	NS	0.1	NS	0.4
Microbiological																				
Escherichia coli (*E. coli*) (CFU/100 mg or MPN/100 mL) [2]	575	**>2,419.6**	575	**>2,419.6**	575	**>2,419.6**	575	**>2,419.6**	575	**8,570**	575	**5,040.0**	-	**-**	575	**48,840**	575	**141,360**	575	**4,040**

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Total Metals (µg/L) [2]																				
Antimony	640 T 1,000 D	1.8 T 0.7 D	640 T 1,000 D	1.8 T 0.3 D	640 T 1,000 D	4.3 T 1.9 D	640 T 1,000 D	2.7 T 1.6 D	640 T 1,000 D	2.6 T <5.0 D	640 T 1,000 D	3.0 T <5.0 D	-	-	640 T 1,000 D	3.6 T <5 D	640 T 1,000 D	1.4 T <5 D	640 T 1,000 D	2.9 T <5 D
Arsenic	80 T 340 D	6.5 T 1.4 D	80 T 340 D	4.2 T 0.6 D	80 T 340 D	7.7 T 2.3 D	80 T 340 D	4.4 T 2.0 D	80 T 340 D	16.6 T <5.0 D	80 T 340 D	6.0 T <5.0 D	-	-	80 T 340 D	5.4 T <5 D	80 T 340 D	5 T <5 D	80 T 340 D	7.4 T <5 D
Barium	98,000 T	241 T 25 D	98,000 T	157 T 8 D	98,000 T	251 T 44 D	98,000 T	160 T 56 D	98,000 T	572 T 43 D	98,000 T	244 T 27 D	-	-	98,000 T	187 T 83 D	98,000 T	137 T 33 D	98,000 T	212 T 37 D
Beryllium	84 T	0.79 T <0.15 D	84 T	0.4 T <0.06 D	84 T	0.74 T <0.06 D	84 T	0.3 T <0.06 D	84 T	2.1 T <5.0 D	84 T	0.53 T <5.0 D	-	-	84 T	0.35 T <5 D	84 T	0.43 T <5 D	84 T	0.69 T <5 D
Cadmium	50 T 3.22 D	1.0 T <0.25 T	50 T 2.66 D	0.9 T <0.10 D	50 T 5.93 D	0.9 T <0.12 D	50 T 11.07 D	0.4 T <0.12 D	50 T 5.31 D	2.4 T <5.0 D	50 T 3.92 D	1.1 T *<5.0 D*	-	-	50 T 7.62 D	0.4 T <0.25 D	50 T 2.33 D	0.4 T <0.2 D	50 T 2.85 D	0.5 T *<5.0 D*
Chromium	1,000 T	26.3 T <2.00 D	1,000 T	14.4 T <0.80 D	1,000 T	27.3 T 2.2 D	1,000 T	11.2 T 1.4 D	1,000 T	67.0 T <5.0 D	1,000 T	20.1 T <5.0 D	-	-	1,000 T	12.8 T <5 D	1,000 T	18 T <5 D	1,000 T	25 T <5 D
Copper	500 T 5.66 D	149 T **11.8 D**	500 T 4.70 D	79.1 T **5.5 D**	500 T 10.22 D	127 T **18.4 D**	500 T 18.70	75.6 T **19.8 D**	500 T 9.19 D	268 T **17.2 D**	500 T 6.85 D	137 T **10.5 D**	-	-	500 T 22.28 D	66.8 T 9.3 D	500 T 7.95 D	49.1 T **13.2 D**	500 T 9.46 D	82.6 T **22.8 D**
Lead	15 T 23.45 D	**48.2 T** 2.3 D	15 T 18.83 D	**39.5 T** 0.3 D	15 T 47.01 D	**35.4 T** 2.0 D	15 T 94.40	**16.0 T** 0.5 D	15 T 41,51 D	**93.5 T** 2.1 D	15 T 29.40 D	**38.4 T** <5.0 D	-	-	15 T 115.22 D	14 T 0.7 D	15 T 35.05 D	12.8 T 0.2 D	15 T 42.95 D	**19.6 T** 0.8 D
Mercury	10 T 2.4 D	0.06 T <0.020 D	10 T 2.4 D	0.04 T <0.020 D	10 T 2.4 D	0.13 T <0.2 D	10 T 2.4 D	<0.092 T <0.092 D	10 T 2.4 D	0.11 T <0.2 D	10 T 2.4 D	0.08 T <0.2 D	-	-	10 T 2.4 D	<0.068 T <0.2 D	10 T 2.4 D	<0.20 T <0.20 D	10 T 2.4 D	<0.066 T <0.2 D
Nickel	511 T 215.5 D	34.8 T 4.4 D	511 T 182.2 D	18.5 T 1.1 D	511 T 366.2 D	34.6 T 7.2 D	511 T 630	16.0 T 4.3 D	511 T 333 D	86.7 T 8.1 D	511 T 256 D	27.8 T <5.0 D	-	-	511 T 737.19 D	16.7 T <5 D	511 T 292.32 D	22.6 T <5 D	511 T 341.66 D	30.5 T <5 D
Selenium	20 T	<0.60 T <0.60 D	20 T	<0.60 T <0.24 D	20 T	1.1 T 0.7 D	20 T	0.78 T 0.6 D	20 T	1.2 T <5.0 D	20 T	0.59 T <5.0 D	-	-	20 T	0.44 T <5 D	20 T	0.53 T <5 D	20 T	0.65 T <5 D
Silver	4,667 T 0.667 D	0.3 T <0.15 D	4,667 T 0.474 D	0.2 T <0.15 D	4,667 T 1.952 D	0.2 T <0.20 D	4,667 T 5.88 D	0.1 T <0.08 D	4,667 T 1.61 D	0.4 T *<5.0 D*	4,667 T 0.94 D	<0.25 T *<5.0 D*	-	-	4,667 T 8.09 D	<0.45 T <5 D	4,667 T 1.23 D	<0.1 T *<5 D*	4,667 T 1.69 D	<0.2 T *<5 D*
Thallium	1 T 700 D	<0.20 T <0.20 D	1 T 700 D	0.29 T <0.08 D	1 T 700 D	0.37 T <0.04 D	1 T 700 D	0.30 T <0.04 D	1 T 700 D	0.41 T <5.0 D	1 T 700 D	0.15 T <5.0 D	-	-	1 T 700 D	<0.2 T <5 D	1 T 700 D	<0.10 T <5 D	1 T 700 D	<0.26 T <5 D
Zinc	5,106 T 53.79 D	458 T 39.5 D	5,106 T 45.56 D	349 T 11.6 D	5,106 T 91.6 D	502 T 51.4 D	5,106 T 157.7	180 T 25.6 D	5,106 T 83.3 D	1,510 T 70.8 D	5,106 T 63.9 D	740 T 21.2 D	-	-	5,106T 184.62 D	259 T 34.9 D	5,106 T 73.10 D	210 T 18.6 D	5,106 T 85.46 D	308 T 34.7 D
Organic Toxic Pollutants																				
Total Petroleum Hydrocarbons (TPH) (mg/L) [2]	NS	<11	NS	<11	NS	<10	NS	<10	NS	<10	NS	<6	-	-	NS	<4.6	NS	<6.9	NS	<7.1
Total Oil and Grease (mg/L) [2]	NS	<5.7	NS	<5.7	NS	7.0	NS	7.6	NS	<5.1	NS	<6	-	-	NS	<4.6	NS	<5.8	NS	<5.9
VOCs, Semi-VOCs, and Pesticides (µg/L) [2]																				
Acrolein	1.9	<0.20	1.9	<0.20	1.9	*<2.00*	1.9	<0.40	1.9	<0.78	1.9	<0.78	-	-	1.9	<0.41	1.9	*<3.95*	1.9	*<0.79*
Acrylonitrile	0.2	<0.16	0.2	<0.16	0.2	*<0.70*	0.2	<0.14	0.2	*<0.53*	0.2	*<0.53*	-	-	0.2	*<0.42*	0.2	*<2.95*	0.2	*<0.59*
Benzene	114	<1.20	114	<0.24	114	<1.20	114	<0.13	114	<0.46	114	<0.46	-	-	114	<0.29	114	<1.30	114	<0.26
Bromoform	133	<2.35	133	<0.47	133	<2.35	133	<0.28	133	<0.68	133	<0.68	-	-	133	<0.33	133	<1.05	133	<0.21
Carbon tetrachloride	2	<1.30	2	<0.26	2	<1.30	2	<0.23	2	<0.31	2	<0.31	-	-	2	<0.20	2	<1.50	2	<0.30
Chlorobenzene	1,553	<0.80	1,553	<0.16	1,553	<0.80	1,553	<0.13	1,553	<0.50	1,553	<0.50	-	-	1,553	<0.33	1,553	<1.15	1,553	<0.23

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Chlorodibromomethane	13	<0.90	13	<0.18	13	<0.90	13	<0.24	13	<0.61	13	<0.61	-	-	13	<0.32	13	<1.20	13	<0.24
Chloroethane (ethyl chloride)	NS	<1.10	NS	<0.22	NS	<1.10	NS	<0.19	NS	<0.40	NS	<0.40	-	-	NS	<0.33	NS	<1.40	NS	<0.28
2-chloroethylvinyl ether	180,000	<0.22	180,000	<0.22	180,000	<0.95	180,000	<0.19	180,000	<0.53	180,000	<0.53	-	-	180,000	<0.43	180,000	<3.25	180,000	<0.65
Chloroform	2,133	<1.15	2,133	<0.23	2,133	<1.15	2,133	<0.14	2,133	<0.49	2,133	<0.49	-	-	2,133	<0.32	2,133	<1.20	2,133	<0.24
Dichlorobromomethane	17	<1.15	17	<0.23	17	<1.15	17	<0.15	17	<0.49	17	<0.49	-	-	17	<0.29	17	<1.30	17	<0.26
1,1-dichloroethane	NS	<1.30	NS	<0.26	NS	<1.30	NS	<0.19	NS	<0.42	NS	<0.42	-	-	NS	<0.29	NS	<1.35	NS	<0.27
1,2-dichloroethane	37	<1.25	37	<0.25	37	<1.25	37	<0.11	37	<0.51	37	<0.51	-	-	37	<0.35	37	<1.30	37	<0.26
1,1-dichloroethylene	7,143	<1.40	7,143	<0.28	7,143	<1.40	7,143	<0.27	7,143	<0.34	7,143	<0.34	-	-	7,143	<0.19	7,143	<1.60	7,143	<0.32
1,2-dichloropropane	17,518	<1.25	17,518	<0.25	17,518	<1.25	17,518	<0.18	17,518	<0.49	17,518	<0.49	-	-	17,518	<0.32	17,518	<1.60	17,518	<0.32
1,3-dichloropropylene[8]	42	cis<1.20 trans<1.10	42	cis<0.24 trans<0.22	42	cis <1.20 trans <1.10	42	<0.13	42	cis <0.51 trans <0.50	42	cis <0.51 trans <0.50	-	-	42	cis <0.28 trans <0.28	42	<1.05	42	<0.21
Ethylbenzene	2,133	<0.65	2,133	<0.13	2,133	<0.65	2,133	<0.15	2,133	<0.46	2,133	<0.46	-	-	2,133	<0.29	2,133	<1.15	2,133	<0.23
Methyl bromide	299	<0.95	299	<0.19	299	<0.95	299	<0.18	299	<0.46	299	<0.46	-	-	299	<0.28	299	<1.15	299	<0.23
Methyl chloride	270,000	<1.40	270,000	<0.28	270,000	<1.40	270,000	<0.23	270,000	<0.46	270,000	<0.46	-	-	270,000	<0.28	270,000	<1.85	270,000	<0.37
Methylene chloride	593	<1.00	593	<0.20	593	<1.00	593	<0.20	593	<0.81	593	<0.81	-	-	593	<0.31	593	<4.00	593	<0.80
1,1,2,2-tetrachloroethane	4	<2.00	4	<0.40	4	<2.00	4	<0.35	4	<0.80	4	<0.80	-	-	4	<0.33	4	<1.55	4	<0.31
Tetrachloroethylene	261	<1.05	261	<0.21	261	<1.05	261	<0.13	261	<0.35	261	<0.35	-	-	261	<0.23	261	<1.45	261	<0.29
Toluene	8,700	<0.95	8,700	<0.19	8,700	<0.95	8,700	0.16	8,700	<0.43	8,700	<0.43	-	-	8,700	0.43	8,700	<1.25	8,700	<0.25
1,2-trans-dichloroethylene	10,127	<1.25	10,127	<0.25	10,127	<1.25	10,127	<0.18	10,127	<0.38	10,127	<0.38	-	-	10,127	<0.24	10,127	<1.25	10,127	<0.25
1,1,1-trichloroethane	1,000	<1.00	1,000	<0.20	1,000	<1.00	1,000	<0.14	1,000	<0.34	1,000	<0.34	-	-	1,000	<0.23	1,000	<1.40	1,000	<0.28
1,1,2-trichloroethane	16	<0.75	16	<0.15	16	<0.75	16	<0.13	16	<0.60	16	<0.60	-	-	16	<0.29	16	<1.50	16	<0.30
Trichloroethylene	29	<0.75	29	<0.15	29	<0.75	29	<0.22	29	<0.48	29	<0.48	-	-	29	<0.28	29	<1.80	29	<0.36
1,2,4-Trimethylbenzene 1,3,5- Trimethylbenzene	NS	<5.0 <5.0	NS	<1.0 <1.0	NS	<5.0 <5.0	NS	<1.0 <1.0	NS	<1.0 <1.0	NS	<1.0 <1.0	-	-	NS	<1.0 <1.0	NS	<5.0 <5.0	NS	<1.0 <1.0
Vinyl chloride	5	<1.00	5	<0.20	5	<1.00	5	<0.22	5	<0.35	5	<0.35	-	-	5	<0.24	5	<2.10	5	<0.42
Xylenes, Total	186,667	<1.50	186,667	<0.30	186,667	<1.50	186,667	<0.13	186,667	<0.52	186,667	<0.52	-	-	186,667	<0.32	186,667	<1.15	186,667	<0.23
Acid Compounds (µg/L) [2]																				
2-chlorophenol	30	*<220.9*	30	*<220.9*	30	*<74.0*	30	<1.48	30	<3.10	30	<3.10	-	-	30	<2.92	30	<4.23	30	<84.6
2,4-dichlorophenol	59	*<217.3*	59	*<217.3*	59	*<82.5*	59	<1.65	59	<2.81	59	<2.81	-	-	59	<3.21	59	<4.82	59	<96.4
2,4-dimethylphenol	171	<117.4	171	<117.4	171	<110.0	171	<2.20	171	<2.64	171	<2.64	-	-	171	<1.32	171	<7.07	171	<141.4
4,6-dinitro-o-cresol	310	<153.5	310	<153.5	310	<61.0	310	<1.22	310	<1.49	310	<1.49	-	-	310	<2.27	310	<4.69	310	<93.8
2,4-dinitrophenol	110	*<133.4*	110	*<133.4*	110	<56.6	110	<1.13	110	<2.21	110	<2.21	-	-	110	<2.64	110	<5.11	110	<102.2
2-nitrophenol	NS	<211.7	NS	<211.7	NS	<78.5	NS	<1.57	NS	<2.84	NS	<2.84	-	-	NS	<2.61	NS	<7.83	NS	<156.6
4-nitrophenol	4,100	<240.5	4,100	<240.5	4,100	<57.0	4,100	<1.14	4,100	<2.98	4,100	3.6	-	-	4,100	<2.03	4,100	<4.03	4,100	<80.6
p-chloro-m-cresol	15	*<227.1*	15	*<227.1*	15	*<82.5*	15	<1.65	15	<1.87	15	<1.87	-	-	15	<3.10	15	<4.05	15	*<81.0*
Pentachlorophenol	25.56	*<173.0*	42.69	<173.0	17.278	*<69.5*	25.041	<1.39	14.992	7.5	18.91	<1.47	-	-	10.65	<3.44	12.14	<7.36	23.56	*<147.2*
Phenol	37	*<182.8*	37	<182.8	37	*<67.0*	37	2.1	37	<2.30	37	<2.30	-	-	37	<1.84	37	<3.99	37	<79.8
2,4,6-trichlorophenol	2	*<246.7*	2	<246.7	2	*<94.5*	2	<1.89	2	*<2.60*	2	*<2.60*	-	-	2	*<3.28*	2	*<4.74*	2	*<94.8*

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4 Standard for total PCBs of 11 µg/L A&We and 19 µg/L PBC.
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SR049	Summer 2013		Winter 2013/14		Summer 2014		Winter 2014/15		Summer 2015		Winter 2015/16		Summer 2016[7]		Winter 2016/17		Summer 2017		Winter 2017/18	
SAMPLING DATE(S):	SWQS	7/21/13	SWQS	11/22/13	SWQS	8/1/14	SWQS	12/4/14	SWQS	7/31/15	SWQS	1/4/16	-	-	SWQS	11/3/16	SWQS	7/14/17	SWQS	1/9/18
Bases/Neutrals (µg/L) [2]																				
Acenaphthene	198	<69.0	198	<69.0	198	<51.5	198	<1.03	198	<0.35	198	<0.35	-	-	198	<1.02	198	<1.88	198	<37.6
Acenaphthylene	NS	<89.1	NS	<89.1	NS	<50.0	NS	<1.00	NS	<1.23	NS	<1.23	-	-	NS	<6.10	NS	<1.75	NS	<35.0
Anthracene	74	*<89.1*	74	*<89.1*	74	*<144.0*	74	<2.88	74	<0.44	74	<0.44	-	-	74	<1.96	74	<2.62	74	<52.4
Benz(a)anthracene	0.02	*<89.1*	0.02	*<89.1*	0.02	*<54.0*	0.02	*<1.08*	0.02	*<0.38*	0.02	*<0.38*	-	-	0.02	*<1.57*	0.02	*<1.96*	0.02	*<39.2*
Benzo(a)pyrene	0.02	*<96.3*	0.02	*<96.3*	0.02	*<188.5*	0.02	*<3.77*	0.02	*<1.41*	0.02	*<1.41*	-	-	0.02	*<3.12*	0.02	*<3.77*	0.02	*<75.4*
Benzo(b)fluoranthene	0.02	*<125.1*	0.02	<125.1	0.02	*<73.0*	0.02	*<1.46*	0.02	*<1.06*	0.02	*<1.06*	-	-	0.02	*<1.28*	0.02	*<2.17*	0.02	*<43.4*
Benzo(g,h,i)perylene	NS	<89.1	NS	<89.1	NS	<64.5	NS	<1.29	NS	<0.72	NS	<0.72	-	-	NS	<2.83	NS	<2.51	NS	<50.2
Benzo(k)fluoranthene	0.02	*<72.1*	0.02	*<72.1*	0.02	*<52.0*	0.02	*<1.04*	0.02	*<0.35*	0.02	*<0.35*	-	-	0.02	*<1.76*	0.02	*<2.33*	0.02	*<46.4*
Chrysene	0.02	*<76.2*	0.02	*<76.2*	0.02	*<70.5*	0.02	*<1.41*	0.02	*<0.46*	0.02	*<0.46*	-	-	0.02	*<1.08*	0.02	*<1.96*	0.02	*<39.2*
Dibenzo(a,h)anthracene	0.02	*<102.0*	0.02	*<102.0*	0.02	*<62.0*	0.02	*<1.24*	0.02	*<0.47*	0.02	*<0.47*	-	-	0.02	*<1.93*	0.02	*<6.04*	0.02	*<120.8*
1,2-dichlorobenzene	205	<13.9	205	<13.9	205	<88.0	205	<1.76	205	<1.04	205	<1.04	-	-	205	<0.58	205	<1.33	205	<0.30
1,3-dichlorobenzene	2,500	<58.2	2,500	<58.2	2,500	<87.0	2,500	<1.74	2,500	<0.47	2,500	<0.47	-	-	2,500	<0.52	2,500	<1.25	2,500	<0.25
1,4-dichlorobenzene	2,000	<54.1	2,000	<54.1	2,000	<78.0	2,000	<1.56	2,000	<1.28	2,000	<1.28	-	-	2,000	<0.50	2,000	<1.25	2,000	<0.29
3,3-dichlorobenzidine	0.03	*<1404.4*	0.03	*<1404.4*	0.03	*<303.0*	0.03	*<6.06*	0.03	*<11.60*	0.03	*<11.60*	-	-	0.03	*<23.45*	0.03	*<25.43*	0.03	*<508.6*
Diethyl phthalate	8,767	<97.8	8,767	<97.8	8,767	<118.5	8,767	<2.37	8,767	<0.36	8,767	<0.36	-	-	8,767	<1.07	8,767	<1.99	8,767	<39.8
Dimethyl phthalate	17,000	<92.2	17,000	<92.2	17,000	<121.0	17,000	<2.42	17,000	<0.47	17,000	<0.47	-	-	17,000	<0.58	17,000	<1.91	17,000	<38.2
Di-n-butyl phthalate	470	<114.8	470	<114.8	470	<92.5	470	<1.85	470	<0.31	470	<0.31	-	-	470	<1.37	470	<2.35	470	<47.0
2,4-dinitrotoluene	421	<105.6	421	<105.6	421	<106.0	421	<2.12	421	<0.26	421	<0.26	-	-	421	<1.30	421	<3.10	421	<62.0
2,6-dinitrotoluene	3,733	<129.8	3,733	<129.8	3,733	<56.0	3,733	<1.12	3,733	<0.38	3,733	<0.38	-	-	3,733	<1.39	3,733	<2.89	3,733	<57.8
Di-n-octyl phthalate	373,333	<148.3	373,333	<148.3	373,333	<55.0	373,333	<1.10	373,333	<1.28	373,333	<1.28	-	-	373,333	<1.67	373,333	<5.50	373,333	<110.0
1,2-diphenylhydrazine (as azobenzene)	NS	<120.0	NS	<120.0	NS	<335.0	NS	<6.70	NS	<1.06	NS	<1.06	-	-	NS	<7.46	NS	<2.15	NS	<43.0
Fluoranthene	28	*<92.2*	28	*<92.2*	28	*<67.5*	28	<1.35	28	<0.27	28	<0.27	-	-	28	<1.06	28	<3.08	28	*<61.6*
Fluorene	1,067	<79.3	1,067	<79.3	1,067	<240.5	1,067	<4.81	1,067	<0.29	1,067	<0.29	-	-	1,067	<0.51	1,067	<2.87	1,067	<57.4
Hexachlorobenzene	0.0003	*<71.6*	0.0003	*<71.6*	0.0003	*<61.5*	0.0003	*<1.23*	0.0003	*<0.34*	0.0003	*<0.34*	-	-	0.0003	*<0.47*	0.0003	*<1.57*	0.0003	*<31.4*
Hexachlorobutadiene	18	<17.0	18	<17.0	18	*<91.0*	18	<1.82	18	<1.67	18	<1.67	-	-	18	<0.41	18	<1.00	18	*<20.0*
Hexachlorocyclopentadiene	3.5	*<116.9*	3.5	*<116.9*	3.5	*<61.5*	3.5	<1.23	3.5	<1.53	3.5	<1.53	-	-	3.5	<2.16	3.5	*<6.10*	3.5	*<122.0*
Hexachloroethane	3.3	*<20.6*	3.3	*<20.6*	3.3	*<81.0*	3.3	<1.62	3.3	<1.23	3.3	<1.23	-	-	3.3	<0.54	3.3	<1.49	3.3	*<29.8*
Indeno(1,2,3-cd)pyrene	0.2	*<104.5*	0.2	*<104.5*	0.2	*<69.5*	0.2	*<1.39*	0.2	*<0.62*	0.2	*<0.62*	-	-	0.2	**4.1**[9]	0.2	*<6.11*	0.2	*<122.2*
Isophorone	961	*<72.6*	961	<72.6	961	<107.0	961	<2.14	961	<0.37	961	<0.37	-	-	961	<0.51	961	<1.77	961	<35.4
Naphthalene	1,524	<61.8	1,524	<61.8	1,524	<91.5	1,524	<1.83	1,524	<0.36	1,524	<0.36	-	-	1,524	<0.49	1,524	<1.54	1,524	<30.8
Nitrobenzene	138	<63.3	138	<63.3	138	<105.0	138	<2.10	138	<1.26	138	<1.26	-	-	138	<0.44	138	<1.80	138	<36.0
N-nitrosodimethylamine	0.03	*<61.8*	0.03	*<61.8*	0.03	*<50.0*	0.03	*<1.00*	0.03	*<1.13*	0.03	*<1.13*	-	-	0.03	*<0.54*	0.03	*<1.62*	0.03	*<32.4*
N-nitrosodi-n-propylamine	0.5	*<77.8*	0.5	*<77.8*	0.5	*<57.5*	0.5	*<1.15*	0.5	*<1.17*	0.5	*<1.17*	-	-	0.5	*<1.02*	0.5	*<1.65*	0.5	*<33.0*
N-nitrosodiphenylamine	6	*<156.6*	6	*<156.6*	6	*<178.5*	6	<3.57	6	<1.15	6	<1.15	-	-	6	<1.67	6	<3.13	6	*<62.6*

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SAMPLING DATE(S):	SWQS	7/21/13	SWQS	11/22/13	SWQS	8/1/14	SWQS	12/4/14	SWQS	7/31/15	SWQS	1/4/16	-	-	SWQS	11/3/16	SWQS	7/14/17	SWQS	1/9/18
Phenanthrene	30	<83.9	30	*<83.9*	30	*<69.5*	30	<1.39	30	<0.31	30	<0.31	-	-	30	<0.49	30	<3.02	30	*<60.4*
Pyrene	800	<84.5	800	<84.5	800	<193.0	800	<3.86	800	<0.67	800	<0.67	-	-	800	<3.21	800	<3.38	800	<67.6
1,2,4-trichlorobenzene	70	<16.5	70	<16.5	70	*<84.5*	70	<1.69	70	<1.04	70	<1.04	-	-	70	<0.55	70	<1.21	70	<24.2
Pesticides (µg/L) [2]																				
Aldrin	0.00005	*<0.046*	0.00005	*<0.016*	0.00005	*<0.027*	0.00005	*<0.027*	0.00005	*<0.012*	0.00005	*<0.012*	-	-	0.00005	*<0.019*	0.00005	*<0.013*	0.00005	*<0.013*
Alpha-BHC	0.005	*<0.038*	0.005	*<0.017*	0.005	*<0.021*	0.005	*<0.021*	0.005	*<0.058*	0.005	*<0.058*	-	-	0.005	*<0.010*	0.005	*<0.015*	0.005	**0.023**
Beta-BHC	0.02	*<0.095*	0.02	<0.093	0.02	*<0.072*	0.02	*<0.072*	0.02	*<0.063*	0.02	*<0.063*	-	-	0.02	*<0.049*	0.02	*<0.083*	0.02	*<0.083*
Gamma-BHC	1	0.062	1	<0.023	1	<0.034	1	<0.034	1	<0.058	1	<0.058	-	-	1	<0.019	1	<0.020	1	<0.020
Delta-BHC	1,600	<0.032	1,600	<0.018	1,600	<0.021	1,600	<0.021	1,600	<0.066	1,600	<0.066	-	-	1,600	<0.035	1,600	<0.012	1,600	<0.012
Chlordane	0.0008	*<0.16*	0.0008	*<0.20*	0.0008	*<0.14*	0.0008	*<0.14*	0.0008	*<0.36*	0.0008	*<0.36*	-	-	0.0008	*<0.61*	0.0008	*<0.029*	0.0008	*<0.029*
4,4'-DDT	0.0002	*<0.029*	0.0002	*<0.016*	0.0002	*<0.025*	0.0002	*<0.025*	0.0002	*<0.017*	0.0002	*<0.017*	-	-	0.0002	*<0.011*	0.0002	<0.020	0.0002	*<0.020*
4,4'-DDE	0.0002	*<0.034*	0.0002	*<0.018*	0.0002	*<0.010*	0.0002	*<0.010*	0.0002	*0.033*	0.0002	*<0.013*	-	-	0.0002	*<0.020*	0.0002	*<0.019*	0.0002	*<0.019*
4,4'-DDD	0.0002	*<0.023*	0.0002	*<0.014*	0.0002	*<0.031*	0.0002	*<0.031*	0.0002	*<0.021*	0.0002	*<0.021*	-	-	0.0002	*<0.021*	0.0002	*<0.023*	0.0002	*<0.023*
Dieldrin	0.00005	*<0.028*	0.00005	*<0.022*	0.00005	*<0.030*	0.00005	*<0.030*	0.00005	*<0.060*	0.00005	*<0.060*	-	-	0.00005	*<0.019*	0.00005	*<0.015*	0.00005	*<0.015*
Alpha-endosulfan	0.2	<0.034	0.2	<0.018	0.2	<0.018	0.2	<0.018	0.2	<0.072	0.2	<0.072	-	-	0.2	<0.018	0.2	<0.015	0.2	<0.015
Beta-endosulfan	0.2	<0.034	0.2	<0.013	0.2	<0.032	0.2	<0.032	0.2	<0.019	0.2	<0.019	-	-	0.2	<0.021	0.2	<0.014	0.2	<0.014
Endosulfan sulfate	0.2	<0.025	0.2	<0.014	0.2	<0.008	0.2	0.071	0.2	<0.016	0.2	0.080	-	-	0.2	<0.022	0.2	*0.021*	0.2	*0.048*
Endrin	0.004	*<0.035*	0.004	*<0.016*	0.004	*<0.017*	0.004	*<0.017*	0.004	*<0.023*	0.004	*<0.023*	-	-	0.004	*<0.042*	0.004	*<0.040*	0.004	*<0.040*
Endrin aldehyde	0.09	<0.038	0.09	*<0.023*	0.09	<0.032	0.09	*<0.032*	0.09	<0.026	0.09	<0.026	-	-	0.09	*<0.024*	0.09	<0.034	0.09	<0.034
Heptachlor	0.00008	*<0.035*	0.00008	*<0.018*	0.00008	*<0.027*	0.00008	***0.063***	0.00008	*<0.035*	0.00008	*<0.035*	-	-	0.00008	*<0.023*	0.00008	*<0.019*	0.00008	*<0.019*
Heptachlor epoxide	0.00004	*<0.032*	0.00004	*<0.020*	0.00004	*<0.008*	0.00004	*<0.008*	0.00004	*<0.062*	0.00004	*<0.062*	-	-	0.00004	*<0.020*	0.00004	*<0.016*	0.00004	*<0.016*
PCB-1242	[4]	<0.41	[4]	<0.55	[4]	<0.37	[4]	<0.37	[4]	<0.14	[4]	<0.14	-	-	[4]	<0.72	[4]	<0.33	[4]	<0.33
PCB-1254	[4]	<0.20	[4]	<0.29	[4]	<0.23	[4]	<0.23	[4]	<0.20	[4]	<0.20	-	-	[4]	<0.22	[4]	<0.17	[4]	<0.17
PCB-1221	[4]	<0.68	[4]	<0.86	[4]	<0.22	[4]	<0.22	[4]	<0.64	[4]	<0.64	-	-	[4]	<0.46	[4]	<0.36	[4]	<0.36
PCB-1232	[4]	<0.66	[4]	<0.34	[4]	<0.55	[4]	<0.55	[4]	<0.37	[4]	<0.37	-	-	[4]	<0.90	[4]	<0.40	[4]	<0.40
PCB-1248	[4]	<0.78	[4]	<0.28	[4]	<0.19	[4]	<0.19	[4]	<0.22	[4]	<0.22	-	-	[4]	<0.24	[4]	<0.21	[4]	<0.21
PCB-1260	[4]	<0.21	[4]	<0.23	[4]	<0.32	[4]	<0.32	[4]	<0.59	[4]	<0.59	-	-	[4]	<0.26	[4]	<0.34	[4]	<0.34
PCB-1016	[4]	<0.36	[4]	<0.33	[4]	<0.18	[4]	<0.18	[4]	<0.55	[4]	<0.55	-	-	[4]	<0.29	[4]	<0.33	[4]	<0.33
Toxaphene	0.0003	*<0.53*	0.0003	*<0.34*	0.0003	*<0.22*	0.0003	*<0.22*	0.0003	*<0.60*	0.0003	*<0.60*	-	-	0.0003	*<0.48*	0.0003	*<0.47*	0.0003	*<0.47*

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PART 10: ASSESSMENT OF MONITORING DATA

A. Stormwater Quality: Provide an evaluation of the sampling results for each outfall monitoring location, including an assessment of any improvements or degradation of stormwater quality from each drainage area. In the year 4, Annual Report, discuss possible explanations for stormwater quality trends, including the implementation of stormwater management practices to reduce the discharge of pollutants to and from the storm sewer system.

Escherichia Coli (*E. coli*) has been detected at concentrations greater than the applicable SWQS at all monitored outfalls throughout the permit term.

Total lead and dissolved copper have been observed consistently in elevated concentrations at all monitored outfalls. A few of the monitored outfalls occasionally have elevated detections of pesticides including 4,4' DDE, heptachlor, Alpha-BHC, and Aldrin.

A discussion of the historical exceedances by outfall is provided below. (Note: the data in the tables in Part 9 of this report begin in 2013, so exceedances that occurred early in the permit term included below are no longer present in Part 9.)

AC033

The primary land uses are open land and residential. The designated uses for the receiving water for this outfall, the ACDC, were modified this reporting year. Prior to 2018, the City was viewing AC033 as discharging to a Phoenix Area Canal. However, upon further review of the City's sampling locations during the ADEQ Triennial Review, it was decided that, since the ACDC is a diversion channel and not a canal, we utilize the standard for a tributary to New River, below Interstate 17 to confluence with Agua Fria River. As a result, we have updated the applicable uses for AC033 to include only aquatic and wildlife ephemeral (A&We) and partial body contact (PBC). Over the last decade, we had compared laboratory results to the Water Quality Standards for designated uses that include agricultural irrigation (AgI) and agricultural livestock watering (AgL), which resulted in a different set of parameters being above the standard.

IB008

Stormwater runoff from this outfall discharges to the Indian Bend Wash. Applicable designated uses are A&We and PBC. The dominant land use category in this area is residential. In addition to *E. coli* exceedances, elevated levels of dissolved copper and total lead have been detected. Endrin Aldehyde was detected once (2009).

SR003

The receiving water for SR003 is the Salt River. Designated uses include aquatic and wildlife effluent dependent water (A&Wedw), PBC, Fish Consumption (FC), AgI and AgL. Land use for this outfall is divided amongst residential, institutional, industrial, commercial, and open land. Elevated concentrations of dissolved copper, total lead, and pesticides, including heptachlor have been observed in this outfall, in addition to *E. coli*. Last year, dissolved zinc was reported at the SWQS for this outfall. The SWQS based on hardness is calculated at 79.75 mg/L and the summer lab result is 79.8 mg/L. This is such a close number that it is unclear how much could be attributed to rounding errors. That was the first occurrence of dissolved zinc at this outfall; thus, investigation is not necessary until another occurrence is documented.

SR030

This outfall discharges to the Salt River. Designated uses for this segment of the Salt River are the same as those listed for SR003. Primary land use categories are open land and residential, with some areas of industrial/commercial use. Total lead, dissolved copper, elevated *E. coli*, 4,4'-DDE (2013, 2014, and recent exceedance in Winter 2017/18), ammonia (2010), and hardness (2009 and 2010) concentrations have been observed in this area. This reporting year, the winter sample detected the presence of alpha-BHC at this outfall. That was the first occurrence of alpha-BHC at this outfall; thus, investigation is not necessary until another occurrence is documented. Last year, heptachlor was above the SWQS for this outfall. That was the first occurrence of heptachlor at this outfall; thus, investigation is not necessary until another occurrence is documented. Despite this, the City included this detection in the heptachlor investigation project completed this reporting year, and discussed below.

SR045

This outfall discharges stormwater to the Salt River. The designated uses for this segment of the Salt River are A&We and PBC. In addition to *E. coli* exceedances, elevated concentrations of total lead and dissolved copper have been reported for this outfall during the permit term. The properties in this area are primarily commercial and light industrial. Last year, pH was found to be slightly low in the winter sample. That was the first occurrence of low pH at this outfall; thus, investigation is not necessary until another occurrence is documented.

SR049

The receiving water for this outfall is the Salt River. The applicable designated uses are A&Wedw, PBC, FC, AgI and AgL. Elevated concentrations of dissolved copper, total lead, and pesticides, including heptachlor (2012 and 2014), high pH (2010), and dissolved zinc (2009) have been observed at this outfall, in addition to *E. coli*. This reporting year, the winter sample detected presence of alpha-BHC at this outfall. That was the first occurrence of alpha-BHC at this outfall; thus, investigation is not necessary until another occurrence is documented. Inspectors noted that this catchment area includes several agricultural properties, (used for grazing by horses, cows, goats, and sheep), along with newer residential areas and light industrial properties. Last year, it was reported that total zinc above the SWQS at this outfall; however, that was incorrect. The SWQS was inadvertently changed during word processing, and was corrected this year. To clarify, there have been no exceedances of zinc this outfall.

SC046

Skunk Creek Wash is the receiving water for this outfall, with designated uses of A&We and PBC. This area is primarily residential with some open land. SWQS exceedances for this outfall are limited to *E. coli*, dissolved copper, and total lead.

B. Water Quality Standards (SWQS): Compare the sampling results for each outfall monitoring location with the applicable SWQS for the receiving water.

The applicable SWQS for each monitoring station are dependent upon the designated uses for the specific receiving water. Prior to 2018, the City was viewing AC033 as discharging to a Phoenix Area Canal. However, upon further review, it was decided that ACDC is a tributary to New River, below Interstate 17 to confluence with Agua Fria River. As a result, we have updated the applicable uses for AC033 as being A&We and PBC, only. Table 10-1 includes the designated uses for each monitoring location:

Table 10-1 Designated Uses for Monitoring Locations

Outfall	Receiving Water	Designated Uses
AC033	ACDC, Skunk Creek, New River	A&We, PBC
IB008	Indian Bend Wash	A&We, PBC
SR003	Salt River at 35th Avenue	A&Wedw, PBC, FC, AgI, and AgL
SR030	Salt River at 27th Avenue	A&Wedw, PBC, FC, AgI, and AgL
SR045	Salt River at 40th Street	A&We, PBC
SR049	Salt River at 67th Avenue	A&Wedw, PBC, FC, AgI, and AgL
SC046	Skunk Creek Wash	A&We, PBC

AgI = Agricultural Irrigation
AgL = Agricultural Livestock Watering
A&We = Aquatic and Wildlife, Ephemeral
A&Wedw =Aquatic and Wildlife, Effluent Dependent Water (acute)
PBC = Partial Body Contact
FC = Fish Consumption

The analytical results reported were compared to the lowest applicable standard, as documented in Part 9.

C. Exceeding a SWQS: Note any exceedance of a surface water quality standard (as measured at the outfall) during the reporting year, including, at a minimum, the following information:

1. Sampling dates: See Table 10-2
2. Monitoring location (outfall identification number): See Table 10-2
3. Receiving water and surface water quality standard exceeded: See Table 10-2
4. Outfall monitoring results (laboratory reports): See Table 10-2 and Part 13

Table 10-2 Analytical Results Exceeding SWQS for Reporting Year 2017/18

Outfall	Sample Date	Parameter	Desig Use	SWQS	Result	Unit
AC033	7/16/17	Copper (D)	A&We	15.41	51.8	mg/L
	7/16/17	E. coli	PBC	575	10,140	MPN
	7/16/17	Lead (T)	PBC	15	32.2	mg/L
	1/9/18	E. coli	PBC	575	3,310	MPN
	1/9/18	Lead (T)	PBC	15	25.2	mg/L
	1/9/18	Copper (D)	A&We	7.2	16.2	mg/L
IB008	7/16/17	Copper (D)	A&We	19.32	34.5	ug/L
	7/16/17	E. coli	PBC	575	1,986.30	MPN
	7/16/17	Lead (T)	PBC	15	41.5	ug/L
	12/17/17	Copper (D)	A&We	16.93	28.4	mg/L
	12/17/17	E. coli	PBC	575	20,350	MPN
SC046	7/16/17	Copper (D)	A&We	15.1	31.6	ug/L
	7/16/17	E. coli	PBC	575	1,553.10	MPN
SR003	7/24/17	Copper (D)	A&Wedw	5.41	18	ug/L
	7/24/17	E. coli	PBC	575	104,620	MPN
	7/24/17	Lead (T)	PBC	15	28	ug/L
	1/9/18	Copper (D)	A&Wedw	8.62	19.5	mg/L
	1/9/18	E. coli	PBC	575	4,140	MPN
	1/9/18	Lead (T)	PBC	15	28.7	mg/L
SR030	7/24/17	Copper (D)	A&Wedw	5.73	13.4	ug/L
	7/24/17	E. coli	PBC	575	20,140	MPN
	1/9/18	Copper (D)	A&Wedw	7.73	28.5	mg/L
	1/9/18	E. coli	PBC	575	1,986.30	MPN
	1/9/18	Lead (T)	PBC	15	49.3	mg/L

Outfall	Sample Date	Parameter	Desig Use	SWQS	Result	Unit
	1/9/18	DDE	FC	0.0002	0.076	ug/L
	1/9/18	Alpha-BHC	FC	0.005	0.036	ug/L
SR045	7/16/17	E. coli	PBC	575	17,230	MPN
	7/16/17	Lead (T)	PBC	15	50.4	ug/L
	2/14/18	E. coli	PBC	575	14,390	MPN
	2/14/18	Lead (T)	PBC	15	50	mg/L
	2/14/18	Copper (D)	A&We	34.51	70.6	ug/L
SR049	7/14/17	Copper (D)	A&Wedw	7.95	13.2	ug/L
	7/14/17	E. coli	PBC	575	141,360	MPN
	1/9/18	Copper (D)	A&Wedw	9.46	22.8	mg/L
	1/9/18	E. coli	PBC	575	4,040	MPN
	1/9/18	Lead (T)	PBC	15	19.6	mg/L
	1/9/18	Alpha-BHC	FC	0.005	0.023	ug/L
ug/L-micrograms per liter; mg/L-milligrams per liter; MPN-most probable number; mL-milliliter; D-dissolved; T-total; SU-standard units						

5. A description of the circumstances that may have caused or contributed to the exceedance of an applicable surface water quality standard:

All monitoring stations showed elevated *E. coli* levels in one season, or both. These exceedances seem to be independent of predominant land uses and varied from site to site and season to season. For example, at IB008, the range has been from 1,986-2,650 most probable number (MPN) since 2013 in both seasons, yet, the winter sample this year exceeded 20,000 MPN. AC033 has had inconsistent results from MPN: 1,610 to 2,419, to 3,310, 6,500, 9,590, 10,140, and extreme at 57,940 MPN. SR003, SR030, SR045, and SR049 had similar fluctuations. In contrast, SC046 was uncharacteristically low at 461 MPN, whereas historically, the range is predominantly 1,046-2,419 MPN. E. *coli* can be associated with pets, humans, and wildlife, such as birds, rodents, and mammals. It can accumulate between rain events causing results to be elevated locally.

Dissolved copper was elevated at all outfalls. Copper is a common component in pesticides, fungicides, and insecticides. This includes algaecides commonly used in pools, spas, and fountains. Copper is also used in automotive parts such as brake pads, brake linings, and moving engine parts. Consequently, sources of elevated copper could include automotive repair shops, roadway run-off, and pool backwashing.

All monitoring stations, except SC046, showed elevated lead levels. Lead is used in automotive parts, including tires and batteries. Lead-based paint is sometimes used on buildings and road stripping, and lead was a common additive in gasoline until the 1970's and early 1980's. Therefore, sources of elevated lead could include automotive repair shops, lead tire weights, roadway runoff, and lead-containing sediment deposited in the past from automotive exhaust.

Heptachlor has historically been detected in four of the City's outfalls, all associated with the Salt River. Levels are elevated downstream of the airport, where the designated use of fish consumption is applied. Stormwater runoff has exceeded the fish consumption designated use, 0.00008 ug/L, at SR030, SR003, and SR049, though there were no exceedances of heptachlor this reporting year. Heptachlor, an organochlorine compound (and a component of technical grade chlordane), was widely used as an insecticide prior to 1974 when it was banned in most countries. It remains available for use, when registered with the Arizona Department of Agriculture for fire ant control in pad mounted transformers, cable television boxes, and telephone cable boxes located underground. In response to an ADEQ inquiry in January 2017, the City undertook an investigation to 1) verify the parameter is in fact heptachlor, and 2) find potential sources. It was determined that the results were false positives, attributed to the method limitations. Refer to the Heptachlor Investigation Report in the attachments for additional information.

Alpha-BHC, a byproduct of an historic pesticide, lidane, was detected this year at SR030 and SR049; yet, not at the outfall in between these (SR003). These two outfalls occur on opposite sides of the river nearly 20 miles apart. It is possible that this chemical product was identified due to method limitations, and not because it is truly present. However, since this is a new detection at each location, the City will not perform a full evaluation until another occurrence for this analyte is detected at one or both of these sites.

DDE, also an organochloride that was historically used as an insecticide, was detected this year at SR030. It has been detected previously (2013 and 2014). Because of recent findings in an evaluation of the presence of heptachlor in samples, it seems prudent to first request quality control documents for all laboratory work associated with these occurrences.

6. If a pollutant is noted at levels above the SWQS at a particular outfall, more than 1X ('reoccurs'), describe actions taken to determine the source(s) of the pollutant per Sections 4.3 and 4.4 of the permit. Also state any proposed follow-up actions or additional and/or revised management practices or pollution controls to prevent the discharge from causing or contributing to an exceedance of a surface water quality standard in the future:

The City follows an internal Standard Operating Procedure (COP #6004) "Stormwater Quality Evaluation and Action Plan," to identify the source of pollutants. The purpose of the procedure is to ensure compliance with Sections 4.2, 4.4, and 8.3 of the MS4 Permit. The procedure discusses how a SWQS exceedance is identified, assigns the responsibility for attempting to identify potential sources of the pollutant(s) of concern and evaluating existing BMPs that may require revision to address the issue(s), provides a schedule for implementation, and outlines the requirements for reporting the occurrence to ADEQ.

This reporting year, the City identified recurring exceedances of *E. coli* at all monitoring stations in one season, or both. The city identified recurring exceedances for total lead at six of the seven monitoring stations. The city also identified all monitoring stations with recurring exceedances of dissolved copper this year. 4’4’DDE was detected this year, after having been absent from samples since 2014.

The first step in evaluating each exceedance was to research potential sources of these pollutants in stormwater. A summary of these findings is discussed in Part 10, Section C.5. Water Quality Inspectors were provided with a summary of the potential sources, along with information on the catchment area for each outfall in question. The inspectors then drove through each catchment area, looking for any obvious causes of the exceedances. In most situations, the inspectors were unable to confirm a specific source of the elevated levels. A summary of their findings is included below:

SC046

Samples at this outfall contained pollutants in exceedance of the SWQS for *E. coli* and dissolved copper.

E. coli
Abundant wildlife was observed (quail, doves, pigeons, roadrunner, various songbirds, rabbits, ground squirrels, and lizards). Ample evidence of domestic animal (dog) waste was found on sidewalks and trails. Both would contribute to elevated *E. coli* in the sampled runoff.

Copper
During the investigation, it was noted that landscaping is primarily rock; some has blueish-green hue; and a mountainous drainage area, including a natural wash, could be the source of naturally occurring copper. Additional sources could be from automotive brake pads of numerous cars observed in driveways and on streets.

IB008

Samples at this outfall contained pollutants in exceedance of the SWQS for *E. coli,* total lead, and dissolved copper. Investigation pending.

AC033

Samples at this outfall contained pollutants in exceedance of the SWQS for *E. coli,* total lead, and dissolved copper. Investigation pending.

SR003

Samples at this outfall contained pollutants in exceedance of the SWQS for *E. coli*, total lead, and dissolved copper.

E. coli
A possible source of e-coli may be goats that are kept on a palm tree orchard located on southwest corner of Buckeye and 35th Avenue (irrigated property).

Lead and Copper
The lead and copper exceedances may be the result of the high traffic and trucking in this area, as well as heavy industry. Active construction may have contributed to overall pollutant levels.

SR030

Samples at this outfall contained pollutants in exceedance of the SWQS for *E. coli*, total lead, dissolved copper, DDE, and Alpha-BHC.

E. coli
Possible sources are the wildlife and domestic animals around the parks, neighborhood, and industrial areas.

Copper
This drainage area is 75% industrial and 25% residential. The main source of copper may include vehicle brake pads, vehicle fluids, leaks, dumping, soil erosion and the deposition of copper air emissions.

Lead
Investigation pending.

DDE
Investigation pending.

Alpha-BHC
First detection at this location. No investigation required.

SR045

Samples at this outfall contained pollutants in exceedance of the SWQS for total lead, dissolved copper, and *E. coli*.

E. coli
The north border of this catchment is the Salt River, which is the home of wildlife and transient, human populations. Animal feces, runoff from the transfer station, and homeless activity could contribute to the elevated E. *coli* in runoff.

Lead
The area is dense with industrial, commercial, construction, auto body, auto repair, and waste transfer and recycling facilities. It’s a high traffic area adjacent to businesses and major transportation, and includes numerous potential sources, such as wood, oil or coal combustion, refuse incineration, fertilizers, heavy industry, industrial part cleaning operations, and junkyards.

Copper
Investigation pending.

SR049

Samples at this outfall contained pollutants in exceedance of the SWQS for *E. coli*, total lead, dissolved copper, and Alpha-BHC.

E. coli
There is a cattle feed lot and several residences with livestock (including goats and horses), as well as various wildlife in the vicinity. Pet waste was also observed.

Copper
Moderate vehicular traffic was observed, and there is construction of the 202 highway within this drainage area and a lot of construction traffic was observed.

Lead
Investigation pending.

Alpha-BHC
First detection at this location. No investigation required.

7. A schedule for implementing the proposed follow-up, stormwater or non-stormwater management practices or pollution controls:

As described above, city inspectors conducted thorough visual reconnaissance of each catchment area, searching for potential sources of the elevated levels. No obvious cause of the elevated constituents was identified.

The potential sources for these pollutants are varied. *E. coli* can come from a variety of sources, including pet waste and bird droppings. Though the city cannot control wild birds, the PWD does enforce pet waste requirements. Phoenix City Code, Chapter 27, Section 27-12 requires all animal owners and custodians to immediately clean up and properly dispose of animal waste left on any public street, alley, gutter, sidewalk, right-of-way, or park. Staff hangs notices on doorknobs to educate the public regarding the need to clean up and properly dispose of pet wastes. The door hangers or similarly worded placards are posted at public facilities such as parks, libraries, and other locations. Pet waste bags are also provided at city parks.

Lead and copper can come from a variety of residential, commercial, and industrial sources. Therefore, the City has decided to use these chemical constituents as one criterion to prioritize industrial facility inspections. Thirty-six facilities were identified through EPA Tier II reports as using or storing large quantities of copper and/or lead on site. In addition, approximately 1,600 facilities were identified through an SIC code search as potentially using these chemicals. These facilities, along with permit-required facilities, make up the ‘high priority’ industrial facility inventory. Inspections of these facilities are ongoing, and will continue throughout the permit term.

The City hired a consultant to assist with an investigation of elevated heptachlor levels. Past data was reviewed and preliminary findings indicate that most of the detections cannot be confirmed, indicating possible false positive results. See the attached Heptachlor Investigation Report for additional information.

The City will continue to evaluate reduction strategies for these pollutants. However, metals such as lead and copper can come from automotive sources such as dust from brake pads, rubber tires, lead tire weights, and engine exhaust. Since these sources are ubiquitous, they may be best controlled at the state or national level.

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PART 11: ESTIMATE OF ANNUAL POLLUTANT LOADINGS

Provide an estimate of the pollutant loadings each year from the municipal storm sewer system to waters of the U.S. for each constituent listed in Section 7.4 of the permit detected by stormwater monitoring within the permit term. Pollutant loadings and event mean concentrations may be estimated from sampling data collected at the representative monitoring locations, taking into consideration land uses and drainage areas for the outfall. Include a description of the procedures for estimating pollutant loads and concentrations, including any modeling, data analysis, and calculation methods. Compare the pollutant loadings estimated each year to previous estimates of pollutant loadings.

Seasonal and annual pollutant load estimates were developed for all of the City's twelve stormwater sub-watersheds (Table 11 -1). Winter, summer, and total annual loads were computed for all water quality parameters where sufficient validated data is available. As in past years, results from the City's monitoring data were used to correlate pollutant concentrations with land uses for twelve stormwater sub-watersheds in Phoenix. Where data were insufficient to perform this evaluation, information from past annual reports was used. The "Simple Method" as described in USEPA's guidance documents was used in performing this analysis[1].

Table 11-1Seasonal and Total Annual Pollutant Load

Constituent	Summer (pounds)	Winter (pounds)	Total Annual (pounds)
BOD_5	666,398	338,055	1,004,453
COD	3,238,335	1,650,921	4,889,256
TDS	3,662,543	1,853,400	5,515,942
Nitrogen, NO2 + NO3, Total	61,107	31,769	92,876
Nitrogen, Organic, Total Kjeldahl	91,858	44,211	136,068
Phosphorous, Total	12,046	6,035	18,082
Arsenic, Total	12,493	8,864	21,358
Antimony, Total	56.69	27.29	83.98
Barium, Total	3,275	1,571	4,846
Beryllium, Total	6.89	3.40	10.29
Cadmium, Total	91.44	43.83	135.26
Chromium, Total	496.49	253.77	750.26
Copper, Total	1,233	584.08	1,817
Lead, Total	702.46	348.48	1,051
Mercury, Total	16.29	8.46	24.76
Nickel, Total	567.56	285.84	853.39
Selenium, Total	95.69	49.91	145.59
Silver, Total	13.0	6.50	19.5
Thallium, Total	4.0	2.25	6.2
Zinc, Total	4,160	2,105	6,265

1 *Guidance Manual for the Preparation of Part 2 of the NPDES Permit Applications for Discharges from Municipal Separate Storm Sewer System, November 1992.*

The following methodology was used in developing pollutant loads:

In the Part 1 MS4 NPDES Permit Application, the City was divided into 13 stormwater sub-watersheds, based upon outfall locations that impacted specific water conveyance structures or tributaries of the Salt River. This division of the permit area was followed until the last AZPDES permit application in 2012. Through annexation, the City had acquired by this time substantial new undeveloped land, primarily in the north. In order to integrate this new land into the load calculation and to provide a consistent basis for analysis, a watershed-based approach was developed.

City GIS staff acquired County land-use spatial data and combined them with sub-watershed boundaries developed by the Maricopa County Flood Control District (MCFCD 2013). These sub-watershed boundaries are very similar to the Watershed Boundary Dataset 10-digit Hydrologic Unit Code (HUC), with exceptions made for local flood control and other man-made diversions (for example, White Tanks A Basin). Clipping these data to the City permit boundaries produced a watershed-based, land-use map that was used to define 12 new areas, now sub-watersheds, used in the pollutant load estimate.

For the purposes of this model, four land-uses were defined from the data: Industrial, Commercial, Residential, and Open Space. The Part 1 application demonstrated that, on a city-wide scale, these four land-use types provide the strongest distinction in stormwater composition.

The Part 1 application also developed pollutant-specific, rainfall-event-normalized, stormwater loading factors for each of the four land-use categories. These factors, called *event-mean concentrations* or EMCs, represent the concentration of each pollutant of concern in the runoff from the four land-use types. The concentration is normalized to the amount of rainfall in the sampling event to accommodate the dynamic nature of runoff chemistry, including a first flush of pollutant buildup between events.

Rainfall/runoff estimates were generated from data collected by the fifty-six Maricopa County Flood Control District (MCFCD) ALERT meteorological stations. Stations were located on GIS projections and rainfall records spatially correlated to each of the twelve sub-watersheds. Monthly rainfall depths were averaged by subwatershed for the summer (June 2017 to October 2017) and winter (November 2017 to May 2018) total amounts for the permit year.

Rainfall was translated to runoff as part of the load calculation, using Schuler (1987),

$$R = P_j\,(P)(R_v)(A)$$

where, P = rainfall depth (inches)

P_j = fraction of events that produce runoff (0.9)

R_v = runoff coefficient

A = sub-watershed area (acres)

Sub-watershed areas were measured from GIS projections. Runoff coefficients that were utilized for each land use are as follows (developed specially for Phoenix under the 2001 Permit Renewal Application effort):

Industrial: 0.053

Commercial: 0.745

Residential: 0.236

Open Space: 0.04

The current AZPDES permit indicates that, if possible, annual monitoring data be used to generate concentration factors in the load model. As in past years, EMCs were taken from the COP Part 1 NPDES MS4 characterization data. These values were compared to USGS monitoring results (Table 11.2) from representative storms.

As in the previous year, several elemental pollutants of concern were not routinely found in Phoenix stormwater at levels above method detection limits. This result over the permitted years has made it difficult to develop valid EMCs for three pollutants of concern: silver, beryllium and thallium. For the 2017 permit year, it was decided that sufficient data was available to calculate a load for these pollutants of concern and they are included in Tables 11.1 to 11.14. The new EMCs are highlighted in red in Table 11.2 and can be compared to the 2017 monitoring data, also highlighted in red.

EMCs were determined for each land-use type and pollutant of concern, as possible (Table 11.2). For each of the twelve stormwater sub-watersheds, EMCs were weighted by the percentage of land-use type, or

$$
\begin{aligned}
EMC_{k,\,j} = \; & (EMC_{j,\,industrial} * \%\, area_{k,\,industrial}) + \\
& (EMC_{j,\,commercial} * \%\, area_{k,\,commercial}) + \\
& (EMC_{j,\,residential} * \%\, area_{k,\,residential}) + \\
& (EMC_{j,\,open\ space} * \%\, area_{k,\,open\ space})
\end{aligned}
$$

where, $EMC_{k,\,j}$ = event mean concentration for the kth sub-watershed and the jth pollutant

Thus, each sub-watershed has a unique EMC for each pollutant, dependent upon land use.

For each of the twelve stormwater sub-watersheds, total runoff was calculated for the summer and winter seasons. These volumes were multiplied by the EMCs and the seasonal load was calculated (Tables 11.3-11.14). Seasonal loads were added to give the annual load per pollutant per sub-watershed. Summation over the twelve stormwater sub-watersheds produced the estimated annual load to the Salt River from stormwater for each pollutant over the permit year.

Table 11-2 Land-Use Based Event Mean Concentrations

Pollutants	2017/18 data (ave all sites)[1]	EMC_O	EMC_R	EMC_I	EMC_C
BOD_5 (mg/L)	84.62	31	12	55.33	0
COD High Level (mg/L)	393.57	130	42.25	68.83	148
Residue, Total at 105 Deg.C (TDS)	238	120	111	122.6	84
Nitrogen $NO_2 + NO_3$, Total, (mg/L as N)	1.48	3.12	1.24	1.14	0.7
Nitrogen Organic, Total Kjeldahl (mg/L as N)	6.93	0.11	5.19	7.24	1.67
Phosphorous, Total, (mg/L as P)	0.79	0.41	0.26	0.78	0.3
Arsenic, Total, (µg/L as As)	5.19	2.4	5.24	7.77	2.95
Antimony Total (µg/L as Sb)	3.30	0.643	1.96	4.81	2.12
Barium Total (µg/L as Ba)	162.96	20.04	170.2	311.3	35.61
Beryllium, Total Recoverable, (µg/L as Be)	0.45	0.20	0.12	0.22	0.39
Cadmium, Total Recoverable, (µg/L as Cd)	0.63	0	3.38	3.68	6.63
Chromium, Total Recoverable, (µg/L as Cr)	15.41	24.3	12.29	3.68	5.71
Copper, Total Recoverable, (µg/L as Cu)	81.15	29	23.25	203.7	15
Lead, Total Recoverable, (µg/L as Pb)	26.88	19.9	25.2	29.67	12.5
Mercury, Total Recoverable, (µg/L as Hg)	0.13	1.08	0.20	0.08	0.04
Nickel, Total Recoverable, (µg/L as Ni)	18.79	23.4	13.4	15.41	12.1
Selenium Total Recoverable, (µg/L as Se)	0.76	7.13	0.09	1.20	0.39
Silver, Total Recoverable, (µg/L as Ag)	0.28	0.45	0.37	0.42	0.32
Thallium Total Recoverable, (µg/L as Th)	0.19	0.20	0.21	0.042	0.21
Zinc, Total Recoverable, (µg/L as Zn)	334.64	96	108.7	345.6	135

NOTES: 1. Censored non detects included in mean as per USACOE 2008, Manual 1110-1-4014, ENVIRONMENTAL STATISTICS

2. Event mean concentrations from 2001 MS4 application, as modified by monitoring data to date. See text. O = open space land use, R = residential land use, I = industrial land use, C = commercial land use.

Event mean concentrations in red are new for this annual report. See text for explanation.

Table 11-3 Lower Arizona Canal Diversion Channel Watershed Pollutant Loadings

Total area, acres: 94,321 | Residential: 41.14% | Industrial: 13.58% | Undeveloped: 19.67% | Commercial: 25.60%

Total Summer (June-Oct) Runoff, cubic feet: 220,273,766 | Total Winter (Nov-May) Runoff, cubic feet: 89,427,882

Constituent	Land Use weighted concentrations	Summer Pollutant Load (pounds)	Winter Pollutant Load (pounds)	Total Annual Pollutant Load (pounds)
BOD_5 (mg/L)	18.55	255,092	103,564	358,656
COD High Level (mg/L)	90.20	1,240,334	503,557	1,743,892
Residue, Total at 105 Deg.C (TDS)	107.4	1,477,365	599,788	2,077,153
Nitrogen $NO_2 + NO_3$, Total, (mg/L as N)	1.46	20,050	8,140	28,190
Nitrogen Organic, Total Kjeldahl (mg/L as N)	3.57	49,080	19,926	69,005
Phosphorous, Total, (mg/L as P)	0.37	5,093	2,068	7,161
Arsenic, Total, (μg/L as As)	4.44	61.02	24.77	85.79
Antimony Total (μg/l as Sb)	2.13	29.27	11.89	41.16
Barium Total (μg/l as Ba)	125.3	1,724	699.92	2,424
Beryllium, Total Recoverable, (μg/L as Be)	0.22	2.99	1.21	4.20
Cadmium, Total Recoverable, (μg/L as Cd)	3.59	49.31	20.02	69.33
Chromium, Total Recoverable, (μg/L as Cr)	11.80	162.28	65.88	228.16
Copper, Total Recoverable, (μg/L as Cu)	46.78	643.22	261.14	904.36
Lead, Total Recoverable, (μg/L as Pb)	21.51	295.83	120.10	415.93
Mercury, Total Recoverable, (μg/L as Hg)	0.31	4.32	1.75	6.07
Nickel, Total Recoverable, (μg/L as Ni)	15.31	210.50	85.46	295.96
Selenium Total Recoverable, (μg/L as Se)	1.70	23.41	9.50	32.91
Silver, Total Recoverable, (μg/L as Ag)	0.377	5.19	2.11	7.29
Thallium Total Recoverable, (μg/L as Th)	0.19	2.59	1.05	3.64
Zinc, Total Recoverable, (μg/L as Zn)	145.1	1,995.74	810.24	2,805.9

Table 11-4 Upper Arizona Canal Diversion Channel Watershed Pollutant Loadings

Total area, acres: 63,903 Residential: 46.30% Industrial: 3.90% Undeveloped: 31.91% Commercial: 17.88%

Total Summer (June-Oct) Runoff, cubic feet: 84,940,685 Total Winter (Nov-May) Runoff, cubic feet: 57,728,505

Constituent	Land Use weighted concentrations	Summer Pollutant Load (pounds)	Winter Pollutant Load (pounds)	Total Annual Pollutant Load (pounds)
BOD_5 (mg/L)	17.61	93,366	63,455	156,821
COD High Level (mg/L)	90.20	478,312	325,077	803,390
Residue, Total at 105 Deg.C (TDS)	109.50	580,623	394,610	975,233
Nitrogen $NO_2 + NO_3$, Total, (mg/L as N)	1.74	9,224	6,269	15,493
Nitrogen Organic, Total Kjeldahl (mg/L as N)	3.02	16,022	10,889	26,910
Phosphorous, Total, (mg/L as P)	0.34	1,778	1,208	2,986
Arsenic, Total, (µg/L as As)	4.02	21.32	14.49	35.81
Antimony Total (µg/l as Sb)	1.68	8.91	6.05	14.96
Barium Total (µg/l as Ba)	103.72	550.01	373.81	923.82
Beryllium, Total Recoverable, (µg/L as Be)	0.20	1.04	0.70	1.74
Cadmium, Total Recoverable, (µg/L as Cd)	2.89	15.34	10.42	25.76
Chromium, Total Recoverable, (µg/L as Cr)	14.61	77.48	52.66	130.14
Copper, Total Recoverable, (µg/L as Cu)	30.65	162.52	110.45	272.97
Lead, Total Recoverable, (µg/L as Pb)	21.41	113.54	77.17	190.70
Mercury, Total Recoverable, (µg/L as Hg)	0.45	2.36	1.60	3.97
Nickel, Total Recoverable, (µg/L as Ni)	16.44	87.16	59.24	146.40
Selenium Total Recoverable, (µg/L as Se)	2.43	12.90	8.77	21.67
Silver, Total Recoverable, (µg/L as Ag)	0.39	2.04	1.39	3.43
Thallium Total Recoverable, (µg/L as Th)	0.20	1.08	0.73	1.82
Zinc, Total Recoverable, (µg/L as Zn)	118.6	628.98	427.48	1,056

Table 11-5 South Mountain Watershed Basin Pollutant Loadings

Total area, acres: 61,998 Residential: 27.30% Industrial: 4.37% Undeveloped 52.98% Commercial: 15.35%

Total Summer (June-Oct) Runoff, cubic feet: 110,822,145 Total Winter (Nov-May) Runoff, cubic feet: 31,392,779

Constituent	Land Use weighted concentrations	Summer Pollutant Load (pounds)	Winter Pollutant Load (pounds)	Total Annual Pollutant Load (pounds)
BOD_5 (mg/L)	22.12	153,033	43,350	196,383
COD High Level (mg/L)	106.1	734,276	208,000	942,276
Residue, Total at 105 Deg.C (TDS)	112.1	775,777	219,756	995,532
Nitrogen $NO_2 + NO_3$, Total, (mg/L as N)	2.15	14,866	4,211	19,078
Nitrogen Organic, Total Kjeldahl (mg/L as N)	2.05	14,184	4,018	18,202
Phosphorous, Total, (mg/L as P)	0.37	2,548	721.89	3,270
Arsenic, Total, (μg/L as As)	3.49	24.17	6.85	31.02
Antimony Total (μg/l as Sb)	1.41	9.76	2.77	12.53
Barium Total (μg/l as Ba)	76.16	526.91	149.26	676.16
Beryllium, Total Recoverable, (μg/L as Be)	0.21	1.43	0.40	1.83
Cadmium, Total Recoverable, (μg/L as Cd)	2.10	14.53	4.12	18.64
Chromium, Total Recoverable, (μg/L as Cr)	17.27	119.47	33.84	153.31
Copper, Total Recoverable, (μg/L as Cu)	32.92	227.76	64.52	292.28
Lead, Total Recoverable, (μg/L as Pb)	20.64	142.78	40.45	183.23
Mercury, Total Recoverable, (μg/L as Hg)	0.63	4.39	1.24	5.63
Nickel, Total Recoverable, (μg/L as Ni)	18.59	128.59	36.43	165.02
Selenium Total Recoverable, (μg/L as Se)	3.92	27.09	7.67	34.77
Silver, Total Recoverable, (μg/L as Ag)	0.40	2.79	0.79	3.58
Thallium Total Recoverable, (μg/L as Th)	0.20	1.39	0.39	1.79
Zinc, Total Recoverable, (μg/L as Zn)	116.3	805.17	228.08	1,033

Table 11-6 Upper Indian Bend Wash Watershed Pollutant Loadings

Total area, acres: 17,187 | Residential: 12.38% | Industrial: 2.10% | Undeveloped: 70.78% | Commercial: 14.73%

Total Summer (June-Oct) Runoff, cubic feet: 15,753,993 | Total Winter (Nov-May) Runoff, cubic feet: 14,467,953

Constituent	Land Use weighted concentrations	Summer Pollutant Load (pounds)	Winter Pollutant Load (pounds)	Total Annual Pollutant Load (pounds)
BOD_5 (mg/L)	24.59	24,185	22,210	46,395
COD High Level (mg/L)	120.5	118,511	108,837	227,348
Residue, Total at 105 Deg.C (TDS)	113.6	111,760	102,637	214,397
Nitrogen $NO_2 + NO_3$, Total, (mg/L as N)	2.49	2,448	2,248	4,696
Nitrogen Organic, Total Kjeldahl (mg/L as N)	1.12	1,102	1,012	2,115
Phosphorous, Total, (mg/L as P)	0.38	376.66	345.91	722.57
Arsenic, Total, (µg/L as As)	2.94	2.90	2.90	5.79
Antimony Total (µg/l as Sb)	1.11	1.09	1.09	2.19
Barium Total (µg/l as Ba)	47.04	46.27	46.27	92.53
Beryllium, Total Recoverable, (µg/L as Be)	0.22	0.21	0.20	0.41
Cadmium, Total Recoverable, (µg/L as Cd)	1.47	1.45	1.33	2.78
Chromium, Total Recoverable, (µg/L as Cr)	19.64	19.32	17.74	37.06
Copper, Total Recoverable, (µg/L as Cu)	29.89	29.40	27.00	56.40
Lead, Total Recoverable, (µg/L as Pb)	19.67	19.35	17.77	37.11
Mercury, Total Recoverable, (µg/L as Hg)	0.80	0.78	0.72	1.50
Nickel, Total Recoverable, (µg/L as Ni)	20.33	19.99	18.36	38.35
Selenium Total Recoverable, (µg/L as Se)	5.14	5.06	4.65	9.70
Silver, Total Recoverable, (µg/L as Ag)	0.42	0.41	0.38	0.79
Thallium Total Recoverable, (µg/L as Th)	0.20	0.20	0.18	0.38
Zinc, Total Recoverable, (µg/L as Zn)	108.56	106.77	98.06	204.83

Table 11-7 Middle Indian Bend Wash Watershed Pollutant Loadings

Total area, acres: 19,142 Residential: 64.54% Industrial: 0.35% Undeveloped: 70.78% Commercial: 12.69%
Total Summer (June-Oct) Runoff, cubic feet: 30,995,226 Total Winter (Nov-May) Runoff, cubic feet: 20,878,729

Constituent	Land Use weighted concentrations	Summer Pollutant Load (pounds)	Winter Pollutant Load (pounds)	Total Annual Pollutant Load (pounds)
BOD_5 (mg/L)	29.88	57,818	38,947	96,765
COD High Level (mg/L)	138.3	267,625	180,275	447,900
Residue, Total at 105 Deg.C (TDS)	167.6	324,427	218,537	542,964
Nitrogen $NO_2 + NO_3$, Total, (mg/L as N)	3.10	6,001	4,043	10,044
Nitrogen Organic, Total Kjeldahl (mg/L as N)	3.67	7,098	4,782	11,880
Phosphorous, Total, (mg/L as P)	0.50	965.17	650.15	1,615
Arsenic, Total, (μg/L as As)	5.48	10,603	7,142	17,745
Antimony Total (μg/l as Sb)	2.01	3.88	2.61	6.50
Barium Total (μg/l as Ba)	129.6	250.86	168.98	419.83
Beryllium, Total Recoverable, (μg/L as Be)	0.26	0.51	0.35	0.86
Cadmium, Total Recoverable, (μg/L as Cd)	3.03	5.87	3.95	9.82
Chromium, Total Recoverable, (μg/L as Cr)	25.87	50.06	33.72	83.78
Copper, Total Recoverable, (μg/L as Cu)	38.15	73.81	49.72	123.53
Lead, Total Recoverable, (μg/L as Pb)	32.04	61.99	41.76	103.76
Mercury, Total Recoverable, (μg/L as Hg)	0.90	1.73	1.17	2.90
Nickel, Total Recoverable, (μg/L as Ni)	26.80	51.86	34.93	86.79
Selenium Total Recoverable, (μg/L as Se)	5.16	9.98	6.72	16.71
Silver, Total Recoverable, (μg/L as Ag)	0.59	1.15	0.77	1.92
Thallium Total Recoverable, (μg/L as Th)	0.31	0.60	0.40	1.00
Zinc, Total Recoverable, (μg/L as Zn)	156.48	302.77	203.95	506.73

Table 11-8 Cave Creek Watershed Pollutant Loadings

Total area, acres: 18,009	Residential: 16.83%	Industrial: 0.28%	Undeveloped: 77.63%	Commercial: 5.26%
Total Summer (June-Oct) Runoff, cubic feet: 9,719,604	Total Winter (Nov-May) Runoff, cubic feet: 9,136,427			

Constituent	Land Use weighted concentrations	Summer Pollutant Load (pounds)	Winter Pollutant Load (pounds)	Total Annual Pollutant Load (pounds)
BOD_5 (mg/L)	26.24	15,921	14,966	30,887
COD High Level (mg/L)	116.0	70,393	66,169	136,563
Residue, Total at 105 Deg.C (TDS)	116.6	70,748	66,504	137,252
Nitrogen $NO_2 + NO_3$, Total, (mg/L as N)	2.67	1,621	1,523	3,144
Nitrogen Organic, Total Kjeldahl (mg/L as N)	1.07	649.05	610.10	1,259
Phosphorous, Total, (mg/L as P)	0.38	230.57	216.74	447.31
Arsenic, Total, (μg/L as As)	2.92	1,773	1,666	3,439
Antimony Total (μg/l as Sb)	0.95	0.58	0.33	0.91
Barium Total (μg/l as Ba)	46.94	28.48	16.25	44.73
Beryllium, Total Recoverable, (μg/L as Be)	0.19	0.12	0.07	0.18
Cadmium, Total Recoverable, (μg/L as Cd)	0.93	0.56	0.32	0.88
Chromium, Total Recoverable, (μg/L as Cr)	21.24	12.89	7.35	20.24
Copper, Total Recoverable, (μg/L as Cu)	27.78	16.86	9.62	26.47
Lead, Total Recoverable, (μg/L as Pb)	20.43	12.40	7.07	19.47
Mercury, Total Recoverable, (μg/L as Hg)	0.87	0.53	0.30	0.83
Nickel, Total Recoverable, (μg/L as Ni)	21.10	12.80	7.30	20.11
Selenium Total Recoverable, (μg/L as Se)	5.58	3.38	1.93	5.31
Silver, Total Recoverable, (μg/L as Ag)	0.43	0.26	0.15	0.41
Thallium Total Recoverable, (μg/L as Th)	0.21	0.13	0.07	0.20
Zinc, Total Recoverable, (μg/L as Zn)	100.89	61.22	57.55	118.77

Table 11-9 Skunk Creek Watershed Pollutant Loadings

Total area, acres: 26,174 Residential: 19.12% Industrial: 1.15% Undeveloped: 59.46% Commercial: 20.26%
Total Summer (June-Oct) Runoff, cubic feet: 25,971,747
Total Winter (Nov-May) Runoff, Runoff, cubic feet: 23,992,049

Constituent	Land Use weighted concentrations	Summer Pollutant Load (pounds)	Winter Pollutant Load (pounds)	Total Annual Pollutant Load (pounds)
BOD_5 (mg/L)	21.36	34,640	32,000	66,640
COD High Level (mg/L)	116.16	188,342	173,986	362,328
Residue, Total at 105 Deg.C (TDS)	111.01	179,994	166,274	346,268
Nitrogen $NO_2 + NO_3$, Total, (mg/L as N)	2.25	3,644	3,366	7,010
Nitrogen Organic, Total Kjeldahl (mg/L as N)	1.48	2,402	2,219	4,622
Phosphorous, Total, (mg/L as P)	0.36	589.01	544.11	1,133
Arsenic, Total, (μg/L as As)	3.12	5.05	4.67	9.72
Antimony Total (μg/l as Sb)	1.24	2.01	1.86	3.87
Barium Total (μg/l as Ba)	55.26	89.60	82.77	172.37
Beryllium, Total Recoverable, (μg/L as Be)	0.22	0.36	0.33	0.69
Cadmium, Total Recoverable, (μg/L as Cd)	2.03	3.29	3.04	6.34
Chromium, Total Recoverable, (μg/L as Cr)	18.00	29.19	26.96	56.15
Copper, Total Recoverable, (μg/L as Cu)	27.07	43.89	40.55	84.44
Lead, Total Recoverable, (μg/L as Pb)	19.53	31.66	29.25	60.91
Mercury, Total Recoverable, (μg/L as Hg)	0.69	1.11	1.03	2.14
Nickel, Total Recoverable, (μg/L as Ni)	19.11	30.98	28.62	59.59
Selenium Total Recoverable, (μg/L as Se)	4.35	7.06	6.52	13.57
Silver, Total Recoverable, (μg/L as Ag)	0.40	0.66	0.61	1.26
Thallium Total Recoverable, (μg/L as Th)	0.21	0.33	0.31	0.64
Zinc, Total Recoverable, (μg/L as Zn)	109.21	177.07	163.57	340.65

Table 11-10 Upper New River Watershed Pollutant Loadings

Total area, acres: 30,056 Residential: 14.35% Industrial: 0.64% Undeveloped: 80.59% Commercial: 4.42%
Total Summer (June-Oct) Runoff, cubic feet: 17,431,284 Total Winter (Nov-May) Runoff, cubic feet: 10,894,553

Constituent	Land Use weighted concentrations	Summer Pollutant Load (pounds)	Winter Pollutant Load (pounds)	Total Annual Pollutant Load (pounds)
BOD_5 (mg/L)	27.06	29,447	18,404	47,851
COD High Level (mg/L)	117.81	128,201	80,126	208,326
Residue, Total at 105 Deg.C (TDS)	117.1	127,466	79,666	207,132
Nitrogen $NO_2 + NO_3$, Total, (mg/L as N)	2.73	2,971	1,857	4,829
Nitrogen Organic, Total Kjeldahl (mg/L as N)	0.96	1,041	650.59	1,692
Phosphorous, Total, (mg/L as P)	0.39	420.03	262.52	682.55
Arsenic, Total, (µg/L as As)	2.87	3.12	1.95	5.07
Antimony Total (µg/l as Sb)	0.92	1.01	0.63	1.63
Barium Total (µg/l as Ba)	44.15	48.04	30.02	78.06
Beryllium, Total Recoverable, (µg/L as Be)	0.19	0.21	0.13	0.34
Cadmium, Total Recoverable, (µg/L as Cd)	0.80	0.87	0.54	1.42
Chromium, Total Recoverable, (µg/L as Cr)	21.62	23.53	14.71	38.24
Copper, Total Recoverable, (µg/L as Cu)	28.68	31.21	19.50	50.71
Lead, Total Recoverable, (µg/L as Pb)	20.40	22.20	13.87	36.07
Mercury, Total Recoverable, (µg/L as Hg)	0.90	0.98	0.61	1.59
Nickel, Total Recoverable, (µg/L as Ni)	21.41	23.30	14.56	37.87
Selenium Total Recoverable, (µg/L as Se)	5.79	6.30	3.94	10.23
Silver, Total Recoverable, (µg/L as Ag)	0.43	0.47	0.29	0.76
Thallium Total Recoverable, (µg/L as Th)	0.21	0.22	0.14	0.36
Zinc, Total Recoverable, (µg/L as Zn)	101.15	68.80	110.08	178.87

Table 11-11 Lower New River Watershed Pollutant Loadings

Total area, acres: 1,395 | Residential: 37.20% | Industrial: 2.48% | Undeveloped: 53.59% | Commercial: 6.74%

Total Summer (June-Oct) Runoff, cubic feet: 1,904,217 | Total Winter (Nov-May) Runoff, cubic feet: 695,699

Constituent	Land Use weighted concentrations	Summer Pollutant Load (pounds)	Winter Pollutant Load (pounds)	Total Annual Pollutant Load (pounds)
BOD_5 (mg/L)	22.45	2,668	974.88	3,643
COD High Level (mg/L)	97.05	11,536	4,215	15,752
Residue, Total at 105 Deg.C (TDS)	114.2	13,585	4,964	18,549
Nitrogen $NO_2 + NO_3$, Total, (mg/L as N)	2.21	262.52	95.92	358.44
Nitrogen Organic, Total Kjeldahl (mg/L as N)	2.28	271.49	99.20	370.69
Phosphorous, Total, (mg/L as P)	0.36	42.31	15.46	57.77
Arsenic, Total, (µg/L as As)	3.63	0.43	0.16	0.59
Antimony Total (µg/l as Sb)	1.34	0.16	0.06	0.22
Barium Total (µg/l as Ba)	84.17	10.00	3.66	13.66
Beryllium, Total Recoverable, (µg/L as Be)	0.18	0.02	0.01	0.03
Cadmium, Total Recoverable, (µg/L as Cd)	1.79	0.21	0.08	0.29
Chromium, Total Recoverable, (µg/L as Cr)	18.07	2.15	0.78	2.93
Copper, Total Recoverable, (µg/L as Cu)	30.25	3.60	1.31	4.91
Lead, Total Recoverable, (µg/L as Pb)	21.62	2.57	0.94	3.51
Mercury, Total Recoverable, (µg/L as Hg)	0.66	0.08	0.03	0.11
Nickel, Total Recoverable, (µg/L as Ni)	18.72	2.23	0.81	3.04
Selenium Total Recoverable, (µg/L as Se)	3.91	0.46	0.17	0.63
Silver, Total Recoverable, (µg/L as Ag)	0.407	0.048	0.018	0.066
Thallium Total Recoverable, (µg/L as Th)	0.205	0.024	0.009	0.033
Zinc, Total Recoverable, (µg/L as Zn)	109.55	13.02	4.76	17.78

Table 11-12 Upper Agua Fria River Watershed Pollutant Loadings

Total area, acres: 492 | Residential: 0.00% | Industrial: 0.00% | Undeveloped: 100.00% | Commercial: 0.00%

Total Summer (June-Oct) Runoff, cubic feet: 88,663 | Total Winter (Nov-May) Runoff, cubic feet: 77,099

Constituent	Land Use weighted concentrations	Summer Pollutant Load (pounds)	Winter Pollutant Load (pounds)	Total Annual Pollutant Load (pounds)
BOD_5 (mg/L)	31.00	171.59	149.21	320.79
COD High Level (mg/L)	130.00	719.56	625.70	1,345
Residue, Total at 105 Deg.C (TDS)	120.0	664.21	577.57	1,242
Nitrogen $NO_2 + NO_3$, Total, (mg/L as N)	3.12	17.27	15.02	32.29
Nitrogen Organic, Total Kjeldahl (mg/L as N)	0.11	0.63	0.54	1.17
Phosphorous, Total, (mg/L as P)	0.41	2.27	1.97	4.24
Arsenic, Total, (μg/L as As)	2.40	0.01	0.01	0.02
Antimony Total (μg/l as Sb)	0.64	0.00	0.00	0.01
Barium Total (μg/l as Ba)	20.04	0.11	0.10	0.21
Beryllium, Total Recoverable, (μg/L as Be)	0.20	0.00	0.00	0.00
Cadmium, Total Recoverable, (μg/L as Cd)	0	0	0	0
Chromium, Total Recoverable, (μg/L as Cr)	24.30	0.13	0.12	0.25
Copper, Total Recoverable, (μg/L as Cu)	29.00	0.16	0.14	0.30
Lead, Total Recoverable, (μg/L as Pb)	19.90	0.11	0.10	0.21
Mercury, Total Recoverable, (μg/L as Hg)	1.08	0.01	0.01	0.01
Nickel, Total Recoverable, (μg/L as Ni)	23.40	0.13	0.11	0.24
Selenium Total Recoverable, (μg/L as Se)	7.13	0.04	0.03	0.07
Silver, Total Recoverable, (μg/L as Ag)	0.445	0.0025	0.0021	0.0046
Thallium Total Recoverable, (μg/L as Th)	0.2047	0.0011	0.0010	0.0021
Zinc, Total Recoverable, (μg/L as Zn)	96.00	0.46	0.53	0.99

Table 11-13 Lower Agua Fria River Watershed Pollutant Loadings

Total area, acres: 24 Residential: 0.00% Industrial: 89.39% Undeveloped: 10.61% Commercial: 0.00%
Total Summer (June-Oct) Runoff, cubic feet: 4,525
Total Winter (Nov-May) Runoff, cubic feet: 2,897

Constituent	Land Use weighted concentrations	Summer Pollutant Load (pounds)	Winter Pollutant Load (pounds)	Total Annual Pollutant Load (pounds)
BOD_5 (mg/L)	52.75	14.90	9.54	24.44
COD High Level (mg/L)	75.32	21.28	13.62	34.90
Residue, Total at 105 Deg.C (TDS)	122.3	34.55	22.13	56.68
Nitrogen $NO_2 + NO_3$, Total, (mg/L as N)	1.35	0.38	0.24	0.63
Nitrogen Organic, Total Kjeldahl (mg/L as N)	6.48	1.83	1.17	3.00
Phosphorous, Total, (mg/L as P)	0.74	0.21	0.13	0.34
Arsenic, Total, (µg/L as As)	7.20	0.00203	0.00130	0.00334
Antimony Total (µg/l as Sb)	4.37	0.00123	0.00079	0.00202
Barium Total (µg/l as Ba)	280.4	0.07920	0.05072	0.1299
Beryllium, Total Recoverable, (µg/L as Be)	0.22	0.00006	0.00004	0.00010
Cadmium, Total Recoverable, (µg/L as Cd)	3.29	0.00093	0.00060	0.00152
Chromium, Total Recoverable, (µg/L as Cr)	5.87	0.00166	0.00106	0.0027
Copper, Total Recoverable, (µg/L as Cu)	185.16	0.05230	0.03349	0.08579
Lead, Total Recoverable, (µg/L as Pb)	28.63	0.00809	0.00518	0.01327
Mercury, Total Recoverable, (µg/L as Hg)	0.19	0.00005	0.00003	0.00009
Nickel, Total Recoverable, (µg/L as Ni)	16.26	0.00459	0.00294	0.00753
Selenium Total Recoverable, (µg/L as Se)	1.83	0.00052	0.00033	0.00085
Silver, Total Recoverable, (µg/L as Ag)	0.425	0.00012	0.00008	0.0002
Thallium Total Recoverable, (µg/L as Th)	0.0593	0.000017	0.000011	0.000027
Zinc, Total Recoverable, (µg/L as Zn)	319.14	0.06	0.09	0.15

Table 11-14 White Tanks A Watershed Pollutant Loadings

Total area, acres: 39 | Residential: 0.00% | Industrial: 90.30% | Undeveloped: 4.26% | Commercial: 5.44%

Total Summer (June-Oct) Runoff, cubic feet: 13,137 | Total Winter (Nov-May) Runoff, cubic feet: 8,431

Constituent	Land Use weighted concentrations	Summer Pollutant Load (pounds)	Winter Pollutant Load (pounds)	Total Annual Pollutant Load (pounds)
BOD_5 (mg/L)	51.29	42.16	26.99	69.15
COD High Level (mg/L)	75.74	62.26	39.87	102.12
Residue, Total at 105 Deg.C (TDS)	120.4	98.97	63.37	162.34
Nitrogen $NO_2 + NO_3$, Total, (mg/L as N)	1.20	0.99	0.63	1.62
Nitrogen Organic, Total Kjeldahl (mg/L as N)	6.63	5.45	3.49	8.94
Phosphorous, Total, (mg/L as P)	0.74	0.61	0.39	1.00
Arsenic, Total, (µg/L as As)	7.28	0.01	0.00	0.01
Antimony Total (µg/l as Sb)	4.49	0.00	0.00	0.01
Barium Total (µg/l as Ba)	283.9	0.23	0.15	0.38
Beryllium, Total Recoverable, (µg/L as Be)	0.23	0.00	0.00	0.00
Cadmium, Total Recoverable, (µg/L as Cd)	3.69	0.00	0.00	0.00
Chromium, Total Recoverable, (µg/L as Cr)	4.67	0.00	0.00	0.01
Copper, Total Recoverable, (µg/L as Cu)	186.00	0.15	0.10	0.25
Lead, Total Recoverable, (µg/L as Pb)	28.32	0.02	0.01	0.04
Mercury, Total Recoverable, (µg/L as Hg)	0.12	0.00	0.00	0.00
Nickel, Total Recoverable, (µg/L as Ni)	15.57	0.01	0.01	0.02
Selenium Total Recoverable, (µg/L as Se)	1.41	0.00	0.00	0.00
Silver, Total Recoverable, (µg/L as Ag)	0.42	0.00034	0.00116	0.0015
Thallium Total Recoverable, (µg/L as Th)	0.06	0.00005	0.00034	0.00039
Zinc, Total Recoverable, (µg/L as Zn)	323.55	0.17	0.27	0.44

ASSESSMENT OF POLLUTANT LOADS

The City uses a pollutant load model that estimates individual pollutant loads by basin and season. As discussed at the end of Part 5 of this report, land use data obtained from the FCDMC is used because it is viewed as more accurate and consistent.

The load is a function of rainfall amounts in each basin, the areal percentage of four land-use classifications (undeveloped, residential, commercial and industrial) and a set of event mean concentrations (EMCs). For each of the City subwatersheds, the same land-use classifications, rainfall-runoff relationship, and EMCs have been used. The only variable has been the amount of rainfall. In this way, the load has decreased or increased as rainfall has changed from year to year and only reflects this variation.

Because rainfall and runoff in central Arizona follow a discontinuous and unpredictable pattern, especially during summer monsoon season when local convection patterns drive rainfall patterns, the volume of runoff observed at a specific outfall can vary by several orders of magnitude from year to year, and can vary just as much from one outfall location to another (i.e., rainfall associated with a specific storm event will vary widely across the COP system). Although some sampled outfalls may receive abundant runoff, precipitation may not occur at others. These factors skew data obtained via statistical analysis; thus efforts to identify overall patterns or trends in pollutant concentrations based on statistical analysis is not meaningful.

Table 11-15 contains a summary of the pollutant load data calculated for reporting years 2014 through the current reporting year. As discussed above, the data demonstrate that changes in pollutant load calculations vary strictly with rainfall volume.

Table 11-15 Pollutant Load Comparison 2014-2018

Constituent	Total Annual Pollutant Load 2013/14 (pounds)	Total Annual Pollutant Load 2014/15 (pounds)	Total Annual Pollutant Load 2015/16 (pounds)	Total Annual Pollutant Load 2016/17 (pounds)	Total Annual Pollutant Load 2017/18 (pounds)
BOD_5 (mg/L)	2,127,604	3,733,690	1,839,037	2,372,602	1,004,453
COD High Level (mg/L)	10,426,176	18,377,162	8,971,215	11,578,413	4,889,256
Residue, Total at 105 Deg.C (TDS)	11,704,768	20,634,575	10,081,558	12,988,914	5,515,942
Nitrogen NO2 + NO3, Total, (mg/L as N)	199,774	352,787	171,979	222,705	92,876
Nitrogen Organic, Total Kjeldahl (mg/L as N)	281,558	494,542	242,821	309,620	136,068
Phosphorous, Total, (mg/L as P)	38,294	67,305	32,947	42,339	18,082
Arsenic, Total, (mg/L as As)	404	726	43,969	57,037	21,358
Antimony Total (mg/l as Sb)	175	309	151	192	83.98
Barium Total (mg/l as Ba)	10,054	17,722	8,669	11,057	4,846
Beryllium, Total Recoverable, (mg/L as Be)	46	81.2	39.9	52.2	10.29
Cadmium, Total Recoverable, (mg/L as Cd)	280	492	241	309	135.26
Chromium, Total Recoverable, (mg/L as Cr)	1,610	2,844	1,395	1,812	750.26
Copper, Total Recoverable, (mg/L as Cu)	3,784	6,588	3,260	4,149	1,817
Lead, Total Recoverable, (mg/L as Pb)	2,220	3,908	1,920	2,474	1,051
Mercury, Total Recoverable, (mg/L as Hg)	54	94.9	46.6	60.7	24.76
Nickel, Total Recoverable, (mg/L as Ni)	1,819	3,206	1,574	2,037	853.39
Selenium Total Recoverable, (mg/L as Se)	317	560	275	359	145.59
Silver, Total Recoverable, (mg/L as Ag)	0	0.00	0.00	0.00	19.5
Thallium Total Recoverable, (mg/L as Th)	NC	NC	NC	NC	6.2
Zinc, Total Recoverable, (mg/L as Zn)	13,083	22,934	11,294	14,475	6,265
Total Annual Runoff (millions of cubic feet)	1,633.2	2,882.6	1,404.1	1,819.7	1,169,043
NC - A statistically representative event mean concentration for thallium could not be calculated as thallium occurs infrequently in stormwater samples regionally.					

PART 12: ANNUAL EXPENDITURES

Provide a brief statement of the expenditures incurred each reporting period (July 1-June 30) to implement and maintain the stormwater management program, including associated monitoring and reporting activities. This figure should include funds related exclusively to implementation of the stormwater program. Provide the estimated budget for implementing and maintaining the stormwater program in the subsequent reporting period. Include a statement of the funding sources used to support program expenditures.

Personnel from the City departments responsible for implementation of the stormwater program provided actual and estimated expenditure data for each fiscal year. The expenditures are included in Table 12-1.

Table 12-1 Annual Expenditures Stormwater Program Implementation

	Fiscal Year 2013	Fiscal Year 2014	Fiscal Year 2015	Fiscal Year 2016	Fiscal Year 2017	Fiscal Year 2018	Fiscal Year 2019 (estimated)
Street Transportation Department	$1,805,029	$2,407,926 (revised)	$1,886,898	$1,949,181	$2,464,300	$2,919,870	$2,589,435
Water Services Department	$1,646,649 (revised)	$1,947,736	$1,867,870	$1,702,105	$1,842,748	$1,792,284	$2,206,652
Planning and Development Department	$484,000	$487,100	$910,900	$1,288,398	$1,563,702	$1,846,831	$203,000
Office of Environmental Programs	$131,845 (revised)	$119,840 (revised)	$121,232 (revised)	$139,424	$132,627	$147,219	$167,674
Office of Environmental Programs – Capital Improvement Projects*	$232,556 (revised)	$231,076 (revised)	$240,854 (revised)	$231,716	$173,421	$99,276	$273,400
TOTALS	$4,300,079 (revised)	$5,193,678 (revised)	$5,027,754 (revised)	$5,310,824	$6,176,798	$6,805,480	$5,440,161

* Up to $250,000 in capital improvement project funding is made available each year, and used as necessary to ensure compliance and/or enhance the City's overall stormwater program. Revisions to prior year's expenditures are based on a recent re-evaluation of program expense tracking.

The City collects a stormwater fee to defray the costs of operating the stormwater management program. Stormwater program charges from the WSD, STD, and OEP are paid out of these funds. The fee does not cover the costs for maintenance of the storm drain system, infrastructure improvements, or other ancillary programs (e.g., HHW, street sweeping, etc.). Stormwater program costs for PDD are funded by construction permit fees.

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PART 13: ATTACHMENTS

Attach a copy of each of the following documents for the first year Annual Report, and each subsequent year if changes are made. If no changes are made to these during a reporting period, indicate, *'no changes were made this period, the 2009 submittal is current'.*

☒ Drainage System Maps

The City considers the storm drains to be protected critical infrastructure. As such, the City has not provided an electronic copy of the GIS maps as an attachment. GIS maps are available for review by ADEQ upon request. Hard copies of the drainage basin maps are provided.

☒ List of major outfalls

☒ List of changes to the major outfall inventory (new outfalls, outfalls out of service), including drainage area and coordinates for the outfalls listed in Table 1 of the permit (4^{th} year report).

☒ Laboratory reports for stormwater monitoring performed in the reporting period.

☐ New or revised ordinances associated with stormwater management.

☒ New or revised public outreach documents.

The following attachments to the Annual Report are in addition to those required as listed above:

☒ Heptachlor Investigation Report

☒ STORM Annual Report

☒ Cost Benefit Analysis

☒ Select Outreach Images

☒ Public Awareness Survey

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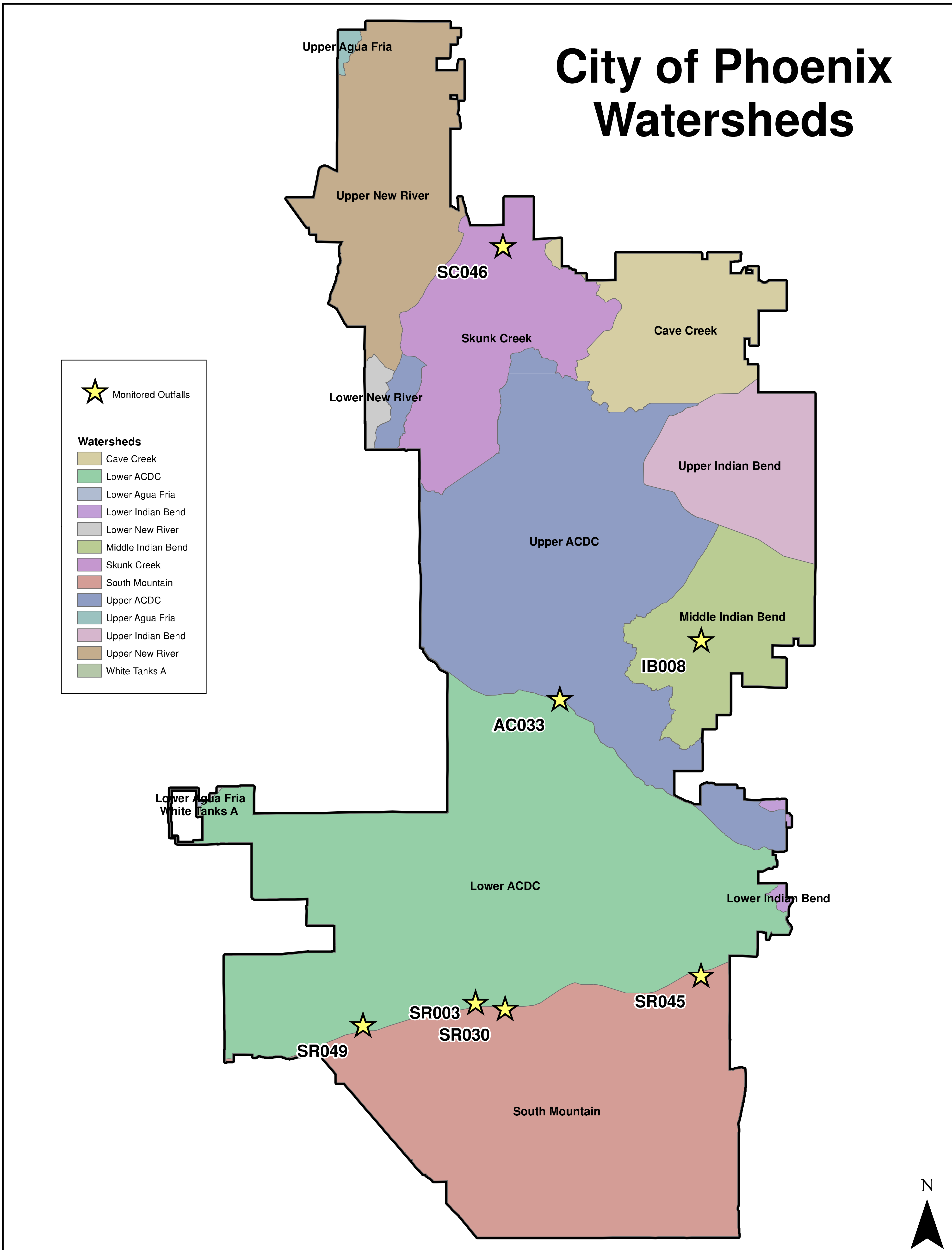
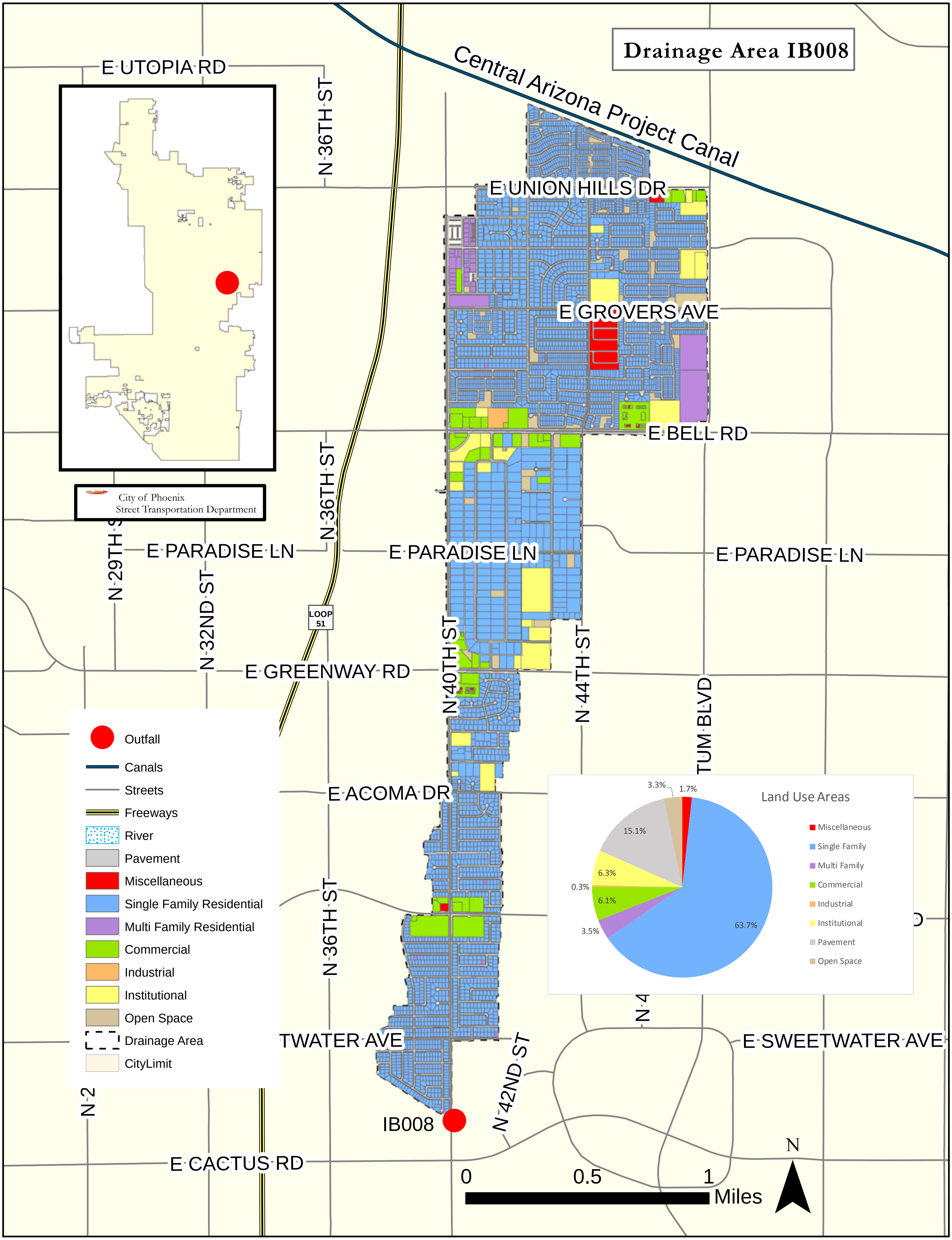
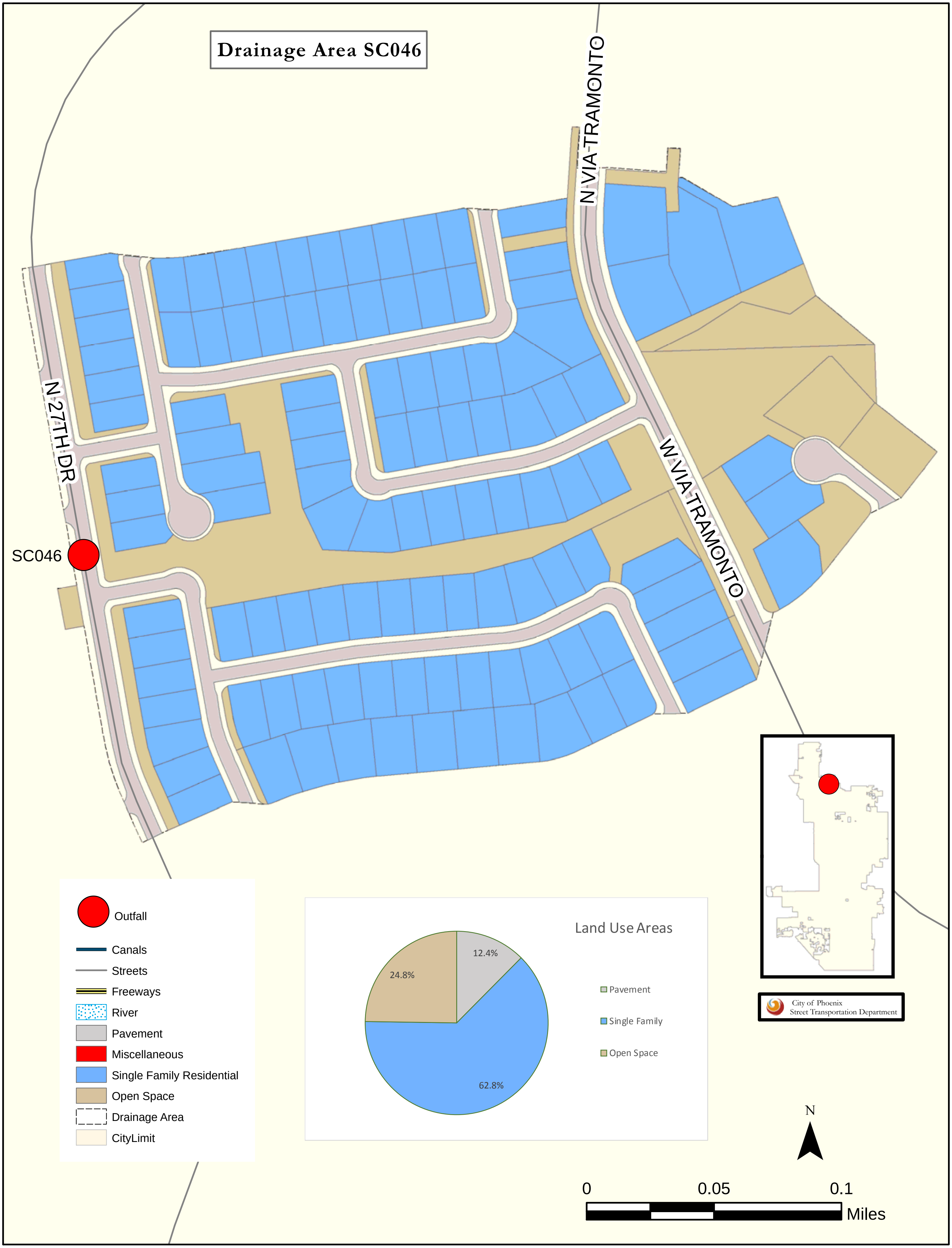
Attachments

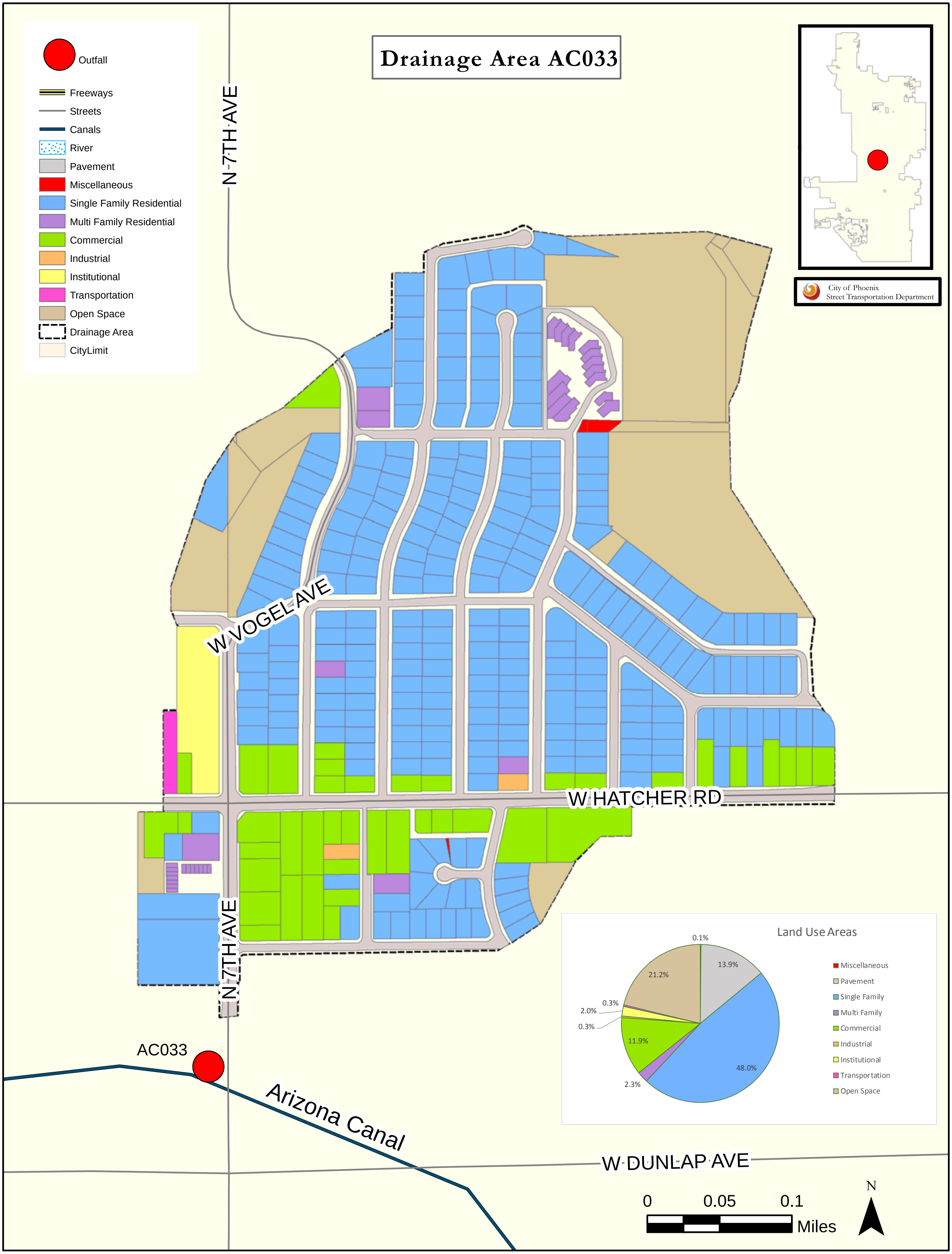
Drainage System Maps


City of Phoenix Watersheds
Upper Agua Fria
Upper New River
SC046
Skunk Creek
Cave Creek
Lower New River
Upper Indian Bend
Upper ACDC
Middle Indian Bend
IB008
AC033
Lower Agua Fria
White Tanks A
Lower ACDC
Lower Indian Bend
SR003
SR030
SR045
SR049
South Mountain
Monitored Outfalls
Watersheds
Cave Creek
Lower ACDC
Lower Agua Fria
Lower Indian Bend
Lower New River
Middle Indian Bend
Skunk Creek
South Mountain
Upper ACDC
Upper Agua Fria
Upper Indian Bend
Upper New River
White Tanks A
N

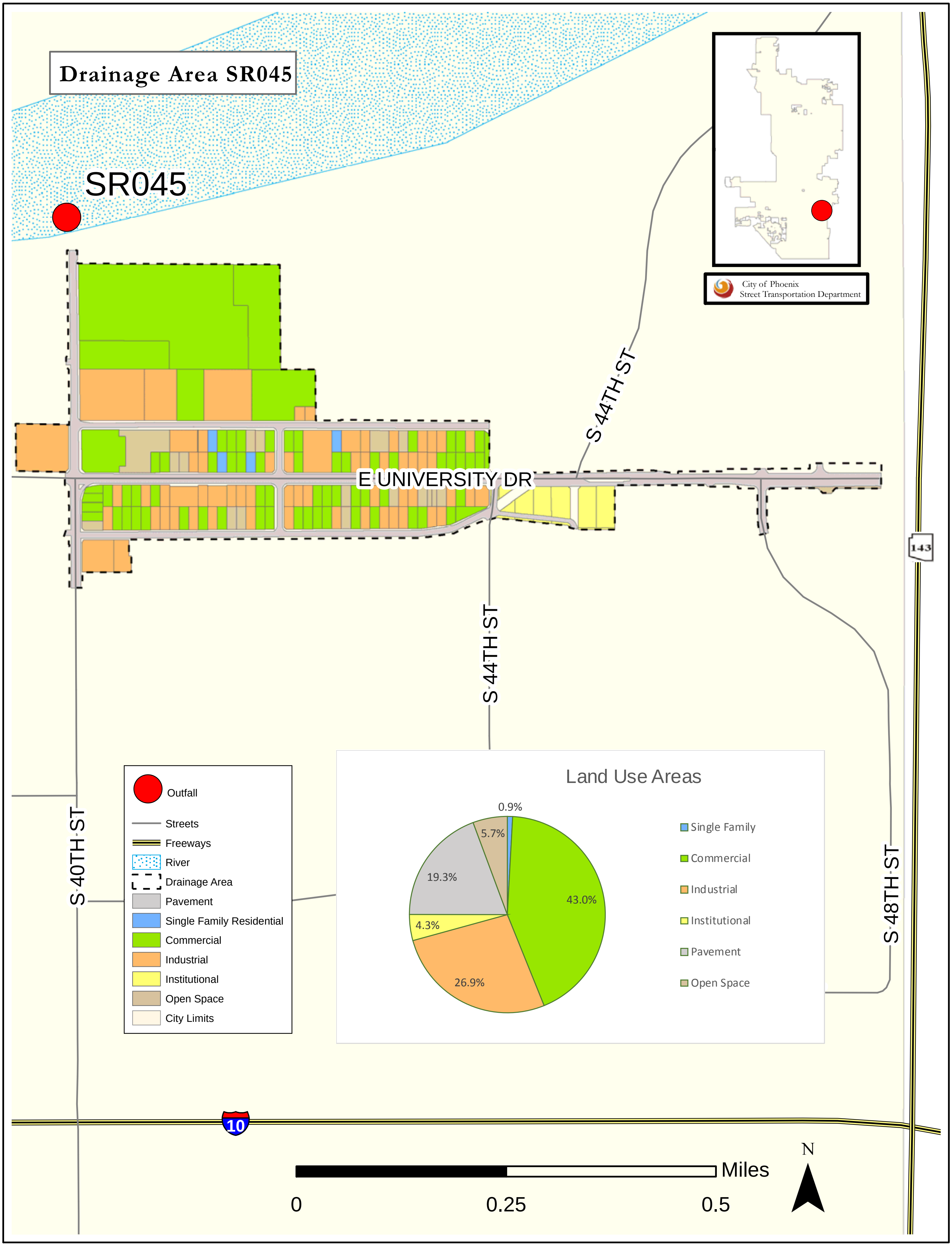

Drainage Area IB008
Central Arizona Project Canal
E UTOPIA RD
N 36TH ST
E UNION HILLS DR
E GROVERS AVE
E BELL RD
City of Phoenix
Street Transportation Department
E PARADISE LN
N 29TH S
N 32ND ST
LOOP 51
E GREENWAY RD
N 40TH ST
N 44TH ST
TUM BLVD
E ACOMA DR
TWATER AVE
E SWEETWATER AVE
N 42ND ST
IB008
E CACTUS RD
N 2
N 4
Outfall
Canals
Streets
Freeways
River
Pavement
Miscellaneous
Single Family Residential
Multi Family Residential
Commercial
Industrial
Institutional
Open Space
Drainage Area
CityLimit
Land Use Areas
3.3%
1.7%
15.1%
6.3%
0.3%
6.1%
3.5%
63.7%
Miscellaneous
Single Family
Multi Family
Commercial
Industrial
Institutional
Pavement
Open Space
0
0.5
1
Miles
N



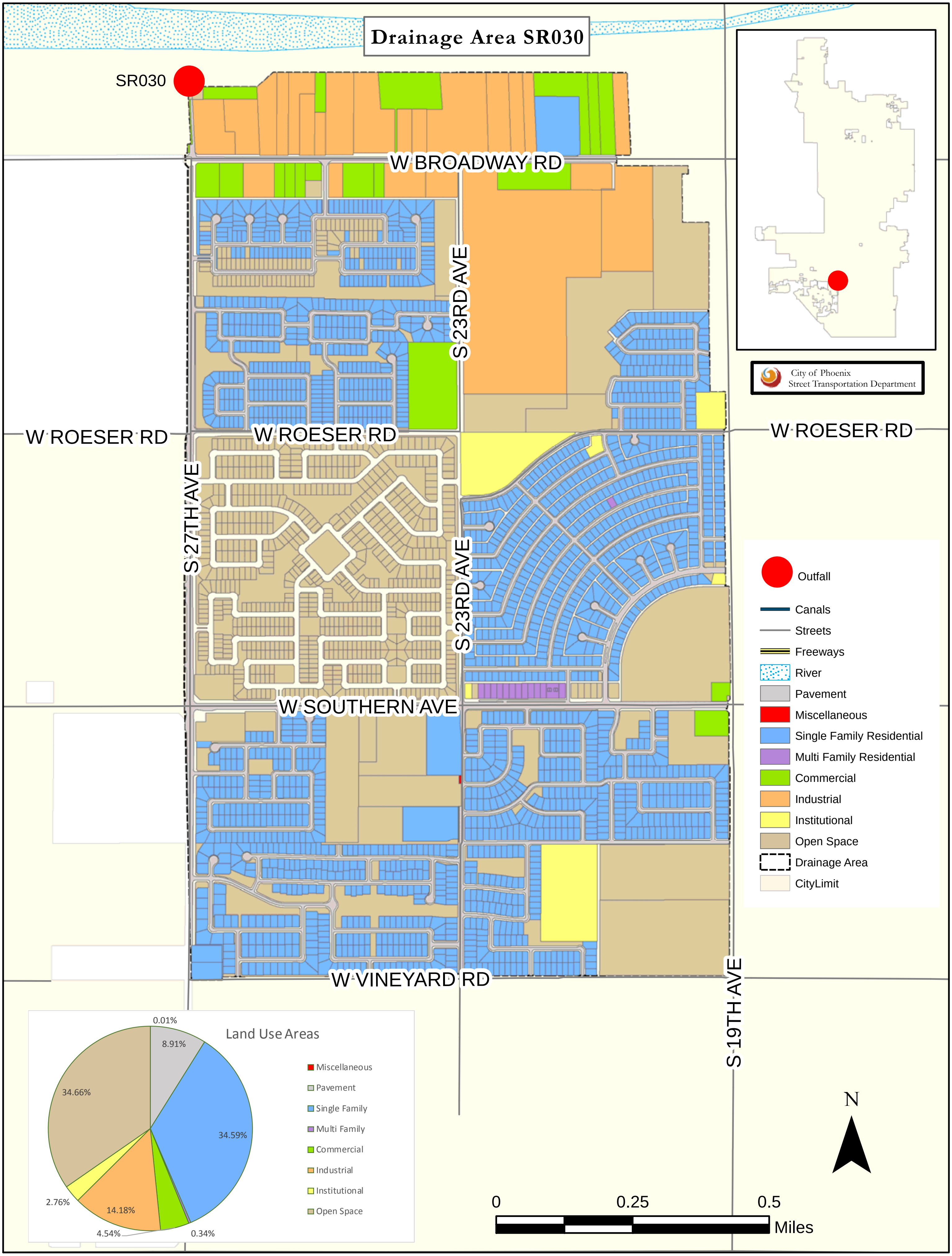
Drainage Area SC046
N VIA TRAMONTO
W VIA TRAMONTO
N 27TH DR
SC046
Outfall
Canals
Streets
Freeways
River
Pavement
Miscellaneous
Single Family Residential
Open Space
Drainage Area
CityLimit
Land Use Areas
12.4%
24.8%
62.8%
Pavement
Single Family
Open Space
City of Phoenix
Street Transportation Department
N
0
0.05
0.1
Miles

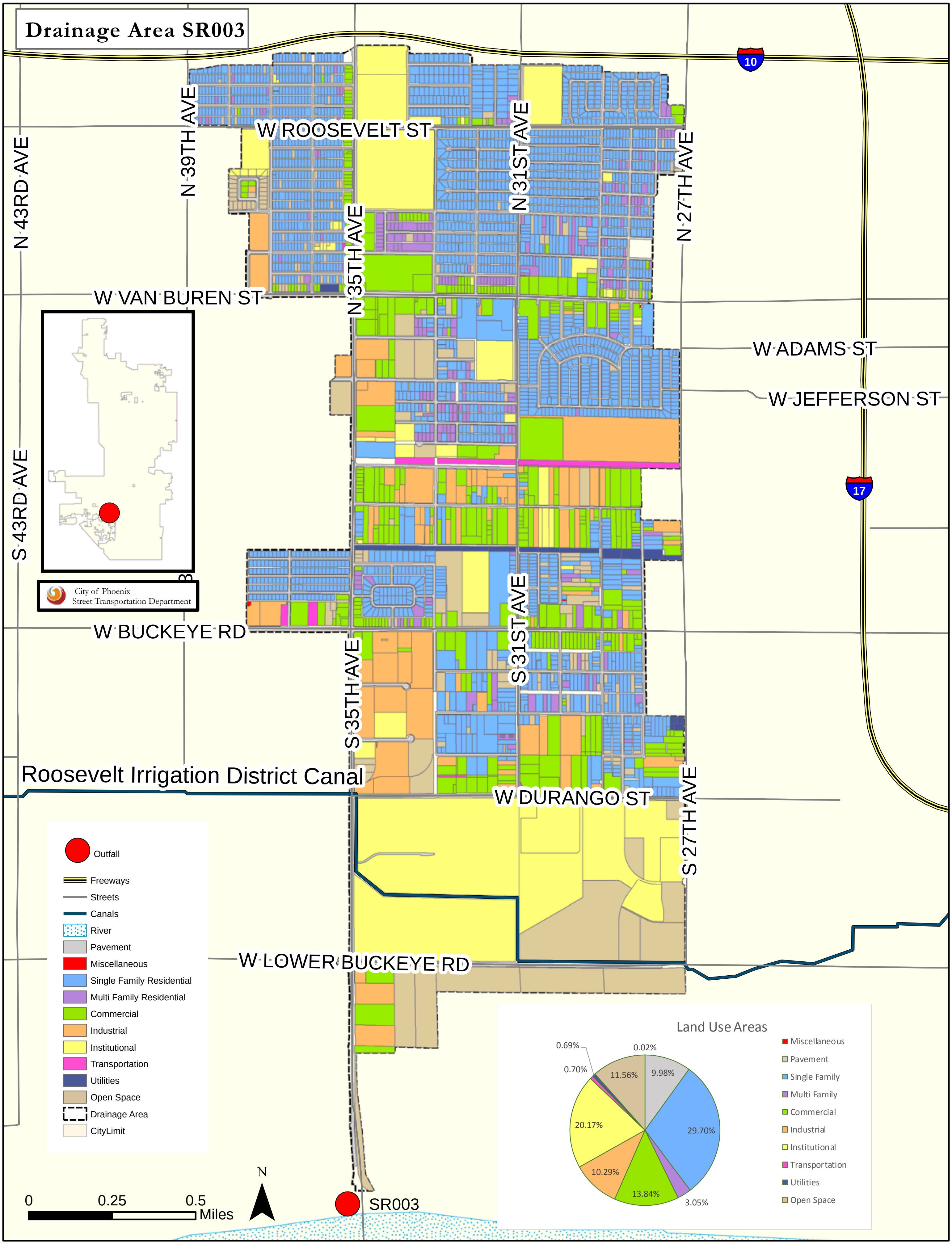


Drainage Area AC033
Outfall
Freeways
Streets
Canals
River
Pavement
Miscellaneous
Single Family Residential
Multi Family Residential
Commercial
Industrial
Institutional
Transportation
Open Space
Drainage Area
CityLimit
City of Phoenix
Street Transportation Department
N 7TH AVE
W VOGEL AVE
W HATCHER RD
N 7TH AVE
AC033
Arizona Canal
W DUNLAP AVE
Land Use Areas
0.1%
13.9%
21.2%
0.3%
2.0%
0.3%
11.9%
48.0%
2.3%
Miscellaneous
Pavement
Single Family
Multi Family
Commercial
Industrial
Institutional
Transportation
Open Space
0
0.05
0.1
Miles
N

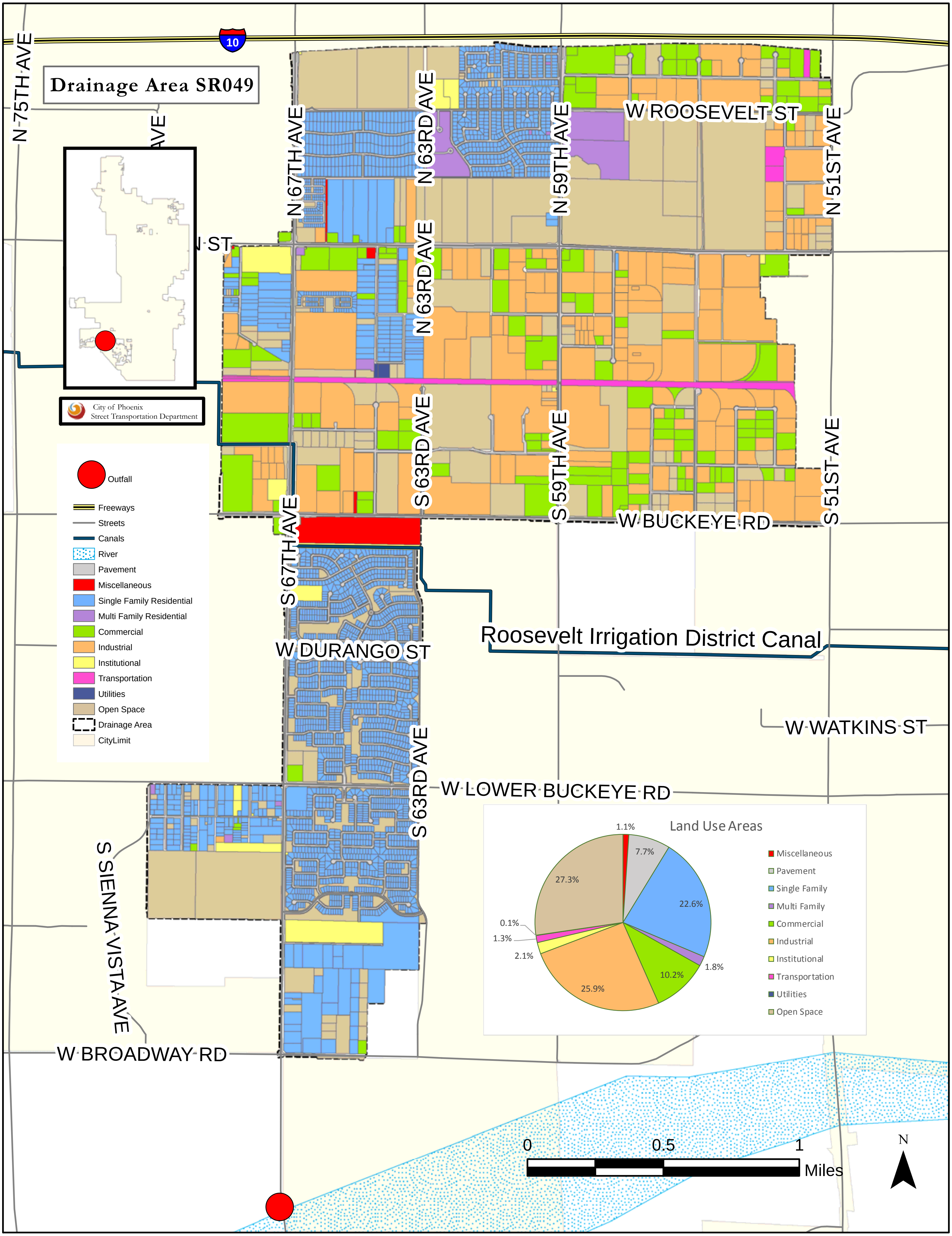


Drainage Area SR045
SR045
City of Phoenix
Street Transportation Department
S 44TH ST
E UNIVERSITY DR
S 44TH ST
S 40TH ST
S 48TH ST
143
10
Outfall
Streets
Freeways
River
Drainage Area
Pavement
Single Family Residential
Commercial
Industrial
Institutional
Open Space
City Limits
Land Use Areas
0.9%
5.7%
19.3%
43.0%
4.3%
26.9%
Single Family
Commercial
Industrial
Institutional
Pavement
Open Space
Miles
0
0.25
0.5
N


Drainage Area SR030
SR030
W BROADWAY RD
S 23RD AVE
W ROESER RD
W ROESER RD
W ROESER RD
S 27TH AVE
S 23RD AVE
W SOUTHERN AVE
W VINEYARD RD
S 19TH AVE
City of Phoenix
Street Transportation Department
Outfall
Canals
Streets
Freeways
River
Pavement
Miscellaneous
Single Family Residential
Multi Family Residential
Commercial
Industrial
Institutional
Open Space
Drainage Area
CityLimit
Land Use Areas
0.01%
8.91%
34.66%
34.59%
2.76%
14.18%
4.54%
0.34%
Miscellaneous
Pavement
Single Family
Multi Family
Commercial
Industrial
Institutional
Open Space
N
0
0.25
0.5
Miles



Drainage Area SR003
W ROOSEVELT ST
N 39TH AVE
N 43RD AVE
N 35TH AVE
N 31ST AVE
N 27TH AVE
W VAN BUREN ST
W ADAMS ST
W JEFFERSON ST
S 43RD AVE
S 31ST AVE
S 35TH AVE
S 27TH AVE
W BUCKEYE RD
Roosevelt Irrigation District Canal
W DURANGO ST
W LOWER BUCKEYE RD
10
17
City of Phoenix
Street Transportation Department
Outfall
Freeways
Streets
Canals
River
Pavement
Miscellaneous
Single Family Residential
Multi Family Residential
Commercial
Industrial
Institutional
Transportation
Utilities
Open Space
Drainage Area
CityLimit
0
0.25
0.5
Miles
N
SR003
Land Use Areas
0.69%
0.02%
0.70%
11.56%
9.98%
20.17%
29.70%
10.29%
13.84%
3.05%
Miscellaneous
Pavement
Single Family
Multi Family
Commercial
Industrial
Institutional
Transportation
Utilities
Open Space



Drainage Area SR049
City of Phoenix
Street Transportation Department
Outfall
Freeways
Streets
Canals
River
Pavement
Miscellaneous
Single Family Residential
Multi Family Residential
Commercial
Industrial
Institutional
Transportation
Utilities
Open Space
Drainage Area
CityLimit
10
N 75TH AVE
N 67TH AVE
N 63RD AVE
N 59TH AVE
N 51ST AVE
W ROOSEVELT ST
W BUCKEYE RD
S 67TH AVE
S 63RD AVE
S 59TH AVE
S 51ST AVE
Roosevelt Irrigation District Canal
W DURANGO ST
W WATKINS ST
W LOWER BUCKEYE RD
S SIENNA VISTA AVE
W BROADWAY RD
Land Use Areas
1.1%
7.7%
22.6%
1.8%
10.2%
25.9%
2.1%
1.3%
0.1%
27.3%
Miscellaneous
Pavement
Single Family
Multi Family
Commercial
Industrial
Institutional
Transportation
Utilities
Open Space
0
0.5
1
Miles
N

List of Major Outfalls

The report contains all active major outfalls 36" or greater serving>50 acres or 12" or greater outfalls serving>2 acres of industrial land use known to the City

Stormwater Management

Total Outfalls: 437

Outfall ID	Site Address	Latitude	Longitude	Drain Type	Drain Size	Last Inspection	Target Inspection
AC001	51st Ave And Cactus Road N/A, Phoenix, AZ	33.60	-111.83	Pipe	78 Inches	02/12/2016	2021
AC002	43rd Ave And Peoria Ave N/A, Phoenix, AZ	33.58	-111.85	Pipe	90 Inches	03/29/2017	2022
AC003	43rd Ave And Peoria Ave N/A, Phoenix, AZ	33.58	-111.85	Pipe	42 Inches	02/11/2016	2021
AC004	35th Ave And Acdc Channel N/A, Phoenix, AZ	33.57	-111.87	Pipe	96 Inches	03/29/2017	2022
AC005	30th Ave And Metrocenter N/A, Phoenix, AZ	33.57	-111.87	Pipe	53 Inches	03/28/2017	2022
AC006	29th Ave And Metrocenter N/A, Phoenix, AZ	33.57	-111.88	Pipe	48 Inches	02/11/2016	2021
AC007	29th Ave And Metrocenter N/A, Phoenix, AZ	33.57	-111.88	Pipe	43 Inches	02/24/2016	2021
AC008	I-17 (Black Canyon Fwy) And Acdc Channel N/A, Phoe	33.57	-111.88	Pipe	27 Inches	02/23/2016	2021
AC010	19th Ave And Acdc Channel N/A, Phoenix, AZ	33.57	-111.90	Pipe	36 Inches	02/23/2016	2021
AC011	7th St And Acdc Channel N/A, Phoenix, AZ	33.60	-111.17	Pipe	42 Inches	02/23/2016	2021
AC012	18th Pl And Acdc Channel N/A, Phoenix, AZ	33.54	-111.96	Pipe	48 Inches	03/29/2016	2021
AC013	24th St. Water Treatment Plant And Acdc Channel N	33.53	-111.97	Pipe	36 Inches	03/09/2016	2021
AC014	2 Mile Tunnel And Acdc Channel N/A, Phoenix, AZ	33.60	-111.83	Pipe	36 Inches	03/09/2016	2021
AC015	33rd Dr And Acdc Channel N/A, Phoenix, AZ	33.57	-111.87	Pipe	12 Inches	02/11/2016	2021
AC018	18th Ave And Hatcher N/A, Phoenix, AZ	33.57	-111.90	Pipe	36 Inches	02/23/2016	2021
AC021	49th Dr And Acdc Channel N/A, Phoenix, AZ	33.59	-111.84	Spillway	50 Feet	02/11/2016	2021
AC022	Lupine Dr And Acdc Channel N/A, Phoenix, AZ	33.59	-111.84	Spillway	50 Feet	02/11/2016	2021
AC023	Yucca St And ACDC Channel N/A, Phoenix, AZ	33.59	-111.84	Spillway	27 Feet	02/11/2016	2021
AC024	39th Ave And Acdc Channel N/A, Phoenix, AZ	33.58	-111.86	Spillway	30 Feet	02/11/2016	2021
AC025	Ironwood Dr And Acdc Channel N/A, Phoenix, AZ	33.58	-111.86	Spillway	30 Feet	02/11/2016	2021
AC026	3rd St And Acdc Channel N/A, Phoenix, AZ	33.56	-111.94	Spillway	70 Feet	02/23/2016	2021
AC028	10th St And Acdc Channel N/A, Phoenix, AZ	33.56	-111.94	Spillway	100 Feet	02/23/2016	2021
AC029	12th St And Acdc Channel N/A, Phoenix, AZ	33.55	-111.94	Spillway	16 Feet	02/23/2016	2021
AC030	13th St And Orangewood N/A, Phoenix, AZ	33.54	-111.95	Spillway	50 Feet	02/23/2016	2021
AC031	14th St And State Ave N/A, Phoenix, AZ	33.54	-111.95	Spillway	90 Feet	03/29/2016	2021
AC033	7th Ave And Acdc Channel N/A, Phoenix, AZ	33.57	-111.92	Pipe	42 Inches	02/23/2016	2021
AC034	12th Ave And Acdc Channel N/A, Phoenix, AZ	33.57	-111.91	Pipe	36 Inches	02/23/2016	2021

Outfall Identification Legend

AC = Arizona Canal Diversion Canal
AF = Agua Fria (West Hwy loop 101)
AW = Ahwatukee
AZ = Arizona Canal
CAP = Central Arizona Project
CC = Cave Creek Wash
CO = Charter Oak
EF = East Fork of the Cave Creek
GC = Grand Canal
IB = Indian Bend Wash
LC = Laveen Area Conveyance Channe
MV = Moon Valley Wash
NM = North Mountain Wash
NR = New River
OC = Old Cross Cut Canal
PD = Papago Diversion Canal
PV = Paradise Valley
RID = Roosevelt Irrigation District
SC = Skunk Creek Wash
SR = Salt River
ST = Sweetwater Tributary of IB
SW = Scatter Wash
TD = Tempe Drainage Channel
TS = Tenth Street Wash
UC = Upper Cave Creek Wash
ZT = Emile Zola Tributary of IB

Outfall ID	Site Address	Latitude	Longitude	Drain Type	Drain Size	Last Inspection	Target Inspection
AC039	14th St And Acdc Channel N/A, Phoenix, AZ	33.58	-111.85	Pipe	36 Inches	03/29/2016	2021
AC044	6th St And Acdc Channel N/A, Phoenix, AZ	33.56	-111.93	Pipe	36 Inches	02/23/2016	2021
AC048	10th St And Acdc Channel N/A, Phoenix, AZ	33.56	-111.94	Pipe	96 Inches	02/23/2016	2021
AC070	Dunlap Ave And Short Tunnel N/A, Phoenix, AZ	33.57	-111.88	Pipe	60 Inches	02/23/2016	2021
AC081	Hwy 51 And Acdc Channel N/A, Phoenix, AZ	33.57	-111.88	Box	6 x 6 Feet	03/29/2016	2021
AC083	24th St. Water Treatment Plant And Acdc Channel N	33.57	-111.88	Pipe	36 Inches	03/29/2016	2021
AC085	2 Mile Tunnel And Acdc Channel N/A, Phoenix, AZ	33.57	-111.88	Pipe	30 Inches	03/09/2016	2021
AC106	2 Mile Tunnel And Acdc Channel N/A, Phoenix, AZ	33.52	-111.99	Pipe	36 Inches	03/09/2016	2021
AC128	7th Ave And Dunlap Ave N/A, Phoenix, AZ	33.57	-111.92	Pipe	12 Inches	02/15/2017	2022
AC130	Paradise Dr And Acdc N/A, Phoenix, AZ	33.59	-111.83	Spillway	64 Feet	02/11/2016	2021
AC131	47th Ave And Acdc N/A, Phoenix, AZ	33.59	-111.84	Spillway	64 Feet	02/11/2016	2021
AC132	46th Ave And Acdc N/A, Phoenix, AZ	33.58	-111.84	Spillway	32 Feet	02/11/2016	2021
AC133	43rd Ave And Acdc N/A, Phoenix, AZ	33.58	-111.85	Spillway	32 Feet	02/11/2016	2021
AC134	43rd Ave And Acdc N/A, Phoenix, AZ	33.58	-111.85	Spillway	32 Feet	02/11/2016	2021
AC135	43rd Ave And Acdc N/A, Phoenix, AZ	33.58	-111.85	Spillway	24 Feet	02/11/2016	2021
AC136	North Ln And Acdc N/A, Phoenix, AZ	33.58	-111.85	Spillway	24 Feet	02/11/2016	2021
AC137	41st Dr And Acdc N/A, Phoenix, AZ	33.58	-111.85	Spillway	24 Feet	02/11/2016	2021
AC138	41st Ln And Acdc N/A, Phoenix, AZ	33.58	-111.85	Spillway	24 Feet	02/11/2016	2021
AC139	41st Ave And Acdc N/A, Phoenix, AZ	33.58	-111.85	Spillway	24 Feet	02/11/2016	2021
AC140	40th Dr And Acdc N/A, Phoenix, AZ	33.58	-111.85	Spillway	24 Feet	02/11/2016	2021
AC141	40th Ln And Acdc N/A, Phoenix, AZ	33.58	-111.85	Spillway	24 Feet	02/11/2016	2021
AC142	40th Ave And Acdc N/A, Phoenix, AZ	33.58	-111.85	Spillway	24 Feet	02/11/2016	2021
AC143	39th Ln And Acdc N/A, Phoenix, AZ	33.58	-111.86	Spillway	24 Feet	02/11/2016	2021
AC144	37th Ave And Acdc N/A, Phoenix, AZ	33.57	-111.86	Spillway	64 Feet	02/11/2016	2021
AC145	36th Ave And Acdc N/A, Phoenix, AZ	33.57	-111.86	Spillway	40 Feet	02/23/2016	2021
AC146	33rd Ave And Acdc N/A, Phoenix, AZ	33.57	-111.13	Spillway	48 Feet	02/23/2016	2021
AC147	23rd Ave And Acdc N/A, Phoenix, AZ	33.57	-111.89	Spillway	40 Feet	02/23/2016	2021
AC148	21st Dr And Acdc N/A, Phoenix, AZ	33.57	-111.90	Spillway	40 Feet	02/23/2016	2021
AC150	20th Dr And Acdc N/A, Phoenix, AZ	33.57	-111.90	Spillway	50 Feet	02/23/2016	2021
AC151	20th Ave And Acdc N/A, Phoenix, AZ	33.57	-111.90	Spillway	40 Feet	02/23/2016	2021

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Outfall ID	Site Address	Latitude	Longitude	Drain Type	Drain Size	Last Inspection	Target Inspection
AC152	20th Dr And Acdc N/A, Phoenix, AZ	33.57	-111.90	Spillway	24 Feet	02/23/2016	2021
AC153	16th Ave And Acdc N/A, Phoenix, AZ	33.57	-111.91	Spillway	36 Feet	02/23/2016	2021
AC154	15th Ave And Acdc N/A, Phoenix, AZ	33.57	-111.91	Spillway	60 Feet	02/23/2016	2021
AC155	14th Ave And Acdc N/A, Phoenix, AZ	33.57	-111.91	Spillway	60 Feet	02/23/2016	2021
AC156	13th Ave And Acdc N/A, Phoenix, AZ	33.57	-111.91	Spillway	60 Feet	02/23/2016	2021
AC157	9th Ave And Acdc N/A, Phoenix, AZ	33.57	-111.91	Spillway	46 Feet	02/23/2016	2021
AC158	8th Ave And Acdc N/A, Phoenix, AZ	33.57	-111.92	Spillway	48 Feet	02/23/2016	2021
AC159	Central Ave And Short Channel N/A, Phoenix, AZ	33.56	-111.93	Spillway	30 Feet	02/23/2016	2021
AC160	8th St And Acdc N/A, Phoenix, AZ	33.56	-111.94	Spillway	24 Feet	02/23/2016	2021
AC161	8th Pl And Acdc N/A, Phoenix, AZ	33.56	-111.94	Spillway	24 Feet	02/23/2016	2021
AC162	Harmont Dr And Acdc N/A, Phoenix, AZ	33.55	-111.94	Spillway	56 Feet	02/23/2016	2021
AC163	Northern Ave And Acdc N/A, Phoenix, AZ	33.55	-111.94	Spillway	80 Feet	02/23/2016	2021
AC165	E Desert Park Ln And Acdc N/A, Phoenix, AZ	33.55	-111.94	Spillway	40 Feet	02/23/2016	2021
AC166	Haywood Ave And Acdc N/A, Phoenix, AZ	33.55	-111.94	Spillway	40 Feet	02/23/2016	2021
AC169	Morten Ave And Acdc N/A, Phoenix, AZ	33.55	-111.94	Spillway	40 Feet	02/23/2016	2021
AC171	15th St And Acdc N/A, Phoenix, AZ	33.54	-111.95	Spillway	320 Feet	03/29/2016	2021
AC173	17th St And Acdc N/A, Phoenix, AZ	33.54	-111.96	Spillway	40 Feet	03/29/2016	2021
AC176	19th St And Acdc N/A, Phoenix, AZ	33.53	-111.96	Spillway	80 Feet	03/29/2016	2021
AC177	20th St And Acdc N/A, Phoenix, AZ	33.53	-111.96	Spillway	40 Feet	03/29/2016	2021
AC178	Maryland Ave And Acdc N/A, Phoenix, AZ	33.53	-111.96	Spillway	24 Feet	03/29/2016	2021
AC179	Maryland Ave And Acdc N/A, Phoenix, AZ	33.53	-111.04	Spillway	40 Feet	03/29/2016	2021
AC180	Maryland Ave And Acdc N/A, Phoenix, AZ	33.53	-111.96	Spillway	32 Feet	03/29/2016	2021
AC181	Maryland Ave And Acdc N/A, Phoenix, AZ	33.53	-111.96	Spillway	40 Feet	03/29/2016	2021
AC182	Marlette Ave And Acdc N/A, Phoenix, AZ	33.53	-111.96	Spillway	32 Feet	03/29/2016	2021
AC183	Claremont St And Acdc N/A, Phoenix, AZ	33.53	-111.96	Spillway	32 Feet	03/29/2016	2021
AC184	Squaw Peak Water Treatment Plant And Acdc N/A, Pho	33.53	-111.97	Spillway	72 Feet	03/29/2016	2021
AC191	I-17 And Acdc Channel N/A, Phoenix, AZ	33.57	-111.88	Spillway	31 Feet	03/29/2016	2021
AC192	3858 W Malapai Dr, Phoenix, AZ 85051	33.58	-112.14	Spillway	25 Feet	02/11/2016	2021
AC193	3848 W Malapai Dr, Phoenix, AZ	33.58	-111.86	Spillway	25 Feet	02/11/2016	2021
AC194	3832 W Malapai Dr. N/A, Phoenix, AZ	33.58	-111.86	Spillway	25 Feet	02/11/2016	2021

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AC195	9th Avenue And Acdc Channel N/A, Phoenix, AZ	33.57	112.08	Pipe	72 Inches	09/07/2016	2021
AC196	1330 North State Ave And Acdc N/A, Phoenix, AZ	33.54	112.05	Spillway	5 Feet	02/24/2017	2022
AF002	Encanto Blvd And Sr101 West (9500 W) N/A, Phoenix,	33.47	-111.73	Pipe	42 Inches	07/16/2015	2020
AF003	Mcdowell Rd And Sr101 West (9700 W) N/A, Phoenix,	33.47	-111.73	Box	4 x 11 Feet	07/16/2015	2020
AF005	Camelback Rd And Sr Loop 101 N/A, Phoenix, AZ	33.51	-111.73	Pipe	35 Inches	07/16/2015	2020
AF006	Camelback Road And 114th Aveune N/A, Phoenix, AZ	33.51	-111.70	Pipe	60 Inches	07/16/2015	2020
AZ001	Arizona Canal And 42nd St N/A, Phoenix, AZ	33.51	-110.01	Pipe	36 Inches	11/21/2014	2019
AZ002	Arizona Canal And 56th St N/A, Phoenix, AZ	33.49	-110.04	Pipe	48 Inches	11/21/2014	2019
AZ003	Arizona Canal And 57th St N/A, Phoenix, AZ	33.49	-110.04	Pipe	48 Inches	11/21/2014	2019
AZ024	Arizona Canal And 21st St N/A, Phoenix, AZ	33.53	-111.97	Pipe	36 Inches	12/03/2014	2019
AZ025	Arizona Canal And 21st St N/A, Phoenix, AZ	33.53	-111.97	Pipe	36 Inches	12/03/2014	2019
AZ028	Arizona Canal And 56th St N/A, Phoenix, AZ	33.49	-110.04	Spillway	6 Feet	11/21/2014	2019
AZ030	Arizona Canal And 44th St N/A, Phoenix, AZ	33.50	-110.01	Spillway	6 Feet	11/21/2014	2019
CC002	23rd Ave And Vogel Ave N/A, Phoenix, AZ	33.57	-111.89	Pipe	48 Inches	08/29/2014	2019
CC003	Peoria Ave And Cave Creek Wash N/A, Phoenix, AZ	33.58	-111.89	Pipe	84 Inches	03/28/2017	2022
CC004	25th Ave And Cholla Rd N/A, Phoenix, AZ	33.59	-111.89	Pipe	78 Inches	08/29/2014	2019
CC005	25th Ave And Cactus Rd N/A, Phoenix, AZ	33.60	-111.89	Pipe	48 Inches	08/26/2014	2019
CC006	25th Ave And Larkspur Dr N/A, Phoenix, AZ	33.60	-111.89	Pipe	30 Inches	08/26/2014	2019
CC008	23rd Ave And Thunderbird Rd N/A, Phoenix, AZ	33.61	-111.89	Pipe	72 Inches	08/29/2014	2019
CC010	19th Ave And Greenway Rd N/A, Phoenix, AZ	33.62	-111.90	Pipe	90 Inches	08/29/2014	2019
CC024	Shangri-La Rd And Cave Creek Wash N/A, Phoenix, AZ	33.59	-111.89	Pipe	36 Inches	11/06/2014	2019
CC041	901 W Danbury Rd, Phoenix, AZ 85023	33.64	-112.09	Spillway	10 Feet	07/30/2014	2019
CC042	17407 N 8th Ave, Phoenix, AZ	33.64	-111.92	Spillway	10 Feet	07/30/2014	2019
CC043	7th Ave And Cave Creek Wash N/A, Phoenix, AZ	33.64	-111.92	Pipe	60 Inches	10/22/2014	2019
CC044	3rd Ave And Grovers Ave N/A, Phoenix, AZ	33.65	-111.92	Spillway	16 Feet	07/30/2014	2019
CC045	5th Ave And Michelle Dr N/A, Phoenix, AZ	33.65	-111.92	Spillway	10 Feet	07/30/2014	2019
CC046	5th Ave And Michigan Ave N/A, Phoenix, AZ	33.65	-111.92	Spillway	10 Feet	07/30/2014	2019
CC047	232 W Michigan Ave, Phoenix, AZ 85023	33.65	-112.08	Spillway	14 Feet	07/30/2014	2019
CC048	5th Ave And Bluefield Cir N/A, Phoenix, AZ	33.65	-111.92	Spillway	10 Feet	07/30/2014	2019
CC049	237 W Wagoner Rd, Phoenix, AZ 85023	33.65	-112.08	Spillway	8 Feet	07/30/2014	2019

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CC050	Union Hills Dr And Cave Creek Wash N/A, Phoenix, A	33.65	-111.92	Pipe	72 Inches	10/22/2014	2019
CC052	15478 N 13th Ave, Phoenix, AZ	33.63	-111.91	Spillway	10 Feet	07/30/2014	2019
CC055	19th Ave And Greenway Rd N/A, Phoenix, AZ	33.62	-111.90	Spillway	3 x 6 Feet	07/30/2014	2019
CC056	19th Ave And Greenway Rd N/A, Phoenix, AZ	33.62	-111.90	Spillway	3 x 6 Feet	07/30/2014	2019
CC057	Cave Creek Golf Course At Acoma Dr N/A, Phoenix, A	33.62	-111.89	Pipe	42 Inches	09/19/2014	2019
CC060	18019 N Villa Rita Dr, Phoenix, AZ	33.65	-111.92	Spillway	18 Feet	07/30/2014	2019
CC062	19823 N 3rd St, Phoenix, AZ	33.67	-111.93	Spillway	29 Feet	07/31/2014	2019
CC063	19819 N 3rd St, Phoenix, AZ	33.66	-111.93	Spillway	20 Feet	07/31/2014	2019
CC064	19801 N 3rd St, Phoenix, AZ	33.67	-111.93	Spillway	7 Feet	07/31/2014	2019
CC065	301 E Behrend Dr, Phoenix, AZ 85024	33.67	-112.07	Spillway	9 Feet	07/31/2014	2019
CC066	301 E Wikieup Ln, Phoenix, AZ 85024	33.67	-111.93	Spillway	9 Feet	07/31/2014	2019
CC067	301 E Sequoia Dr, Phoenix, AZ 85024	33.66	-112.07	Spillway	9 Feet	07/31/2014	2019
CC068	301 E Oraibi Dr, Phoenix, AZ 85024	33.66	-112.07	Spillway	9 Feet	07/31/2014	2019
CC069	301 E Piute Ave, Phoenix, AZ 85024	33.66	-112.07	Spillway	9 Feet	07/31/2014	2019
CC070	301 E Utopia Rd, Phoenix, AZ 85024	33.66	-112.07	Spillway	9 Feet	07/31/2014	2019
CC071	401 E Wescott Dr, Phoenix, AZ 85024	33.66	-112.07	Spillway	13 Feet	07/31/2014	2019
CC072	18650 N 2nd Ave, Phoenix, AZ	33.66	-111.92	Spillway	12 Feet	08/01/2014	2019
CC073	18819 N 2nd Ave, Phoenix, AZ	33.66	-111.92	Spillway	10 Feet	07/31/2014	2019
CC074	18802 N 2nd Dr, Phoenix, AZ	33.66	-111.92	Spillway	9 Feet	07/31/2014	2019
CC075	201 W Taro Ln, Phoenix, AZ 85027	33.66	-112.08	Spillway	10 Feet	07/31/2014	2019
CC076	27th Ave And Cholla Rd N/A, Phoenix, AZ	33.59	-111.89	Spillway	62 Feet	07/22/2014	2019
CC077	519 W Helena Dr, Phoenix, AZ 85023	33.64	-112.08	Spillway	15 Feet	07/22/2014	2019
CC078	4th Ave And Muriel Dr N/A, Phoenix, AZ	33.65	-111.92	Spillway	24 Feet	07/22/2014	2019
CC079	4th Ave And Angela Dr N/A, Phoenix, AZ	33.65	-111.92	Spillway	16 Feet	07/22/2014	2019
CC080	4th Ave And Angela Dr N/A, Phoenix, AZ	33.65	-111.92	Spillway	16 Feet	07/22/2014	2019
CC081	17415 N 6th Ave, Phoenix, AZ	33.64	-111.92	Spillway	19 Feet	07/22/2014	2019
CC082	Cave Creek Gc And Cave Creek Wash N/A, Phoenix, AZ	33.62	-111.89	Pipe	42 Inches	09/19/2014	2019
CC083	23rd Ave And Greenway Rd N/A, Phoenix, AZ	33.62	112.11	Pipe	48 Inches	09/19/2014	2019
CC087	Deer Valley Road And 11th Pl N/A, Phoenix, AZ	33.68	-111.94	Pipe	66 Inches	11/14/2014	2019
CC094	7th St And Lone Cactus N/A, Phoenix, AZ	33.68	112.07	Pipe	54 Inches	10/13/2015	2020

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CO001	Nisbet Rd And 42nd St N/A, Phoenix, AZ	33.62	111.99	Spillway	5 Feet	12/13/2016	2021
CO003	42nd St And Whitney Ln N/A, Phoenix, AZ	33.62	111.99	Spillway	11 Feet	12/13/2016	2021
CO005	42nd St. South Of Acoma Dr. East Side Of Channel N	33.62	111.99	Spillway	5 Feet	12/13/2016	2021
CO006	Located At 14245 N. 42nd St. East Side Of Channel	33.62	111.99	Spillway	5 Feet	12/13/2016	2021
CO007	42nd St And Hearn Rd. East Side Of Channel N/A, Ph	33.62	111.99	Spillway	9 Feet	12/13/2016	2021
CO008	41st Place And Gelding Dr. N/A, Phoenix, AZ	33.62	111.99	Spillway	30 Feet	12/14/2016	2021
CO009	41st Place And Sheena Dr. N/A, Phoenix, AZ	33.61	111.99	Spillway	9 Feet	12/14/2016	2021
CO010	Thunderbird Rd And 41st Pl N/A, Phoenix, AZ	33.61	111.99	Spillway	5 Feet	12/14/2016	2021
CO011	Thunderbird Rd And 41st Place N/A, Phoenix, AZ	33.61	111.99	Spillway	5 Feet	12/14/2016	2021
CO012	4202 E 4202 East Sheena Dr. Dr, Phoenix, AZ	33.61	111.99	Spillway	10 Feet	12/14/2016	2021
CO013	4202 E Redfield Dr, Phoenix, AZ	33.61	111.99	Spillway	10 Feet	12/14/2016	2021
CO014	Thunderbird Rd And 41st Place N/A, Phoenix, AZ	33.61	111.99	Spillway	5 Feet	12/14/2016	2021
CO015	Thunderbird Rd And 41st Place N/A, Phoenix, AZ	33.61	111.99	Spillway	5 Feet	12/14/2016	2021
CO017	4215 E Andora Dr, Phoenix, AZ	33.61	111.99	Spillway	4 Feet	12/14/2016	2021
CO018	13221 N 42nd St, Phoenix, AZ	33.61	111.99	Spillway	9 Feet	12/14/2016	2021
CO019	13021 N 42nd St, Phoenix, AZ	33.61	111.99	Spillway	9 Feet	12/15/2016	2021
CO020	4156 E Sweetwater Ave, Phoenix, AZ	33.60	111.99	Spillway	5 Feet	12/15/2016	2021
CO021	4127 E Windrose Dr, Phoenix, AZ	33.60	111.99	Spillway	9 Feet	12/15/2016	2021
EF001	Cave Creek Rd And Greenway Pkwy N/A, Phoenix, AZ	33.63	-111.97	Pipe	72 Inches	09/30/2015	2020
EF002	16th St And Greenway Pkwy N/A, Phoenix, AZ	33.63	-111.96	Pipe	84 Inches	09/30/2015	2020
EF003	18th St And Greenway Pkwy N/A, Phoenix, AZ	33.63	-111.96	Pipe	84 Inches	09/30/2015	2020
EF004	20th St And Greenway Pkwy N/A, Phoenix, AZ	33.63	-111.96	Pipe	96 Inches	09/30/2015	2020
EF006	9th St And Greenway Pkwy N/A, Phoenix, AZ	33.64	-111.94	Pipe	96 Inches	08/20/2015	2020
EF007	9th St And Greenway Pkwy N/A, Phoenix, AZ	33.64	-111.94	Pipe	36 Inches	08/27/2015	2020
EF008	Cave Creek Rd And Greenway Pkwy N/A, Phoenix, AZ	33.63	-111.97	Pipe	72 Inches	10/01/2015	2020
EF009	16th St And Greenway Pkwy N/A, Phoenix, AZ	33.64	-111.95	Pipe	48 Inches	09/30/2015	2020
EF010	7th St And Greenway Pkwy N/A, Phoenix, AZ	33.64	-111.93	Pipe	84 Inches	08/21/2015	2020
EF011	7th St And Greenway Pkwy N/A, Phoenix, AZ	33.64	-111.93	Pipe	36 Inches	08/20/2015	2020
EF012	7th St And Greenway Pkwy N/A, Phoenix, AZ	33.64	-111.93	Pipe	36 Inches	08/20/2015	2020
EF013	Cave Creek Rd And Greenway Pkwy N/A, Phoenix, AZ	33.63	-111.97	Spillway	22 Feet	08/19/2015	2020

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EF014	22nd Pl And Monte Cristo N/A, Phoenix, AZ	33.63	-111.97	Spillway	50 Feet	08/19/2015	2020
EF015	22nd St And East Fork N/A, Phoenix, AZ	33.63	-111.97	Pipe	36 Inches	09/30/2015	2020
EF016	22nd St And East Fork N/A, Phoenix, AZ	33.63	-111.97	Pipe	36 Inches	09/30/2015	2020
EF017	22nd St And Monte Cristo N/A, Phoenix, AZ	33.63	-111.96	Spillway	40 Feet	08/19/2015	2020
EF018	21st St And East Fork N/A, Phoenix, AZ	33.63	-111.96	Pipe	36 Inches	09/30/2015	2020
EF019	21st St And East Fork N/A, Phoenix, AZ	33.63	-111.96	Pipe	42 Inches	09/30/2015	2020
EF020	20th Pl And Monte Cristo N/A, Phoenix, AZ	33.63	-111.96	Spillway	12 Feet	08/19/2015	2020
EF021	2012 E Monte Cristo Ave, Phoenix, AZ 85022	33.63	-112.04	Spillway	21 Feet	08/19/2015	2020
EF022	20th St And Greenway Pkwy N/A, Phoenix, AZ	33.63	-111.96	Spillway	15 Feet	08/19/2015	2020
EF023	19th St And East Fork (1926 E Monte Cristo) N/A, P	33.63	-111.96	Spillway	10 Feet	08/19/2015	2020
EF025	1410 E Sandra Ter, Phoenix, AZ	33.64	-111.95	Spillway	15 Feet	08/19/2015	2020
EF026	14th St And Grandview Rd N/A, Phoenix, AZ	33.64	-111.95	Spillway	21 Feet	08/19/2015	2020
EF027	12th St And East Fork N/A, Phoenix, AZ	33.64	-111.94	Box	36 Feet	08/26/2015	2020
EF028	16431 N 12th St, Phoenix, AZ	33.64	-111.94	Spillway	50 Feet	08/19/2015	2020
EF033	301 W Lemarche Ave, Phoenix, AZ	33.63	-111.92	Spillway	10 Feet	08/27/2015	2020
EF034	301 W Monte Cristo Ave, Phoenix, AZ 85023	33.63	-112.08	Pipe	6 Feet	08/27/2015	2020
EF035	15802 N 4th Ave, Phoenix, AZ	33.63	-111.92	Spillway	12 Feet	08/27/2015	2020
EF036	15803 N 4th Dr, Phoenix, AZ	33.63	-111.92	Spillway	14 Feet	08/27/2015	2020
EF037	Moon Valley Park N/A, Phoenix, AZ	33.63	-111.92	Pipe	5 Feet	08/27/2015	2020
EF038	214 W Kathleen Rd, Phoenix, AZ 85023	33.63	-112.08	Spillway	10 Feet	08/27/2015	2020
EF039	16042 N 1st St, Phoenix, AZ	33.63	-111.93	Pipe	8 Feet	08/27/2015	2020
EF040	1407 W Beck Ln, Phoenix, AZ 85023	33.63	-112.09	Spillway	21 Feet	08/26/2015	2020
EF041	1101 W Beck Ln, Phoenix, AZ 85023	33.63	-112.09	Spillway	19 Feet	08/26/2015	2020
EF042	15406 N 7th Dr, Phoenix, AZ	33.63	-111.92	Spillway	25 Feet	08/26/2015	2020
EF043	1527 W Caribbean Ln, Phoenix, AZ 85023	33.62	-112.09	Spillway	10 Feet	08/26/2015	2020
EF044	1445 W Caribbean Ln, Phoenix, AZ 85023	33.62	-112.09	Spillway	6 Feet	08/26/2015	2020
EF045	1455 W Caribbean Ln, Phoenix, AZ 85023	33.62	-112.09	Spillway	10 Feet	08/26/2015	2020
EF046	1503 W Caribbean Ln, Phoenix, AZ 85023	33.62	-112.09	Spillway	6 Feet	08/26/2015	2020
EF051	19th Pl And Greenway Pkwy N/A, Phoenix, AZ	33.63	-111.96	Pipe	36 Inches	09/30/2015	2020
EF052	Cave Creek Rd And Greenway Pkwy N/A, Phoenix, AZ	33.63	-111.97	Spillway	48 Feet	08/19/2015	2020

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Outfall ID	Site Address	Latitude	Longitude	Drain Type	Drain Size	Last Inspection	Target Inspection
EF053	1802 E Paradise Ln, Phoenix, AZ 85022	33.63	-112.04	Spillway	18 Feet	08/20/2015	2020
EF054	16th St And Greenway Pkwy N/A, Phoenix, AZ	33.64	-111.95	Spillway	23 Feet	08/20/2015	2020
EF055	16th St And Greenway Pkwy N/A, Phoenix, AZ	33.64	-111.95	Spillway	14 Feet	08/20/2015	2020
EF056	1610 E Sandra Ter, Phoenix, AZ	33.64	-111.95	Spillway	6 Feet	08/20/2015	2020
EF057	1526 W Caribbean Ln, Phoenix, AZ 85023	33.62	-112.09	Spillway	12 Feet	08/26/2015	2020
EF058	15406 N 7th Dr, Phoenix, AZ	33.63	-111.92	Pipe	90 Inches	08/26/2015	2020
EF063	7th St And Greenway Pkwy N/A, Phoenix, AZ	33.64	-111.93	Spillway	150 Feet	08/27/2015	2020
EF065	Union Hills And 25th Way N/A, Phoenix, AZ	33.65	112.03	Pipe	48 Inches	07/22/2015	2020
EF066	Union Hills And 25th Way N/A, Phoenix, AZ	33.65	112.03	Pipe	63 Inches	07/22/2015	2020
EF069	Utopia Rd Between 27th And 28th Street N/A, Phoeni	33.66	112.02	Pipe	48 Inches	07/22/2015	2020
EF070	Utopia Road Between 27th And 28th St. N/A, Phoenix	33.66	112.02	Pipe	96 Inches	07/22/2015	2020
EF086	20300 N 26th St, Phoenix, AZ	33.67	112.04	Pipe	76 Inches	07/24/2015	2020
EF087	20300 N 26th St, Phoenix, AZ	33.67	112.02	Pipe	76 Inches	07/24/2015	2020
EF088	Cave Creek And 101 N/A, Phoenix, AZ	33.67	112.04	Pipe	58 Inches	07/24/2015	2020
EF091	2302 E Grovers Ave, Phoenix, AZ	33.66	112.04	Pipe	96 Inches	08/04/2015	2020
GC001	Grand Ave And Grand Canal N/A, Phoenix, AZ	33.49	-111.87	Pipe	24 Inches	01/07/2015	2020
GC002	Grand Ave And Grand Canal N/A, Phoenix, AZ	33.49	-111.87	Pipe	36 Inches	01/07/2015	2020
GC033	Grand Canal And E Of Pueblo Grande Museum Park N/A	33.44	-110.02	Spillway	14 Feet	01/07/2015	2020
IB001	52nd St And Shea Blvd N/A, Phoenix, AZ	33.58	-110.03	Pipe	36 Inches	08/15/2013	2018
IB002	52nd St And Shea Blvd N/A, Phoenix, AZ	33.58	-110.03	Pipe	84 Inches	07/18/2013	2018
IB003	Tatum Blvd And Cholla St N/A, Phoenix, AZ	33.59	-110.02	Pipe	66 Inches	02/05/2014	2019
IB004	Tatum Blvd And Cholla St N/A, Phoenix, AZ	33.59	-110.02	Pipe	66 Inches	02/05/2014	2019
IB005	52nd St And Indian Bend Wash N/A, Phoenix, AZ	33.58	-110.03	Box	14 x 3 Feet	07/18/2013	2018
IB007	36th St And Sweetwater Ave N/A, Phoenix, AZ	33.60	-112.00	Pipe	78 Inches	08/05/2013	2018
IB008	40th St And Indian Bend Wash N/A, Phoenix, AZ	33.60	-110.00	Pipe	66 Inches	08/23/2013	2018
IB010	40th Street And Indian Bend Wash. North Side Of Wa	33.60	-110.00	Pipe	36 Inches	03/15/2017	2022
IB011	56th St And Indian Bend Wash N/A, Phoenix, AZ	33.57	-110.04	Pipe	66 Inches	06/13/2014	2019
IB013	Cactus Rd And Indian Bend Wash N/A, Phoenix, AZ	33.60	-110.01	Pipe	72 Inches	08/14/2013	2018
IB016	Tatum Blvd And Cholla St N/A, Phoenix, AZ	33.59	-110.02	Pipe	36 Inches	08/22/2013	2018
IB018	Cactus Rd And Indian Bend Wash N/A, Phoenix, AZ	33.60	-110.01	Pipe	72 Inches	08/15/2013	2018

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Outfall ID	Site Address	Latitude	Longitude	Drain Type	Drain Size	Last Inspection	Target Inspection
IB021	10202 N 54th Pl, Phoenix, AZ	33.58	-110.04	Pipe	36 Inches	10/14/2013	2018
IB024	3631 E Dahlia Dr, Phoenix, AZ 85032	33.60	-112.00	Spillway	21 Feet	08/23/2018	2023
IB026	12806 N 37th Ct, Phoenix, AZ	33.60	-112.00	Spillway	8 Feet	08/23/2018	2023
IB027	4150 E Cactus Rd, Phoenix, AZ 85032	33.60	-110.01	Spillway	11 Feet	08/14/2013	2018
IB035	Thunderbird Rd And Indian Bend Wash N/A, Phoenix,	33.61	-111.01	Pipe	60 Inches	08/22/2018	2023
IB036	Thunderbird Rd And Indian Bend Wash N/A, Phoenix,	33.61	-112.01	Pipe	60 Inches	08/22/2018	2023
IB037	Thunderbird Rd And Indian Bend Wash N/A, Phoenix,	33.61	-112.01	Box	6 x 10 Feet	08/22/2018	2023
IB038	Thunderbird Rd And Indian Bend Wash N/A, Phoenix,	33.61	-112.01	Pipe	84 Inches	08/22/2018	2023
IB043	10811 N 52nd St, Phoenix, AZ	33.58	-110.03	Spillway	18 Feet	07/18/2013	2018
IB044	11016 N 50th St, Phoenix, AZ	33.59	-110.03	Spillway	12 Feet	07/18/2013	2018
IB045	4943 E Cholla St, Phoenix, AZ 85254	33.59	-110.03	Spillway	7 Feet	07/18/2013	2018
IB050	40th St And Indian Bend Wash. North Side Of Wash.	33.60	112.00	Pipe	48 Inches	03/15/2017	2022
LC001	4532 W Alta Vista Rd, Phoenix, AZ	33.39	-111.84	Spillway	9 Feet	09/15/2016	2021
LC002	6616 S 46th Gn N/A, Phoenix, AZ	33.39	-111.84	Spillway	13 Feet	09/15/2016	2021
LC003	46th Dr And Vineyard Rd N/A, Phoenix, AZ	33.38	-111.84	Spillway	32 Feet	09/15/2016	2021
LC008	53rd Ln And Baseline Rd N/A, Phoenix, AZ	33.38	-111.83	Pipe	66 Inches	09/15/2016	2021
LC015	63rd Land And Beverly Rd N/A, Phoenix, AZ	33.37	112.20	Pipe	26 Inches	09/27/2016	2021
LC017	7377 W Magdalena Ln N/A, Phoenix, AZ	33.37	112.21	Pipe	34 Inches	09/27/2016	2021
LC018	7810 S 74th Ave, Phoenix, AZ	33.37	-111.78	Pipe	36 Inches	09/27/2016	2021
LC020	S 63rd Ave And Lacc N/A, Phoenix, AZ	33.37	112.19	Pipe	60 Inches	09/21/2016	2021
LC022	4724 W Carson Rd, Phoenix, AZ	33.38	-111.84	Spillway	8 Feet	09/15/2016	2021
LC023	North Side Of Channel. About 50 Ft. West Of 51st S	33.38	-111.83	Pipe	62 Inches	09/15/2016	2021
LC026	Inside West Tunnel Culvert @ Baseline And Lacc N/A	33.38	-111.82	Pipe	48 Inches	09/20/2016	2021
LC028	74th Lane And Fawn N/A, Phoenix, AZ	33.37	112.22	Spillway	10 Feet	09/28/2016	2021
MV001	19th Ave And Sweetwater Ave N/A, Phoenix, AZ 85009	33.60	112.10	Pipe	48 Inches	07/12/2017	2022
MV005	12th Ave And Thunderbird Rd N/A, Phoenix, AZ 85029	33.61	112.09	Pipe	54 Inches	07/12/2017	2022
MV007	7th St And Hearn Rd N/A, Phoenix, AZ	33.62	-111.93	Pipe	48 Inches	08/02/2017	2022
MV016	13th Ln And Thunderbird Rd N/A, Phoenix, AZ	33.61	-111.91	Spillway	11 Feet	07/12/2017	2022
MV019	7th St. And E. Roberts Rd. West Side Of Street N/A	33.61	112.06	Pipe	50 Inches	08/09/2017	2022
MV020	7th St. And E. Roberts Rd. West Side Of Street. N/	33.61	112.06	Pipe	50 Inches	08/09/2017	2022

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MV023	23rd Avenue And Wood Drive Ave, Phoenix, AZ 85029	33.60	-112.11	Spillway	46 Feet	07/12/2017	2022
NR004	4640 W Heyerdahl Ct, Phoenix, AZ	33.87	112.16	Pipe	40 Inches	08/31/2016	2021
NR005	N 45th Ave And W Emily Dr N/A, Phoenix, AZ	33.88	112.16	Pipe	40 Inches	08/31/2016	2021
NR006	45th Ave And Judson Drive N/A, Phoenix, AZ	33.88	112.16	Pipe	36 Inches	08/31/2016	2021
OC001	Old Cross Cut And Washington St, South Tunnel N/A,	33.45	-110.02	Pipe	36 Inches	06/03/2014	2019
OC002	Old Cross Cut And Van Buren St, South Tunnel N/A,	33.45	-110.02	Pipe	42 Inches	06/03/2014	2019
OC004	46th St And Mcdowell Rd N/A, Phoenix, AZ	33.47	-110.02	Pipe	42 Inches	01/28/2014	2019
OC005	48th St And Thomas Rd N/A, Phoenix, AZ	33.48	-110.02	Pipe	36 Inches	01/29/2014	2019
OC006	48th St And Earll Dr N/A, Phoenix, AZ	33.48	-110.02	Pipe	52 Inches	01/28/2014	2019
OC007	48th St And Indian School Rd N/A, Phoenix, AZ	33.49	-110.02	Pipe	36 Inches	01/28/2014	2019
OC008	46th St And Mcdowell Rd N/A, Phoenix, AZ	33.47	-110.02	Pipe	54 Inches	01/28/2014	2019
OC022	48th St And Oak St N/A, Phoenix, AZ	33.47	-110.02	Pipe	48 Inches	01/28/2014	2019
OC028	48th St And Indian School Rd N/A, Phoenix, AZ	33.50	-110.02	Spillway	5 Feet	01/28/2014	2019
OC039	46th Street And Roosevelt Street - Old Cross Cut N	33.46	-110.02	Box	6 x 5 Feet	05/16/2014	2019
OC053	48th St And Osborn Rd N/A, Phoenix, AZ	33.49	-110.02	Pipe	52 Inches	01/28/2014	2019
OC054	48th St And Osborn Rd N/A, Phoenix, AZ	33.49	-110.02	Box	8 x 6 Feet	01/28/2014	2019
OC055	48th St And Weldon Ave N/A, Phoenix, AZ	33.49	-110.02	Pipe	48 Inches	01/28/2014	2019
OC062	48th St And Thomas Rd N/A, Phoenix, AZ	33.48	-110.02	Pipe	36 Inches	01/28/2014	2019
OC072	Old Cross Cut And Granada N/A, Phoenix, AZ	33.47	-110.02	Pipe	42 Inches	01/28/2014	2019
OC073	47th St And Melvin St N/A, Phoenix, AZ	33.45	-110.02	Spillway	13 Feet	03/07/2014	2019
OC074	46th St And Taylor St N/A, Phoenix, AZ	33.45	-110.02	Spillway	28 Feet	03/07/2014	2019
OC075	46th St And Taylor St N/A, Phoenix, AZ	33.45	-110.02	Spillway	12 Feet	03/07/2014	2019
OC076	46th St And Fillmore St N/A, Phoenix, AZ	33.45	-110.02	Spillway	29 Feet	03/07/2014	2019
OC077	46th St And Pierce St N/A, Phoenix, AZ	33.46	-110.02	Spillway	30 Feet	03/07/2014	2019
OC078	46th St And Mckinley St N/A, Phoenix, AZ	33.46	-110.02	Spillway	27 Feet	03/07/2014	2019
OC083	48th St And Earll Dr N/A, Phoenix, AZ	33.48	-110.02	Spillway		01/28/2014	2019
PD001	91st Ave And Papago Diversion Channel N/A, Phoenix	33.46	-111.74	Pipe	90 Inches	04/07/2014	2019
PD002	83rd Ave And Papago Diversion Channel N/A, Phoenix	33.46	-111.24	Pipe	90 Inches	04/07/2014	2019
PD003	75th Ave And Papago Diversion Channel N/A, Phoenix	33.63	-111.78	Pipe	90 Inches	05/22/2014	2019
PD004	67th Ave And Papago Diversion Channel N/A, Phoenix	33.46	-111.80	Pipe	90 Inches	04/07/2014	2019

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PD005	59th Ave And Papago Diversion Channel N/A, Phoenix	33.46	-111.19	Pipe	90 Inches	04/07/2014	2019
PD006	51st Ave And Papago Diversion Channel N/A, Phoenix	33.46	-111.83	Pipe	84 Inches	04/07/2014	2019
PD007	43rd Ave And Papago Diversion Channel N/A, Phoenix	33.46	-111.85	Pipe	96 Inches	05/28/2014	2019
PD008	43rd Ave And Papago Diversion Channel N/A, Phoenix	33.46	-111.85	Pipe	54 Inches	05/28/2014	2019
PD009	39th Ave And Papago Diversion Channel N/A, Phoenix	33.46	-111.86	Pipe	78 Inches	05/29/2014	2019
PD010	35th Ave And Papago Diversion Channel N/A, Phoenix	33.57	-111.87	Pipe	54 Inches	05/28/2014	2019
PD011	31st Ave And Papago Diversion Channel N/A, Phoenix	33.46	-111.87	Box	10 x 4 Feet	12/13/2013	2018
PD014	31st Ave And Papago Diversion Channel N/A, Phoenix	33.46	-111.87	Pipe	48 Inches	05/28/2014	2019
PD015	32nd Ave And Papago Diversion Channel N/A, Phoenix	33.46	-111.87	Pipe	40 Inches	12/13/2013	2018
PD016	34th Ave And Papago Diversion Channel N/A, Phoenix	33.46	-111.87	Pipe	42 Inches	05/28/2014	2019
PD017	43rd Ave And Papago Diversion Channel N/A, Phoenix	33.46	-111.85	Pipe	18 Inches	05/28/2014	2019
PD023	2901 W Culver St In Papago Diversion N/A, Phoenix,	33.46	-111.88	Spillway	14 Feet	04/07/2014	2019
PV002	34th St And Lincoln Dr N/A, Phoenix, AZ 85253	33.53	112.00	Pipe	48 Inches	08/23/2017	2022
PV004	35th St And Lincoln Dr N/A, Phoenix, AZ 85253	33.53	112.00	Pipe	48 Inches	08/23/2017	2022
SC001	56th Ave And Union Hills Dr N/A, Phoenix, AZ	33.66	-111.82	Box	10x11 Feet	07/13/2016	2021
SC002	51st Ave And Skunk Creek, Near Norhtwest Bike Lane	33.66	-111.83	Pipe	36 Inches	07/07/2016	2021
SC006	19432 N 50th Ave, Phoenix, AZ	33.66	-111.83	Spillway	10 Feet	07/07/2016	2021
SC008	19653 N 48th Ln, Phoenix, AZ	33.66	-111.84	Spillway	16 Feet	07/13/2016	2021
SC009	19623 N 48th Ave, Phoenix, AZ	33.66	-111.84	Spillway	24 Feet	07/07/2016	2021
SC010	47th Dr And Behrend Dr N/A, Phoenix, AZ	33.66	-111.84	Spillway	6 Feet	07/07/2016	2021
SC012	4790 W Oraibi Dr, Phoenix, AZ 85308	33.66	-112.16	Spillway	6 Feet	07/13/2016	2021
SC013	19634 N 47th Dr, Phoenix, AZ	33.66	-111.84	Spillway	4 Feet	07/07/2016	2021
SC014	19640 N 47th Ave, Phoenix, AZ	33.66	-111.84	Pipe	6 Feet	07/07/2016	2021
SC015	46th Dr And Behrend Dr N/A, Phoenix, AZ	33.67	-111.84	Pipe	6 Feet	07/07/2016	2021
SC016	19810 N 46th Ave, Phoenix, AZ	33.67	-111.84	Pipe	6 Feet	07/07/2016	2021
SC017	19828 N 45th Ln, Phoenix, AZ	33.67	112.16	Spillway	6 Feet	07/13/2016	2021
SC022	2749 W Darien Way, Phoenix, AZ	33.80	-111.88	Spillway	10 Feet	07/12/2016	2021
SC023	27th Ct And Florimond Rd N/A, Phoenix, AZ	33.80	-111.88	Spillway	50 Feet	07/12/2016	2021
SC024	27th Ln And Via Aquila N/A, Phoenix, AZ	33.81	-111.88	Box	4 x 2 Feet	07/12/2016	2021
SC025	27th Ln And Via Aquila, West Side N/A, Phoenix, AZ	33.81	-111.88	Box	4 x 2 Feet	07/12/2016	2021

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SC027	Carefree Hwy And 27th Dr N/A, Phoenix, AZ	33.80	-111.88	Pipe	36 Inches	07/12/2016	2021
SC031	35th Dr And Soft Wind Dr N/A, Phoenix, AZ	33.70	-111.86	Pipe	30 Inches	08/16/2016	2021
SC032	20659 N 41st Ln, Phoenix, AZ	33.67	-111.85	Spillway	18 Feet	07/26/2016	2021
SC033	20669 N 41st Ln, Phoenix, AZ	33.67	-111.85	Spillway	17 Feet	07/26/2016	2021
SC034	20657 N 42nd Ave, Phoenix, AZ	33.67	-111.85	Spillway	18 Feet	07/26/2016	2021
SC035	20622 N 42nd Ave, Phoenix, AZ	33.67	-111.85	Spillway	17 Feet	07/26/2016	2021
SC036	20670 N 41st Ave, Phoenix, AZ	33.67	-111.85	Spillway	45 Feet	07/26/2016	2021
SC037	Sc Wash And Sr101 Frontage Rd N/A, Phoenix, AZ	33.67	-111.85	Pipe	36 Inches	07/26/2016	2021
SC040	Via Puzzola And Via Del Deserto N/A, Phoenix, AZ	33.81	-111.88	Pipe	36 Inches	07/12/2016	2021
SC043	2761 W Via Calabria N/A, Phoenix, AZ	33.80	0.00	Spillway	19 Feet	07/12/2016	2021
SC044	35th Ave And Parkside Ln N/A, Phoenix, AZ	33.69	112.13	Pipe	35 Inches	08/16/2016	2021
SC046	35206 N 27th Dr, Phoenix, AZ	33.80	-111.88	Pipe	36 Inches	07/12/2016	2021
SC048	W Oberlin Way And N 26th Ave N/A, Phoenix, AZ	33.74	112.11	Spillway	32 Feet	08/16/2016	2021
SC049	Pinnacle Peack Road And 40th Lane N/A, Phoenix, A	33.70	112.15	Pipe	62 Inches	08/17/2016	2021
SC050	South Side Of Pinnacle Peak Road At 40th Lane. N/A	33.70	112.15	Pipe	60 Inches	08/17/2016	2021
SC052	Southside Of Pinnacle Peak Road Just Before 47th A	33.70	112.16	Pipe	54 Inches	08/17/2016	2021
SC053	Southside Of Pinnacle Peak Road Just Before 47th A	33.70	112.16	Pipe	48 Inches	08/17/2016	2021
SC054	Southside Of Pinnacle Peak Road Just Before 47th A	33.70	112.16	Pipe	42 Inches	08/17/2016	2021
SC055	Southside Of Pinnacle Peak Road And 51st Avenue. N	33.70	112.17	Pipe	42 Inches	08/17/2016	2021
SC058	4531 W Soft Wind Dr, Phoenix, AZ	33.72	112.16	Spillway		08/17/2016	2021
SC059	23620 N 45th Ave, Phoenix, AZ	33.71	112.16	Pipe	24 Inches	08/17/2016	2021
SC060	23804 N 44th Ln, Phoenix, AZ	33.70	112.16	Spillway	6 Feet	08/17/2016	2021
SC061	Mariposa Grande And 45th Dr N/A, Phoenix, AZ	33.70	112.16	Spillway	10 Feet	08/17/2016	2021
SC064	Alamedia Road Between 43rd Ave And 45th Dr N/A, Ph	33.71	112.16	Pipe	24 Inches	08/17/2016	2021
SC065	44th Ln And W Misty Willow Ln N/A, Phoenix, AZ	33.70	112.16	Spillway	9 Feet	08/17/2016	2021
SC067	35th Avenue And Williams Drive N/A, Phoenix, AZ	112.21	34.16	Pipe	56 Inches	08/16/2016	2021
SR001	51st Ave And Salt River N/A, Phoenix, AZ	33.41	-111.83	Pipe	96 Inches	03/08/2018	2019
SR002	43rd Ave And Salt River N/A, Phoenix, AZ	33.41	-111.85	Pipe	90 Inches	03/08/2018	2019
SR003	35th Ave And Salt River N/A, Phoenix, AZ	33.41	-111.87	Pipe	75 Inches	03/06/2018	2019
SR004	27th Ave And Salt River N/A, Phoenix, AZ 85009	33.42	-111.88	Pipe	72 Inches	03/20/2018	2019

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Outfall ID	Site Address	Latitude	Longitude	Drain Type	Drain Size	Last Inspection	Target Inspection
SR005	25th Ave And Salt River N/A, Phoenix, AZ	33.42	-111.89	Pipe	102 Inches	04/11/2017	2022
SR006	22nd Ave And Salt River N/A, Phoenix, AZ	33.42	-111.89	Pipe	72 Inches	04/12/2017	2022
SR007	19th Ave And Salt River N/A, Phoenix, AZ	33.41	-111.90	Pipe	54 Inches	04/12/2017	2022
SR008	15th Ave And Salt River N/A, Phoenix, AZ	33.41	-111.91	Pipe	96 Inches	09/18/2015	2020
SR009	11th Ave And Salt River N/A, Phoenix, AZ	33.42	-111.91	Pipe	81 Inches	04/09/2015	2020
SR010	7th Ave And Salt River N/A, Phoenix, AZ	33.42	-111.92	Pipe	54 Inches	03/20/2018	2019
SR012	Central Ave And Salt River N/A, Phoenix, AZ	33.42	-111.93	Pipe	42 Inches	05/11/2015	2020
SR013	Central Ave And Salt River N/A, Phoenix, AZ	33.42	-111.93	Box	10 x 21 Feet	04/07/2015	2020
SR014	3rd St And Salt River N/A, Phoenix, AZ	33.42	-111.93	Pipe	36 Inches	05/31/2016	2021
SR015	3rd St And Salt River N/A, Phoenix, AZ	33.42	-111.93	Pipe	84 Inches	03/20/2018	2019
SR016	10th St And Salt River N/A, Phoenix, AZ	33.42	-111.94	Pipe	54 Inches	04/15/2015	2020
SR017	12th St And Salt River N/A, Phoenix, AZ	33.42	-111.94	Pipe	96 Inches	04/15/2015	2020
SR018	16th St And Salt River N/A, Phoenix, AZ	33.42	-111.95	Pipe	66 Inches	01/05/2015	2020
SR019	20th St And Salt River N/A, Phoenix, AZ	33.42	-111.96	Box	10 x 21 Feet	04/05/2016	2021
SR020	24th St And Salt River N/A, Phoenix, AZ	33.42	-111.97	Pipe	84 Inches	03/27/2018	2019
SR024	28th St And Salt River N/A, Phoenix, AZ	33.42	-111.98	Pipe	90 Inches	05/07/2015	2020
SR026	37th St And Salt River N/A, Phoenix, AZ	33.43	-111.99	Pipe	42 Inches	05/12/2015	2020
SR027	36th St And Salt River, Under Sky Harbor N/A, Phoe	33.43	-112.00	Pipe	82 Inches	05/02/2017	2022
SR029	47th St And Salt River N/A, Phoenix, AZ	33.43	-110.02	Pipe	78 Inches	05/02/2017	2022
SR030	27th Ave And Salt River N/A, Phoenix, AZ	33.41	-111.88	Pipe	108 Inches	03/06/2018	2019
SR031	19th Ave And Salt River N/A, Phoenix, AZ	33.41	-111.90	Pipe	60 Inches	04/12/2017	2022
SR032	7th Ave And Salt River N/A, Phoenix, AZ	33.42	-111.92	Pipe	72 Inches	06/15/2016	2021
SR033	Central Ave And Salt River N/A, Phoenix, AZ	33.42	-111.93	Pipe	66 Inches	04/14/2015	2020
SR035	7th St And Salt River N/A, Phoenix, AZ 85009	33.42	-112.07	Pipe	72 Inches	10/24/2017	2022
SR036	15th St And Salt River N/A, Phoenix, AZ	33.42	-111.95	Pipe	72 Inches	05/07/2015	2020
SR037	16th St And Salt River N/A, Phoenix, AZ	33.42	-111.95	Pipe	36 Inches	05/07/2015	2020
SR038	24th St And Salt River N/A, Phoenix, AZ	33.42	-111.97	Pipe	72 Inches	04/08/2015	2020
SR039	28th St And Salt River N/A, Phoenix, AZ	33.42	-111.98	Pipe	96 Inches	05/07/2015	2020
SR045	40th St And Salt River N/A, Phoenix, AZ	33.43	-110.00	Pipe	54 Inches	05/07/2015	2020
SR046	7th St And Salt River N/A, Phoenix, AZ	33.42	-111.94	Pipe	24 Inches	04/16/2015	2020

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SR048	45th St And Salt River N/A, Phoenix, AZ	33.43	-110.02	Pipe	48 Inches	05/12/2015	2020
SR049	67th Ave And Salt River N/A, Phoenix, AZ 85043	33.40	-112.20	Pipe	96 Inches	02/27/2018	2019
SR052	52nd St And Hohokam Frwy N/A, Phoenix, AZ	33.44	-110.03	Box	8 x 5 Feet	01/29/2015	2020
SR056	28th St And Salt River N/A, Phoenix, AZ	33.42	-111.98	Pipe	36 Inches	05/07/2015	2020
SR059	25th Ave And Salt River N/A, Phoenix, AZ	33.42	-111.87	Pipe	60 Inches	04/11/2017	2022
SR061	32nd St And Salt River N/A, Phoenix, AZ	33.42	-111.99	Box	7 x 5 Feet	03/27/2018	2019
SR062	38th St And Salt River N/A, Phoenix, AZ	33.43	-112.00	Pipe	60 Inches	05/12/2015	2020
SR063	15th Ave And Salt River N/A, Phoenix, AZ	33.41	-111.91	Pipe	60 Inches	04/08/2015	2020
SR064	19th Ave And Salt River N/A, Phoenix, AZ	33.41	-111.90	Pipe	36 Inches	04/06/2015	2020
SR068	28th St And Salt River N/A, Phoenix, AZ	33.42	-111.98	Box	8 x 8 Feet	05/27/2016	2021
SR069	31st St And Salt River N/A, Phoenix, AZ	33.42	-111.99	Pipe	60 Inches	05/12/2015	2020
SR070	33rd St And Salt River N/A, Phoenix, AZ	33.42	-111.99	Pipe	36 Inches	05/12/2015	2020
SR071	33rd St And Salt River N/A, Phoenix, AZ	33.42	-111.99	Pipe	60 Inches	05/12/2015	2020
SR072	45th St And Salt River N/A, Phoenix, AZ	33.43	-110.01	Pipe	48 Inches	05/12/2015	2020
SR073	45th St And Salt River N/A, Phoenix, AZ	33.43	-110.01	Pipe	60 Inches	05/12/2015	2020
SR075	43rd Ave And Broadway Rd N/A, Phoenix, AZ	33.40	-111.85	Box	10 Feet	04/04/2017	2022
SR076	43rd Ave And Broadway Rd N/A, Phoenix, AZ	33.40	-111.85	Pipe	48 Inches	04/04/2017	2022
SR077	22nd Ave And Rio Salado Service Yard N/A, Phoenix,	33.42	-111.89	Spillway	17 Feet	04/12/2017	2022
SR079	35th Ave And Salt River N/A, Phoenix, AZ	33.41	-111.87	Pipe	42 Inches	04/12/2017	2022
SR080	51st Ave And Salt River N/A, Phoenix, AZ	33.40	-111.83	Pipe	42 Inches	04/04/2017	2022
SR082	75th Ave S/O Broadway Rd N/A, Phoenix, AZ	33.40	112.22	Pipe	84 Inches	04/04/2017	2022
SR083	83rd Ave And Salt River N/A, Phoenix, AZ 85339	33.38	-112.23	Pipe	12 Inches	03/06/2018	2019
SR084	Sw Corner Of The 153 Expressway And The Salt River	33.43	-110.02	Pipe	72" Inches	05/12/2015	2020
SR088	31st Ave. And Salt River N/A, Phoenix, AZ 85009	33.41	112.12	Pipe	30 Inches	03/06/2018	2019
SR089	31st And Salt River N/A, Phoenix, AZ 85009	33.41	112.12	Spillway	11 Feet	03/06/2018	2019
ST004	Sweetwater Ave And 35th St N/A, Phoenix, AZ 85032	33.60	112.01	Pipe	36 Inches	08/17/2017	2022
SW001	33rd Ave And Deer Valley Rd N/A, Phoenix, AZ 85308	33.40	-112.07	Pipe	54 Inches	12/14/2017	2022
SW006	43rd Ave And Behrend Dr N/A, Phoenix, AZ	33.67	-111.85	Pipe	36 Inches	10/31/2017	2022
SW009	21041 N 33rd Ave, Phoenix, AZ 85027	33.68	-112.13	Pipe	8 Feet	12/28/2017	2022
SW011	33rd Ave And Deer Valley Rd N/A, Phoenix, AZ 85027	33.41	-112.07	Pipe	36 Inches	12/14/2017	2022

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Outfall ID	Site Address	Latitude	Longitude	Drain Type	Drain Size	Last Inspection	Target Inspection
SW015	38th Ave And Beardsley Rd N/A, Phoenix, AZ	33.67	-111.86	Pipe	96 Inches	12/13/2017	2022
SW019	31st Dr And Deer Valley Rd N/A, Phoenix, AZ 85027	33.41	-112.07	Pipe	36 Inches	12/14/2017	2022
SW026	31st Ave And Deer Valley Rd N/A, Phoenix, AZ 85027	33.41	-112.07	Pipe	36 Inches	12/14/2017	2022
SW032	22125 Sands Dr, Phoenix, AZ 85027	33.69	-112.12	Pipe	53 Inches	12/28/2017	2022
SW037	35th Avenue And Mohawk Lane N/A, Phoenix, AZ 85308	33.67	-112.14	Pipe	48 Inches	12/13/2017	2022
SW040	35th Avenue And Mohawk Lane N/A, Phoenix, AZ 85027	33.67	-112.13	Pipe	42 Inches	12/13/2017	2022
TD008	3402 S 40th St, Phoenix, AZ 85040	33.42	-112.00	Pipe	36 Inches	10/17/2017	2022
TD010	3425 S 40th St, Phoenix, AZ 85040	33.42	-111.99	Pipe	18 Inches	10/17/2017	2022
TD013	3402 E Illini St, Phoenix, AZ 85040	33.41	-112.01	Pipe	24 Inches	10/17/2017	2022
TS002	11421 N Cave Creek Rd, Phoenix, AZ	33.59	-111.95	Pipe	48 Inches	09/13/2016	2021
TS007	1425 E Desert Cove Rd, Phoenix, AZ	33.58	-111.95	Pipe	36 Inches	09/13/2016	2021
TS008	14th St And Desert Cove Ave N/A, Phoenix, AZ	33.59	-111.95	Spillway	52 Feet	09/13/2016	2021
TS009	15th Way And Sahauro Dr. N/A, Phoenix, AZ	33.58	-111.95	Spillway	36 Inches	09/13/2016	2021
TS011	10th St. And Townley Ave. N/A, Phoenix, AZ	33.57	-111.94	Spillway	36 Feet	10/11/2016	2021
TS013	11th Street And Townley Ave. N/A, Phoenix, AZ	33.57	112.04	Box	8 Feet	10/18/2016	2021
TS014	Dunlap And 11th Street N/A, Phoenix, AZ	33.57	112.06	Spillway	72 Inches	10/18/2016	2021
TS018	1107 Hatcher Rd, Phoenix, AZ	33.57	112.06	Spillway	45 Inches	10/19/2016	2021
TS025	1839 E Cinnabar Ave, Phoenix, AZ	33.58	112.06	Spillway	9 Feet	10/19/2016	2021
ZT001	33rd Pl And Sharon Dr N/A, Phoenix, AZ	33.61	-111.99	Spillway	18 Feet	10/05/2016	2021
ZT002	33rd Pl And Emile Zola Ave N/A, Phoenix, AZ	33.61	-111.99	Spillway	46 Feet	10/05/2016	2021

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List of Changes to the Major Outfall Inventory

City of Phoenix
WATER SERVICES DEPARTMENT
ENVIRONMENTAL SERVICES DIVISION
Quality Reliability Value

The report contains all active major outfalls 36" or greater serving>50 acres or 12" or greater outfalls serving>2 acres of industrial land use .
(Added or Removed from Inventory)

Total Outfall Added: 14
Total Outfall Removed: 4

Stormwater Management
Outfall Status Change by Fiscal

Fiscal Year: 2018

Outfall Added : 14

Outfall ID	Site Address	Latitude	Longitude	Drain Type	Drain Size	Last Inspection	Target Inspection
AW-Ahwatukee	**Count 2**						
AW066	E On Pecos Road From 11th Way To 12th Street N/A,	33.29	-112.06	Spillway	12 Feet	1/19/2018	2023
AW067	Pecos Rd And 36th St N/A, Phoenix, AZ 85044	33.29	-112.01	Pipe	18 Inches	2/7/2018	2023
MV-Moon Valley	**Count 7**						
MV020	7th St. And E. Roberts Rd. West Side Of Street. N/	33.61	112.06	Pipe	50 Inches	8/9/2017	2022
MV022	7th St. And E. Roberts Rd. West Side Of Street. N/	33.61	112.06	Spillway	25 Feet	8/9/2017	2022
MV021	7th St. And E. Roberts Rd. West Side Of Street. N/	33.67	-111.97	Pipe	28 Inches	8/9/2017	2022
MV023	23rd Avenue And Wood Drive Ave, Phoenix, AZ 85029	33.60	-112.11	Spillway	46 Feet	7/12/2017	2022
MV025	13002 N 13th Ln, Phoenix, AZ 85029	33.60	112.09	Spillway	4 Feet	7/12/2017	2022
MV024	2319 W Wood Dr, Phoenix, AZ 85029	33.60	112.11	Pipe	20 Inches	7/12/2017	2022
MV019	7th St. And E. Roberts Rd. West Side Of Street N/A	33.61	112.06	Pipe	50 Inches	8/9/2017	2022
SW-Scatter Wash	**Count 1**						
SW040	35th Avenue And Mohawk Lane N/A, Phoenix, AZ 85027	33.67	-112.13	Pipe	42 Inches	12/13/2017	2022
TD-Tempe Drainage Channel	**Count 4**						
TD016	3828 E Anne St, Phoenix, AZ 85040	33.41	-112.00	Pipe	18 Inches	10/17/2017	2022
TD017	3828 E Anne St, Phoenix, AZ 85040	33.41	-112.00	Pipe	18 Inches	10/17/2017	2022
TD015	3828 E Anne St, Phoenix, AZ 85040	33.41	-112.00	Pipe	18 Inches	10/17/2017	2022
TD014	3411 S 44th St, Phoenix, AZ 85040	33.41	-111.98	Pipe	24 Inches	10/17/2017	2022

Outfall Removed : 4

Outfall ID	Site Address	Latitude	Longitude	Drain Type	Drain Size	Last Inspection	Target Inspection
AW-Ahwatukee	**Count 2**						
AW062	Pecos Rd And 44th St N/A, Phoenix, AZ	33.29	-110.01	Spillway			
AW065	S 34th Way And Pecos Road N/A, Phoenix, AZ	35.96	112.04	Spillway	15 Inches		
MV-Moon Valley	**Count 1**						
MV003	19th Ave And Sweetwater Ave N/A, Phoenix, AZ	33.60	-111.90	Pipe	18 Inches		
SW-Scatter Wash	**Count 1**						
SW017	40th Ave And Beardsley Rd N/A, Phoenix, AZ 85308	33.67	-112.14	Pipe	18 Inches		

New or Revised
Public Outreach Documents

Sign Up

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Forgot account?

City of Phoenix Water Services Department
March 17 at 8:04am ·

Put a little green in your day with our Stormwater Mascot Hopper this #StPatricksDay! Remember to keep #PHXWater clean by picking up trash, cleaning any spills, and bagging lawn clippings and yard waste this weekend and every day ... only rain belongs in the stormdrain! #PHX #PHXWaterSmart #StPatricksDay

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See more of City of Phoenix Water Services Department on Facebook

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BRAND SPOTLIGHT SPONSORED CONTENT

4 ways to be a good neighbor

POSTED: 7:45 AM, Jun 19, 2018
UPDATED: 10:25 AM, Jul 9, 2018

SHARE ARTICLE

Monsoon season is here! Well-maintained stormwater systems are essential to minimize flooding, maintain access to homes and businesses, minimizing traffic delays, and return clean runoff from urban areas to the natural environment. The City of Phoenix owns most of the storm drain infrastructure and associated streets; however, some are privately owned, whether by a home owner's association, or an industrial or commercial complex.

Here are four ways you can be an advocate this monsoon season!

Know who to contact

Knowing who is responsible for maintaining a particular drainageway could save time and money. If there is an issue, such as, a blocked catch basin, a downed tree, water ponding on the corner – rapid response to remove the debris, or clog, will depend on whether you contact the correct individual, company, or organization.

Maintain a list of contacts. If you live in a private community, your property management company or homeowner's association is likely to be responsible for maintenance of the drainage areas around your home. For public property, you can contact your local municipality. In the City of Phoenix, you can contact www.phoenix.gov/atyourservice or the Street Transportation Department Dispatch at 602.262.6284

Of course, for emergencies, a downed powerline, or rising floodwater, dial 911. If you see someone dump anything into a storm drain in Phoenix, call the Stormwater Hotline at 602-256-3190 or contact your local municipality.

Keep pollutants off the ground

The solution to pollution is… not dilution. It's prevention. Spent containers of chemicals, piles of dirt or mulch, and collections of rusty car parts can contaminate the environment if they are exposed to rainfall or runoff. Pet waste left on the ground, or even in your backyard, oil drips from your car, and over-applied fertilizer or pesticide are all sources of pollution. Bacteria, oil, chemicals, and even dirt are environmental contaminants. These are costly to remove from stormwater at the end of the line. If they reach surface waters, impacts to fish, birds, and recreationalists can be expected.

Pick up waste, dispose of it properly. Clean up leaks and spills, or better yet, perform routine maintenance on equipment to prevent leaks and replace parts or equipment before they break, or fail. Never pour oil on the ground for dust control; always recycle it!

Watch the flow

Where does it go? Does it collect on your lawn? How does it get to the street? Does it pick up pollutants along the way? After that, where is it flowing? To a nearby park? A natural wash? Does it make it to a river?

Next time it rains, watch. Which path does it take? Does it look clean? Is there a sheen? Is there a puddle or pond that takes more than two days to evaporate or infiltrate? If so, take note. Snap a picture. Report it.

Report back

The monsoon can be unpredictable. Not every property can be stabilized and protected against every storm. But it helps to be prepared. Well-maintained infrastructure performs better in a storm. Report problems you identify in your neighborhood, such as clogged catch basins. Capture a photo of the leftover pond that remains a few days after the last downpour. Contact your city if you see someone dumping something into the storm drain.

Everyone can help to protect our community from stormwater damage. Being conscientious in maintaining public and private drainage systems, reducing pollutants, and reporting damaged infrastructure are to key to minimizing impacts to humans and the environment.

Remember –Clean Water Starts with You!

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ABC15 Arizona with City of Phoenix Water Services Department.

January 8, 2018 at 2:30pm · Paid ·

🌧️ TELL US: Does your neighborhood flood when it rains?

Green infrastructure can help. Checkout these simple methods from the City of Phoenix Water Services Department that are keeping your water cleaner! #abc15sponsor

What is green infrastructure?

The goal of green infrastructure is to maintain, mimic or recreate a natural, environment – that relies on soils and plants to do the work; keep a balanced system.

ABC15.COM

Like Comment Share

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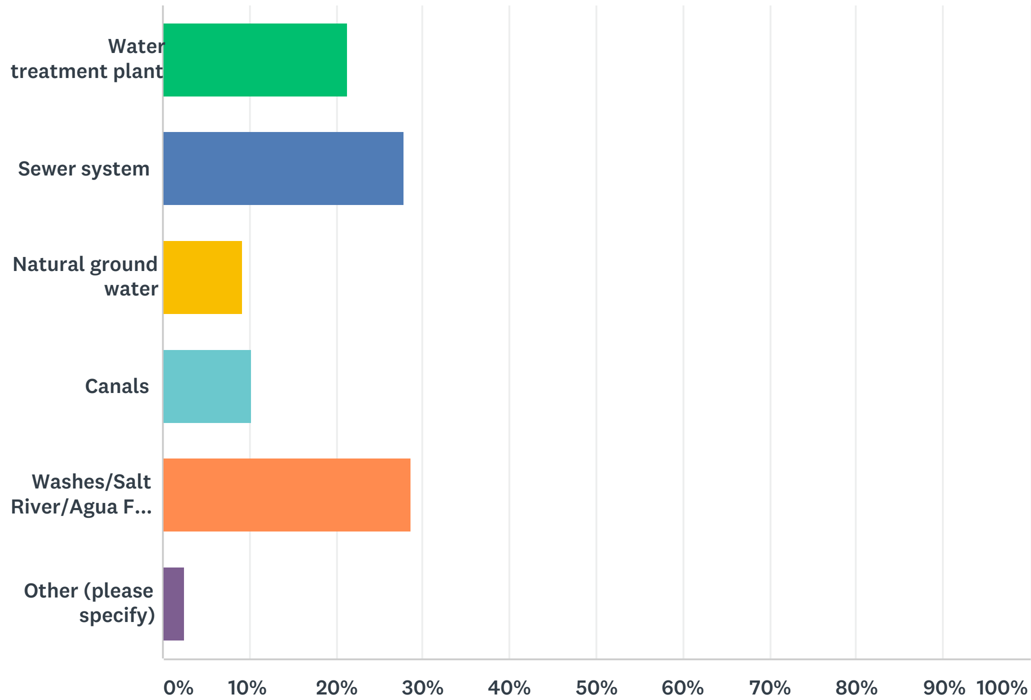
Public Awareness Survey

Q1 Where does water that flows into storm drains end up?

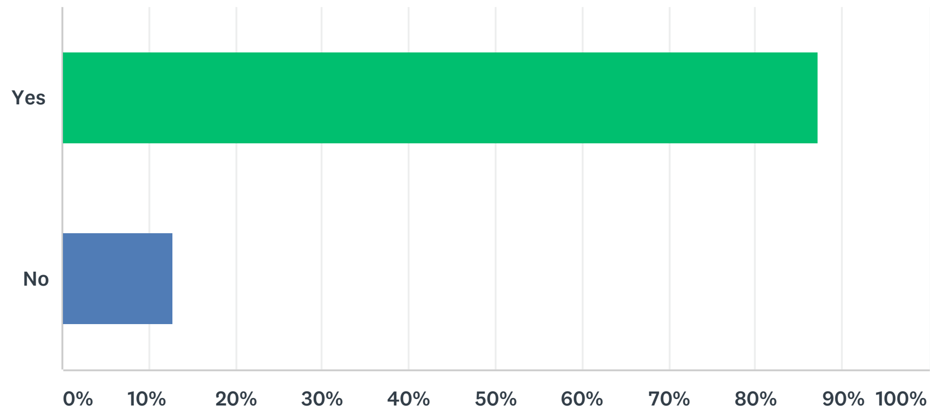
Answered: 1,014 Skipped: 6



ANSWER CHOICES	RESPONSES	
Water treatment plant	21.40%	217
Sewer system	27.81%	282
Natural ground water	9.27%	94
Canals	10.36%	105
Washes/Salt River/Agua Fria River	28.70%	291
Other (please specify)	2.47%	25
TOTAL		1,014

Q2 Do you think we have a problem in the Valley with pollution entering storm drains?

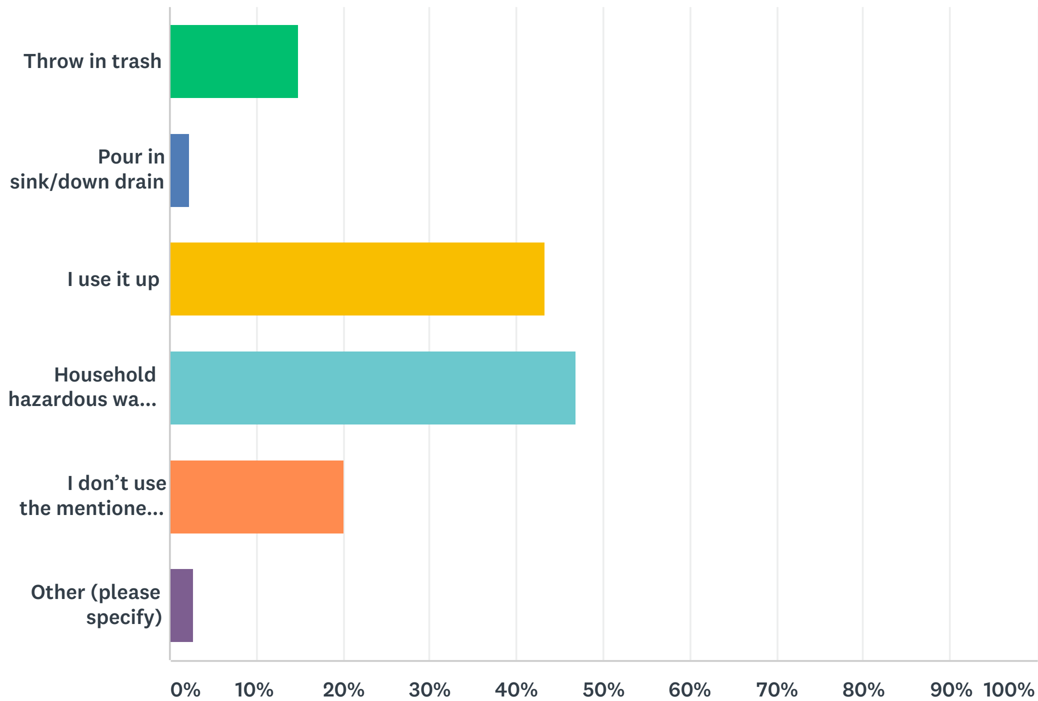
Answered: 1,013 Skipped: 7



ANSWER CHOICES	RESPONSES	
Yes	87.17%	883
No	12.83%	130
TOTAL		1,013

Q3 How do you currently dispose of things such as household and garden chemicals or pesticides? Select all applicable:

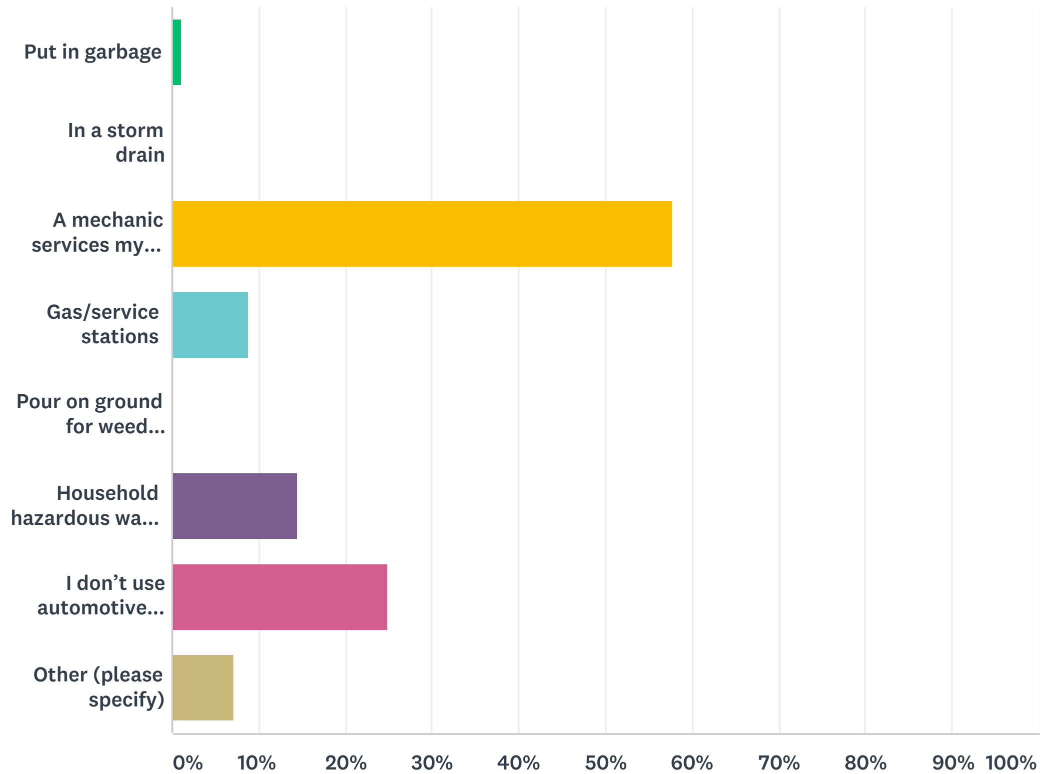
Answered: 1,018   Skipped: 2



ANSWER CHOICES	RESPONSES	
Throw in trash	14.83%	151
Pour in sink/down drain	2.26%	23
I use it up	43.32%	441
Household hazardous waste collection day	46.86%	477
I don't use the mentioned chemicals	20.14%	205
Other (please specify)	2.75%	28
Total Respondents: 1,018		

Q4 How do you dispose of automotive fluids (e.g., oil, transmission fluid)? Select all applicable:

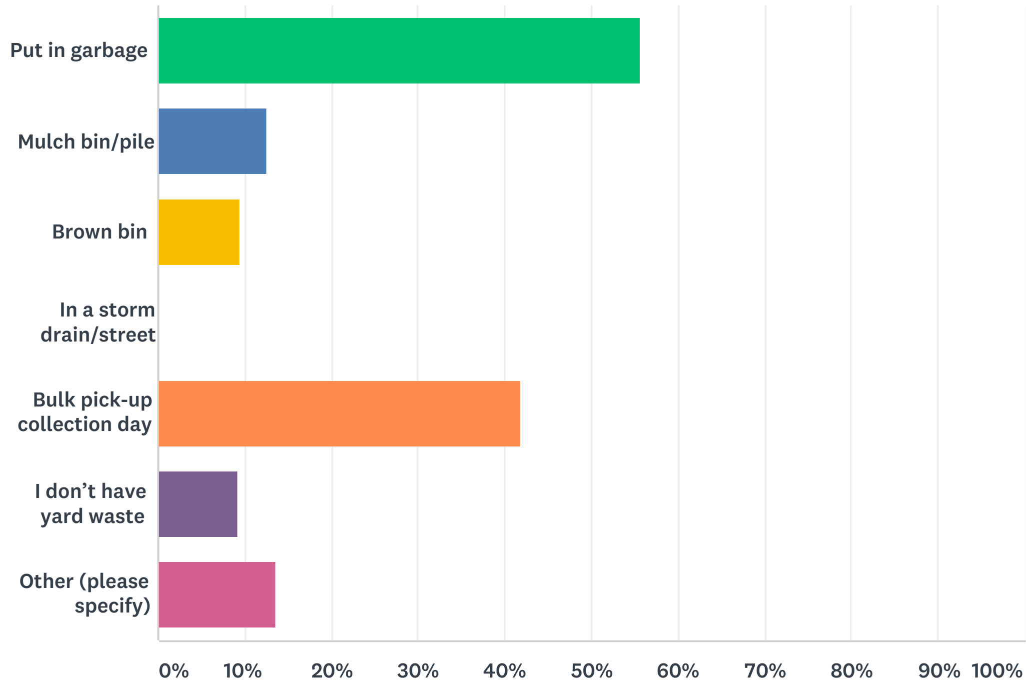
Answered: 1,018   Skipped: 2



ANSWER CHOICES	RESPONSES	
Put in garbage	1.08%	11
In a storm drain	0.10%	1
A mechanic services my vehicle	57.76%	588
Gas/service stations	8.84%	90
Pour on ground for weed control	0.00%	0
Household hazardous waste collection day	14.54%	148
I don’t use automotive fluids	24.95%	254
Other (please specify)	7.17%	73
Total Respondents: 1,018		

Q5 How do you dispose of yard waste? Select all applicable:

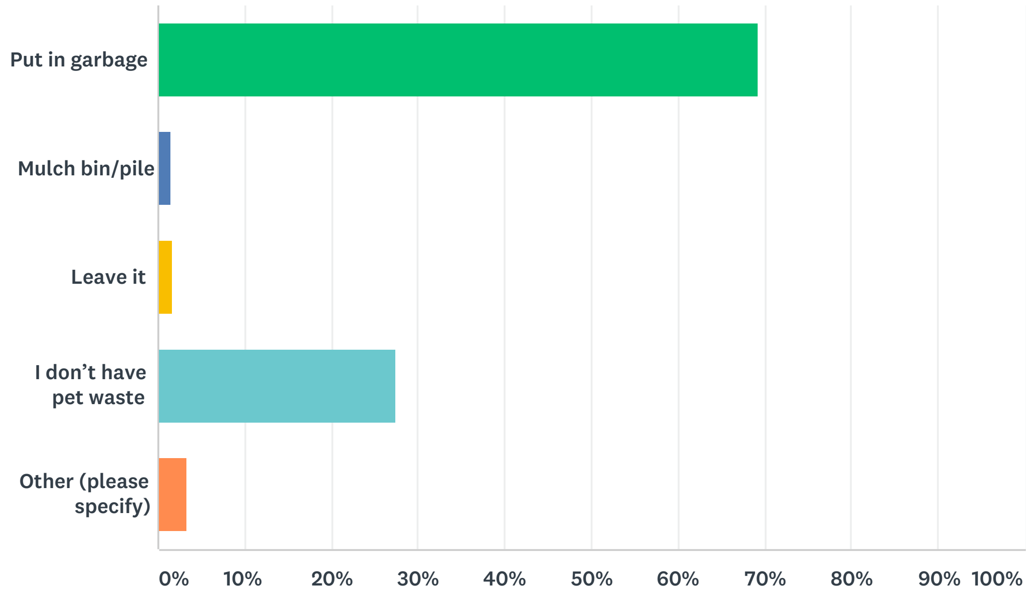
Answered: 1,019   Skipped: 1



ANSWER CHOICES	RESPONSES	
Put in garbage	55.64%	567
Mulch bin/pile	12.46%	127
Brown bin	9.42%	96
In a storm drain/street	0.00%	0
Bulk pick-up collection day	41.81%	426
I don't have yard waste	9.22%	94
Other (please specify)	13.54%	138
Total Respondents: 1,019		

Q6 How do you dispose of pet waste? Select all applicable:

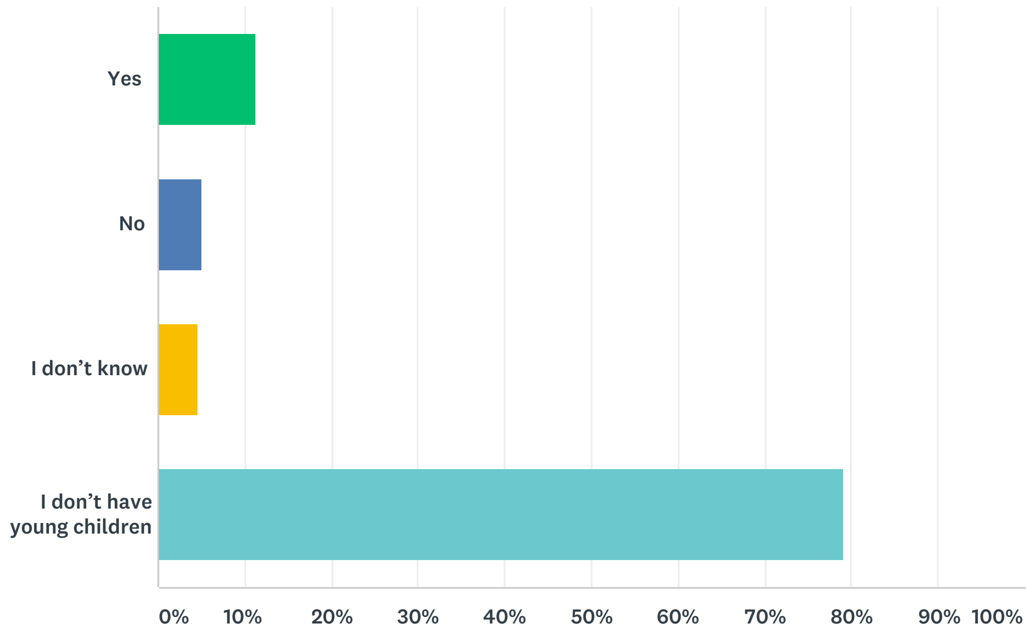
Answered: 1,016 Skipped: 4



ANSWER CHOICES	RESPONSES	
Put in garbage	69.19%	703
Mulch bin/pile	1.38%	14
Leave it	1.77%	18
I don't have pet waste	27.46%	279
Other (please specify)	3.35%	34
Total Respondents: 1,016		

Q7 Do your younger children understand what should or should not go in a storm drain?

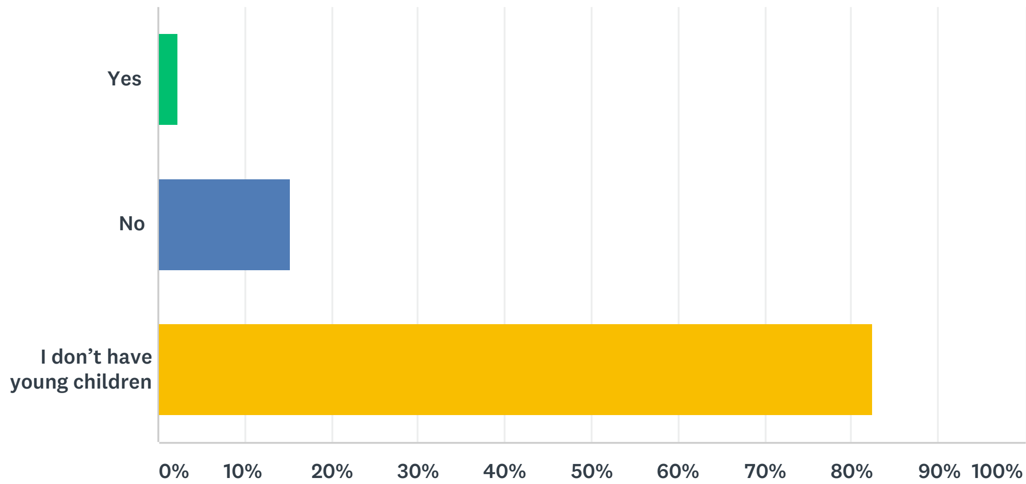
Answered: 1,016 Skipped: 4



ANSWER CHOICES	RESPONSES	
Yes	11.22%	114
No	5.12%	52
I don't know	4.53%	46
I don't have young children	79.13%	804
TOTAL		1,016

Q8 Have your young children mentioned, or brought home any materials from school related to this topic?

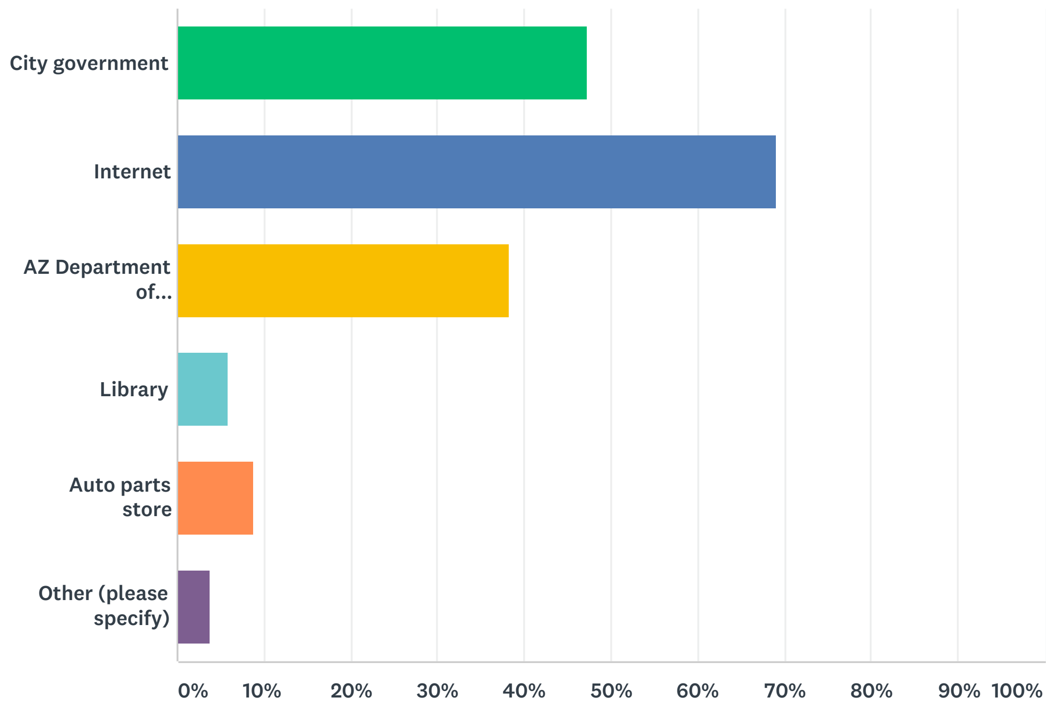
Answered: 1,008   Skipped: 12



ANSWER CHOICES	RESPONSES	
Yes	2.28%	23
No	15.28%	154
I don't have young children	82.44%	831
TOTAL		1,008

Q9 If you wanted to learn how to dispose of things like household chemicals, automotive fluids, lawn and garden chemicals, and pet wastes, where would you go? Select all applicable:

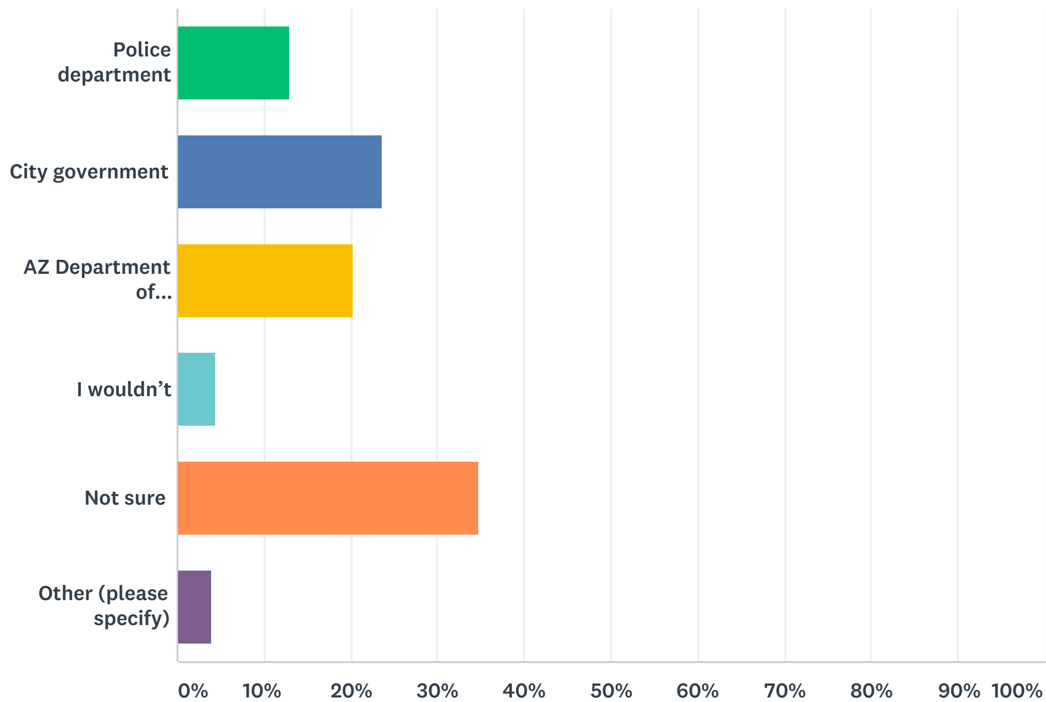
Answered: 1,017   Skipped: 3



ANSWER CHOICES	RESPONSES	
City government	47.20%	480
Internet	69.12%	703
AZ Department of Environmental Quality	38.25%	389
Library	5.90%	60
Auto parts store	8.75%	89
Other (please specify)	3.83%	39
Total Respondents: 1,017		

Q10 If you saw someone dumping trash or chemicals, automotive fluids, lawn and garden chemicals, and pet wastes, where would you go for information?

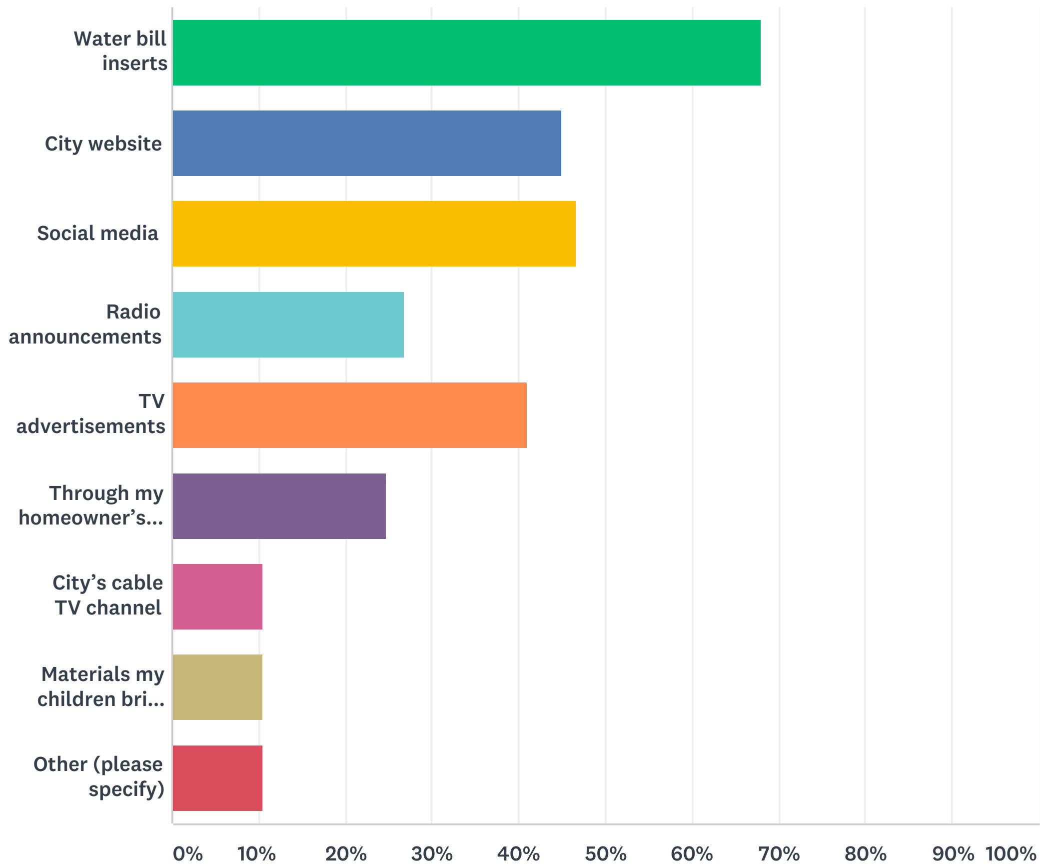
Answered: 1,016 Skipped: 4



ANSWER CHOICES	RESPONSES	
Police department	12.89%	131
City government	23.72%	241
AZ Department of Environmental Quality	20.28%	206
I wouldn't	4.43%	45
Not sure	34.74%	353
Other (please specify)	3.94%	40
TOTAL		1,016

Q11 The City wants the community to learn more about stormwater and tips to prevent pollution. What is a good way to provide information to you? Select all applicable:

Answered: 1,018 Skipped: 2



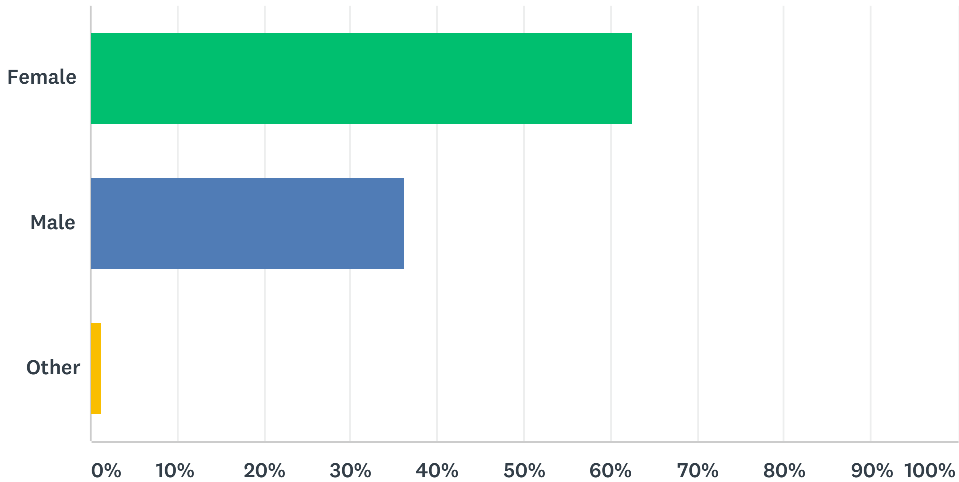
ANSWER CHOICES	RESPONSES	
Water bill inserts	67.98%	692
City website	44.89%	457
Social media	46.56%	474
Radio announcements	26.82%	273
TV advertisements	40.96%	417
Through my homeowner's association	24.75%	252
City's cable TV channel	10.41%	106
Materials my children bring home from school	10.51%	107
Other (please specify)	10.41%	106
Total Respondents: 1,018		

Q12 Is there anything else you want to tell us about storm drains and their use?

Answered: 491 Skipped: 529

Q13 Your gender:

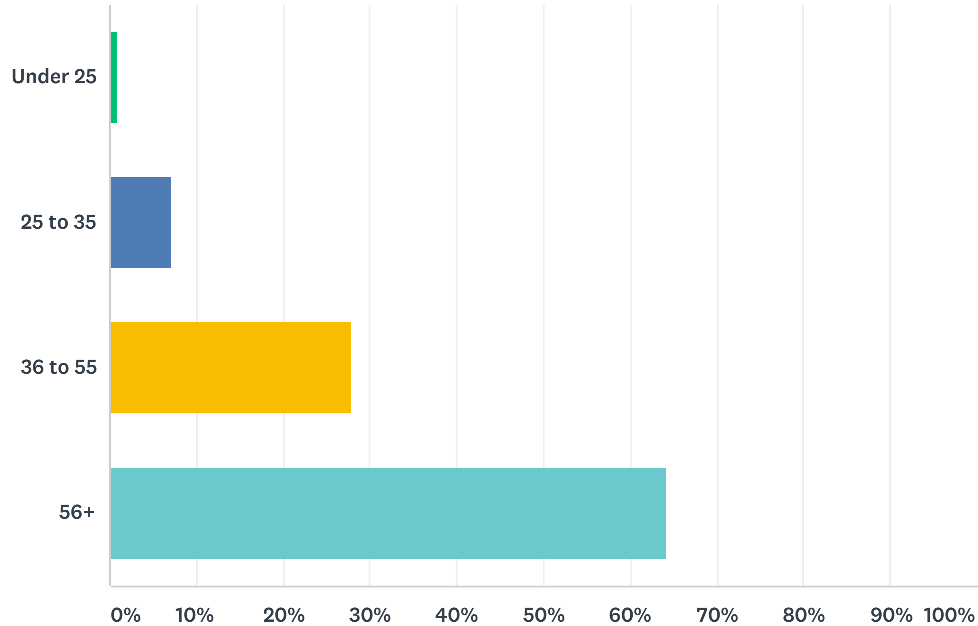
Answered: 992 Skipped: 28



ANSWER CHOICES	RESPONSES	
Female	62.50%	620
Male	36.29%	360
Other	1.21%	12
TOTAL		992

Q14 Your age group:

Answered: 996 Skipped: 24



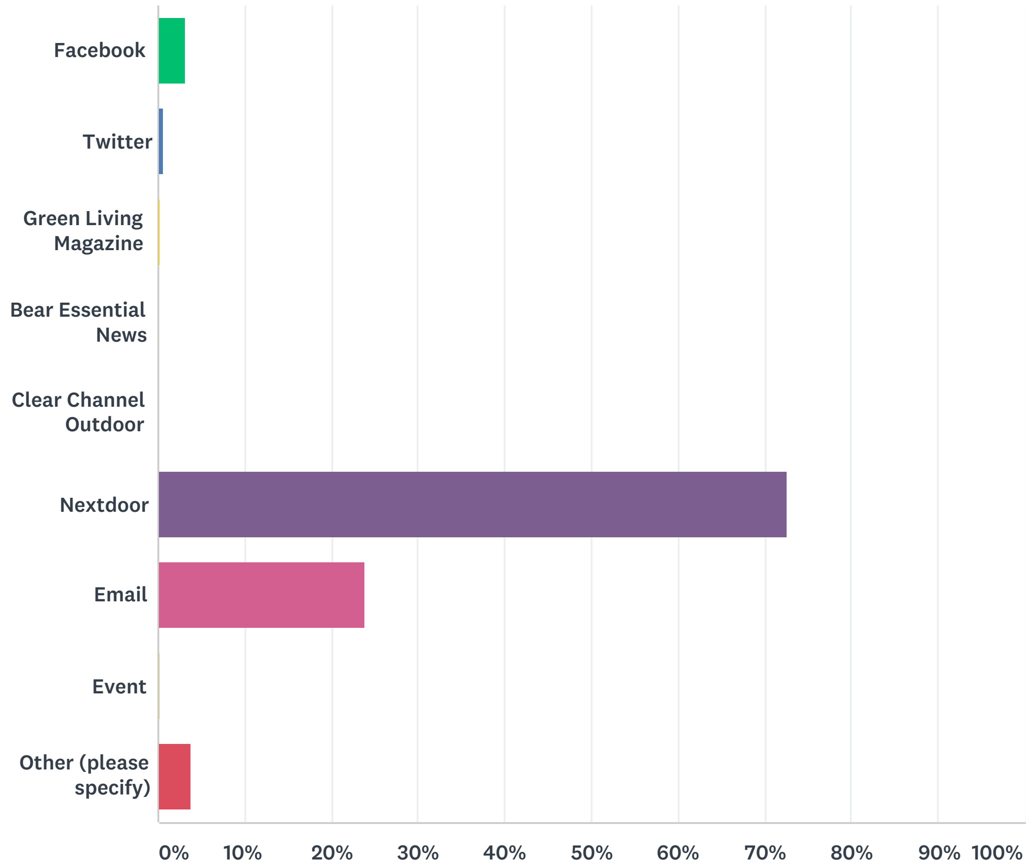
ANSWER CHOICES	RESPONSES	
Under 25	0.80%	8
25 to 35	7.13%	71
36 to 55	27.91%	278
56+	64.16%	639
TOTAL		996

Q15 ZIP code

Answered: 1,003 Skipped: 17

Q16 How did you hear about us?

Answered: 1,010 Skipped: 10



ANSWER CHOICES	RESPONSES	
Facebook	3.17%	32
Twitter	0.59%	6
Green Living Magazine	0.20%	2
Bear Essential News	0.00%	0
Clear Channel Outdoor	0.10%	1
Nextdoor	72.57%	733
Email	23.76%	240
Event	0.20%	2
Other (please specify)	3.66%	37
Total Respondents: 1,010		

Heptachlor Investigation Report

TECHNICAL MEMORANDUM

To: Linda Palumbo, City of Phoenix Water Services Dept.

From: Rebecca Sydnor and Sean Gormley, Amec Foster Wheeler

CC: Leigh Padgitt, City of Phoenix Water Services Dept.

Re: Heptachlor Investigation

Date: Submittal: August 30, 2017
Final Submittal: December 18, 2017

Background

The City of Phoenix (City) Water Services Department (WSD) reported heptachlor surface water quality standard (SWQS) exceedances in stormwater from three City outfalls that discharge to the Salt River. Samples that exceeded the SWQS were identified at Outfalls SR049, SR030, and SR003 and occurred between 2012 and 2016. As a result of repeated detections, Arizona Department of Environmental Quality (ADEQ) required the City to undertake an investigation to determine the source of the heptachlor. To assist in that response, Amec Foster Wheeler Environment & Infrastructure (Amec Foster Wheeler) was asked to support the investigation.

This final submittal is submitted to the City on December 18, 2017 and summarizes activities completed since July 1, 2017 undertaken as outlined in the initial memorandum. Results and recommendations from this additional investigation are presented in the 'December 18, 2017 Update' section at the conclusion of this report. Based on the investigation conclusion, no additional activities are warranted.

An initial memorandum was submitted to the City on August 30, 2017 and summarized activities through June 30, 2017. At the time of submittal Amec Foster Wheeler reported to have performed a review of the historic data; evaluated alternative laboratory methods; and evaluated each drainage basin for historic uses, recent authorized uses, and remediation sites where heptachlor could have been present. If warranted, remaining activities included: performing dry and wet weather field reconnaissance of the drainage basins and developing a Sediment Trapping Plan. Findings from this initial investigation are summarized in the "Conclusions through June 30' section.

Investigation Status

Review of Historic Data

For this evaluation, Amec Foster Wheeler reviewed data provided by the City of Phoenix Laboratory Superintendent. The information provided included raw data for samples collected in 2012, 2014 and 2016 that had reported detections of heptachlor, as well as representative method detection limit study data and initial calibration to help evaluate laboratory performance for low concentration samples.

The purpose of this evaluation was to perform a review for evidence of possible interferences in analysis of stormwater samples using gas chromatography with electron capture detection (GC/ECD). Based on the quality control (QC) data provided, review of the chromatography and annotations added by the analyst during data review, no concern were noted. The documentation provided showed excellent chromatography and QC performance, and the analyst notes were clear and helpful.

It was immediately evident that the chromatograms show the presence of many peaks not related to the target compounds. There are also many instances where there are peaks that elute within the retention time window required for identification of a target compound on one of the two analytical columns used, but not on the second column, showing that the target analyte was not present.

In some cases, however, peaks were present at the correct retention time on both columns, which is considered to show that the target analyte is most likely present. In cases where concentrations are high enough to allow, the City of Phoenix laboratory subjects positive results from GC/ECD analysis to reanalyze using mass selective detection (MSD), which is considered a best practice in environmental analysis because MSD is much less subject to positive interference from non-target chemicals. It is of note that in almost all cases where concentrations were high enough to allow use of confirmation using MSD, the target analyte was found to be not present, despite being apparently detected using GC/ECD. This includes multiple heptachlor results in the data set provided by the City of Phoenix, as well as other target chlorinated insecticide analytes. A comparison of heptachlor results generated using EPA Method 608 to GC/MSD confirmation results for the matching samples is provided in the table below.

Comparison of Heptachlor Results by EPA Method 608 to GC/MSD Confirmation Data

Sample	Date Analyzed by Method 608	Method 608 Concentration µg/L (ppb)	GC/MSD Confirmation Result
81989	12/20/2012	0.081	Result was not confirmed by GC/MSD results. Amec Foster Wheeler reviewed the provided MS output and agrees with the City Lab evaluation. The spectral match very poor, with multiple mass fragments not present compared to the reference spectrum.
81950	12/20/2012	0.087	
75819	12/08/2016	0.379	
81980	12/20/2012	0.059	Reported heptachlor concentration was too low to allow confirmation using GC/MSD.
79261	12/22/2014	0.063	
79277	12/22/2014	0.063	
79314	12/22/2014	0.045	
79636	12/08/2016	0.040	

Based on this evidence, it appears most likely that apparent heptachlor detections at concentrations too low to be confirmed by MSD are likely to also be false positive results, although this cannot be absolutely established using the data. As discussed below, the most useful approach to address the potential for low level false positive heptachlor results is to consider use of alternative analytical approaches that provide higher selectivity with low enough detection limits to provide definitive data that meet required data quality objectives.

Alternative Lab Methods

In order to assess the possible use of GC/MSD with selective ion monitoring to provide definitive data with adequate detection limits, the City of Phoenix completed a stormwater sampling and analysis program in May of 2017. Tabulated results for these samples were received from the City of Phoenix on June 23, 2017. Raw data and chromatograms were not reviewed by Amec Foster Wheeler for these samples.

On May 8, 2017, a dry weather sample (SR003 Dry) was collected to allow comparison of baseline results for analysis using EPA Method 608 (GC/ECD) to those generated using EPA Method 525.2 (GC/MSD-SIM). Neither heptachlor nor any other target insecticides were detected in this sample using either method, although the reported compound list differed between the 2 methods. In addition, detections using the GC/MSD-SIM method were lower than detection limits using the GC/ECD method for these dry weather samples, demonstrating that the GC/MSD-SIM approach could work.

On May 9, 2017, two stormwater samples (SR003 Wet and SR049 Wet) were collected for analysis using EPA Method 525.2 (GC/MSD-SIM). Total suspended solids were present in both samples at concentrations greater than 100 mg/L, which clogged the sample preparation apparatus and prevented extraction of an adequate sample volume to reduce the detection limit to the same level as for the dry weather sample. Despite the high suspended solids and consequent limitations in volume extracted for these specific stormwater samples, detection limits for heptachlor were only slightly higher than typically obtained using GC/ECD for samples without elevated suspended solid concentrations. Neither heptachlor nor other target insecticides were detected in either sample using this method, although, as before, the reported analytes differ from the list reported for sample SR003 Dry using GC/ECD.

Based on this limited initial study, use of GC/MSD-SIM appeared to have potential to provide more definitive data for heptachlor in stormwater samples, and to eliminate what appear to be likely false positive heptachlor results from previous years based on the historical pattern of lack of confirmation of heptachlor results by GC/MSD where concentrations are adequate. If needed in the future, it is possible that the GC/MSD-SIM method can be extended to more of the target analytes reported by the City of Phoenix Laboratory using EPA Method 608, but more evaluation by the lab will be required.

Based on results of this study, analysis by GC/MSD-SIM using EPA Method 525.2 appears to give detection limits that are adequately low for most samples. If, however, use of the GC/MSD-SIM method becomes problematic in future events due to high suspended solids levels, it may be necessary to consider analysis of stormwater by EPA Method 1699 (Method 1699: Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS), which uses extended chromatographic run times and high resolution mass spectrometric detection to produce highly selective analyte results with very low detection limits. The lower analytical detection limits mean that lower sample volumes would need to be extracted to achieve required sample specific detection limits, helping to reduce or eliminate problems achieving target detection limits in samples with high suspended solids. Disadvantages of using Method 1699 include cost, which is significantly higher than either EPA Method 608 (GC/ECD) or EPA Method 525.2 (GC/MSD-SIM), and availability from a limited number of laboratories. In addition, Method 1699, while an EPA developed method, has not currently been approved for Clean Water Act monitoring under 40CFR136, so additional regulatory approvals would be necessary before use to evaluate regulatory compliance in a monitoring program.

Review of Historic Uses, Recent Authorized Uses, and Remediation Sites

Based on a review of historic imagery, much of the drainage basins evaluated in this study have historically been used in former agriculture operations and may have been subject to pesticide application before heptachlor began being phased out in 1974 and banned in 1988. Development of each drainage basin was steady through the mid-2000's. Basin SR003 shows little change in recent years. Basin SR030 shows one large construction project in close proximity to the Salt River converting agricultural land to Grayson Square residential community between 2005 and 2009. Basin SR049 shows a number of infill projects, particularly between Lower Buckeye Road and Broadway Road between 2007 and 2009. No other major developments were identified in recent years. The Grayson Square area, in the lower portion of basin SR049, and current agriculture areas that are still in active use along the Salt River may be assessed during dry or wet weather field reconnaissance, if warranted. See figures in **Attachment A**.

Based on an inquiry through the Arizona Department of Agriculture (AZDA), there have been no records of organochlorine pesticide (OCP) use, including heptachlor, between 2012 – 2017. AZDA records retention policy is limited to five years; therefore, there no records are available for review prior to June 2012.

In reviewing ADEQ's GIS Web Mapping application for remediation site in the basin areas, there were four inactive and one active remediation sites identified within basin SR003, three inactive remediation sites within basin SR030, and two inactive remediation sites in basin SR049. See figures in **Attachment B**. None of the remediation sites were related to heptachlor. Amec Foster Wheeler will review these locations during the dry or wet weather field reconnaissance, if warranted.

Anecdotal reports indicate that one business, Keller Electrical Industries, may have used heptachlor for fire ant control in transformers that they manufacture. Transformers were sold and installed state-wide. Amec Foster Wheeler contacted Keller Electrical by phone and e-mail to request information on heptachlor use in their transformers or components and possible installation locations within the drainage areas. Amec Foster Wheeler has not received a response from Keller Electrical regarding the use of heptachlor in their electrical equipment. Keller Electrical was also considered as a potential storage location for heptachlor; however, they are physically located in Tempe, Az. Note: the Keller Electrical manufacturing facility is not located in any of the catchment areas evaluated.

Conclusions through June 30, 2017

Summary

Based on the preliminary investigation indicating false positive results are the likely cause of heptachlor detections, Amec Foster Wheeler did not anticipate the need to perform dry or wet weather field reconnaissance or develop and implement a plan for sediment trapping, as originally intended. Additional Best Management Practices to reduce or eliminate the exceedances of heptachlor are not likely to be needed if the recommendations below are implemented and confirm the preliminary finding that the historic detections are false positives. As discussed below, the City elected to perform additional confirmatory sampling and analysis, and the results verify the original conclusions regarding presence of analytical interferences, and the need to employ mass spectrometric detection to allow definitive evaluation of the presence or absence of Heptachlor.

December 18, 2017 Update

To confirm the preliminary determination, the City of Phoenix, with support from Amec Foster Wheeler, elected to collect and analyze one additional wet weather sample from each outfall. Samples were analyzed using Method 608 (GC/ECD) and EPA Method 525.2 (GC/MSD-SIM). Results from the sampling event were assessed to determine consistency between the two test methods and were used to verify what conclusions can be drawn regarding the likelihood of false positives. Wet weather samples were collected from outfalls SR003, SR030 and SR049 on July 24, 2017.

In addition, the City intended to collect dry weather samples from SR003 and SR049, if any is present prior to September 30, with the intent to also analyze those samples using Method 608 (GC/ECD) and EPA Method 525.2 (GC/MSD-SIM). However, dry weather flows were not observed at any outfall; thus, no additional dry weather flow was analyzed.

Results of this follow-up sampling are discussed below, and will be presented to ADEQ.

Heptachlor Results for Wet Weather Samples Collected during July 2017

As presented above, the city collected wet weather samples from SR003, SR030 and SR049 for pesticide analysis on July 24, 2017. All three samples were analyzed using EPA Method 608 (GC/ECD) with confirmatory analysis performed using EPA Method 525.2 (GC/MSD-SIM). Amec Foster Wheeler reviewed a summary of the results for these samples provided by the City of Phoenix, and did not review raw data for these samples.

Heptachlor was not detected in the samples from SR003 or SR049 using either EPA Method 608 or EPA Method 525.2. Heptachlor was detected in the sample from SR030 using EPA Method 608, but was not detected in the analysis performed using EPA Method 525.2, which employs the more definitive mass spectrometric detection. Results for these samples are presented in the table below.

Comparison of Heptachlor Results by EPA Method 608 to GC/MSD Confirmation Data for Samples Collected July 24, 2017

Sample Location	Heptachlor Concentration by EPA Method 608 GC/ECD in Units of (µg/L or ppb)	Heptachlor Concentration by EPA Method 525.2 (GC/MSD-SIM) in units of (µg/L or ppb)
SR003	<0.019	<0.016
SR030	0.030	<0.016
SR049	<0.019	<0.016

Laboratory reporting limits for the confirmatory analyses using EPA Method 525.2 were lower than reporting limits using EPA Method 608.

Summary

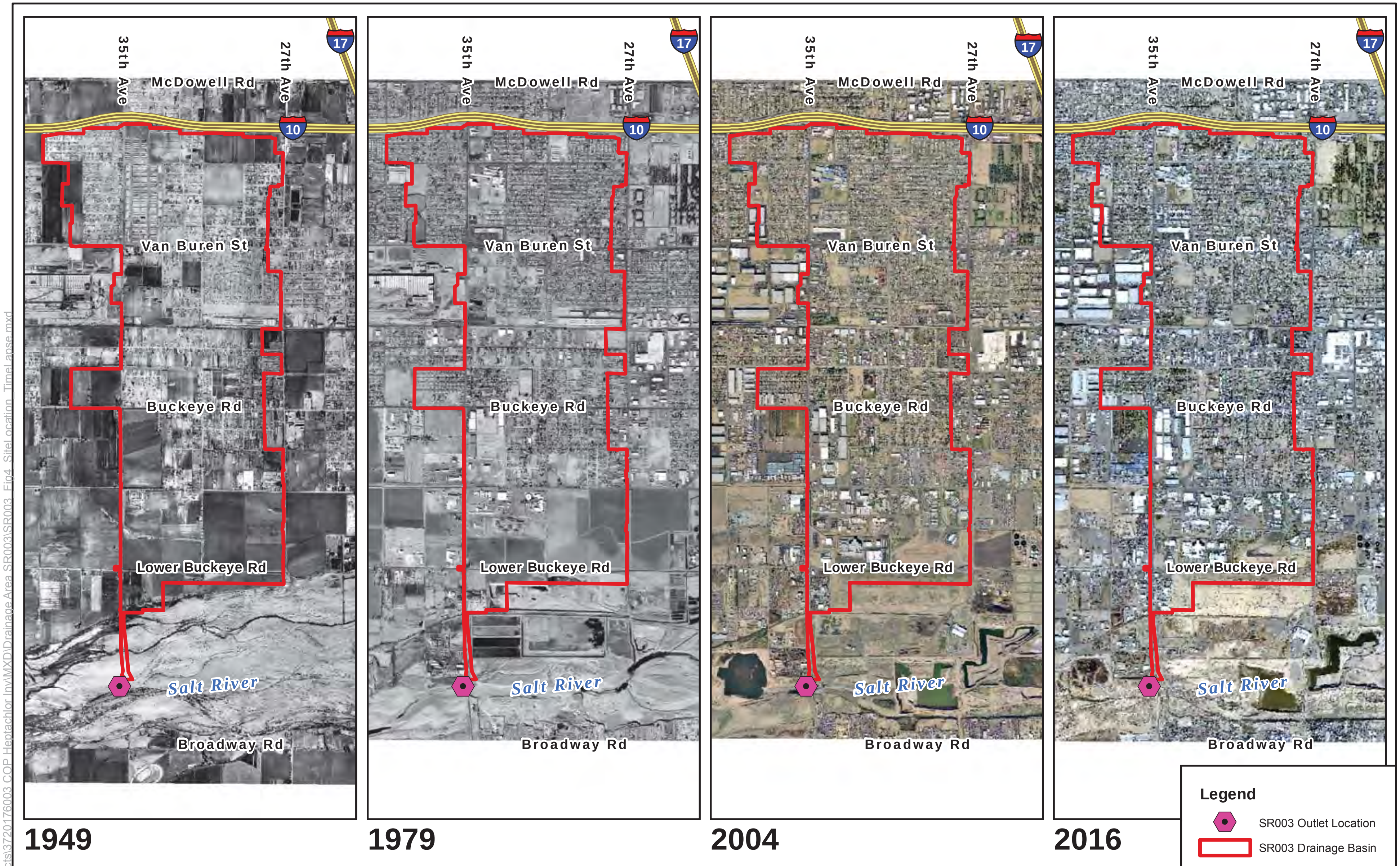
Data for the July 24, 2017 samples from these locations continues to demonstrate that detected Heptachlor concentrations are false positives, and that analysis using GC/MSD-SIM following EPA Method 525.2 demonstrates that detectable concentrations of Heptachlor are not present.

Next Steps

Based on the results of this investigation, additional analysis of wet weather results would not result in a change to the conclusion that detections using EPA Method 608 are false positives. No additional confirmation sampling is recommended nor are any additional field investigations.

Amec Foster Wheeler recommends the City verify any future Heptachlor detections resulting from analyzing by EPA Method 608 GC/ECD by using EPA Method 525.2 (GC/MSD-SIM).

Attachment A
Historical Imagery



0 0.85 1.7 3.4 Miles

Job No.:	37-2017-6003
PM:	RLS
Date:	7/20/2017
Scale:	1" = 4500'

N

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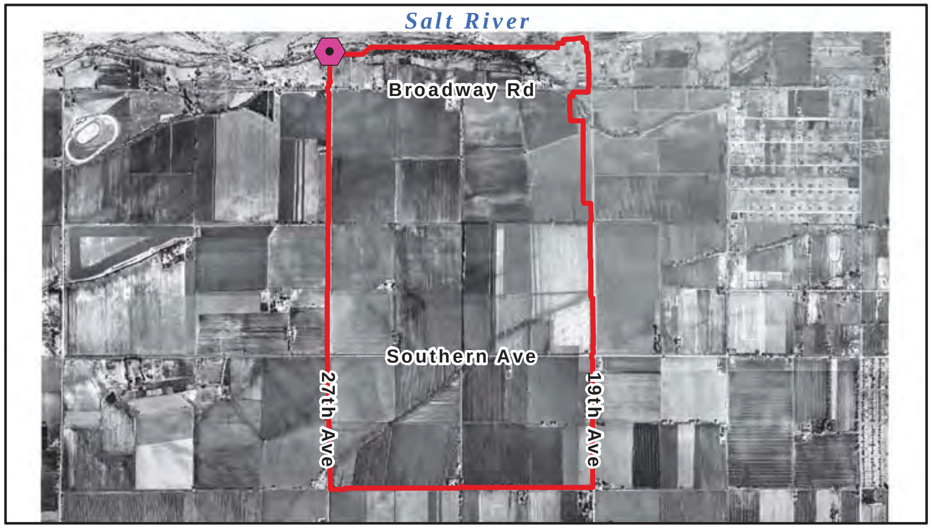
Heptachlor Source Investigation
City of Phoenix
Phoenix, Arizona

SR003 Drainage Basin Time Lapse
Maricopa County Historic Aerial Photography

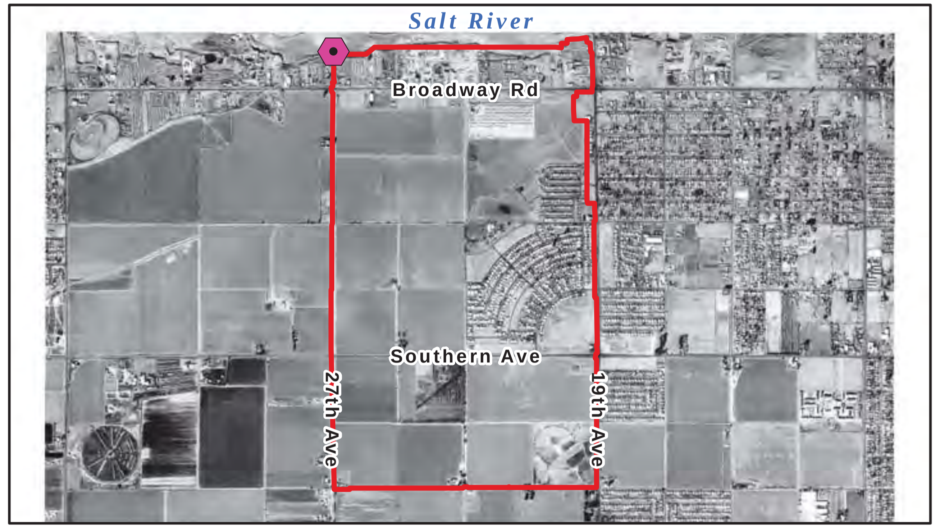
FIGURE
1

amec foster wheeler

Path: X:\Projects\2017 Projects\3720176003 COP Heptachlor Inv\MXD\Drainage Area SR003\SR003_Fig4_SiteLocation_TimeLapse.mxd

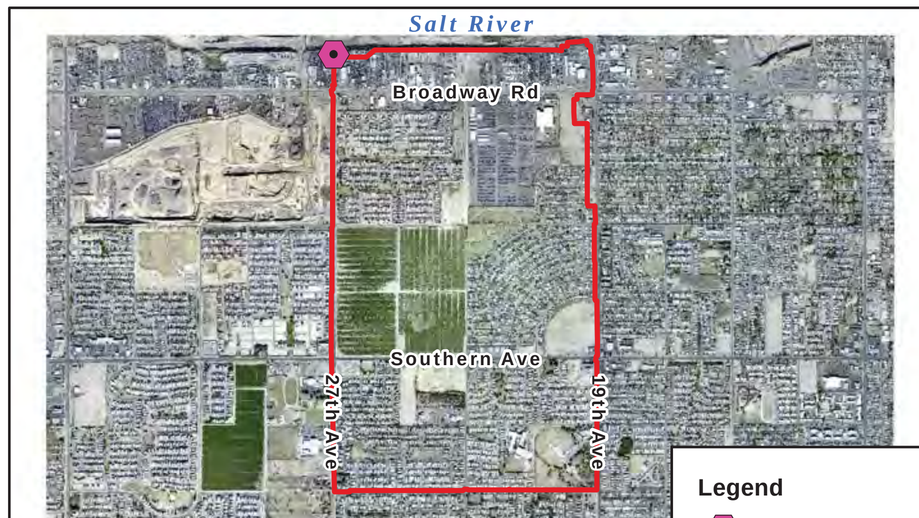


1949



1979

2004



2016

Legend

- SR030 Outlet Location
- SR030 Drainage Basin

0 0.72 1.44 2.88 Miles

Job No.:	37-2017-6003
PM:	RLS
Date:	7/20/2017
Scale:	1" = 3800'

N

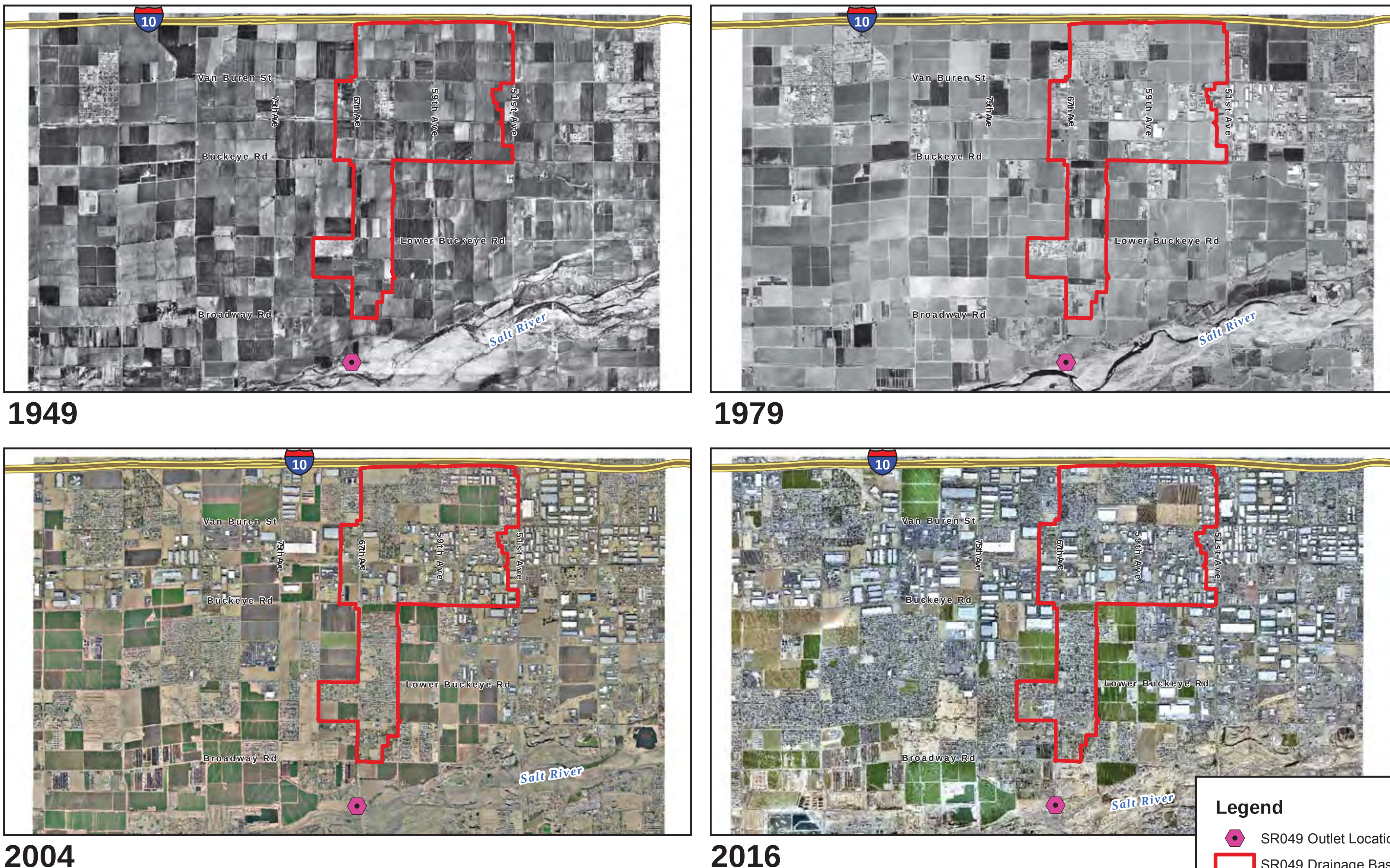
Heptachlor Source Investigation
City of Phoenix
Phoenix, Arizona

SR030 Drainage Basin Time Lapse
Maricopa County Historic Aerial Photography

FIGURE
2

amec foster wheeler

Path: X:\Projects\2017 Projects\3720176003 COP Heptachlor Inv\MXD\Drainage Area SR030\SR030_Fig5_SiteLocation_TimeLapse.mxd



Legend

- SR049 Outlet Location
- SR049 Drainage Basin

0 0.9 1.8 3.6 Miles

N

Job No.:	37-2017-6003
PM:	RLS
Date:	7/25/2017
Scale:	1" = 9500'

Heptachlor Source Investigation
City of Phoenix
Phoenix, Arizona

SR049 Drainage Basin Time Lapse
Maricopa County Historic Aerial Photography

FIGURE 3

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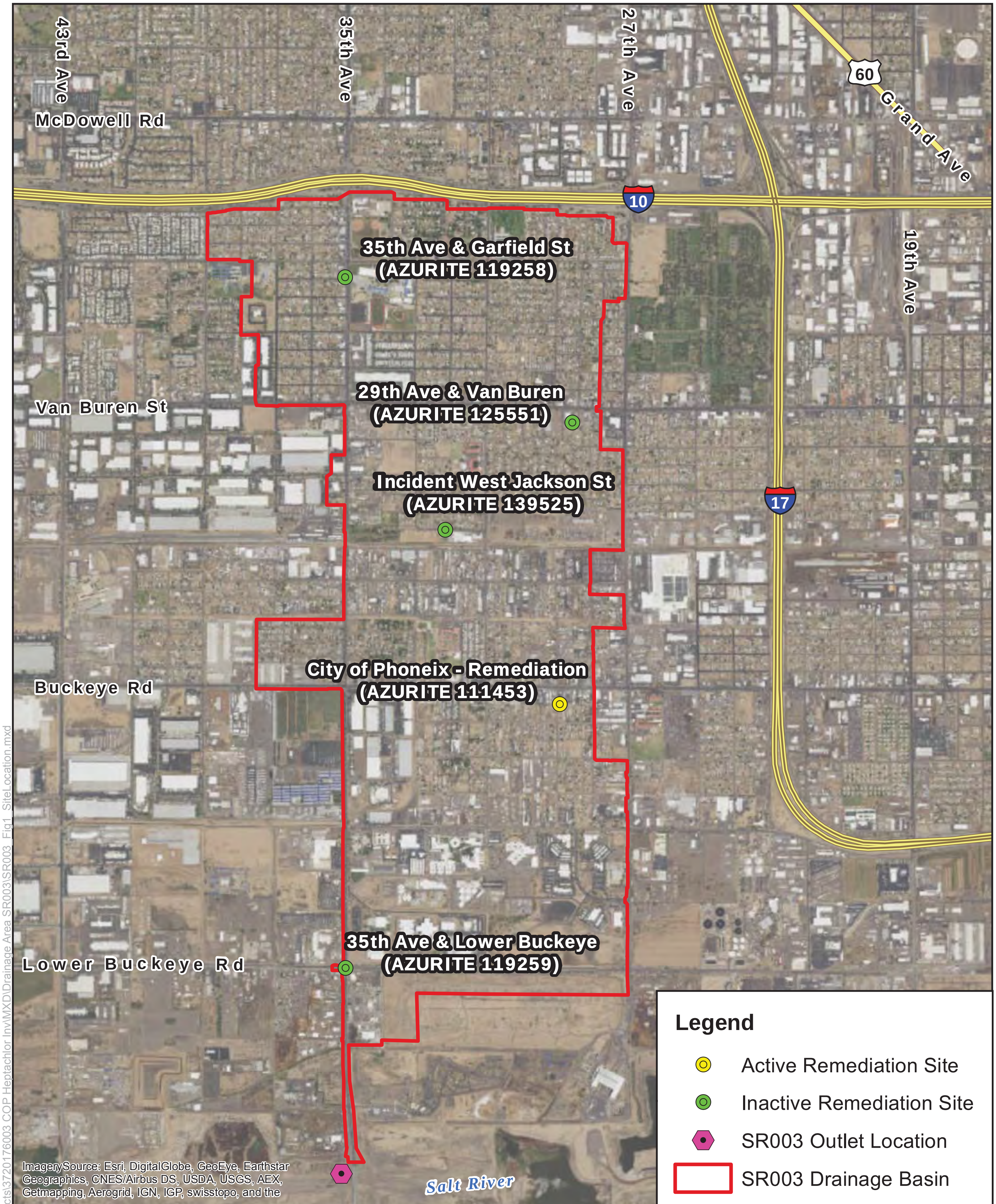
Path: X:\Projects\2017 Projects\3720176003 COP Heptachlor Inv\MXD\Drainage Area SR049\SR049_Fig6_SiteLocation_TimeLapse.mxd

Attachment B

Remediation Site Locations



Job No.:	3720176003
PM:	RLS
Date:	7/20/2017
Scale:	1" = 2500'

N

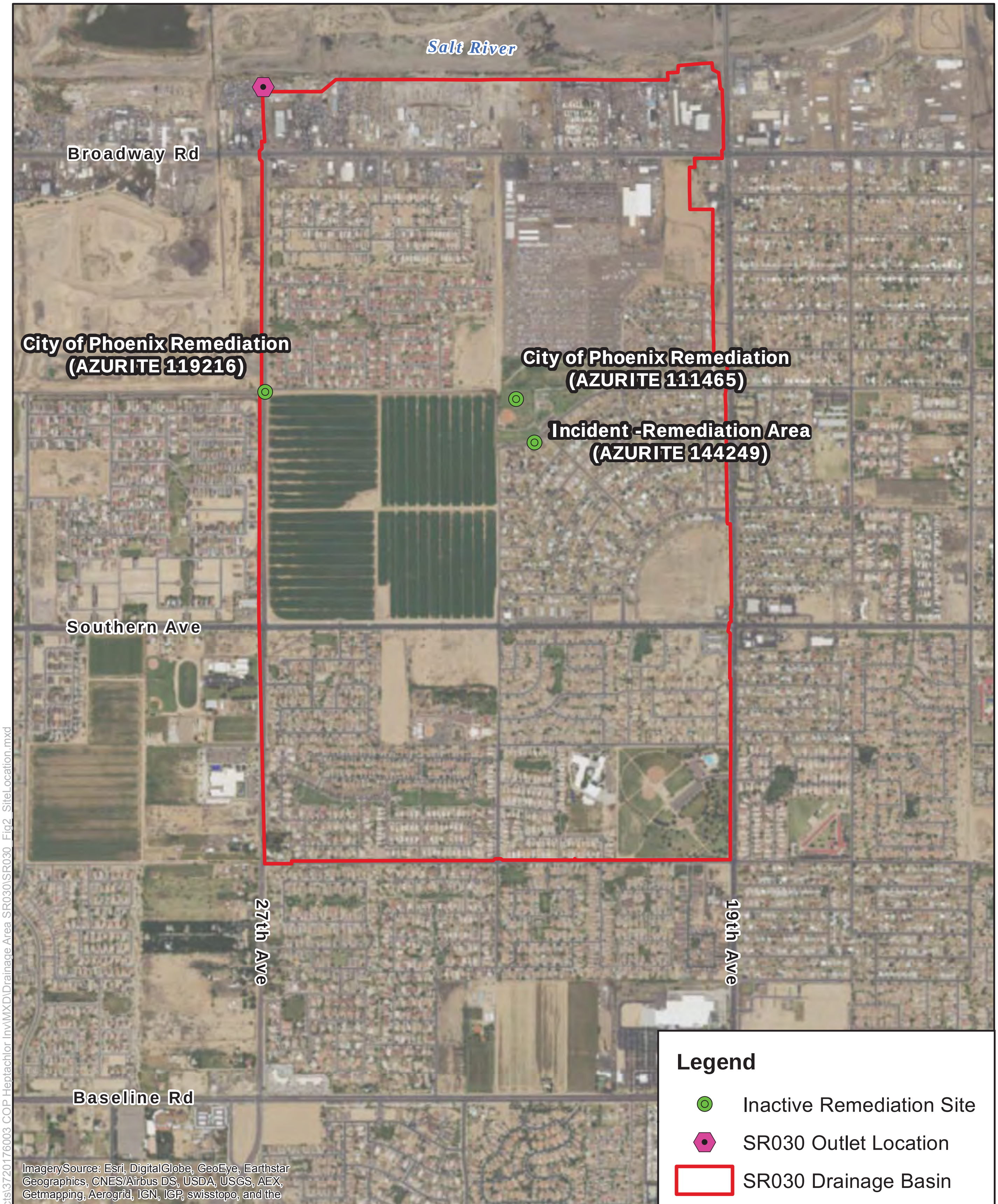
Heptachlor Source Investigation
City of Phoenix
Phoenix, Arizona

SR003 Remediation Sites

FIGURE
4

amec foster wheeler

Path: X:\Projects\2017 Projects\3720176003 COP Heptachlor Inv\MXD\Drainage Area SR003\SR003_Fig1_SiteLocation.mxd



Job No.:	3720176003
PM:	RLS
Date:	7/20/2017
Scale:	1" = 1500'

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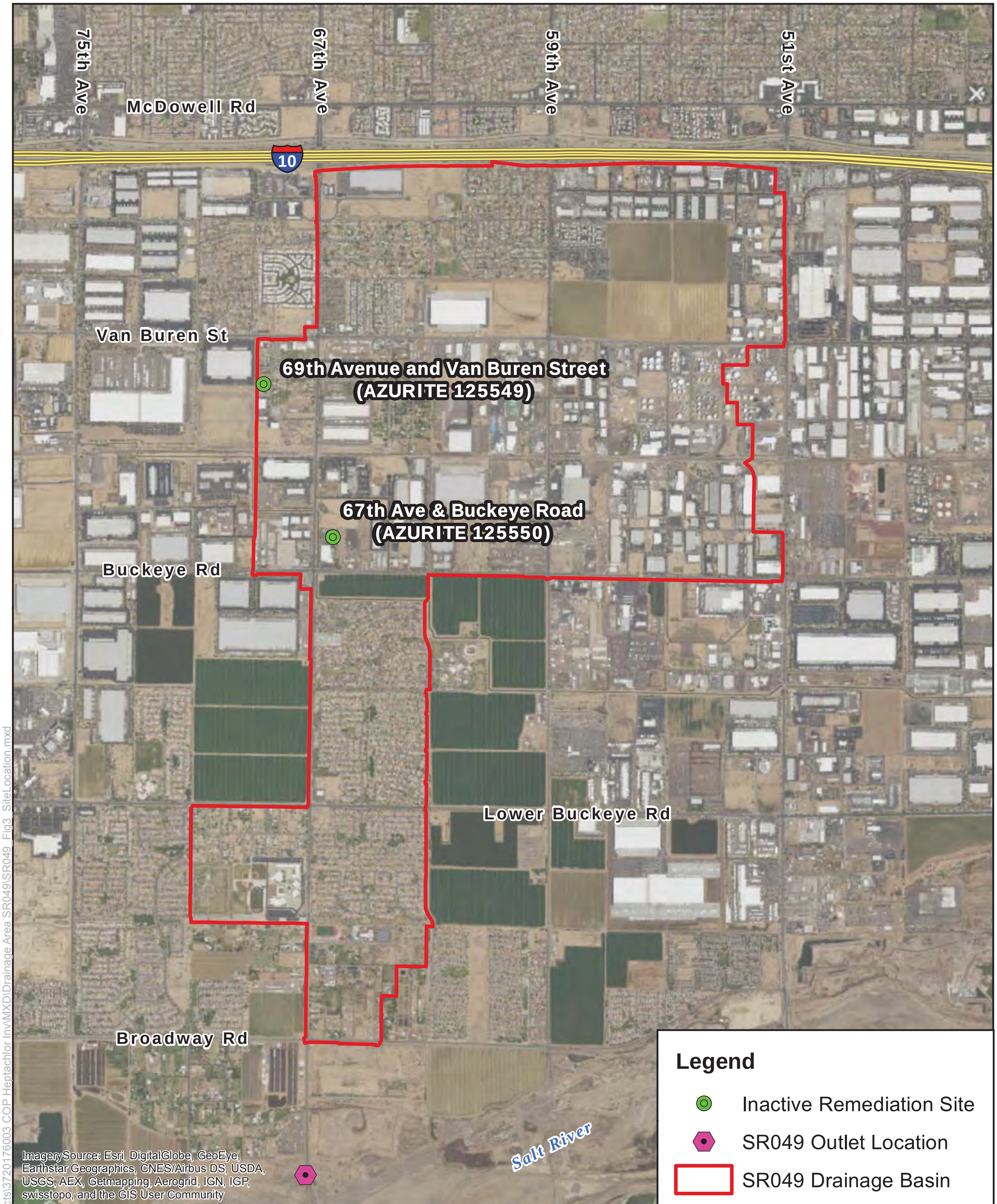
Heptachlor Source Investigation
City of Phoenix
Phoenix, Arizona

SR030 Remediation Sites

FIGURE
5

amec foster wheeler

Path: X:\Projects\2017 Projects\3720176003 COP Heptachlor Inv\MXD\Drainage Area SR030\SR030_Fig2_SiteLocation.mxd



Job No.:	3720176003
PM:	RLS
Date:	7/20/2017
Scale:	1" = 2500'

Heptachlor Source Investigation
City of Phoenix
Phoenix, Arizona

SR049 Remediation Sites

FIGURE
6

amec foster wheeler

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Path: X:\Projects\2017 Projects\3720176003 COP Heptachlor Inv\MXD\Drainage Area SR049\SR049_Fig3_SiteLocation.mxd

STORM Annual Report

STORM – Fiscal Year 2018 Annual Report (July 1, 2017 – June 30, 2018)

SUMMARY

Arizona's Stormwater Outreach for Regional Municipalities (STORM) provides a platform for collaborative effort by which educational outreach may be provided to residents in the greater Phoenix area with the message of pollution prevention to keep our waters clean. In Fiscal Year 2018, STORM members completed outreach via web, social media, and events. The coordination among 25 member cities, towns, and non-traditional municipal separate storm sewer systems or affiliates, resulted in:

Events – 77 events and 13,000 direct contacts compared to fiscal 2017 (108 events with 15,000 direct contacts). STORM organization participated in one event (OdySea Conservation Expo) and hosted two events this fiscal year. Members continue to function independently and may use STORM promotional items.

Videos – three educational videos were developed with information about pets, lawns, and pools. The component contaminants and best practices to manage pollutant discharges were covered by a handsome talking dog. These can be found on STORM's YouTube channel (a.k.a., arizona storm), and some member websites as well.

Website – received a total of 12,600 webpage views; by 6,528 new users and 617 returning visitors. There were nearly 8,000 webpage sessions in FY18. A session is defined as a period of time a user is engaged in the website, meaning, more people are actively using and searching the STORM website.

MEMBERSHIP

ADOT, Apache Junction, Avondale, Buckeye, Casa Grande, Chandler, El Mirage, Fountain Hills, Gilbert, Glendale, Goodyear, Guadalupe, Litchfield Park, Luke Air Force Base, Maricopa County, Mesa, Paradise Valley, Peoria, Phoenix, Pinal County, Queen Creek, Scottsdale, Surprise, Tempe, Tolleson.

FINANCIAL

Total Revenue		Total Expenditures	
Beginning Balance FY18	$27,707	Website, Facebook, ABC15	$23,436
Membership Dues Received	$52,500	Educational Videos	$14,850
		Promotional Items & Marketing	$12,058
		Administrative & Accounting	$1,516
		Construction Seminar	$144
Total	$80,207	Total	$52,004

STATISTICS

Members meet monthly on the fourth Tuesday at 130PM. These working meetings are the primary method of sharing relevant information about regulatory issues, identifying potential outreach events, updating committee efforts, and reporting. Members track outreach events online for inclusion in this annual report, which supports a regional front, stretches municipal dollars and coordinates consistent messages in the Middle Gila River Watershed.

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STORM – Fiscal Year 2018 Annual Report (July 1, 2017 – June 30, 2018)

STORM members conducted 77 events or workshops throughout the central Arizona region with an estimated three-hundred thousand attendees, of which thirteen thousand attendees engaged with municipal staff about stormwater pollution prevention. At these events, 7,217 print materials (brochures and activity books) and 5,110 promotional items (pet waste bags, cups, frisbees, pencils, sack bags, jar openers, and magnets) were distributed. Table 1 identifies the month, number of events, estimated attendance and public engagement with our members.

Table 1 – Events and Website Views									
2017					2018				
Month	*Events*	*Attended*	*Engaged*	*Website*	*Month*	*Events*	*Attended*	*Engaged*	*Website*
July	3	20,340	709	2,300	January	4	7,165	445	258
August	3	33	33	731	February	11	17,282	3,058	211
September	3	2,015	364	336	March	10	227,837	1,593	253
October	13	5,469	2,073	321	April	10	7,175	1,107	197
November	5	588	582	260	May	8	2,355	1,361	1,600
December	5	1,517	1,577	183	June	2	50	50	1,300

SOCIAL MEDIA CAMPAIGN

Social Media, specifically Facebook, campaigns were very successful this fiscal year. STORM contracted with ABC15 to run an advertisement campaign. The campaign included regular banner ads on their website, Facebook ads, Facebook posts, and large banner ads. The eight-month campaign resulted in more than 3.5M impressions and almost fifteen thousand clicks (engagement). View Attachment for specifics.

In addition, STORM members contributed time to post and interact with the public on the AZSTORM Facebook page. STORM posted 232 times with a reach of 82,505 resulting in 5,759 actions taken, 1,649 Followers (increase from 1,277) and 1,642 Page Likes (increase from 1,293). It is worthwhile to note that when Facebook posts were boosted, approximately 33,193 were reached for a nominal fee of $375. Table 2 includes the top five posts, when they posted, how many reached and liked, and the topic.

Table 2 – Top 5 Posts			
Day and Time	**Reach**	**Likes**	**Topic**
Mar 6, 2018 6:36 am	25,458	2,616	(Pet waste) #bestormwatersmart & gain flexibility!! http://azstorm.org/
Jun 14, 2018 6:44 pm	6,848	561	Tomorrow is the beginning of #Monsoon2018. Rain is in the forecast tonight through Saturday. Know how to be prepared and #bestormwatersmart. Only rain should go down the storm drain! www.azstorm.org
May 1, 2018 5:59 am	6,178	302	Ahhh...with the temps warming up it's pool season!! Make sure you know where to put the water when conducting pool maintenance. Sparky will get you started on what to do. https://youtu.be/vmhkj31t8j4
Apr 2, 2018 6:32 am	5,909	492	We LOVE seeing inlet protection around construction sites preventing stormwater pollution!! #bestormwatersmart and learn more construction site stormwater ideas at goo.gl/63yMwR
Feb 14, 2018 6:32 am	4,724	440	❤❤❤ it when people do it right! #Bestormwatersmart. If it drips use a drip pan!

ATTACHMENT

EDUCATION, MARKETING, WEBSITE & FACEBOOK HIGHLIGHTS

STORM
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STORM – Fiscal Year 2018 Annual Report (July 1, 2017 – June 30, 2018)

Education Videos: Pets, Pools, & Lawns

Target Audience: Residents

Total Cost: $14,850

Marketing: ABC 15 Giveaway Promo

Target Audience: General Public

Arizona Grand Gift Card $453.00; Ipad $368.00

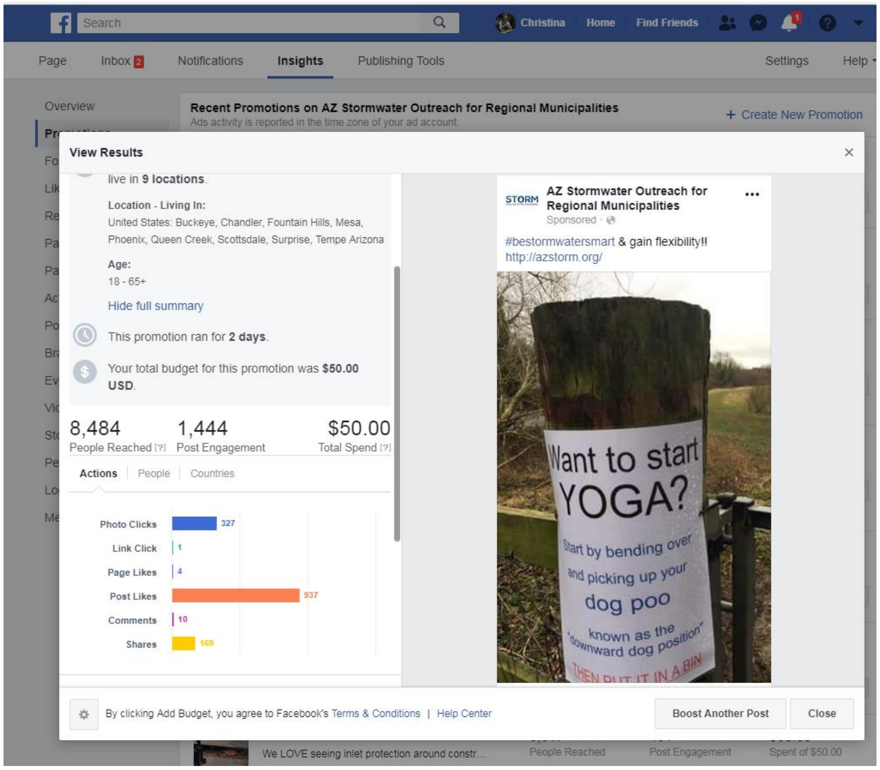
Promotional Items (500 each): Total Cost; $12,058

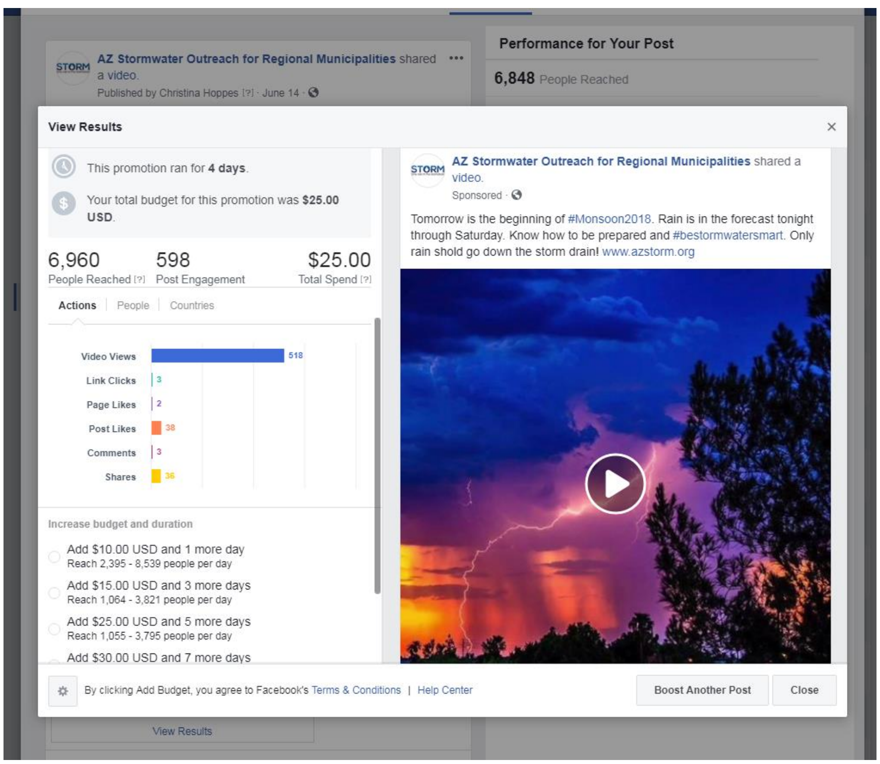
Pet Waste Bag Dispensers ($9999.25)

PAD 50 sheet Things to Do ($556.25)

Key Chains ($681.26)

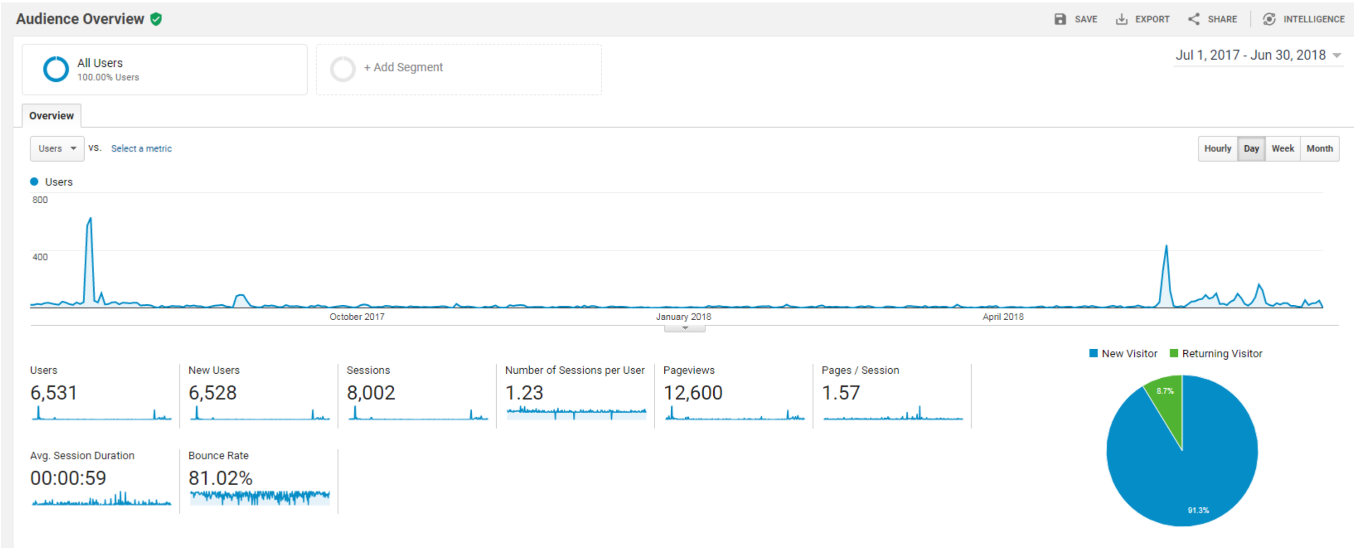
Example Posts from Facebook





STORM – Fiscal Year 2018 Annual Report (July 1, 2017 – June 30, 2018)

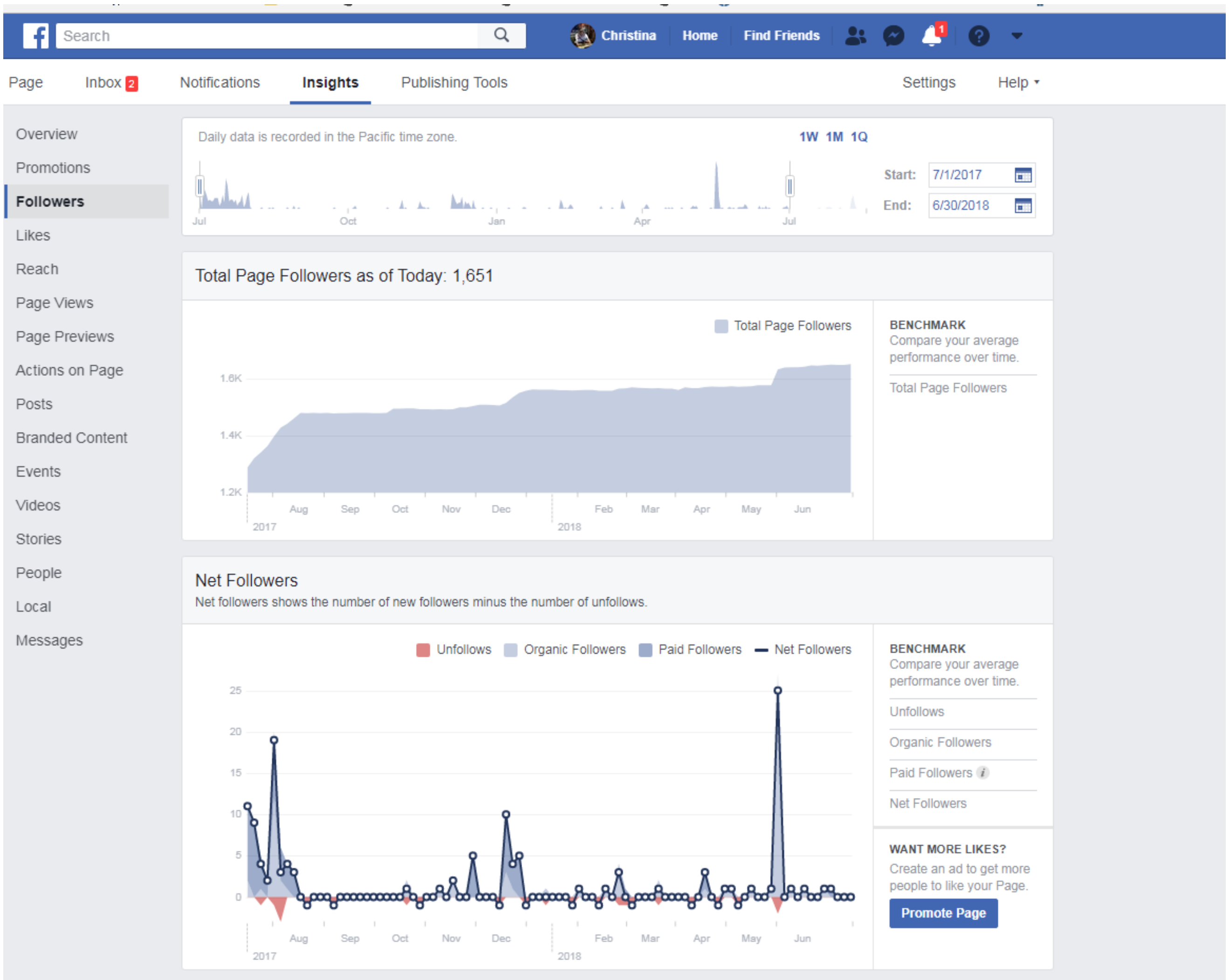
AZSTORM.ORG Website Analytics



Break down of new (91.3%) versus return visitors (8.7%) to the website, includes number of visitors (6,531), number of page views (12,600) and bounce (to other pages).

STORM – Fiscal Year 2018 Annual Report (July 1, 2017 – June 30, 2018)

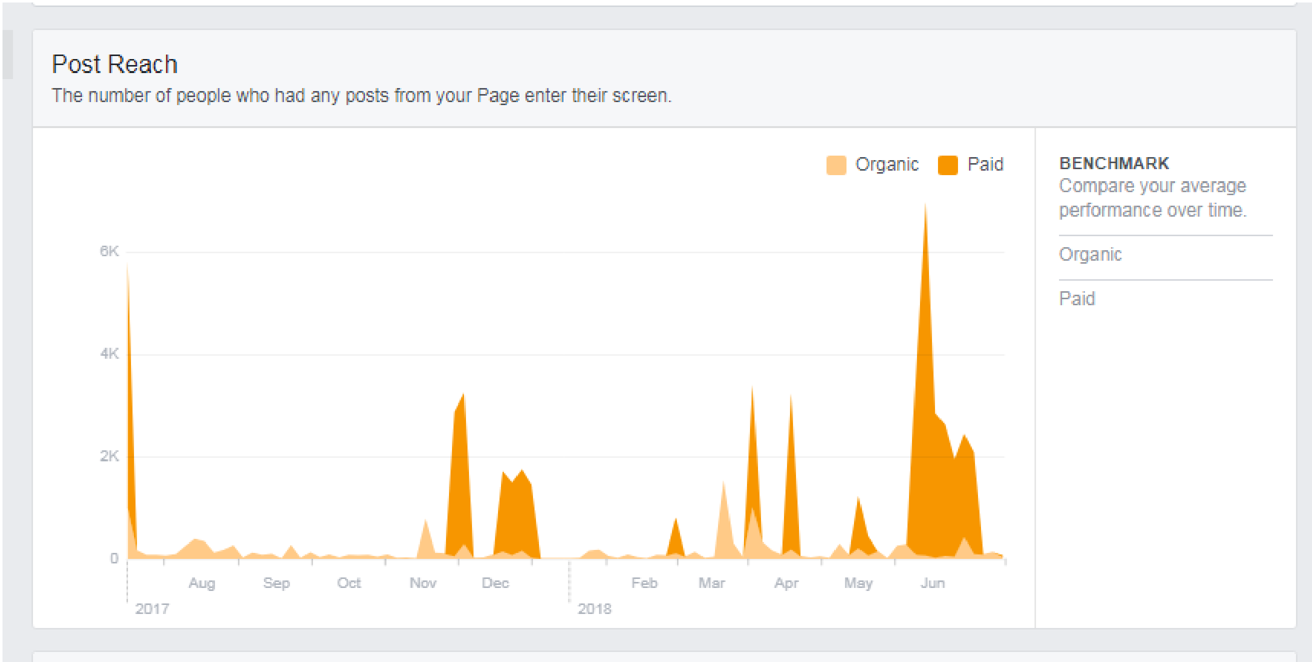
Facebook Analytic

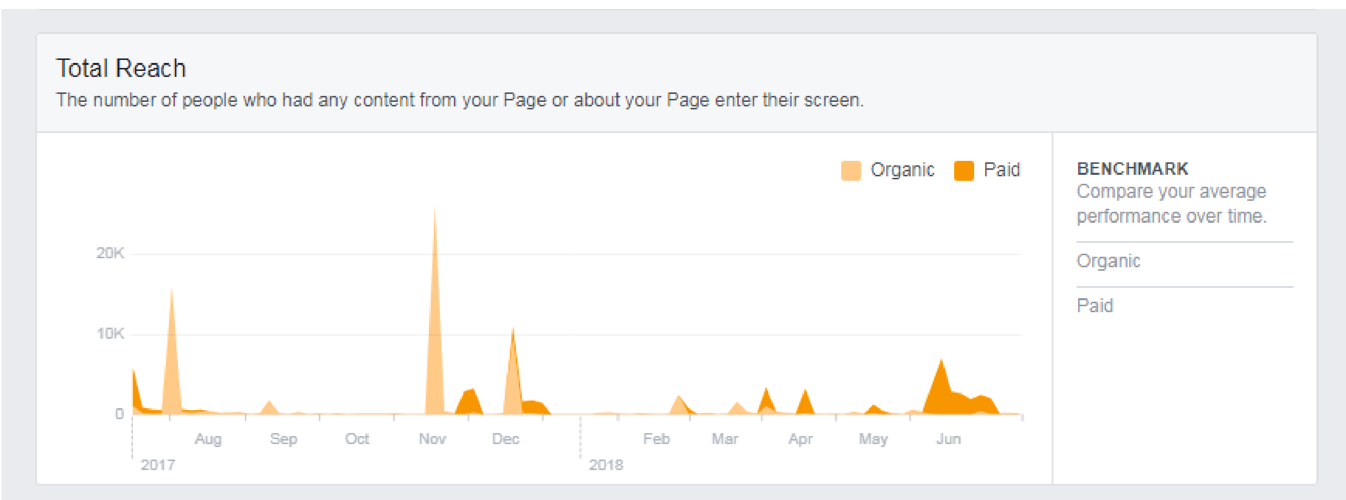


Net increase in followers of a social media campaign and after paid advertising.

STORM – Fiscal Year 2018 Annual Report (July 1, 2017 – June 30, 2018)

Facebook Analytic





Number of people who were served STORM messaging on their screens.

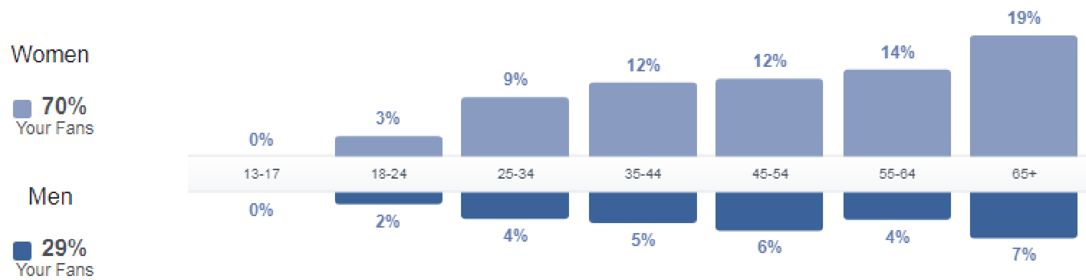
STORM – Fiscal Year 2018 Annual Report (July 1, 2017 – June 30, 2018)

Facebook Analytic

Notifications | **Insights** | Publishing Tools | Settings | Help

Your Fans | **Your Followers** | **People Reached** | **People Engaged**

Aggregated demographic data about the people who like your Page based on the age and gender information they provide in their user profiles.



Country	Your Fans
United States of America	1,629
Canada	5
Iran	2
Mexico	2
France	1
Guinea	1
Indonesia	1
India	1
Iraq	1
China	1

City	Your Fans
Phoenix, AZ	407
Mesa, AZ	93
Glendale, AZ	42
Gilbert, AZ	41
Chandler, AZ	38
Scottsdale, AZ	34
Kingman, AZ	32
Tempe, AZ	32
Casa Grande, AZ	29
Bullhead City, AZ	27

Language	Your Fans
English (US)	1,576
Spanish	46
English (UK)	20
Spanish (Spain)	7
Arabic	1
French (France)	1
Polish	1

See More

Demographics of followers.

STORM – Fiscal Year 2018 Annual Report (July 1, 2017 – June 30, 2018)

ABC15 Campaign

2018 Fiscal Year| Recap

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The campaign delivered your message 2,330,272 times and drove 48,727 clicks so far.

General public – backwashing (Code), bag/tie, pick up feces, manage herbicides and fertilizers

Business – chemical suppliers, exterminators, landscapers; same messages, tailored

	Performance	
	Impressions	Clicks
Regular Banner Ads	894,342	2,408
Facebook Ads	337,142	4,320
Facebook Posts	682,572	13,674
Large Banner Ads	118,197	220
Emails	216,809	25,656
IG Post	16,302	
Video (3x)	12,082	2,449
Contest Page	41,162	
Opt-Ins	4,559 (opt-ins)	
Contests	7,105 (entries)	
News Mentions	845,975	
Totals	3,176,347	48,727

1

KNXV-TV Phoenix

July 2017| Cost Per Click Banner Ads

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	Performance		
	Impressions	Clicks	Click Thru
Facebook Post	300,094	893	.30%

1

KNXV-TV Phoenix

ABC15 Campaign (continued)

July 2017| Facebook Post

STORM
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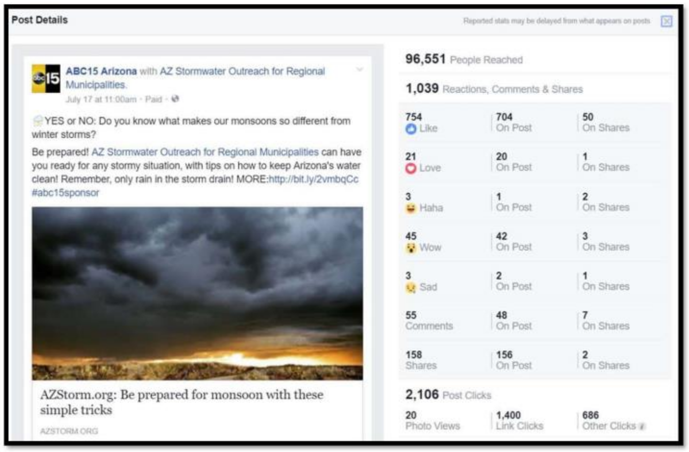

	Performance		
	Impressions	Post Clicks	Link Clicks
Facebook Post	96,551	2,106	1,400

1

KNXV-TV Phoenix abc15 ARIZONA

October/November 2017| Quiz Facebook Post & Banner Ads

STORM
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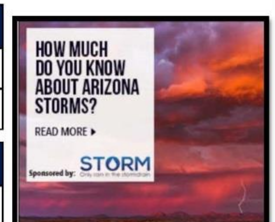
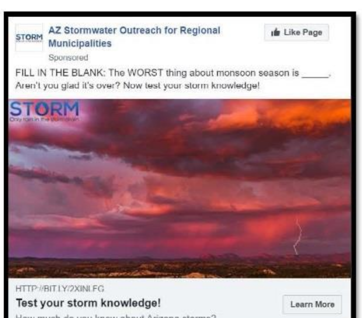
665 QUIZ SUBMISSIONS!

	Performance		
	Impressions	Link Clicks	Click Thru
Facebook Ads	22,801	1,350	6.11%

	Performance		
	Impressions	Link Clicks	Click Thru
Banner Ads	124,176	183	.15%





- ✓ What is a monsoon?
- ✓ What can you do to reduce stormwater runoff?
- ✓ When water rises rapidly, what is this called?
- ✓ Where does stormwater go in Arizona once it comes to town?
- ✓ What is virga?
- ✓ Which of the following pollutants gets picked up by stormwater?
- ✓ A "haboob" is what type of storm?
- ✓ What is it called when rainwater that does not soak in and flows overland?

1

KNXV-TV Phoenix abc15 ARIZONA

ABC15 Campaign (continued)

December 2017| Holiday Giveaways

STORM
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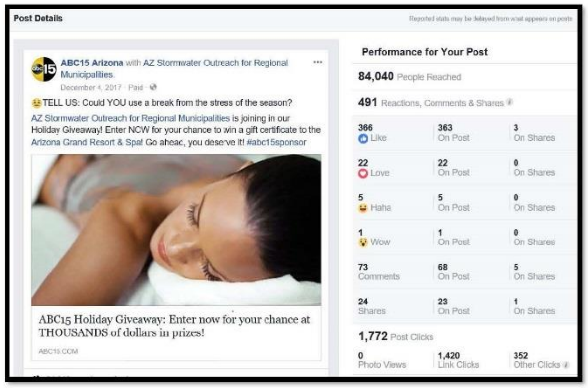
3,335 ENTRIES
2,280 OPT INS

	Performance		
	Impressions	Post Clicks	Link Clicks
Facebook Post	84,040	1,772	1,420

✓ Have you heard of STORM?



1

KNXV-TV Phoenix
abc15 ARIZONA

May/June 2018| Cost Per View Video

STORM
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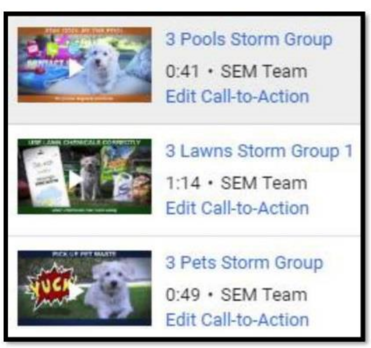
	Performance		
	Video Views	Clicks	View Rate
Vidoes	12,082	2,449	31%



View rate
42.82%
24.51%
31.95%

1

KNXV-TV Phoenix
abc15 ARIZONA

Cost Benefit Analysis

Triple Bottom Line Cost Benefit Analysis of Green Infrastructure/Low Impact Development (GI/LID) in Phoenix, AZ

Results Report

Prepared by Autocase for the City of Phoenix

June 20th, 2018

Glossary of Terms

BCR	Benefit Cost Ratio
CBA	Cost Benefit Analysis
CAC	Criteria Air Contaminants
CapEx	Capital Expenditure
CBA	Cost Benefit Analysis
CO_2e	Carbon dioxide equivalent
EPA	U.S. Environmental Protection Agency
eGrid	Emissions grid
GHG	Greenhouse Gas
GWP	Global Warming Potential
M	Million
MWh	Megawatt-hour(s)
NPV	Net Present Value
NO_x	Nitrogen Oxide
N_2O	Nitrous Oxide
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter Smaller than 2.5 micrometres
SO_2	Sulfur Dioxide
TBL	Triple Bottom Line
TBL-CBA	Triple Bottom Line-Cost Benefit Analysis
TBL-NPV	Triple Bottom Line-Net Present Value
USD	U.S. Dollars
VOCs	Volatile Organic Compounds

Table of Contents

1 Introduction

1.1 Project Background

Stantec, Autocase, and Watershed Management Group (WMG) were engaged by the City of Phoenix (City) – with The Nature Conservancy (TNC) as a contributing and reviewing partner – to perform a triple bottom line cost benefit analysis (TBL-CBA) of various Green Infrastructure/Low Impact Development (GI/LID) features, as well as look at the triple bottom line impacts of three case study sites in the area.

The TBL-CBA business case was conducted in Autocase - a cloud-based software tool, to provide insights into the net present value (NPV) of costs and benefits of the projects to the City, as well as the broader societal and environmental impacts over a 50-year time horizon using a 3% discount rate to convert all future cash flows into a present value.

TBL-CBA is a systematic evidence-based economic business case framework that uses best practice Life Cycle Cost Analysis and Cost Benefit Analysis (CBA) techniques to quantify and attribute monetary values to the Triple Bottom Line (TBL) impacts resulting from an investment. TBL-CBA expands the traditional financial reporting framework (such as capital, and operations and maintenance costs) to also consider social and environmental performance. TBL-CBA provides an objective, transparent and defensible economic business case approach to assess the costs and benefits pertaining to the project being analyzed.

This study provides information for City projects and private development that may want to implement and incorporate GI/LID facilities. The costs and co-benefits of GI/LID features in the Phoenix environment need to be evaluated to identify the benefits and aid in potentially identifying to which stakeholders they accrue. The City identified key motivating factors for this study, as follows:

1. The need to evaluate the following key parameters:
    a. Financial costs and benefits;
    b. Carbon emissions and air pollution;
    c. Heat island impacts;
    d. Water quality improvement;
    e. Flood risk reduction;
    f. Property value uplift.
2. The need to identify and ensure a common understanding of benefits vs. initial costs vs. life cycle costs
3. The need to provide recommendations on appropriate feature types according to associated costs and benefits.

Given the importance of heat stress in Phoenix, instead of using historical temperatures this report incorporates future climate change in to its analysis. Taking the emissions pathway RCP8.5 “higher emissions” scenario from NOAA’s climate explorer (NOAA, 2018), the analysis incorporates future temperature and rainfall predictions for Maricopa County in to Autocase. In so doing, the results will aid in resilience decision-making related to urban heat island.

Local data were used whenever possible and available; information from various sources, such as EPA's SUSTAIN database and the National Stormwater Management Calculator was used to supplement any gaps and are identified throughout the report.

1.2 Report Structure

This report consists of two analyses: one for the general 1,000 sq ft feature types, and one for the three case study sites.

In Chapters 2 and 3 are the project description and results for the general feature analysis, which investigates generalized costs (on a per-1,000 sq ft basis) and benefits of six feature types that may be utilized in the City of Phoenix. The features that will be analyzed are:

1. Concrete
2. Swale
3. Bioretention basin
4. Infiltration trench
5. Pervious pavers
6. Porous concrete
7. Porous asphalt

In Chapters 4 and 5 are the project description and results for three GI/LID case studies, which looks at costs and benefits of three specific projects previously implemented in the Phoenix Metro area (Primera Iglesia, Glendale Community Center, and a combined project of Central Station/Civic Space Park/Taylor Mall).

A combined Conclusion and Policy Analysis section intended to help the City of Phoenix make broad decisions on overall GI/LID feature implementation in Phoenix, while recognizing that projects should be evaluated on an individual basis to determine TBL results and which features might be most beneficial for specific sites. Information on specific methodology used for the analyses is included in Section 8.

1.3 Project Parameters

The specific parameters – or impacts – to be assessed for each feature type (including concrete) in Autocase are:

Impact Type	Cost/Benefit
Financial	Capital Expenditures (CapEx)
Financial	Operations and Maintenance (O&M)
Financial	Avoided CapEx on Additional Detention
Financial	Avoided O&M on Additional Detention
Financial	Avoided CapEx on Additional Piping
Financial	Avoided O&M on Additional Piping
Financial	Replacement Costs
Financial	Residual Value of Assets
Social	Heat Island Effect (Mortality)
Social	Heat Island Effect (Morbidity)
Social	Flood Risk
Social	Property Value
Environmental	Water quality
Environmental	Carbon Emissions from Concrete
Environmental	Air Pollution Reduced by Vegetation
Environmental	Carbon Reduction by Vegetation
Environmental	Air Pollution from Energy Use Reduction
Environmental	Carbon Emissions from Energy Use Reduction

A description of each parameter and the associated valuation methodology is included in Section 8.3.

1.4 Summary of Feature Costs

Table 1 outlines the capital expenditure (CapEx) and annual operations and maintenance (O&M) costs that are used to evaluate the features throughout the report. Details on their sources and how they were derived is given within each feature's description below. Local and site-specific values were used where possible. If those were not available, either Autocase estimates were used (informed by EPA's SUSTAIN database), or the National Stormwater Management Calculator values were used.

Table 1: Summary of Feature Costs

Feature		Unit	Cost ($)		
			Low	Expected	High
Concrete	CapEx	$ per 1,000 sq ft	$4,500	$5,750	$7,000
	O&M	$ per 1,000 sq ft	$0	$0	$0
Swale	CapEx	$ per 1,000 sq ft	$1,124	$5,527	$11,358
	O&M	$ per 1,000 sq ft	$97	$120.95	$151
Porous concrete	CapEx	$ per 1,000 sq ft	$6,370	$7,000	$10,670
	O&M	$ per 1,000 sq ft	$12	$24	$48
Bioretention basin	CapEx	$ per 1,000 sq ft	$2,000	$3,000	$4,000
	O&M	$ per 1,000 sq ft	$97	$121	$151
Infiltration trench	CapEx	$ per 1,000 sq ft	$400	$1,450	$4,200
	O&M	$ per 1,000 sq ft	$97	$121	$151
Pervious pavers	CapEx	$ per 1,000 sq ft	$7,540	$12,970	$17,800
	O&M	$ per 1,000 sq ft	$12	$24	$48
Underground stormwater storage	CapEx	$ per 1,000 cubic ft	$904	$1,205	$1,506
	O&M	$ per 1,000 cubic ft	$1	$1	$6
Trees	CapEx	$ per tree	$160	$591	$739
	O&M	$ per tree	$12	$16	$20
Planter boxes	CapEx	$ per 1,000 sq ft	$550	$8,000	$24,500
	O&M	$ per 1,000 sq ft	$97	$121	$151
Retention basin	CapEx	$ per 1,000 cubic ft	$4,260	$11,550	$22,710
	O&M	$ per 1,000 cubic ft	$15	$30	$60
Porous asphalt	CapEx	$ per 1,000 sq ft	$2,840	$6,330	$9,470
	O&M	$ per 1,000 sq ft	$12	$24	$48
Shrubs	CapEx	$ per 1,000 sq ft	$109	$218	$355
	O&M	$ per 1,000 sq ft	-	-	-

Notes:

- **O&M for shrubs is included within the O&M cost of specific features (e.g., bioretention basin, bioswale, etc.).**

1.5 Common Inputs

The following section illustrates the inputs used for the project, including information about the city, the financial assumptions, and specifications about each feature type analyzed with Autocase. These variables were kept standard across all feature type evaluations.

Table 2: Common Inputs

Input	Unit	Value	Notes
Dominant soil type		B	
24-hour design storm	Inches	1	A 0.5-inch and 2-inch storm were also assessed, with results for these analyses in Section 10.1 and 10.2.
Stormwater model		TR-55	
Operations duration	Years	50	
Construction duration	Years	1	
Discount rate	%	3%	

2 Project Description (GI/LID Feature Types)

This section outlines the GI/LID feature types that are analyzed in this report, as well as states the more detailed design assumptions used in order to generate results within Autocase.

2.1 Features to be Analyzed

The list of GI/LID features to be analyzed in this general feature analysis section are:

1. **Rain garden/Bioretention basin:** shallow earthen depressions that collect stormwater runoff into native soils to support planted vegetation.
2. **Swale:** rock or vegetated swales are open, shallow channels that are designed to slowly convey runoff flow to downstream discharge points.
3. **Infiltration trench:** a channel-like subsurface excavation that has been filled with gravel to provide large pore spaces for stormwater to infiltrate.
4. **Pervious pavers:** Also called interlocking porous concrete pavers, these permeable surfaces use the spaces between the pavers to infiltrate water and can be designed to reduce peak runoff.
5. **Porous concrete:** a specific type of concrete with a high porosity used for flat work applications that allows rainfall to pass directly through and infiltrate the soil below.
6. **Porous asphalt:** allows rainfall to drain through the surface into a stone recharge bed and infiltrate the soil below.

Each of these features were analyzed individually against the key parameters through Autocase to evaluate 'standalone' costs and benefits. They each were then compared against a base case 'Concrete' feature type in Autocase to assess their *incremental* or *relative* impact. The concrete base case was chosen to reflect a more typical 'gray' site. To be able to compare and evaluate the various feature types, it was important this analysis use consistent control variables. Therefore, the size of each feature (including concrete) was kept consistent at 1,000 square feet, and a 15:1 watershed area was used to represent the surface area that would generate runoff flowing in to each feature. The same design storm event and other similar variables (detailed in Section 2.3.2–Common Inputs) were also kept consistent so any changes in costs/benefits would be attributable to the feature type.

2.2 Project Inputs

The following section illustrates the inputs used for the feature type analysis, such as depths, storage volume, and cost information.

2.2.1 Base Case Design Specifications (Concrete)

Concrete was used as the base case against which the GI/LID feature types were compared. This means the costs and benefits for the base case were assessed assuming that 1,000 sq ft of new concrete was constructed instead of a GI/LID feature.

Table 3: 1,000 sq ft Feature Type Concrete Inputs

	Unit	Expected Value
Name of feature		Concrete
Area	Sq ft	1,000
Depth of coverage material	Inches	3
CapEx	$	$5,750 (Low = $4,500, High = $7,000)
Annual O&M	$	$0

Notes:

- The low CapEx cost of $4,500 is for areas greater than 1,000 sq ft. The high CapEx cost of $7,000 is for areas less than 1,000 sq ft.
- Per City of Phoenix Street Maintenance Division, operation and maintenance costs for concrete sidewalk is $0 because no recurring maintenance is required. It is instead fully replaced when damaged/deteriorated. The average life for a concrete sidewalk in Phoenix (barring external forces) is 25-30 years. This is factored in to the life cycle cost model in Autocase and is reflected in the replacement cost.

2.2.2 GI/LID Feature Type Design Specifications

2.2.2.1 Swale

Table 4: 1,000 sq ft Feature Type Porous Swale Inputs

	Unit	Expected Value
Name of feature		Swale
Area	Sq ft	1,000
Maximum Ponding/Treatment Depth	Inches	9
Channel Bank Height	Inches	2
Soil type		B
Maximum Surface Infiltration Rate	Inches per hour	4.5
Minimum Surface Infiltration Rate	Inches per hour	0.25
Infiltration Rate Reduction Factor	per hour	1
Capital Expenditure	$	$5,527 (Low = $1,124, High = $11,358)
Annual O&M	$	$121 (Low = $97, High = $151)

Notes:

- Based off the swale at Taylor Mall, 2nd to 3rd Street. Using Google Earth (address of 444 N. Central Avenue) to count trees and estimate shrubs and note the concrete curb and curb cut, fine grading within planting area; and using the plan sheets and cost lines. Used the plan sheets to measure lengths and widths.
- CapEx: Low does not include concrete removal or the concrete single curb, but does include 1 tree, 8 shrubs, 8 feet of curb cuts. Expected does not include concrete removal, but does include concrete single curb, 2 trees, 16 shrubs, 16 feet of curb cuts. High includes concrete removal, concrete single curb, 3 trees, 26 shrubs, 24 feet of curb cuts (8 openings, 3' each).
- O&M costs are from Watershed Management Group estimates based on $120/1,000 sq. ft. at a rate of $75/hr (low/high = +/- 25%).

Figure 1: Swale
Source: City of Phoenix, Office of Environmental Programs.

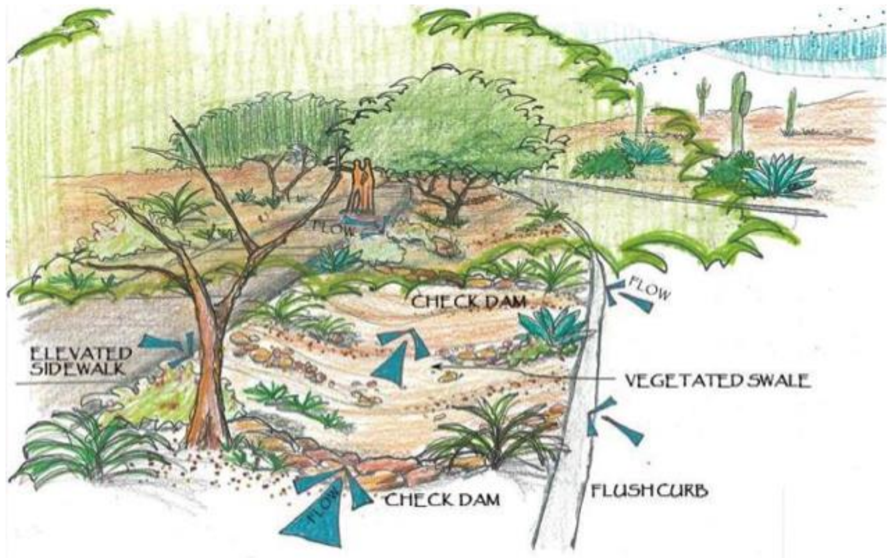


Figure 2: Elements of a Swale
Source: PIMA County, 2015. "Low Impact Development and Green Infrastructure Guidance Manual".

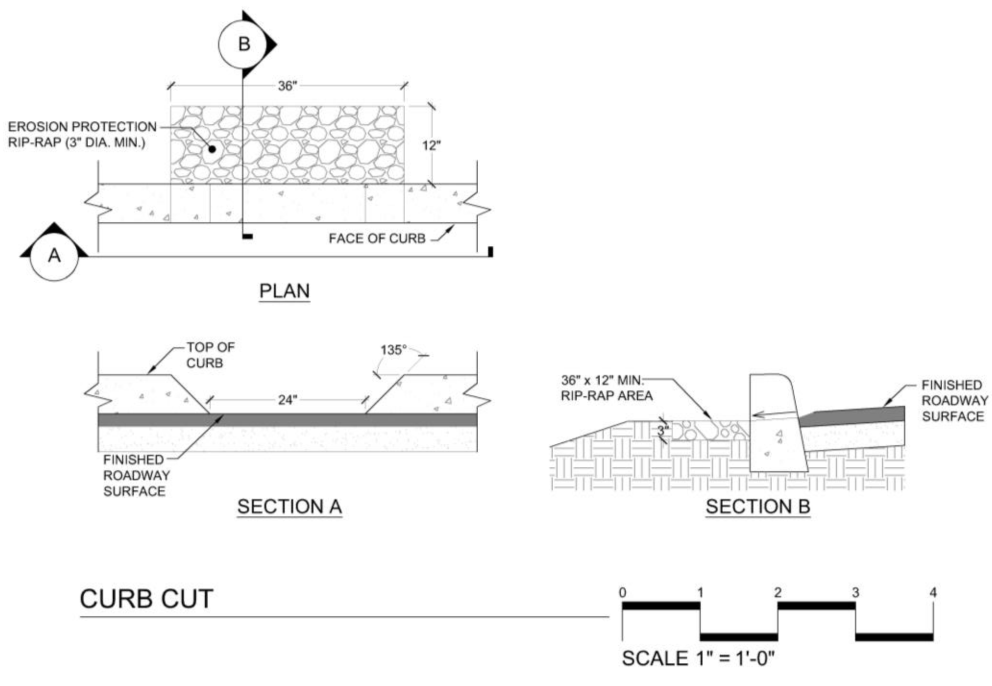


Figure 3: Typical Curb Cut Design Detail
Source: WMG
Notes: Swales may use curb cuts to draw in water in to the feature, thus its inclusion here.

2.2.2.2 Bioretention Basin/Rain Garden

Table 5: 1,000 sq ft Feature Type Bioretention Basin Inputs

	Unit	Expected Value
Name of feature		Bioretention/Rain garden
Area	sq ft	1,000
Maximum Ponding/Treatment Depth	Inches	6
Depth of Coverage Materials	Inches	3
Percent Empty Space in Material	%	40
Does this feature allow for infiltration?		Yes
Trees Planted	#	3
Shrubs planted	#	28
Shrubs Average Expected Lifespan	Year	10
Shrubs Max Expected Lifespan	Year	20
Soil type		B
Maximum Surface Infiltration Rate	Inches per hour	4.5
Minimum Surface Infiltration Rate	Inches per hour	0.25
Infiltration Rate Reduction Factor	per hour	1
CapEx	$	$3,000 (Low = $2,000, High = $4,000)
Annual O&M	$	$121 (Low = $97, High = $151)

Notes:

- Capital costs for Bioretention Basins are based on WMG's experience over the last decade in Tucson as well as the last 5 years in Phoenix designing and constructing basins. Costs include labor, design, curb cuts, shrubs, grasses, trees, rock and/or wood mulch, permitting, excavation and soil hauling. Costs vary depending on existing site conditions such as topography, land use, hardscape and soil type as well as if a curb cut is needed.
- O&M costs are from Watershed Management Group estimates based on $120/1,000 sq ft at a rate of $75/hr.

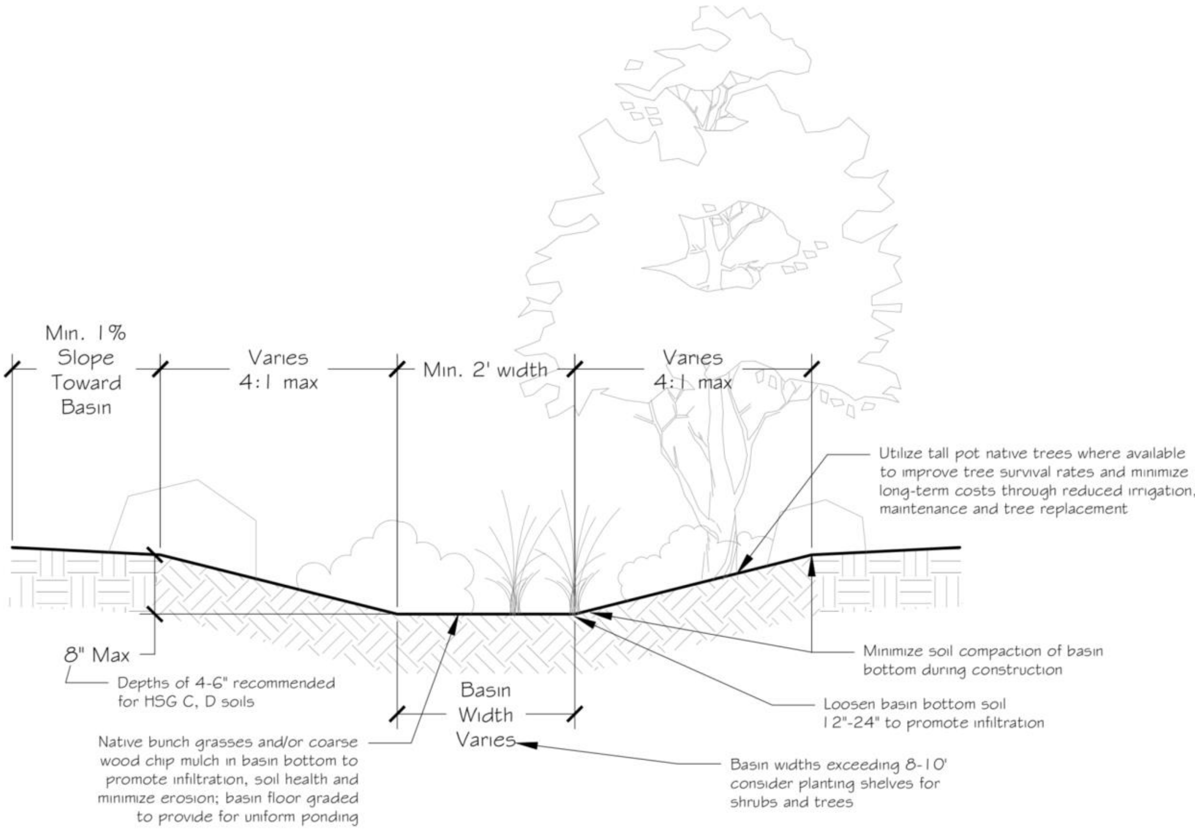


Figure 4: Typical Bioretention Basin Cross-section
Source: Watershed Management Group

Figure 5: Bioretention Basin
Source: City of Phoenix, Office of Environmental Programs.

2.2.2.3 Infiltration Trench

Table 6: 1,000 sq ft Feature Type Infiltration Trench Inputs

	Unit	Expected Value
Name of feature		Infiltration Trench
Area	sq ft	1,000
Depth of Coverage Materials	Inches	24
Percent Empty Space in Material	%	40
Rate of Gray Discharge from Outlet of Feature	-	-
Soil type		B
Maximum Surface Infiltration Rate	Inches per hour	4.5
Minimum Surface Infiltration Rate	Inches per hour	0.25
Infiltration Rate Reduction Factor	per hour	1
Capital Expenditure	$	$1,450 (Low = $400, High = $4,200)
Annual O&M	$	$120 (Low = $97, High = $151)

Notes:

- CapEx is from EPA's SUSTAIN database and includes: backfilling, excavation, filter fabric, grading/finishing, grass, gravel, mulch, observation well, perennials, soil/planting media.
- O&M costs are from Watershed Management Group estimates based on $120/1,000 sq ft at a rate of $75/hr.

Figure 6: Infiltration Trench

Source: PIMA County, 2015. "Low Impact Development and Green Infrastructure Guidance Manual".

2.2.2.4 Pervious Pavers

Table 7: 1,000 sq ft Feature Type Pervious Pavers Inputs

	Unit	Expected Value
Name of feature		Pervious pavers
Area	Sq ft	1,000
Depth of Coverage Materials	Inches	3
Percent Empty Space in Material	%	20
Rate of Gray Discharge from Outlet of Feature	-	-
Soil type		B
Maximum Surface Infiltration Rate	Inches per hour	4.5
Minimum Surface Infiltration Rate	Inches per hour	0.25
Infiltration Rate Reduction Factor	per hour	1
Capital Expenditure	$	$12,970 (Low = $7,540, High = $17,800)
Annual O&M	$	$24 (Low = $12, High = $48)

Notes:

- CapEx: Expected = using Taylor Mall 100 Plan Cost Model. Low and High from SUSTAIN.
- O&M costs calculated from Glendale Park and Ride at 99th Ave, which is porous concrete. O&M cost for power washing for FY 2017 was $2,580 across an area of 214,053 sq ft. Low = 1 wash per year, Expected = 2 times per year, High = 4 times per year.

Figure 7: Pervious Pavers (Interlocking Porous Concrete Pavers)
Source: City of Phoenix, Office of Environmental Programs.

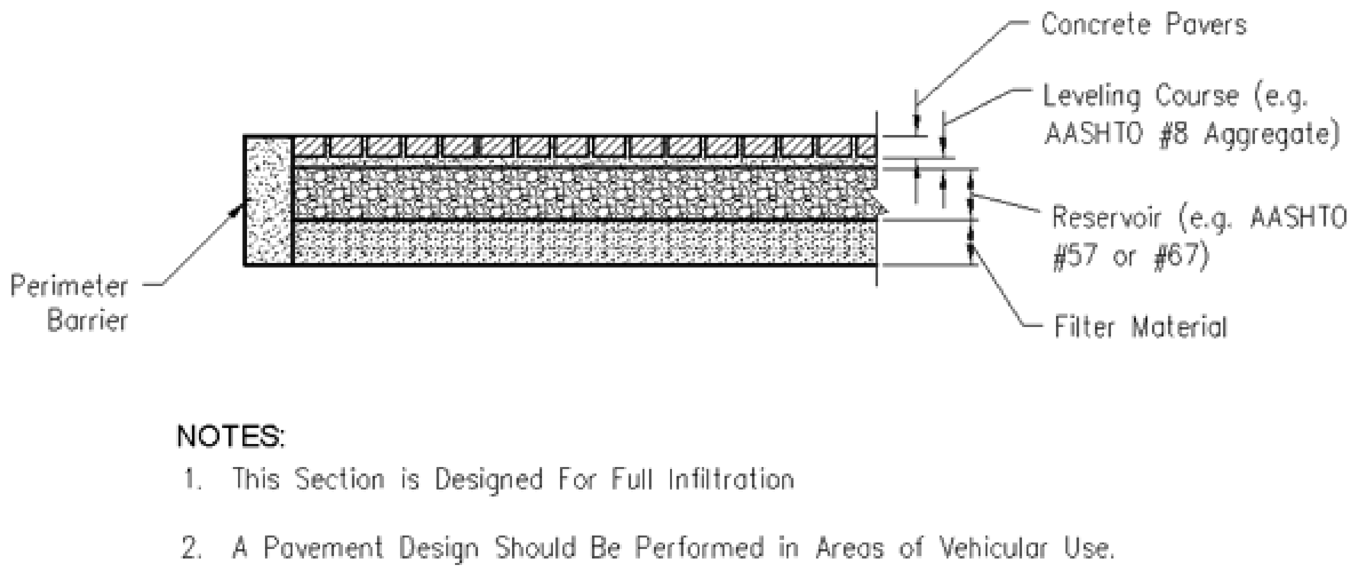


Figure 8: Design Detail for Typical Pervious Pavers
Source: PIMA County, 2015. "Low Impact Development and Green Infrastructure Guidance Manual".

2.2.2.5 Porous Concrete

Table 8: 1,000 sq ft Feature Type Porous Concrete Inputs

	Unit	Expected value
Name of feature		Porous concrete
Area	Sq ft	1,000
Depth of Coverage Materials	Inches	4
Percent Empty Space in Material	%	20
Rate of Gray Discharge from Outlet of Feature	-	0
Soil type		B
Maximum Surface Infiltration Rate	Inches per hour	4.5
Minimum Surface Infiltration Rate	Inches per hour	0.25
Infiltration Rate Reduction Factor	per hour	1
Capital Expenditure	$	$7,000 (Low = $6,370, High = $10,670)
Annual O&M	$	$24 (Low = $12, High = $48)

Notes:

- CapEx: Expected = Site specific cost from the line items taken from Central Station Upgrades. Low and High values taken from SUSTAIN.
- O&M costs calculated from Glendale Park and Ride at 99th Ave, which is porous concrete. O&M cost for power washing for FY 2017 was $2,580 across an area of 214,053 sq ft. Low = 1 wash per year, Expected = 2 times per year, High = 4 times per year

Figure 9: Example Porous Concrete Installation
Source: City of Phoenix, Office of Environmental Programs

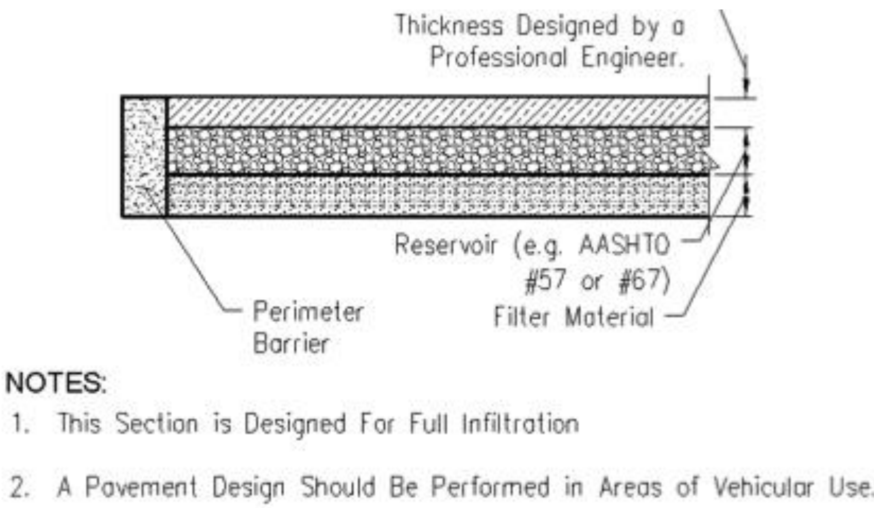


Figure 10: Porous Concrete Detail
Source: PIMA County, 2015. "Low Impact Development and Green Infrastructure Guidance Manual".
Note: Taken from page 117. In the source above, the picture says "Pervious Concrete Pavers but is referring to porous concrete.

2.2.2.6 Porous Asphalt

Table 9: 1,000 sq ft Feature Type Asphalt Inputs

	Unit	Expected Value
Name of feature		Porous asphalt
Area	Sq ft	1,000
Depth of Coverage Materials	Inches	3
Percent Empty Space in Material	%	20
Rate of Gray Discharge from Outlet of Feature	-	-
Soil type		B
Maximum Surface Infiltration Rate	Inches per hour	4.5
Minimum Surface Infiltration Rate	Inches per hour	0.25
Infiltration Rate Reduction Factor	per hour	1
Capital Expenditure	$	$6,330 (Low = $2,840, High = $9,470
Annual O&M	$	$24 (Low = $12, High = $48).

Notes:

- Autocase default from SUSTAIN including: Excavation, Filter Fabric, Grading/finishing, Gravel, Observation Well, and Underdrain Pipe.
- O&M costs calculated from Glendale Park and Ride at 99th Ave, which is porous concrete. O&M cost for power washing for FY 2017 was $2,580 across an area of 214,053 sq ft. Low = 1 wash per year, Expected = 2 times per year, High = 4 times per year.

Figure 11: Porous Asphalt
Source: Stantec

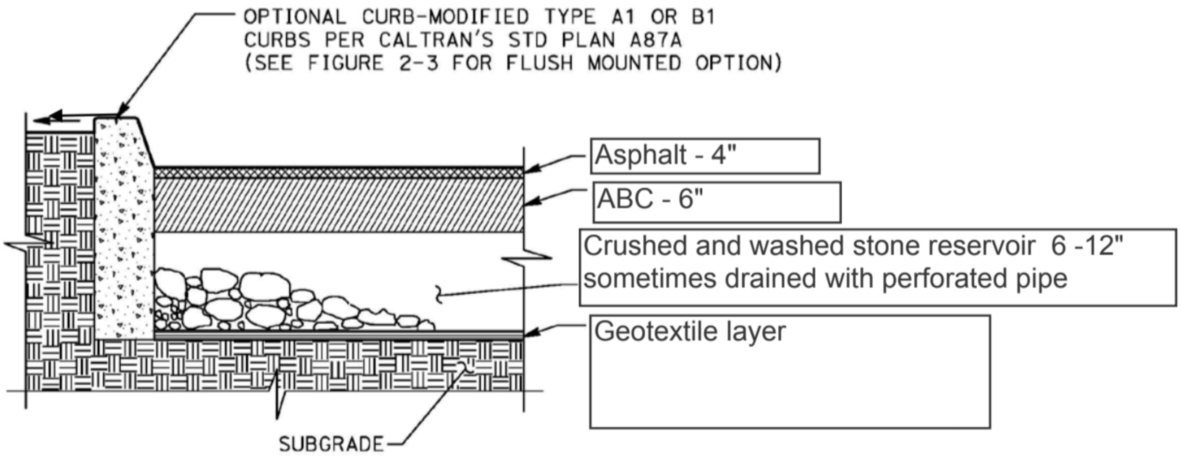


Figure 12: Design Detail for Typical Asphalt
Source: Stantec

3 Triple Bottom Line Net Present Value Results (GI/LID Feature Types)

This Section provides an overview of the results of the general feature type analysis that was presented in the previous section. Dollar amounts reflect costs and benefits estimated for the full 50-year life cycle used for each feature where the area of each feature is 1,000 square feet.

The tables and graphs that follow show the total cost of ownership of each feature, along with the social and environmental benefits that are generated over the 50-year time horizon. Negative numbers represent a cost or disbenefit (financial, social, or environmental), whereas positive numbers illustrate a saving or benefit; the larger the number, the greater the cost or benefit.

3.1 Summary of Results

3.1.1 Summary of Results Absolute

A summary of the Absolute financial, social, and environmental impacts for each feature type are given in Table 10. Absolute values are those that address each feature type individually without reference or comparison to the base case of concrete. Figure 13 represents these results visually.

From a purely financial perspective, Concrete (-$7,400), Bioretention basins (-$7,600) and Infiltration trenches (-$5,500) are the least expensive to build and operate over 50 years, whereas Pervious pavers are the most expensive (-$18,500). From a social perspective, Swales and Bioretention basins generate the most social impact at around $11,800 and $11,700, respectively. Concrete ($1,800), Infiltration trench ($1,200), and Porous asphalt ($1,000) generate the least social benefit. In terms of environmental benefits, Swale and Bioretention basin both generate the most environmental benefits at around $4,300 each over 50 years. The Concrete feature generates the worst impact at -$3,200. Looking at the overall TBL-NPV, we can see that only Swale and Bioretention basin are positive ($6,200 and $8,300). The largest negative TBL-NPVs are Concrete, Pervious pavers, and Porous asphalt at -$8,800 and -$14,200, and -$6,600 respectively.

We must note that these are Absolute results, and in order to make a comparison against a base case of Concrete, we need to identify the incremental differences between each LID feature and the base case of Concrete (i.e. a Relative analysis).

Table 10: Summary of Absolute Triple Bottom Line Results ($/1,000 sq ft)

	Concrete (base case)	Swale	Bioret'n Basin	Infiltration Trench	Pervious Pavers	Porous Concrete	Porous Asphalt
Financial	-$7,426	-$9,856	-$7,627	-$5,465	-$18,494	-$10,638	-$9,563
Social	$1,809	$11,775	$11,655	$1,165	$2,364	$2,623	$1,019
Environmental	-$3,176	$4,313	$4,300	$1,661	$1,912	$1,912	$1,912
Triple Bottom Line NPV	**-$8,793**	**$6,233**	**$8,328**	**-$2,638**	**-$14,218**	**-$6,102**	**-$6,632**

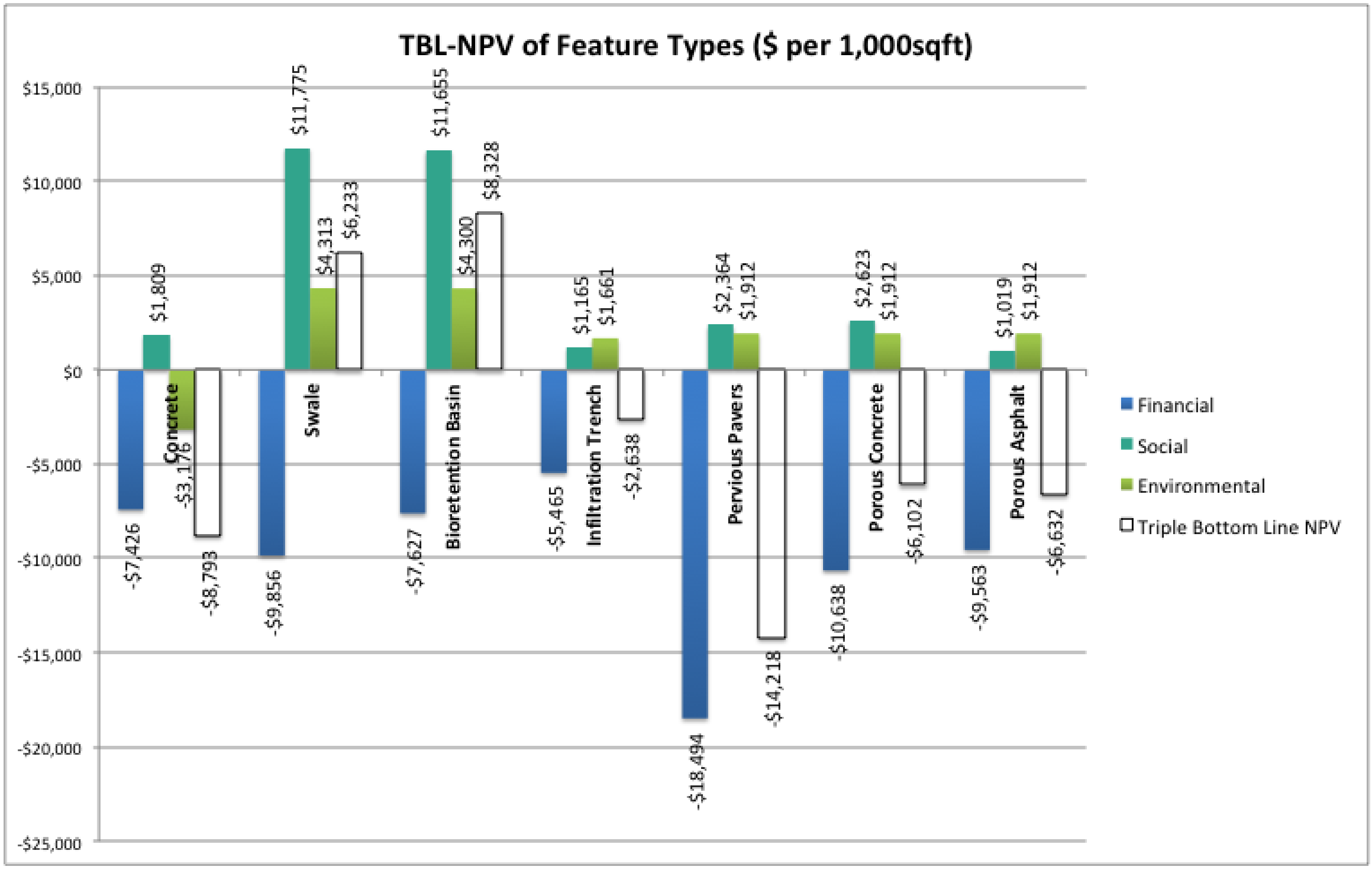


Figure 13: Absolute TBL-NPV Results of Feature Types ($ per 1,000 sq ft)

3.1.2 Summary of Results: Relative

A summary of the Relative – or incremental (i.e. versus Concrete base case) financial, social, and environmental impacts for each feature type are given in Table 11. Figure 14 offers a visual representation of these.

From a purely financial perspective, only Infiltration trench is cheaper than concrete over 50 years at around $2,000 in savings. All other features are more expensive, with Pervious pavers are about $11,100 more expensive per 1,000 sq ft. In terms of social impacts, Swale and Bioretention basin stand out as winners – generating almost an additional $10,000 each. Only Infiltration trench and Porous asphalt generate negative social impacts at -$600 and -$800. Environmentally, all features perform better than Concrete[1], with Swale and Bioretention basin each generating around $7,500 additional benefit, while the lowest – Infiltration trench still generates almost $5,000 more than Concrete. Finally, in terms of TBL-NPV, all but Pervious pavers (-$1,000) generate positive TBL-NPV, with Swale ($15,000) and Bioretention basin ($17,100) the clear leaders.

Table 11: Summary of Relative Triple Bottom Line Results Compared to Concrete ($/1,000 sq ft)

	Swale	Bioretent'n Basin	Infiltration Trench	Pervious Pavers	Porous Concrete	Porous Asphalt
Financial	-$2,429	-$200	$1,962	-$11,067	-$3,211	-$2,136
Social	$9,966	$9,846	-$644	$555	$814	-$790
Environmental	$7,489	$7,476	$4,837	$5,088	$5,088	$5,088
Triple Bottom Line NPV	**$15,026**	**$17,122**	**$6,155**	**-$5,424**	**$2,691**	**$2,162**

[1] The environmental benefits are consistently large across the features; this is primarily due to two factors: 1) avoided carbon from concrete production being the same across the board; and 2) the similar infiltration rates of the features, which feeds into the flood risk and water quality benefits. Both these impacts generate large value (as will be seen in the detailed tables below).

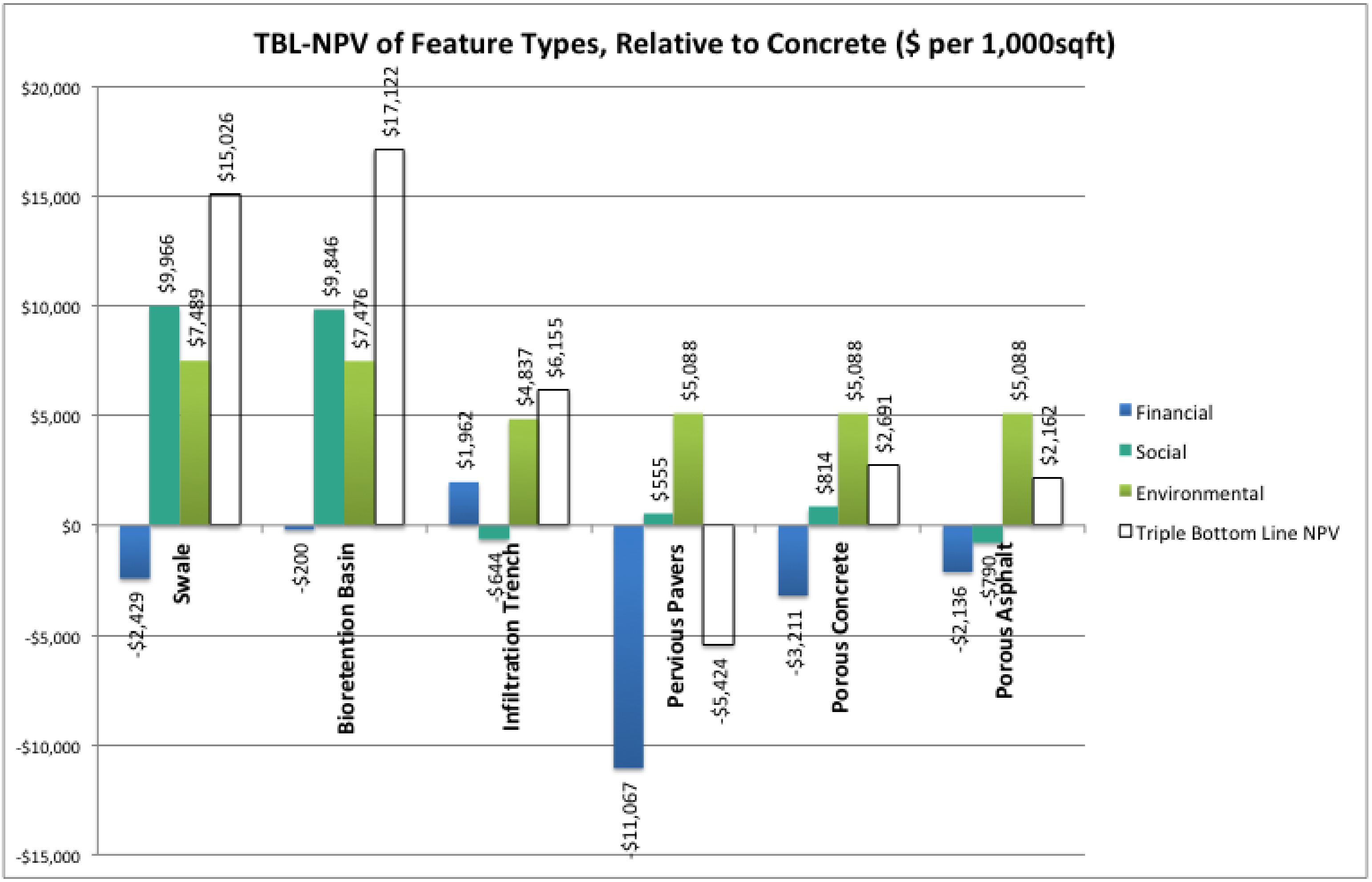


Figure 14: TBL-NPV Results of Feature Types Relative to Concrete ($ per 1,000 sq ft)

3.2 Detailed results

Table 12 breaks down the Absolute results for the feature types by each impact type – or parameter. Table 13 provides the Relative (i.e. vs. concrete) value for each feature by impact type. For a more detailed breakdown of the results, which include the 95% confidence intervals for each cost and benefit, please see the following sections. Positive numbers represent a benefit or value generation, while negative numbers are additional costs or dis-benefit generated.

3.2.1 Detailed Results: Absolute

From Table 12, we can dive deeper to identify the driving forces of value for each feature on an absolute basis. For example, from a financial perspective we can see that O&M for Swale (-$3,200), Bioretention basin (-$3,200), and Infiltration Trench (-$3,100) are a considerable cost factor compared to their CapEx, whereas Replacement cost are a dominant force for Pervious pavers (-$6,000), Porous concrete (-$2,800), and Porous asphalt (-$3,100). From a social perspective, Swale and Bioretention basin generate significant Heat island effect benefits at around $10,000 each.

Environmentally, the biggest water quality benefits are created by Swale ($2,700) and Bioretention basin ($2,600), however Pervious pavers, Porous concrete, and Porous asphalt still generate almost $2,000 each. The use of Concrete generates carbon emissions valued at around -$3,200. Swale and Bioretention basin also generate benefits from reduced CO_2 and air pollution caused by vegetation as well as lower energy use.

Table 12: Absolute TBL-CBA Values for Each Feature by Impact Type ($/1,000sq ft)

Impact Type	Cost/Benefit	Concrete (Base Case)	Swale	Bioret'n Basin	Infiltrat'n Trench	Pervious Pavers	Porous Concrete	Porous Asphalt
Financial	Capital Expenditures	-$5,796	-$5,820	-$3,022	-$1,715	-$12,976	-$7,596	-$6,321
Financial	Operations and Maintenance	$0	-$3,165	-$3,170	-$3,115	-$676	-$675	-$675
Financial	CapEx on Additional Detention	-$24	$0	$0	$0	$0	$0	0
Financial	O&M on Additional Detention	-$6	$0	$0	$0	$0	$0	0
Financial	CapEx on Additional Piping	-$505	$0	$0	$0	$0	$0	0
Financial	O&M on Additional Piping	-$76	$0	$0	$0	$0	$0	0
Financial	Replacement Costs	-$1,452	-$1,371	-$1,662	-$672	-$5,906	-$2,788	-$3,124
Financial	Residual Value of Assets	$431	$501	$227	$38	$1,064	$422	$558
Social	Heat Island Effect (Mortality)	$1,807	$10,041	$10,369	$0	$1,753	$1,997	$409
Social	Heat Island Effect (Morbidity)	$2	$6	$6	$1	$2	$2	$0
Social	Flood Risk	$0	$1,421	$1,151	$1,036	$481	$495	$481
Social	Property Value	$0	$308	$129	$128	$129	$129	$129
Environmental	Water quality	$0	$2,682	$2,629	$1,661	$1,912	$1,912	$1,912
Environmental	Carbon Emissions from Concrete	-$3,176	$0	$0	$0	$0	$0	0
Environmental	Air Pollution Reduced by Vegetation	$0	$1,033	$1,080	$0	$0	$0	0
Environmental	Carbon Reduction by Vegetation	$0	$76	$70	$0	$0	$0	0
Environmental	Air Pollution Reduced by Energy Use	$0	$290	$290	$0	$0	$0	0
Environmental	Carbon Reduction by Energy Use	$0	$231	$231	$0	$0	$0	0
Total:	**TBL-NPV**	**-$8,793**	**$6,233**	**$8,328**	**-$2,638**	**-$14,218**	**-$6,102**	**-$6,632**

3.2.2 Detailed Results: Relative

Table 13 enables us to see where benefits – or dis-benefits – are being created relative to a Concrete base case. Looking at the financial impacts, some interesting factors emerge. In terms of CapEx, Swale costs roughly the same as Concrete, Bioretention basin and Infiltration trench cost less by around $2,800 and $4,100, respectively, while Pervious pavers cost about $7,200 more per 1,000 sq ft. For O&M, all features are more expensive than Concrete; Swale, Bioretention basin, and Infiltration trench cost around $3,000 more over 50 years, while Pervious pavers, Porous concrete, and Porous asphalt only cost around $700 more due to the lack of vegetation maintenance associated with them. We also see that there are small cost savings ($600) associated with additional piping and detention for all features versus Concrete.

Regarding social factors, we can see that the vegetated features i.e. Swale and Bioretention generate significant heat island effect benefits compared to Concrete. By factoring in future temperature predictions using NOAA’s Climate Explorer, we can see how each feature will impact heat risk mortality under higher temperatures than those currently felt. Infiltration trench and Porous asphalt create disbenefits compared to Concrete from heat risk mortality due to their darker surface. For flood risk, given that all features have a higher infiltration rate compared to Concrete, each one generates a benefit, with the vegetated features creating the most ($1,000 to $1,500) compared to Pervious pavers, Porous concrete, and Porous asphalt ($500).

There are some significant environmental benefits created by GI/LID features when compared to Concrete. Firstly, water quality improvements due to reduced runoff range from around $2,700 for Swale to almost $2,000 for Porous concrete. Each feature achieves a benefit of around $3,200 in avoided carbon emissions from Concrete. Lastly, the Swale and Bioretention basin each generate around $1,600 in reduced carbon emissions and air pollution from vegetation and avoided energy use due to shading.

Table 13: Relative TBL-NPV Results for Each Feature by Impact Type Compared to Concrete ($/1,000 sq ft)

Impact Type	Cost/Benefit	Swale	Bioret'n Basin	Infiltrat'n Trench	Pervious Pavers	Porous Concrete	Porous Asphalt
Financial	Capital Expenditures	-$24	$2,774	$4,081	-$7,180	-$1,800	-$526
Financial	Operations and Maintenance	-$3,165	-$3,170	-$3,115	-$676	-$675	-$675
Financial	CapEx on Additional Detention	$24	$24	$24	$24	$24	$24
Financial	O&M on Additional Detention	$6	$6	$6	$6	$6	$6
Financial	CapEx on Additional Piping	$505	$505	$505	$505	$505	$505
Financial	O&M on Additional Piping	$76	$76	$76	$76	$76	$76
Financial	Replacement Costs	$81	-$210	$780	-$4,454	-$1,336	-$1,672
Financial	Residual Value of Assets	$69	-$204	-$394	$633	-$10	$126
Social	Heat Island Effect (Mortality)	$8,233	$8,562	-$1,807	-$55	$190	-$1,398
Social	Heat Island Effect (Morbidity)	$4	$4	-$1	$0	$1	-$1
Social	Flood Risk	$1,421	$1,151	$1,036	$481	$495	$481
Social	Property Value	$308	$129	$128	$129	$129	$129
Environmental	Water quality	$2,682	$2,629	$1,661	$1,912	$1,912	$1,912
Environmental	Carbon Emissions from Concrete	$3,176	$3,176	$3,176	$3,176	$3,176	$3,176
Environmental	Air Pollution Reduced by Vegetation	$1,033	$1,080	$0	$0	$0	$0
Environmental	Carbon Reduction by Vegetation	$76	$70	$0	$0	$0	$0
Environmental	Air Pollution Reduced by Energy Use	$290	$290	$0	$0	$0	$0
Environmental	Carbon Reduction by Energy Use	$231	$231	$0	$0	$0	$0
Total:	**TBL-NPV**	**$15,026**	**$17,122**	**$6,155**	**-$5,424**	**$2,691**	**$2,162**

3.3 Swales

Swales generate an estimated $15,026 (95% confidence interval of -$2,151 to $33,600) in triple bottom line net present value over a 50-year time horizon relative to Concrete, with -$2,400 created through financial impacts, $10,000 through social benefits, and $7,500 through environmental benefits.

Figure 15 shows a waterfall chart of the breakdown of these values. On the chart, blue represents value being created, whereas red represents a cost, relative to concrete. We can see that Swales have almost no incremental capital expenditure (CapEx) but do have higher operations & maintenance (O&M) costs compared to Concrete. We can see that varying amounts of value are created across the social and environmental spectrum of impacts, with the most significant being heat island benefit ($8,200), flood risk ($1,400), water quality ($2,700), and avoided carbon emissions from concrete use ($3,200).

The 95% confidence intervals shown in Table 14 allow us to see the uncertainty in some of these figures. For example, CapEx and Replacement costs could be higher or lower than Concrete. There is a large spread in heat island benefits ($4,603 to $12,005), as well as water quality ($453 to $5,561), and when all impacts have been assessed it creates a large spread in overall TBL-NPV (-$2,151 to $33,600) but reveals a small chance of generating a negative TBL-NPV as compared to Concrete.

Financial	Social	Environmental
-$2,429	$9,966	$7,489

Triple Bottom Line NPV	**$15,026**

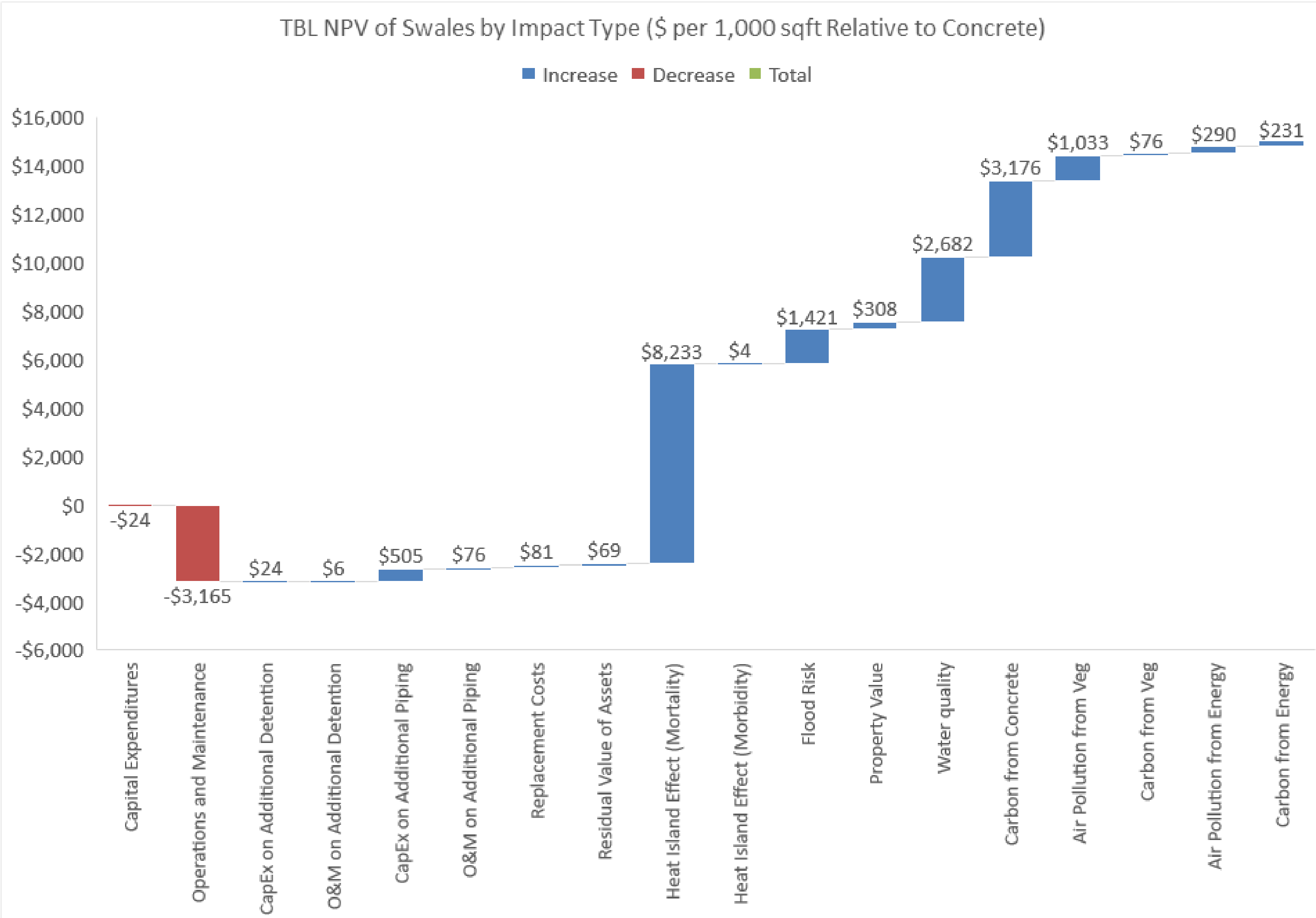


Figure 15: Breakdown of TBL NPV for Swales

Table 14: Swale Relative Results Compared to Concrete with 95% CI ($/1,000 sq ft)

Impact Type	Cost/Benefit	Mean Value	95% Confidence Interval		
Financial	Capital Expenditures	**-$24**	-$4,802	to	$4,188
Financial	Operations and Maintenance	**-$3,165**	-$3,650	to	-$2,675
Financial	CapEx on Additional Detention	**$24**	$9	to	$39
Financial	O&M on Additional Detention	**$6**	$0	to	$11
Financial	CapEx on Additional Piping	**$505**	$403	to	$642
Financial	O&M on Additional Piping	**$76**	$45	to	$110
Financial	Replacement Costs	**$81**	-$2,290	to	$2,589
Financial	Residual Value of Assets	**$69**	-$820	to	$1,058
Social	Heat Island Effect (Mortality)	**$8,233**	$4,603	to	$12,005
Social	Heat Island Effect (Morbidity)	**$4**	-$2	to	$12
Social	Flood Risk	**$1,421**	$1,408	to	$1,433
Social	Property Value	**$308**	$205	to	$429
Environmental	Water quality	**$2,682**	$453	to	$5,561
Environmental	Carbon Emissions from Concrete	**$3,176**	$1,294	to	$5,771
Environmental	Air Pollution Reduced by Vegetation	**$1,033**	$696	to	$1,380
Environmental	Carbon Reduction by Vegetation	**$76**	$31	to	$140
Environmental	Air Pollution Reduced by Energy Use	**$290**	$173	to	$460
Environmental	Carbon Reduction by Energy Use	**$231**	$94	to	$451
Total	**Triple Bottom Line NPV**	**$15,026**	-$2,151	to	$33,604

3.4 Bioretention Basin

Bioretention basin generates an estimated $17,122 (95% confidence interval of $4,300 to $32,300) in triple bottom line net present value over a 50-year time horizon relative to Concrete, with -$200 created through financial impacts, $9,800 through social benefits, and $7,500 through environmental benefits.

Figure 16 shows a waterfall chart of the breakdown of these values. On the chart, blue represents value being created, whereas red represents a cost, relative to concrete. We can see that Bioretention basins have a lower CapEx than Concrete but is outweighed by higher O&M. Varying amounts of value are created across the social and environmental spectrum of impacts, with the most significant being heat island benefit ($8,600), flood risk ($1,200), water quality ($2,600), and avoided carbon emissions from concrete use ($3,200).

The 95% confidence intervals shown in Table 15 allow us to see the uncertainty in some of these figures. There is a large spread in heat island benefits ($4,831 to 12,440), as well as water quality ($444 to $5,451), and when all impacts have been assessed it creates a large spread in overall TBL-NPV of $4,307 to $32,254; nevertheless, even at the low estimate we still generate a positive TBL-NPV as compared to Concrete.

Financial	Social	Environmental
-$200	$9,846	$7,476
Triple Bottom Line NPV		**$17,122**

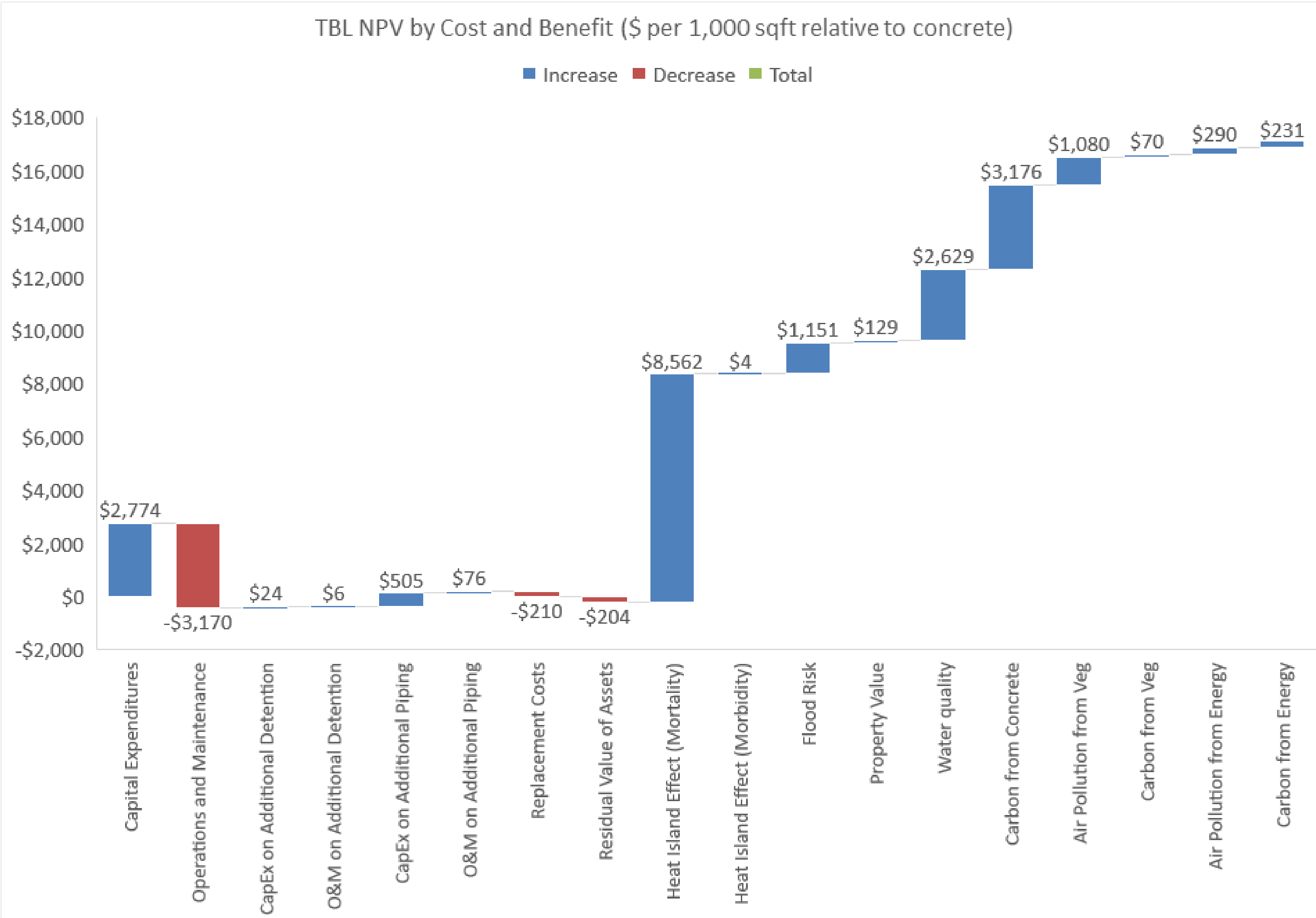


Figure 16: Breakdown of TBL NPV for Bioretention Basins

Table 15: Bioretention Basin Relative Results Compared to Concrete with 95% CI ($/1,000 sq ft)

Impact Type	Cost/Benefit	Mean Value	95% Confidence Interval		
Financial	Capital Expenditures	**$2,774**	$1,133	to	$4,400
Financial	Operations and Maintenance	**-$3,170**	-$3,662	to	-$2,680
Financial	CapEx on Additional Detention	**$24**	$9	to	$39
Financial	O&M on Additional Detention	**$6**	$0	to	$11
Financial	CapEx on Additional Piping	**$505**	$403	to	$642
Financial	O&M on Additional Piping	**$76**	$45	to	$110
Financial	Replacement Costs	**-$210**	-$1,713	to	$1,978
Financial	Residual Value of Assets	**-$204**	-$723	to	$266
Social	Heat Island Effect (Mortality)	**$8,562**	$4,831	to	$12,440
Social	Heat Island Effect (Morbidity)	**$4**	-$2	to	$12
Social	Flood Risk	**$1,151**	$1,138	to	$1,163
Social	Property Value	**$129**	$81	to	$183
Environmental	Water quality	**$2,629**	$444	to	$5,451
Environmental	Carbon Emissions from Concrete	**$3,176**	$1,294	to	$5,771
Environmental	Air Pollution Reduced by Vegetation	**$1,080**	$732	to	$1,428
Environmental	Carbon Reduction by Vegetation	**$70**	$29	to	$129
Environmental	Air Pollution Reduced by Energy Use	**$290**	$173	to	$460
Environmental	Carbon Reduction by Energy Use	**$231**	$94	to	$451
Total	**Triple Bottom Line NPV**	**$17,122**	$4,307	to	$32,254

3.5 Infiltration Trench

Infiltration trench generates an estimated $6,200 (95% confidence interval of -$2,601 to $15,815) in triple bottom line net present value over a 50-year time horizon relative to Concrete, with $2,000 created through financial savings, -$600 through social impacts, and $4,800 through environmental benefits.

Figure 17 shows a waterfall chart of the breakdown of these values. On the chart, blue represents value being created, whereas red represents a cost, relative to concrete. We can see that Infiltration trenches have a lower CapEx than Concrete; this saving outweighs the higher O&M. Varying amounts of value (as well as dis-benefits) are created across the social and environmental spectrum of impacts, with the most significant being heat island benefit (-$1,800), flood risk ($1,000), water quality ($1,700), and avoided carbon emissions from concrete use ($3,200).

The 95% confidence intervals shown in Table 16 allow us to see the uncertainty in some of these figures. There is a large spread in CapEx ($1,471 to $6,056), as well as water quality ($280 to $3,444), and when all impacts have been assessed it creates a large spread in overall TBL-NPV of -$2,601 to $15,815, showing that there is a possibility – albeit small – of negative TBL-NPV compared to Concrete.

Financial	Social	Environmental
$1,962	-$644	$4,837
Triple Bottom Line NPV		**$6,155**

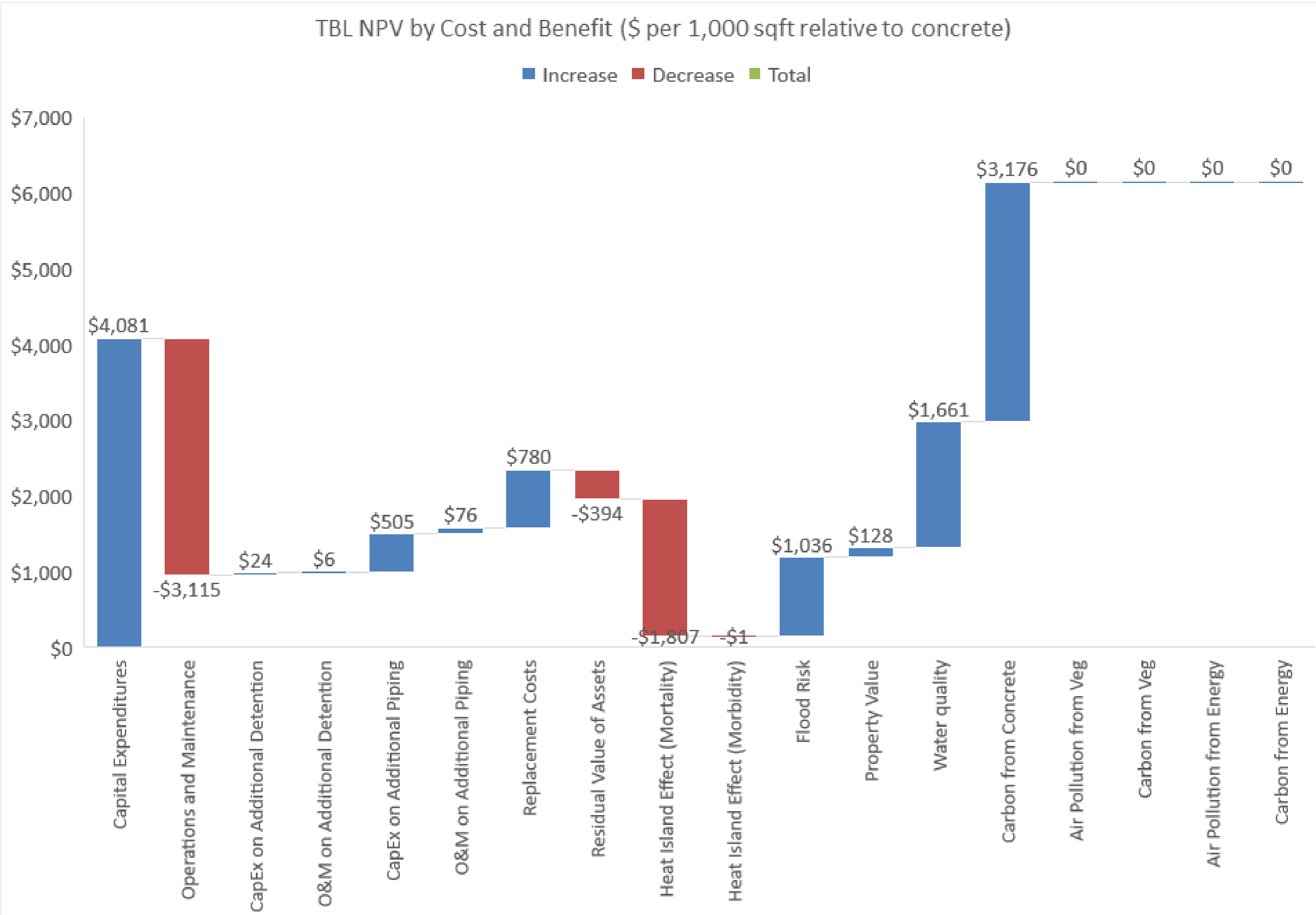


Figure 17: Breakdown of TBL NPV for Infiltration Trenches

Table 16: Infiltration Trench Relative Results Compared to Concrete with 95% CI ($/1,000 sq ft

Impact Type	Cost/Benefit	Mean Value	95% Confidence Interval		
Financial	Capital Expenditures	**$4,081**	$1,471	to	$6,056
Financial	Operations and Maintenance	**-$3,115**	-$3,115	to	-$3,115
Financial	CapEx on Additional Detention	**$24**	$9	to	$39
Financial	O&M on Additional Detention	**$6**	$0	to	$11
Financial	CapEx on Additional Piping	**$505**	$403	to	$642
Financial	O&M on Additional Piping	**$76**	$45	to	$110
Financial	Replacement Costs	**$780**	-$846	to	$2,859
Financial	Residual Value of Assets	**-$394**	-$868	to	$45
Social	Heat Island Effect (Mortality)	**-$1,807**	-$2,387	to	-$1,258
Social	Heat Island Effect (Morbidity)	**-$1**	-$3	to	$0
Social	Flood Risk	**$1,036**	$1,036	to	$1,036
Social	Property Value	**$128**	$81	to	$175
Environmental	Water quality	**$1,661**	$280	to	$3,444
Environmental	Carbon Emissions from Concrete	**$3,176**	$1,294	to	$5,771
Environmental	Air Pollution Reduced by Vegetation	**$0**	$0	to	$0
Environmental	Carbon Reduction by Vegetation	**$0**	$0	to	$0
Environmental	Air Pollution Reduced by Energy Use	**$0**	$0	to	$0
Environmental	Carbon Reduction by Energy Use	**$0**	$0	to	$0
Total	**Triple Bottom Line NPV**	**$6,155**	-$2,601	to	$15,815

3.6 Pervious Pavers

Pervious pavers generate an estimated -$5,400 (95% confidence interval of -$21,411 to $12,068) in triple bottom line net present value over a 50-year time horizon relative to Concrete, with -$11,100 created through financial impacts, $600 through social impacts, and $5,100 through environmental benefits.

Figure 18 shows a waterfall chart of the breakdown of these values. On the chart, blue represents value being created, whereas red represents a cost, relative to concrete. We can see that Pervious pavers have a much higher CapEx and replacement cost than Concrete. Varying amounts of value are created across the social and environmental spectrum of impacts, with the most significant being flood risk ($500), water quality ($1,900), and avoided carbon emissions from concrete use ($3,200).

The 95% confidence intervals shown in Table 17 allow us to see the uncertainty in some of these figures. There is a large spread in CapEx (-$11,670 to -$2,323), as well as water quality ($323 to $3,963), and when all impacts have been assessed it creates a large spread in overall TBL-NPV of -$21,411 to $12,068, indicating that there is a fair possibility of either a positive or negative TBL-NPV compared to Concrete.

Financial	Social	Environmental
-$11,067	$555	$5,088
Triple Bottom Line NPV		**-$5,424**

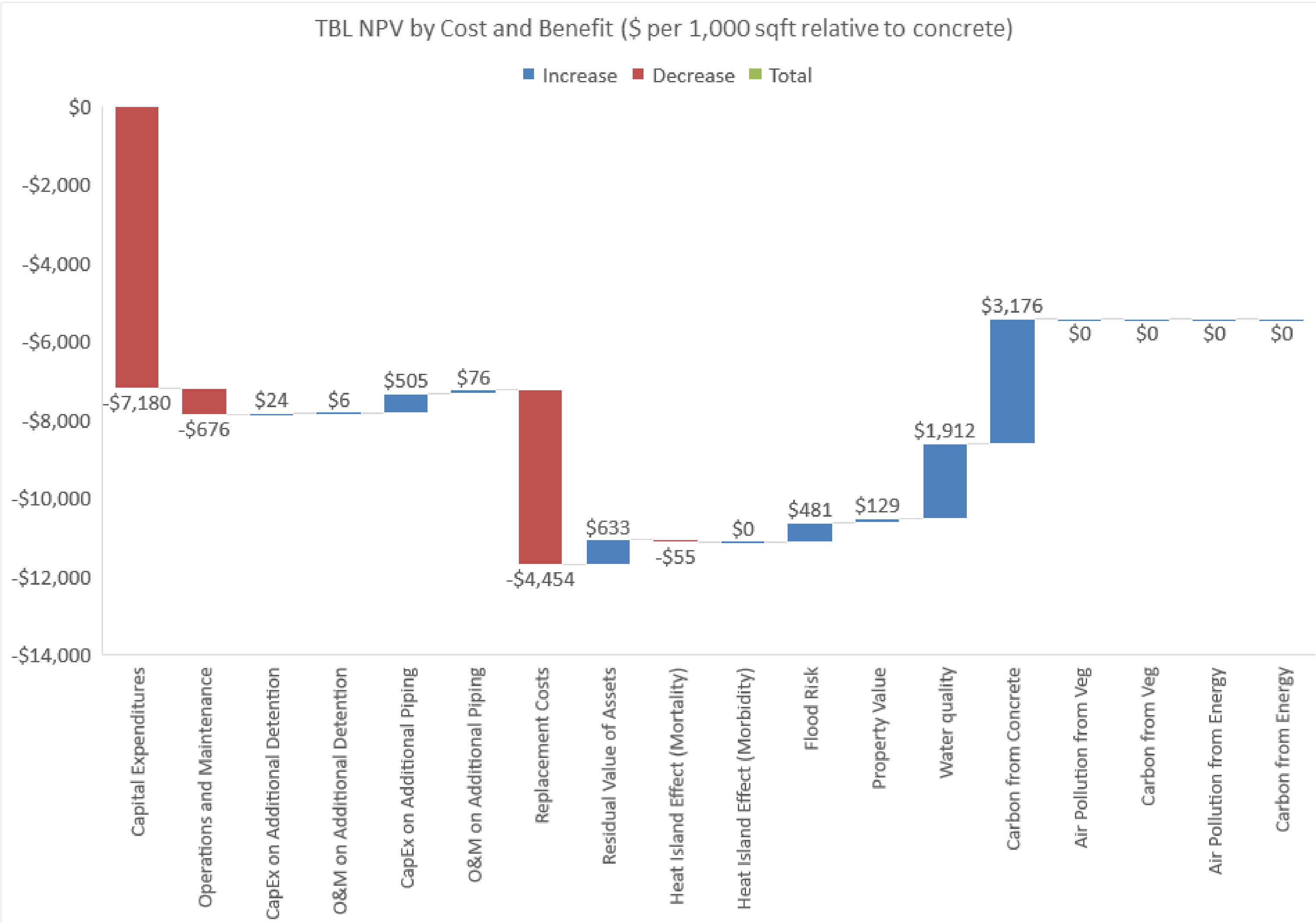


Figure 18: Breakdown of TBL NPV for Pervious Pavers

Table 17: Pervious Pavers Relative Results Compared to Concrete with 95% CI ($/1,000 sq ft

Impact Type	Cost/Benefit	Mean Value	95% Confidence Interval		
Financial	Capital Expenditures	**-$7,180**	-$11,670	to	-$2,323
Financial	Operations and Maintenance	**-$676**	-$1,019	to	-$381
Financial	CapEx on Additional Detention	**$24**	$9	to	$39
Financial	O&M on Additional Detention	**$6**	$0	to	$11
Financial	CapEx on Additional Piping	**$505**	$403	to	$642
Financial	O&M on Additional Piping	**$76**	$45	to	$110
Financial	Replacement Costs	**-$4,454**	-$9,355	to	-$157
Financial	Residual Value of Assets	**$633**	-$832	to	$2,671
Social	Heat Island Effect (Mortality)	**-$55**	-$1,167	to	$1,057
Social	Heat Island Effect (Morbidity)	**$0**	-$3	to	$4
Social	Flood Risk	**$481**	$481	to	$481
Social	Property Value	**$129**	$82	to	$181
Environmental	Water quality	**$1,912**	$323	to	$3,963
Environmental	Carbon Emissions from Concrete	**$3,176**	$1,294	to	$5,771
Environmental	Air Pollution Reduced by Vegetation	**$0**	$0	to	$0
Environmental	Carbon Reduction by Vegetation	**$0**	$0	to	$0
Environmental	Air Pollution Reduced by Energy Use	**$0**	$0	to	$0
Environmental	Carbon Reduction by Energy Use	**$0**	$0	to	$0
Total	**Triple Bottom Line NPV**	**-$5,424**	-$21,411	to	$12,068

3.7 Porous Concrete

Porous concrete generates an estimated $2,700 (95% confidence interval of -$8,647 to $14,938) in triple bottom line net present value over a 50-year time horizon relative to Concrete, with -$3,200 created through financial impacts, $800 through social impacts, and $5,100 through environmental benefits.

Figure 19 shows a waterfall chart of the breakdown of these values. On the chart, blue represents value being created, whereas red represents a cost, relative to concrete. We can see that Porous concrete has a much higher CapEx and replacement cost than Concrete. Varying amounts of value are created across the social and environmental spectrum of impacts, with the most significant being flood risk ($500), water quality ($1,900), and avoided carbon emissions from concrete use ($3,200).

The 95% confidence intervals shown in Table 18 allow us to see the uncertainty in some of these figures. There is a large spread in CapEx (-$4,358 to $152), replacement cost (-$4,079 to $1,262), as well as water quality ($323 to $3,963). When all impacts have been assessed it creates a large spread in overall TBL-NPV of -$8,647 to $14,938, indicating that there is a fair possibility of either a positive or negative TBL-NPV compared to Concrete.

Financial	Social	Environmental
-$3,211	$814	$5,088
Triple Bottom Line NPV		**$2,691**

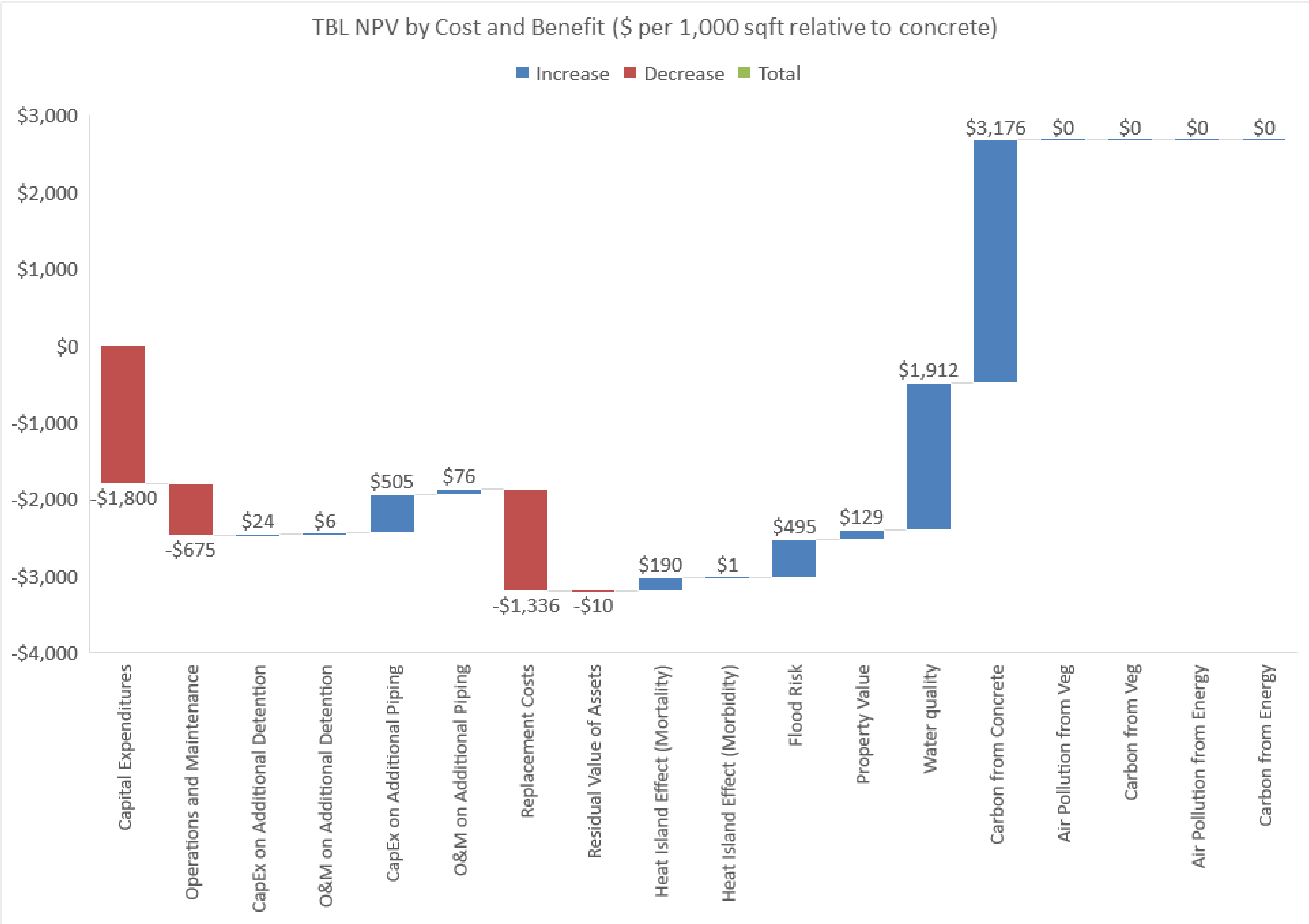


Figure 19: Breakdown of TBL NPV for Porous Concrete

Table 18: Porous Concrete Relative Results Compared to Concrete with 95% CI ($/1,000 sq ft

Impact Type	Cost/Benefit	Mean Value	95% Confidence Interval		
Financial	Capital Expenditures	**-$1,800**	-$4,358	to	$152
Financial	Operations and Maintenance	**-$675**	-$1,015	to	-$386
Financial	CapEx on Additional Detention	**$24**	$9	to	$39
Financial	O&M on Additional Detention	**$6**	$0	to	$11
Financial	CapEx on Additional Piping	**$505**	$403	to	$642
Financial	O&M on Additional Piping	**$76**	$45	to	$110
Financial	Replacement Costs	**-$1,336**	-$4,079	to	$1,262
Financial	Residual Value of Assets	**-$10**	-$845	to	$1,313
Social	Heat Island Effect (Mortality)	**$190**	-$997	to	$1,380
Social	Heat Island Effect (Morbidity)	**$1**	-$3	to	$4
Social	Flood Risk	**$495**	$495	to	$495
Social	Property Value	**$129**	$81	to	$180
Environmental	Water quality	**$1,912**	$323	to	$3,963
Environmental	Carbon Emissions from Concrete	**$3,176**	$1,294	to	$5,771
Environmental	Air Pollution Reduced by Vegetation	**$0**	$0	to	$0
Environmental	Carbon Reduction by Vegetation	**$0**	$0	to	$0
Environmental	Air Pollution Reduced by Energy Use	**$0**	$0	to	$0
Environmental	Carbon Reduction by Energy Use	**$0**	$0	to	$0
Total	**Triple Bottom Line NPV**	**$2,691**	-$8,647	to	$14,938

3.8 Porous Asphalt

Porous asphalt generates an estimated $2,200 (95% confidence interval of -$9,949 to $15,908) in triple bottom line net present value over a 50-year time horizon relative to Concrete, with -$2,100 created through financial impacts, -$800 through social impacts, and $4,800 through environmental benefits.

Figure 20 shows a waterfall chart of the breakdown of these values. On the chart, blue represents value being created, whereas red represents a cost, relative to concrete. We can see that Porous asphalt has small CapEx and O&M incremental costs, while replacement cost is the main cost driver. Varying amounts of value (as well as dis-benefits) are created across the social and environmental spectrum of impacts, with the most significant being heat island effect (-$1,400), water quality ($1,900), and avoided carbon emissions from concrete use ($3,200).

The 95% confidence intervals shown in Table 19 allow us to see the uncertainty in some of these figures. There is a large spread in CapEx (-$3,762 to $2,915), replacement cost (-$4,857 to $1,668), as well as water quality ($323 to $3,963). When all impacts have been assessed it creates a large spread in overall TBL-NPV of -$9,949 to $15,908, indicating that there is a fair possibility of either a positive or negative TBL-NPV compared to Concrete.

Financial	Social	Environmental
-$2,136	-$790	$4,837
Triple Bottom Line NPV		**$2,162**

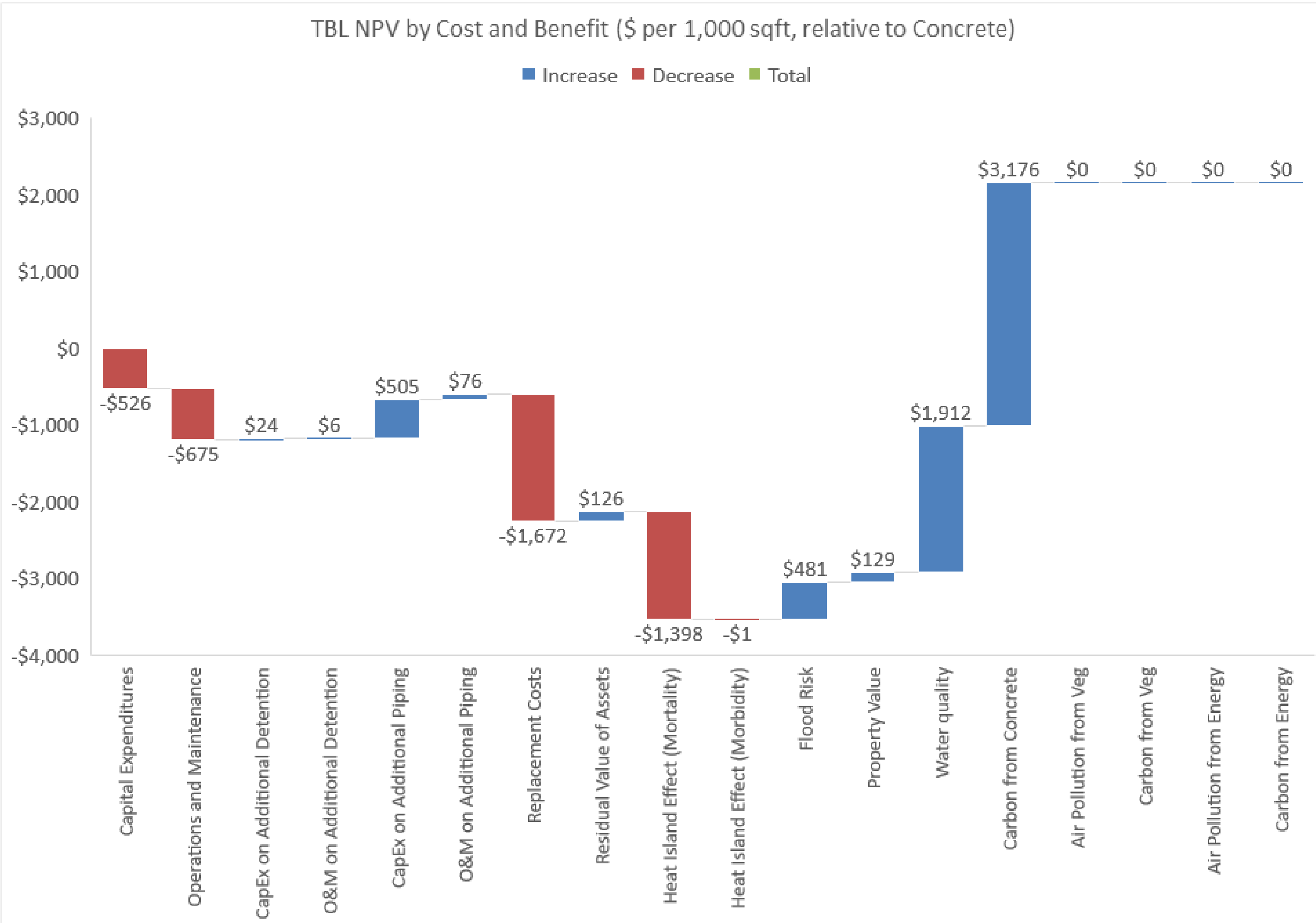


Figure 20: Breakdown of TBL NPV for Porous Asphalt

Table 19: Porous Asphalt Relative Results Compared to Concrete with 95% CI ($/1,000 sq ft)

Impact Type	Cost/Benefit	Mean Value	95% Confidence Interval		
Financial	Capital Expenditures	**-$526**	-$3,762	to	$2,915
Financial	Operations and Maintenance	**-$675**	-$1,015	to	-$386
Financial	CapEx on Additional Detention	**$24**	$9	to	$39
Financial	O&M on Additional Detention	**$6**	$0	to	$11
Financial	CapEx on Additional Piping	**$505**	$403	to	$642
Financial	O&M on Additional Piping	**$76**	$45	to	$110
Financial	Replacement Costs	**-$1,672**	-$4,857	to	$1,668
Financial	Residual Value of Assets	**$126**	-$845	to	$1,233
Social	Heat Island Effect (Mortality)	**-$1,398**	-$2,103	to	-$718
Social	Heat Island Effect (Morbidity)	**-$1**	-$4	to	$0
Social	Flood Risk	**$481**	$481	to	$481
Social	Property Value	**$129**	$82	to	$178
Environmental	Water quality	**$1,912**	$323	to	$3,963
Environmental	Carbon Emissions from Concrete	**$3,176**	$1,294	to	$5,771
Environmental	Air Pollution Reduced by Vegetation	**$0**	$0	to	$0
Environmental	Carbon Reduction by Vegetation	**$0**	$0	to	$0
Environmental	Air Pollution Reduced by Energy Use	**$0**	$0	to	$0
Environmental	Carbon Reduction by Energy Use	**$0**	$0	to	$0
Total	**Triple Bottom Line NPV**	**$2,162**	-$9,949	to	$15,908

4 Project Description (Case Study Sites)

This section describes the three case study sites that are assessed in this report, as well as outlines some of the more detailed design assumptions used in order to generate results within Autocase.

4.1 Sites to be Analyzed

The case study sites analyzed as part of this assessment are:

1. Primera Iglesia is located at 701 S. 1st Street, Phoenix, Arizona. The project installation date was November 2011 and included 15 new trees requiring no supplemental irrigation after the vegetation was established, 4,500 sq ft bioretention basin/rain garden, and curb cuts and cores. The project provided the first Phoenix area GI/LID site demonstration.
2. Glendale Community Center is located at 14075 N. 59th Avenue, Glendale, Arizona. The project installation date was March 2016 and included 8 new trees, two bioretention basins/rain gardens totalling 6,000 sq ft, which is expected to harvest 10,000 gallons of rainwater per year, and curb cuts.
3. A combined project encompassing Central Station, Civic Space Park, and Taylor Mall includes a transit center, public park, and pedestrian improvements generally located around 444 N. Central Avenue in Phoenix. The traditional features include landscaping and one new retention basin[2] equalling 0.33 acres and one existing retention basin equalling 0.147 acres. GI/LID features include 680 shrubs, 52,000 sq ft of pervious pavers, 13,000 sq ft of vegetated swales with trees, 1,600 sq ft of tree planters, 30,000 sq ft of porous concrete, 243 new trees, and one underground stormwater storage cistern[3] with a capacity of 9,600 cf.

Each of these were then compared against a base case to assess their *incremental* – or *relative* impact.

For Primera Iglesia and Glendale Community Center, the previously existing land cover was used as the base case because both locations were previously developed with no anticipated changes except the GI/LID projects. Therefore, the condition without the GI/LID projects would have remained without alteration. This previously existing land cover at both locations consisted of rocks and compacted, un-vegetated dirt surface. This land cover is not an automated feature type in Autocase, however after speaking to WMG and City staff, it was deemed that the best comparison in Autocase for the existing land cover type was asphalt due to the poor infiltration, water runoff, and heat island impact. Therefore, for Primera and Glendale Community Center, 'Asphalt' was used within Autocase as the base case from which to compare the design. A 20,000 square foot watershed area was included for the case study and comparison base design at Primera Iglesia, and a 25,000 square foot watershed area for both design scenarios at Glendale, in order to represent the surface area that would generate runoff flowing in to each project.

For the Central Station/Civic Space Park/Taylor Mall project, the base case used was concrete. Although the previously existing condition was asphalt parking lot, this case study used an alternate development land cover instead. If GI/LID had not been included as part of the redevelopment, the redevelopment would still have occurred. Therefore, using the previously existing condition as we did for the other two case studies would not have been appropriate. Most the area with GI/LID features constructed would

[2] A storage area to manage stormwater runoff to prevent flooding and downstream erosion.

[3] A rigid device of metal, plastic, or other solid material that captures and stores water from an impervious surface.

likely have been concrete (e.g., pervious pavers and porous concrete at Civic Space Park would likely have been an impervious concrete plaza) and asphalt (e.g., Taylor Mall parking spaces); therefore, the base case selected is a concrete feature equal to the size of the LID features. The base case design also included the new and existing retention basins (0.33 acres and 0.147 acres, respectively), as well as 118 trees to conform to local requirements for retention and tree spacing. A 10.3-acre feature watershed area was included in each analysis to represent the surface area that would generate runoff flowing into the project.

4.2 Project Inputs

This and all further subsections in Section 3 provide information on the specific inputs used in Autocase for each case study and its associated base case comparison design. The specific inputs for the case studies are based on the actual design plans, Google Earth reviews of the finished project, construction cost documents, which are supplemented by SUSTAIN database and the National Stormwater Management Calculator.

4.2.1 Primera Iglesia

4.2.1.1 Base Case

This section outlines the inputs used in Autocase for the base case for Primera Iglesia.

Figure 21: Primera Iglesia (Before)
Source: Watershed Management Group

Table 20: Primera Iglesia Base Case Inputs

	Unit	Expected Value
Name of feature	-	Asphalt
Area	Sq ft	4,480
New or existing?	-	Existing

Notes:

- A feature watershed of 20,000 sq ft was also included as part of the base case.

4.2.1.2 LID Design

This section outlines the inputs used in Autocase for the LID design for Primera Iglesia.

Figure 22: Primera Iglesia (After)
Source: Watershed Management Group

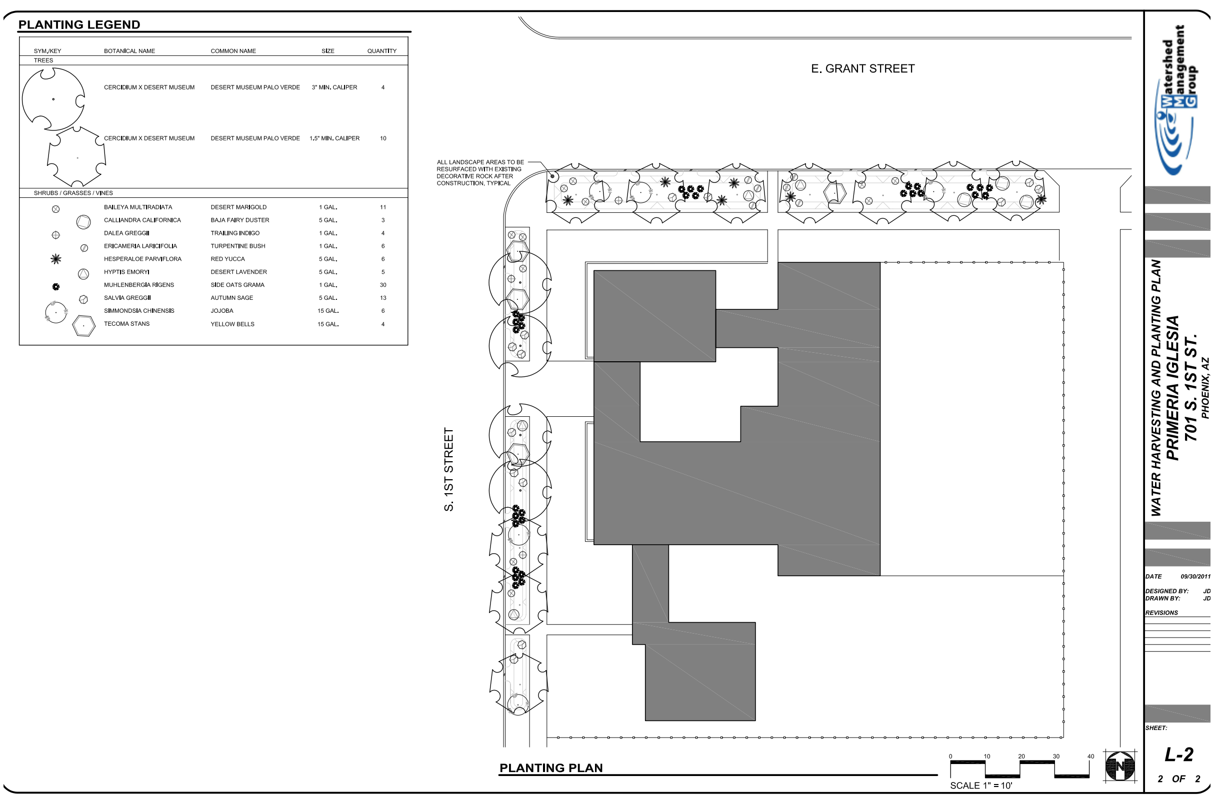


Figure 23: Primera Iglesia Site Plans
Source: Watershed Management Group

Table 21: Primera Iglesia Bioretention Basin Inputs

	Unit	Expected Value
Name of feature		Bioretention/Rain garden
Area	sq ft	4,480
New or existing?		New
Maximum Ponding/Treatment Depth	Inches	6
Depth of Coverage Materials	Inches	3
Percent Empty Space in Material	%	40
Rate of Gray Discharge from Outlet of Feature	-	-
Does this feature allow for infiltration?	Yes/No	Yes
Trees Planted	#	15
Shrubs planted	#	125
Shrubs Average Expected Lifespan	Year	10
Shrubs Max Expected Lifespan	Year	20
Soil type		B
Maximum Surface Infiltration Rate	Inches per hour	4.5
Minimum Surface Infiltration Rate	Inches per hour	0.25
Infiltration Rate Reduction Factor	per hour	1
Capital Expenditure	$	$8,785
Annual O&M	$	$542 (Low = $433, High = $677)

Notes:

- CapEx come from WMG site costs for Primera Iglesia
- A feature watershed of 20,000 sq ft was also included as part of the design case.
- O&M costs are from Watershed Management Group estimates based on $120/1,000 sq ft at a rate of $75/hr.

4.2.2 Glendale Community Center

4.2.2.1 Base Case

This section outlines the inputs used in Autocase for the base case for Glendale Community Center.

Figure 24: Glendale Community Center (Before)
Source: Watershed Management Group

Table 22: Glendale Community Center Base Case Inputs

	Unit	Design case
Name of feature	-	Asphalt
Area	Sq ft	6,000
New or existing?	-	Existing

Notes:

- A feature watershed of 25,000 sq ft was also included as part of the base case.
- Asphalt was chosen as the Base Case feature type in Autocase, due to the porosity and solar absorption properties of the existing features.

4.2.2.2 LID Design

This section outlines the inputs used in Autocase for the LID design for Glendale Community Center.

SYM./KEY	BOTANICAL NAME	COMMON NAME	SIZE	QUANITITY	EMITTER (PER PLANT)	E. SIZE (GPH)	ZONE
TREES							
	Chilopsis linearis	Desert Willow	15 GAL.	8	4	2	TREE
SHRUBS / GRASSES							
	Hyptis emoryi	Desert Lavender	5 GAL.	3	2	1	SHRUB
	Simmondsia chinensis	Jojoba	5 GAL.	3	2	1	SHRUB
	Larrea tridentata	Creosote	5 GAL.	3	2	1	SHRUB
	Calliandra eriophylla	Pink Fairy Duster	5 GAL.	13	2	1	SHRUB
	Justicia californica	Chuparosa	5 GAL.	12	2	1	SHRUB
	Viguiera parishii	Goldeneye	5 GAL.	15	2	1	SHRUB
	Encelia farinosa	Brittlebush	1 GAL.	3	2	1	SHRUB
	Baileya multiradiata	Desert Marigold	1 GAL.	15	2	1	SHRUB
	Melampodium leucanthum	Blackfoot Daisy	1 GAL.	15	2	1	SHRUB
	Asclepias subulata	Desert Milkweed	5 GAL.	9	2	1	SHRUB
	Penstemon eatoni	Firecracker Penstemon	1 GAL.	6	2	1	SHRUB
	Bouteloua curtipendula	Sideoats Grama	1 GAL.	21	2	1	SHRUB
SURFACE MATERIALS							
	Boulders Surface Select	2 TON					
	Rip-Rap 3"-12" (Palomino Gold)	9 TON					
Not Shown	Decorative Gravel (Palomino Gold)	32 TON					

NOTES:

EXISTING DECORATIVE ROCK, RIVER ROCK, AND LANDSCAPE DEBRIS TO BE REMOVED FROM SITE.

EXISTING VEGETATION TO BE REMOVED FROM SITE IF NOT MARKED TO REMAIN.

EXCAVATION OF RAINWATER HARVESTING FEATURE TO BE MININAL AS SITE IS LOCATED IN EXISTING RETENTION BASIN.

LANDSCAPE AREA ADJACENT TO WALKWAYS TO BE GRADED 3" BELOW HARDSCAPE TOP SURFACE TO ALLOW FOR 2" OF SURFACE COVER.

EXCAVATED SOIL NOT USED TO CREATE BERMS TO BE REMOVED FROM SITE.

3"-12" RIP-RAP TO BE USED FOR ERROSION CONTROL IN AREAS AS SHOWN ON DRAWING.

LANDSCAPE AREA TO BE RESURFACED WITH 2" LAYER OF DECORATIVE GRAVEL AFTER CONSTRUCTION.

TREES TO BE PLANTED A MINIMUM OF 20' AWAY FROM ANY BUILDING.

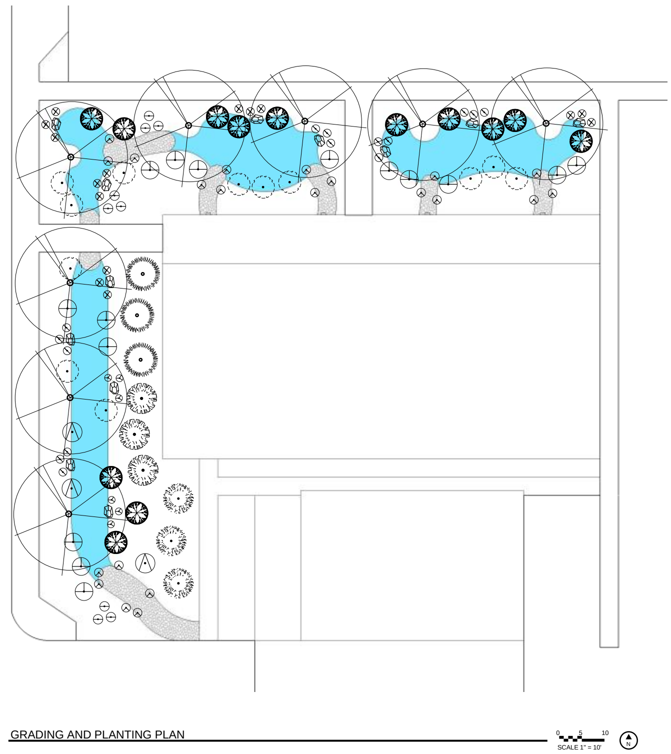


Figure 25: Glendale Site Plans (draft design)
Source: Watershed Management Group

Figure 26: Glendale Community Center (After)
Source: Watershed Management Group

Table 23: Glendale Community Center Bioretention Basin Inputs

	Unit	Design case
Name of feature		Bioretention/Rain garden
Area	sq ft	6,000
New or existing?		New
Maximum Ponding/Treatment Depth	Inches	6
Depth of Coverage Materials	Inches	3
Percent Empty Space in Material	%	40
Rate of Gray Discharge from Outlet of Feature	-	-
Does this feature allow for infiltration?	Yes/No	Yes
Trees Planted	#	8
Shrubs planted	#	128
Shrubs Average Expected Lifespan	Year	10
Shrubs Max Expected Lifespan	Year	20
Soil type		B
Maximum Surface Infiltration Rate	Inches per hour	4.5
Minimum Surface Infiltration Rate	Inches per hour	0.25
Infiltration Rate Reduction Factor	per hour	1
Capital Expenditure	$	$14,100
Annual O&M	$	$726 (Low = $581, High = $907)

Notes:

- A feature watershed of 25,000 sq ft was also included as part of the design case.
- CapEx and O&M costs come from WMG site costs for Primera iglesia.
- O&M costs are from Watershed Management Group estimates based on $120/1,000 sq ft at a rate of $75/hr.
- Numbers here differ to the design schematic as this was based on as-built measurements and costs.

4.2.3 Central Station/Civic Space Park/Taylor Mall

4.2.3.1 Base Case

This section outlines the inputs used in Autocase for the base case for Central Station/Civic Space Park/Taylor Mall.

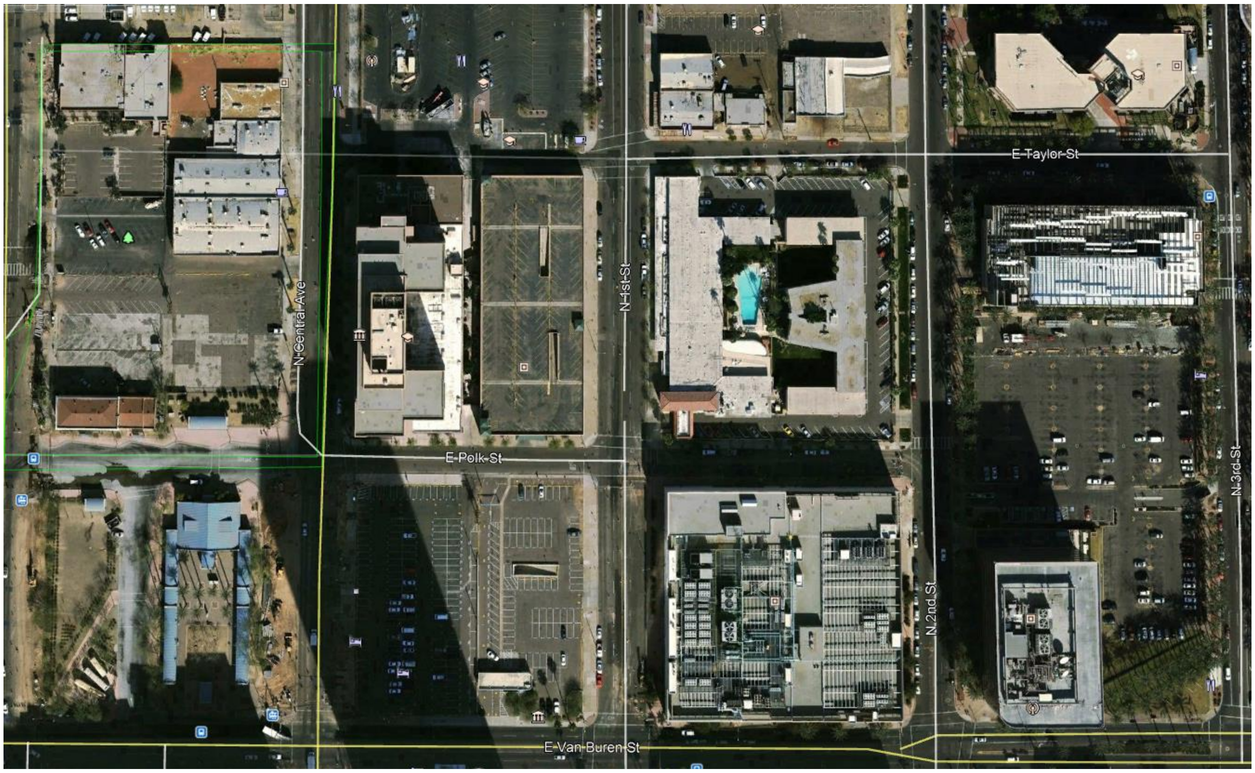


Figure 27: Central Station/Civic Space Park/Taylor Mall project area (before, circa 2005)

Table 24: Central/Civic/Taylor Base Case Inputs: Trees

	Unit	Expected Value
Name of feature		Additional Trees
New or existing?		New
Number of new trees being planted	#	118
Soil type		B
Maximum Surface Infiltration Rate	Inches per hour	4.5
Minimum Surface Infiltration Rate	Inches per hour	0.25
Infiltration Rate Reduction Factor	per hour	1
Capital Expenditure	$	$69,738 (Low = $18,880, High = $87,173)
Annual O&M	$	$1,841 (Low = $1,381, High = $2,301)

Notes:

- The base case also includes a feature watershed of 10.3 acres.
- CapEx = $591.00 per tree taken from Taylor Mall 100% Plan Model. Low = SUSTAIN, High = Local +25%
- O&M = $15.60 per tree. Watershed Management Group based $160/1,000 sq ft at a rate of $100 per hour (instead of $75/hr, as trees are costlier) and assuming each tree is 9 square meters. Low/High = +/- 25%.

Table 25: Central/Civic/Taylor Base Case Inputs: Concrete

	Unit	Expected Value
Name of feature		Concrete
Area	Acre	2.21
New or existing?		New
Depth of coverage material	Inches	3
Capital expenditure	$	$554,622 (Low = $434,052, High = $675,192)
Annual O&M	$	$0

Notes:

- CapEx and O&M source are City of Phoenix Streets department for per-1,000 sq ft cost estimates.

Table 26: Central/Civic/Taylor Base Case Inputs: New Retention Basin

	Unit	Design case
Name of feature		New Retention basin
Area	Acre	0.33
New or existing?		New
Maximum Ponding/Treatment Depth	Inches	12
Rate of Gray Discharge from Outlet of Feature	-	-
Minimum Permanent Depth	Inches	12
Capital Expenditure	$	$166,029 (Low = $61,237, High = $326,452)
Annual O&M	$	$431 (Low = $216, High = $862)

Notes:

- CapEx = $4,260 per cu ft and includes excavation and landscaping.
- CapEx and O&M are from the National Stormwater Management Calculator.

Table 27: Central/Civic/Taylor Base Case Inputs: Existing Retention Basin

	Uni	Expected Value
Name of feature		Existing Retention basin
Area	Acre	0.145
New or existing?		Existing
Maximum Ponding/Treatment Depth	Inches	36
Rate of Gray Discharge from Outlet of Feature	-	-
Minimum Permanent Depth	Inches	36

Notes:

- This already exists on the site so there is no incremental cost with this.

4.2.3.2 LID Design

This section outlines the inputs used in Autocase for the LID design for Central Station/Civic Space Park/Taylor Mall.

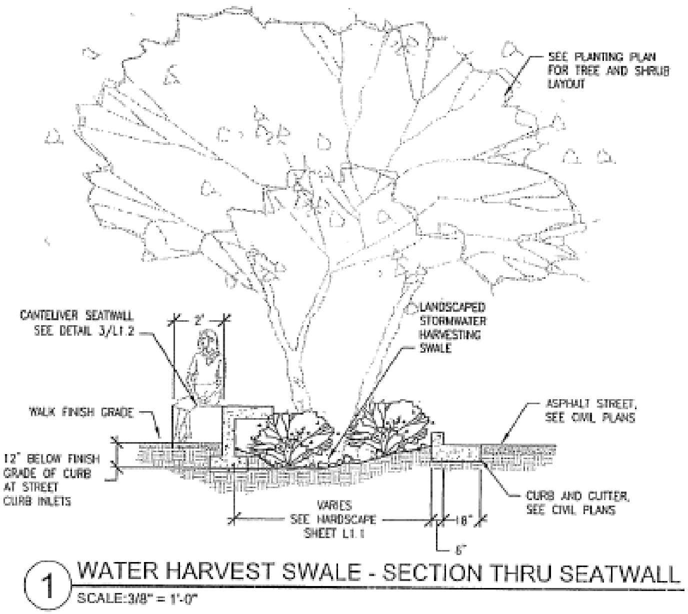


Figure 28: Taylor Mall Site Plan

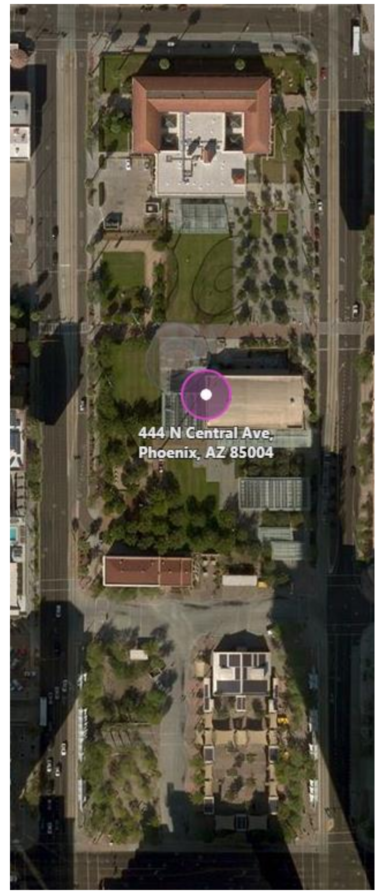


Figure 29: Central Station/Civic Space (after)

Figure 30: Taylor Mall (After)

Table 28: Central/Civic/Taylor GI/LID Inputs: Shrubs

	Unit	Expected Value
Name of feature		Shrubs
New or existing?		New
Number of new shrubs being planted	#	680
Area of new shrubs being planted	Acre	-
Soil type	Choice	B
Shrubs Average Expected Lifespan	Year	8.5
Shrubs Max Expected Lifespan	Year	10
Soil type		B
Maximum Surface Infiltration Rate	Inches per hour	4.5
Minimum Surface Infiltration Rate	Inches per hour	0.25
Infiltration Rate Reduction Factor	per hour	1
Capital Expenditure	$	$9,280 (Low = $4,640, High = $15,081)
Annual O&M	$	-

Notes:

- O&M included as part of O&M costs of other features.

Table 29: Central/Civic/Taylor GI/LID Inputs: Pervious Pavers

	Unit	Expected Value
Name of feature		Pervious Paver
Area	Sq ft	51,960
New or existing?		New
Depth of Coverage Materials	Inches	3.5
Percent Empty Space in Material	%	20
Rate of Gray Discharge from Outlet of Feature	-	-
Soil type		B
Maximum Surface Infiltration Rate	Inches per hour	4.5
Minimum Surface Infiltration Rate	Inches per hour	0.25
Infiltration Rate Reduction Factor	per hour	1
Capital Expenditure	$	$673,921 (Low = $391,778, High =$924,888)
Annual O&M	$	$1,253 (Low = $626, High = $2,505)

Notes:

- CapEx of $12.97 per 1 sq ft was found using Taylor Mall 100% Plan Cost Model. Low and High from SUSTAIN
- O&M costs are based off $12/1,000 sq ft for power washing costs for porous concrete at Glendale Park and Ride for FY 2017. Low = 1 wash, Expected = 2 washes, High = 4 washes.

Table 30: Central/Civic/Taylor GI/LID Inputs: Swale

	Unit	Expected Value
Name of feature		Swale
Area	Sq ft	13,070
New or existing?		New
Maximum Ponding/Treatment Depth	Inches	12
Channel Bank Height	Inches	12
Soil type		B
Maximum Surface Infiltration Rate	Inches per hour	4.5
Minimum Surface Infiltration Rate	Inches per hour	0.25
Infiltration Rate Reduction Factor	per hour	1
Capital Expenditure	$	$72,238 (Low = $14,686, High = $148,455
Annual O&M	$	$1,581 (Low = $1,265, High = $1,976)

Notes:

- CapEx: Swale cost taken from 2nd-3rd st site plans, which was 1,717 sq ft and then scaled to 13,070 sq ft to encompass all swales constructed as part of this project.
- CapEx: Low = Includes 1 tree, 8 shrubs, 8 feet of curb cuts per 1,000 sq ft. Does not include concrete removal or the concrete single curb. Expected = Does not include concrete removal. Includes concrete single curb, 2 trees, 16 shrubs, 16 feet of curb cuts per 1,000 sq ft. High = Includes concrete removal, concrete single curb, 3 trees, 26 shrubs, 24 feet of curb cuts (8 openings, 3' each) per 1,000 sq ft.
- O&M: WMG estimates at $120/1,000 sq ft at $75 per hour labor cost.

Table 31: Central/Civic/Taylor GI/LID Inputs: Tree Planter

	Unit	Expected Value
Name of feature		Tree planter
Area	Sq ft	1,600
New or existing?		New
Storage volume	Cubic feet	2,925
Depth of Coverage Materials	Inches	12
Percent Empty Space in Material	%	30
Capital Expenditure	$	$12,800 (Low = $880, High = $39,200)
Annual O&M	$	$194 (Low = $155, High = $242

Notes:

- CapEx = Expected, Low, and High values from National Stormwater Management Calculator
- O&M: WMG estimates at $120/1,000 sq ft at $75 per hour labor cost.

Table 32: Central/Civic/Taylor GI/LID Inputs: Porous Concrete

	Unit	Design case
Name of feature		Porous concrete
Area	Sq ft	29,826
New or existing?		New
Depth of Coverage Materials	Inches	4
Percent Empty Space in Material	%	20
Rate of Gray Discharge from Outlet of Feature	-	0
Soil type		B
Maximum Surface Infiltration Rate	Inches per hour	4.5
Minimum Surface Infiltration Rate	Inches per hour	0.25
Infiltration Rate Reduction Factor	per hour	1
Capital Expenditure	$	$208,782 (Low = $190,000, High = $318,000)
Annual O&M	$	$719 (Low = $359, High = $1,438)

Notes:

- CapEx: Expected = Site specific cost from the line items taken from Central Station Upgrades. Low and High values taken from SUSTAIN.
- O&M costs are based off $12/1,000 sq ft for power washing costs for porous concrete at Glendale Park and Ride for FY 2017. Low = 1 wash per year, Expected = 2 times per year, High = 4 times per year.

Table 33: Central/Civic/Taylor GI/LID Inputs: Trees

	Unit	Expected Value
Name of feature		Additional Trees
New or existing?		New
Number of new trees being planted	#	243
Area of new trees being planted	Acre	-
Soil type		B
Maximum Surface Infiltration Rate	Inches per hour	4.5
Minimum Surface Infiltration Rate	Inches per hour	0.25
Infiltration Rate Reduction Factor	per hour	1
Capital Expenditure	$	$143,530 (Low = $38,858, High = $179,413)
Annual O&M	$	$3,798 (Low = $2,841, High = $4,763

Notes:

CapEx: $591.00 per tree. Mean amount per tree taken from Taylor Mall 100% Plan Model. Low = SUSTAIN, High = Local +25%

O&M: $15.60 per tree. Watershed Management Group at $100 per hour and assuming each tree is 9 square meters. Low/High = +/- 25%.

Table 34: Central/Civic/Taylor GI/LID Inputs: Underground Stormwater Storage

	Unit	Expected Value
Name of feature		Underground stormwater storage
Storage volume	Cubic feet	9,587
New or existing?		New
Surface Area Draining into feature	Acres	2.3
Expected outflow when filled	Cubic feet/hr	0
Capital expenditure	$	$11,550 (Low = $8,662, High = $14,437)
Annual O&M	$	$13 (Low = $5, High = $60)

Notes:

- CapEx: Site plans for Civic Space Park. High/Low = +/- 25%
- O&M: SUSTAIN

Table 35: Central/Civic/Taylor GI/LID Inputs: New Retention Basin

	Unit	Design case
Name of feature		Retention basin
Area	Acre	0.33
New or existing?		New
Maximum Ponding/Treatment Depth	Inches	12
Rate of Gray Discharge from Outlet of Feature	-	-
Minimum Permanent Depth	Inches	12
Capital Expenditure	$	$166,029 (Low = $61,237, High = $326,452)
Annual O&M	$	$431 (Low = $216, High = $862)

Notes:

- CapEx = $4,260 per cu ft and includes excavation and landscaping.
- CapEx and O&M are from the National Stormwater Management Calculator.

Table 36: Central/Civic/Taylor GI/LID Inputs: Existing Retention Basin

	Unit	Expected Value
Name of feature		Retention basin
Area	Acre	0.145
New or existing?		Existing
Maximum Ponding/Treatment Depth	Inches	36
Rate of Gray Discharge from Outlet of Feature	-	-
Minimum Permanent Depth	Inches	36

Notes:

- This already exists on the site so there is no incremental cost with this.

5 Triple Bottom Line Net Present Value Results (Case Study Sites)

This Section provides an overview of the results of the three case study sites. Dollar amounts reflect costs and benefits estimated for the full 50-year time horizon. The Central/Civic/Taylor inputs were based on design plans and cost estimates – not as-built or invoices, however feature sizes were verified by ground truthing. The tables and graphs that follow show the total cost of ownership of each site, along with the social and environmental benefits that are generated over the 50-year time horizon. Negative numbers represent a cost or disbenefit (financial, social, or environmental), whereas positive numbers illustrate a saving or benefit – the larger the number, the greater the cost or benefit.

5.1 Summary of Results

A summary of the financial, social, and environmental impacts for each case study site are given in Table 37. Results indicate that Primera Iglesia and Glendale Community Center each generate positive TBL-NPV ($54,600 and $67,500, respectively) over 50 years, while Central Station/Civic Space Park/Taylor Mall is estimated to have a negative TBL-NPV of around -$170,000.

We can see that each project generates large social and environmental benefits. Primera Iglesia creates around $65,000 and $15,000, respectively, Glendale Community Center creates $90,000 and $16,000, and Central/Civic/Taylor generates around $408,000 and $435,000 in social and environmental benefits.

It is important to remember that for Primera Iglesia and Glendale Community Center, the base case was a do-nothing (i.e. no cost) scenario; the land cover would have remained the same at no cost. If these sites were to have replaced their land cover with newly built non-GI/LID features, the financial results may have looked more favourable toward LID. The base case for Central/Civic/Taylor was new concrete i.e. new concrete would have been laid down instead of GI/LID. Despite this base case being new concrete (thus incurring a CapEx) and other required features, the financial cost of GI/LID on this project was still significantly higher.

Table 37: Summary of Triple Bottom Line Results Compared to Base Case

	Primera Iglesia	Glendale Community Center	Central/Civic/Taylor
Financial	-$26,286	-$38,455	-$1,014,293
Social	$65,879	$89,866	$408,123
Environmental	$15,019	$16,053	$435,336
Triple Bottom Line NPV	**$54,612**	**$67,464**	**-$170,834**

5.2 Detailed Results

Table 38 breaks down the results for the sites by each impact type. For a more detailed breakdown of the results, which include the 95% confidence intervals for each cost and benefit, please refer to the sections that follow. The purpose of this table is not to compare one site against another, given the different features implemented, their locations, and size of projects, but to help understand where value is being generated or lost for each project.

In terms of financial impacts, it is clear that CapEx is a large driver within all projects. However, O&M actually outweighs CapEx in Primera Iglesia and Glendale Community Center. Another key takeaway from this table is the replacement costs (see methodology section 8.3.1.3), which are significant cost factors – coming in at about half as much as CapEx. If these were to be lower in practice than the expected ones estimated here (perhaps due to good upkeep and maintenance), then the projects would look more favourable on a pure financial basis.

Socially, we see the biggest driver of benefits comes from heat island effect. Given future temperature predictions for Maricopa County under RCP8.5, even small reductions in temperature from shading and vegetation will generate significant heat risk mortality benefits. Flood risk attenuation is the second key driver for social impacts, arising from the improved infiltration resulting from GI/LID.

In terms of environmental factors, we can see that water quality benefits from reduced runoff create significant value. Avoided concrete use in the Central/Civic/Taylor site is also a key benefit driver. Finally, we can see that each site generates benefit from carbon emissions and air pollution due to vegetation and avoided energy use.

Table 38: TBL-NPV Results for Each Feature by Impact Type

Impact Type	Cost/Benefit	Primera Iglesia	Glendale Community Center	Central/ Civic/Taylor
Financial	Capital Expenditures	-$8,863	-$14,226	-$576,502
Financial	Operations and Maintenance	-$14,169	-$18,693	-$153,037
Financial	CapEx on Additional Detention	$36	$46	$0
Financial	O&M on Additional Detention	$9	$12	$0
Financial	CapEx on Additional Piping	$769	$973	$0
Financial	O&M on Additional Piping	$114	$144	$0
Financial	Replacement Costs	-$4,850	-$7,794	-$333,981
Financial	Residual Value of Assets	$669	$1,084	$49,228
Social	Heat Island Effect (Mortality)	$59,148	$78,232	$333,713
Social	Heat Island Effect (Morbidity)	$20	$9	$598
Social	Flood Risk	$5,260	$8,974	$65,457
Social	Property Value	$1,451	$2,650	$8,354
Environmental	Water quality	$5,444	$6,742	$92,319
Environmental	Carbon Emissions from Concrete	$0	$0	$281,536
Environmental	Air Pollution Reduced by Vegetation	$6,397	$6,974	$31,586
Environmental	Carbon Reduction by Vegetation	$469	$378	$3,114
Environmental	Air Pollution from Energy Use Reduction	$1,479	$1,106	$14,608
Environmental	Carbon Emissions from Energy Use Reduction	$1,230	$853	$12,173
Total:	**Triple Bottom Line NPV**	**$54,612**	**$67,464**	**-$170,834**

5.3 Primera Iglesia

Primera Iglesia has a TBL-NPV of $55,000 (95% confidence interval of $23,653 to $88,273) over 50 years and creates around $66,000 and $15,000 in social and environmental benefits, respectively. Diving deeper into the results, we see that O&M is the largest driver within the financial impacts at around -$14,000 over 50 years. However, in terms of social benefits, the tree coverage and LID features generate significant heat island reduction benefits ($59,000), and flood risk reduction ($5,300). There are positive environmental benefits, with around $5,400 through improved water quality, and $9,600 in reduced carbon emissions and air pollution through vegetation and avoided energy use.

Looking at the confidence intervals in Table 39, we can see that there is a fairly tight spread within the financial impacts, suggesting they have less uncertainty surrounding them. The most uncertainty is around heat island effect ($41,178 to $78,135) and water quality ($920 to $11,288). When all impacts have been assessed it creates a large spread in overall TBL-NPV of $23,653 to $88,273, but even the low estimate creates a positive TBL-NPV.

Financial	Social	Environmental
-$26,286	$65,879	$15,019
Triple Bottom Line NPV		**$54,612**

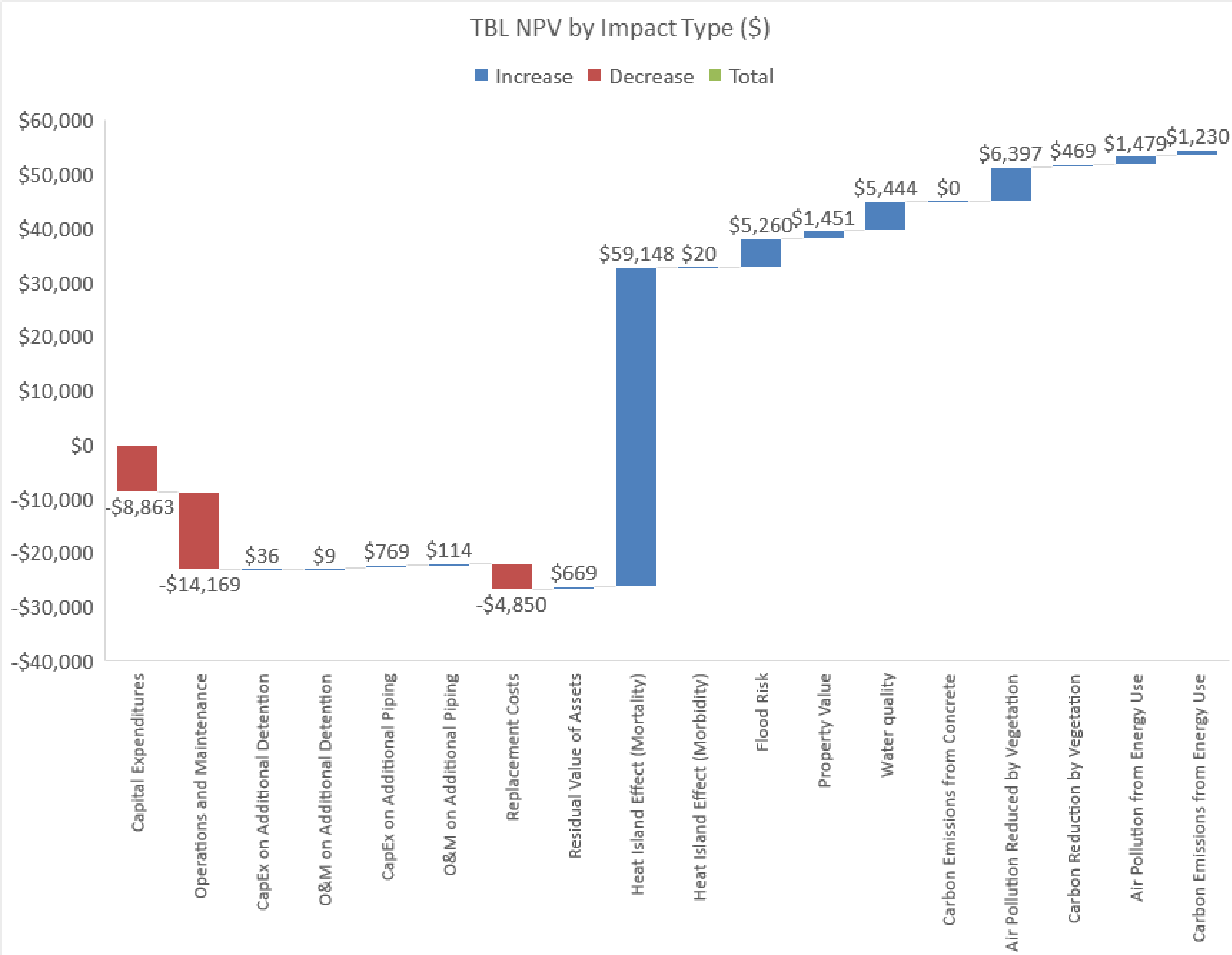


Figure 31: Breakdown of TBL NPV by Impact Type for Primera Iglesia

Table 39: TBL-NPV Results for Each Feature by Impact Type, Primera Iglesia

Impact Type	Cost/Benefit	Mean Value	95% Confidence Interval		
Financial	Capital Expenditures	**-$8,863**	-$8,863	to	-$8,863
Financial	Operations and Maintenance	**-$14,169**	-$16,506	to	-$12,117
Financial	CapEx on Additional Detention	**$36**	$12	to	$60
Financial	O&M on Additional Detention	**$9**	$0	to	$17
Financial	CapEx on Additional Piping	**$769**	$620	to	$988
Financial	O&M on Additional Piping	**$114**	$69	to	$172
Financial	Replacement Costs	**-$4,850**	-$6,114	to	-$3,597
Financial	Residual Value of Assets	**$669**	$501	to	$841
Social	Heat Island Effect (Mortality)	**$59,148**	$41,178	to	$78,135
Social	Heat Island Effect (Morbidity)	**$20**	$20	to	$20
Social	Flood Risk	**$5,260**	$5,260	to	$5,260
Social	Property Value	**$1,451**	$944	to	$1,987
Environmental	Water quality	**$5,444**	$920	to	$11,288
Environmental	Carbon Emissions from Concrete	**$0**	$0	to	$0
Environmental	Air Pollution Reduced by Vegetation	**$6,397**	$4,107	to	$8,651
Environmental	Carbon Reduction by Vegetation	**$469**	$184	to	$851
Environmental	Air Pollution from Energy Use Reduction	**$1,479**	$868	to	$2,220
Environmental	Carbon Emissions from Energy Use Reduction	**$1,230**	$454	to	$2,360
Total	**Triple Bottom Line NPV**	**$54,612**	$23,653	to	$88,273

5.4 Glendale Community Center

Glendale Community Center has a TBL-NPV of $67,000 (95% confidence interval of $30,804 to $107,469) over 50 years and creates around $106,000 in social and environmental benefits. Breaking down the results, we see that O&M costs (-$18,700) and CapEx (-$14,200) are the main drivers of the negative financial results. In terms of social benefits, the tree coverage and LID features generate significant heat island reduction benefits ($78,000) and flood risk reduction ($9,000). There are positive environmental benefits, with around $6,700 through improved water quality, and $9,300 in reduced carbon emissions and air pollution through vegetation and avoided energy use.

Looking at the confidence intervals in Table 40, we can see that there is a fairly tight spread within the financial impacts, suggesting they have less uncertainty surrounding them. The most uncertainty is around heat island effect ($54,463 to $103,344) and water quality ($1,139 to $13,978). When all impacts have been assessed it creates a large spread in overall TBL-NPV of $27,370 to $109,919, but even the low estimate creates a positive TBL-NPV over 50 years.

Financial	Social	Environmental
-$38,455	$89,866	$16,053
Triple Bottom Line NPV		**$67,464**

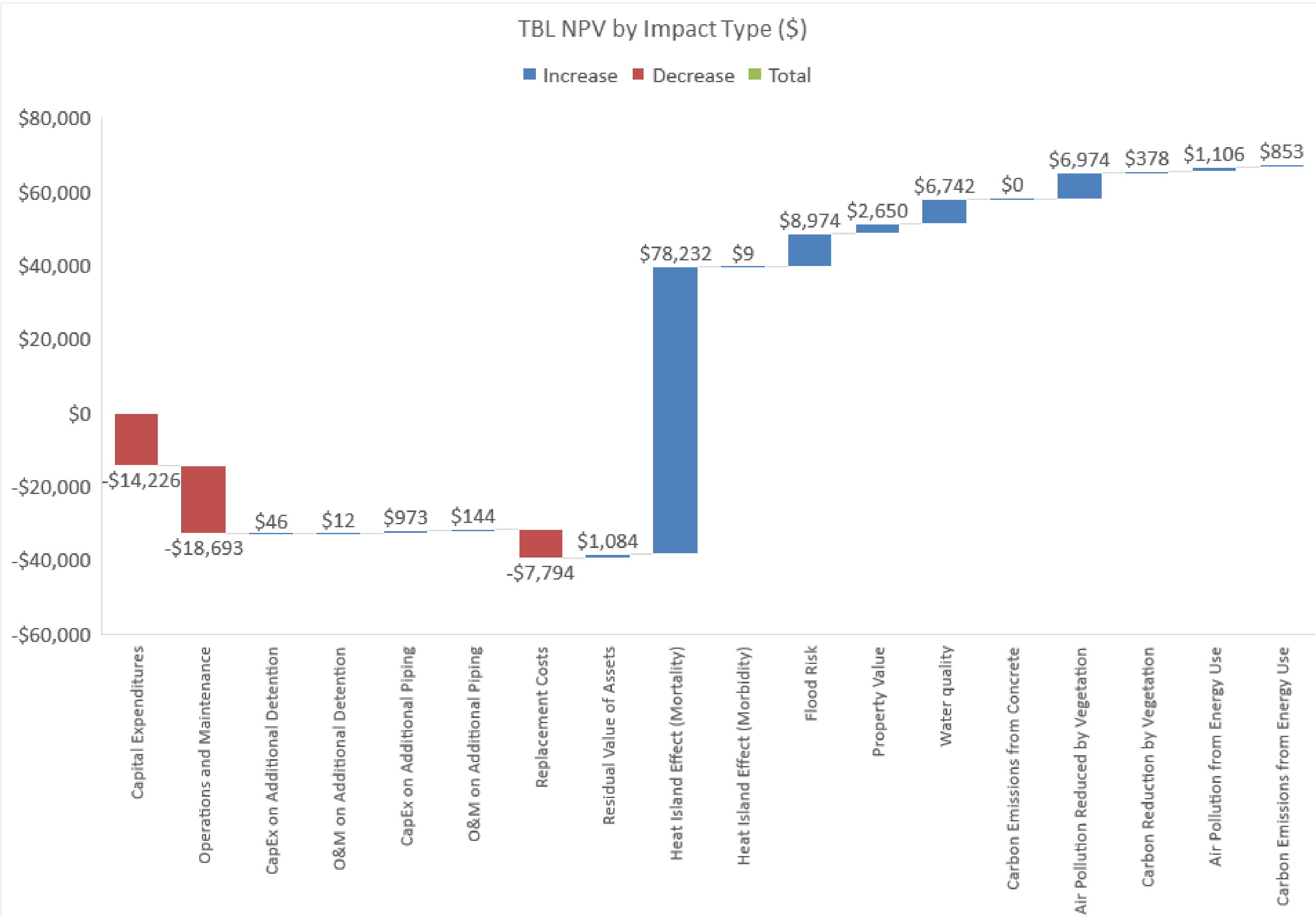


Figure 32: Breakdown of TBL NPV by Impact Type for Glendale

Table 40: TBL-NPV Results for Each Feature by Impact Type, Glendale Community Center

Impact Type	Cost/Benefit	Mean Value	95% Confidence Interval		
Financial	Capital Expenditures	**-$14,226**	-$14,226	to	-$14,226
Financial	Operations and Maintenance	**-$18,693**	-$22,127	to	-$16,243
Financial	CapEx on Additional Detention	**$46**	$15	to	$76
Financial	O&M on Additional Detention	**$12**	$0	to	$22
Financial	CapEx on Additional Piping	**$973**	$785	to	$1,252
Financial	O&M on Additional Piping	**$144**	$88	to	$218
Financial	Replacement Costs	**-$7,794**	-$9,951	to	-$5,635
Financial	Residual Value of Assets	**$1,084**	$788	to	$1,374
Social	Heat Island Effect (Mortality)	**$78,232**	$54,463	to	$103,344
Social	Heat Island Effect (Morbidity)	**$9**	$9	to	$9
Social	Flood Risk	**$8,974**	$8,974	to	$8,974
Social	Property Value	**$2,650**	$1,660	to	$3,645
Environmental	Water quality	**$6,742**	$1,139	to	$13,978
Environmental	Carbon Emissions from Concrete	**$0**	$0	to	$0
Environmental	Air Pollution Reduced by Vegetation	**$6,974**	$4,615	to	$9,306
Environmental	Carbon Reduction by Vegetation	**$378**	$147	to	$703
Environmental	Air Pollution from Energy Use Reduction	**$1,106**	$660	to	$1,534
Environmental	Carbon Emissions from Energy Use Reduction	**$853**	$332	to	$1,587
Total	**Triple Bottom Line NPV**	**$67,464**	$27,370	to	$109,919

5.5 Central Station/Civic Space Park/ Taylor Mall

Central Station/Civic Space Park/Taylor Mall has an overall TBL-NPV of -$170,000 (95% confidence interval of -$1,552,617 to $1,314,054) over 50 years but creates almost $850,000 in social and environmental benefits. The increased cost of implementing the extensive LID features (mainly CapEx from 51,960 square feet of Pervious pavers [$675,000] and 29,826 square feet of Porous concrete [$210,000]) compared to a Concrete alternative results in the negative TBL NPV. Breaking down the results, we see that O&M costs (-$153,000), CapEx (-$576,000), and Replacement Costs (-$334,000) are the force behind the negative TBL NPV results. In terms of social benefits, the tree coverage and LID features generate heat island reduction benefits ($333,000), and flood risk reduction ($65,000). There are positive environmental outcomes, with around $92,000 generated through improved water quality, $282,000 in avoided cost of using concrete, and $61,000 in reduced carbon emissions and air pollution through vegetation and avoided energy use.

Looking at the confidence intervals in Table 41, we can see that there is a significant spread within CapEx (-$915,078 to -$253,456) and Replacement costs (-$617,912 to -$41,247), suggesting they have less certainty surrounding them. There is also large uncertainty around heat island effect ($114,609 to $558,548) and water quality (-$48,719 to $255,721). When all impacts have been assessed it creates a large spread in overall TBL-NPV of -$1,552,617 to $1,314,054, suggesting that there is a good chance that the site could generate either a positive or negative TBL-NPV.

Financial	Social	Environmental
-$1,014,293	$408,123	$435,336

Triple Bottom Line NPV	**-$170,834**

Autocase

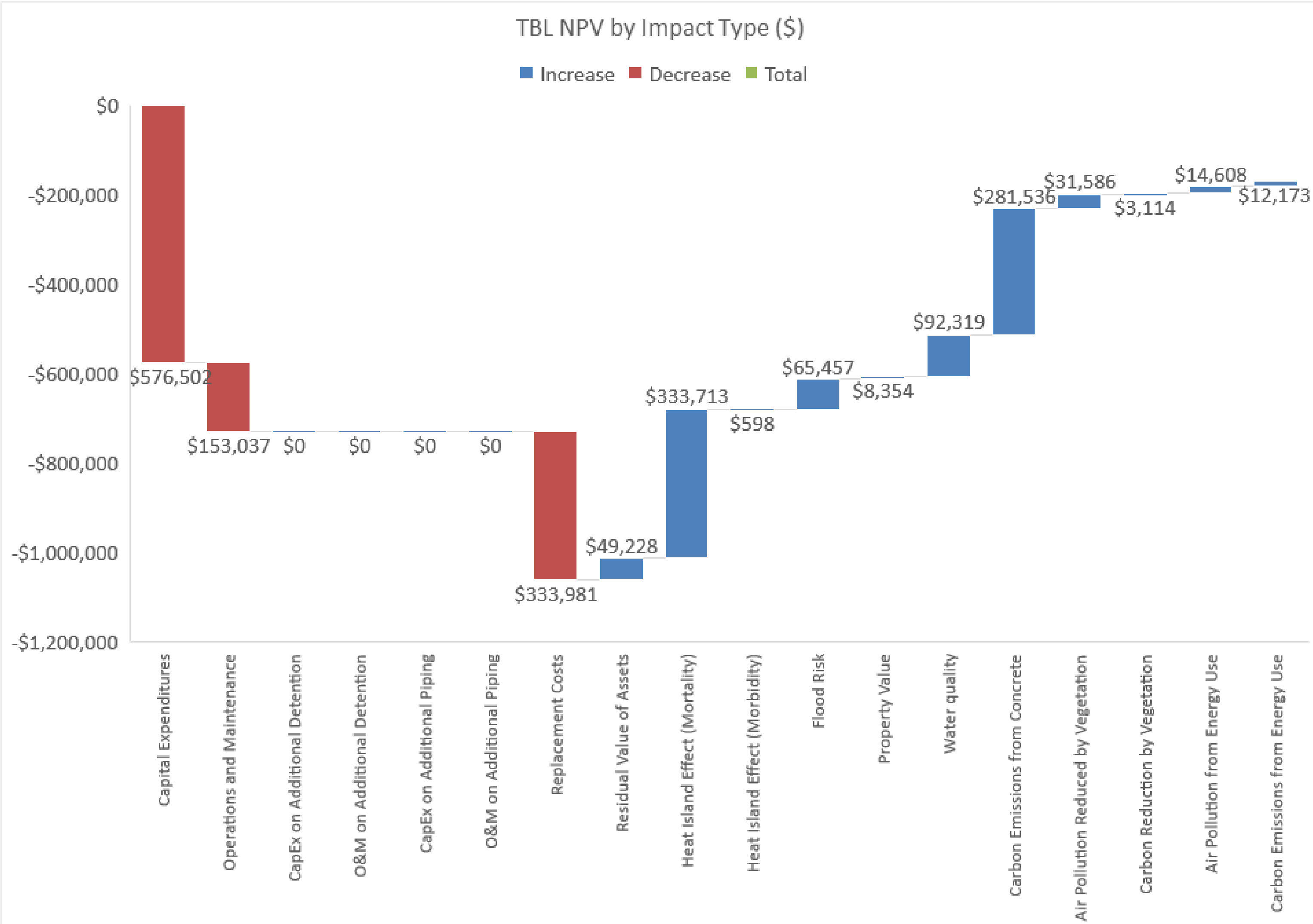


Figure 33: Breakdown of TBL NPV by Impact Type for Central/Civic/Taylor

Table 41: TBL-NPV Results for Each Feature by Impact Type, Central Station/Civic Space Park/Taylor Mall

Impact Type	Cost/Benefit	Mean Value	95% Confidence Interval		
Financial	Capital Expenditures	**-$576,502**	-$915,078	to	-$253,456
Financial	Operations and Maintenance	**-$153,037**	-$202,970	to	-$106,861
Financial	CapEx on Additional Detention	**$0**	$0	to	$0
Financial	O&M on Additional Detention	**$0**	$0	to	$0
Financial	CapEx on Additional Piping	**$0**	$0	to	$0
Financial	O&M on Additional Piping	**$0**	$0	to	$0
Financial	Replacement Costs	**-$333,981**	-$617,912	to	-$41,247
Financial	Residual Value of Assets	**$49,228**	-$73,487	to	$180,993
Social	Heat Island Effect (Mortality)	**$333,713**	$114,609	to	$558,548
Social	Heat Island Effect (Morbidity)	**$598**	-$1,891	to	$3,301
Social	Flood Risk	**$65,457**	$65,457	to	$65,457
Social	Property Value	**$8,354**	$4,164	to	$12,335
Environmental	Water quality	**$92,319**	-$48,719	to	$255,721
Environmental	Carbon Emissions from Concrete	**$281,536**	$117,296	to	$514,838
Environmental	Air Pollution Reduced by Vegetation	**$31,586**	$19,487	to	$43,357
Environmental	Carbon Reduction by Vegetation	**$3,114**	-$1,117	to	$8,109
Environmental	Air Pollution from Energy Use Reduction	**$14,608**	-$2,555	to	$34,417
Environmental	Carbon Emissions from Energy Use Reduction	**$12,173**	-$9,902	to	$38,542
Total	**Triple Bottom Line NPV**	**-$170,834**	-$1,552,617	to	$1,314,054

6 Stakeholder and Policy Consideration

This section was co-authored by Watershed Management Group and The Nature Conservancy and provides an overview of the policy opportunities based on the results of this report and potential steps forward for considering Triple Bottom Line benefits in City of Phoenix projects. City of Phoenix codes and ordinances have been reviewed and are listed below in Section 6.4. The results of the Autocase report justify evaluation of the Triple Bottom Line benefits in project alternatives and the recommendations below provide steps to do that.

6.1 Correlate multiple benefits to City departments & City sustainability goals

It is recommended to clearly communicate the results of the study to relevant departments and stakeholders, as well as to encourage stakeholder involvement and participation. Table 42 lists the co-benefits identified in the study and some of the relevant City and County stakeholders likely to receive those benefits.

Table 42: TBL-NPV: Co-benefits and relevant City and County stakeholders

Co-benefit Identified in the CBA	Benefiting Department(s)
Heat mitigation	Parks and Recreation Department; Office of Homeland Security and Emergency Management; Transit Department; Street Transportation Department; Human Services Department; Office of Sustainability
Flood risk reduction	Planning and Development Department; Office of Homeland Security and Emergency Management; Street Transportation Department (flood-related maintenance), Public Works Department (Floodplain management); Flood Control District of Maricopa County
Carbon emissions	Office of Environmental Programs; Office of Sustainability; Public Works Department
Water quality improvement	Office of Environmental Programs; Water Services Department
Air pollution	Public Works Department; Office of Environmental Programs; Office of Sustainability, Maricopa County Department of Air Quality
Property value uplift	Community and Economic Development, Public Works Department
Health (heat morbidity / mortality)	Maricopa County Department of Public Health

The list above is incomplete, but it provides a starting point for determining which departments may be interested in the results of the study, which co-benefits may carry the most weight, and which department budgets can be tracked to identify any cost offsets or long-term value revealed by the analysis. It is important to communicate the long-term value (in terms of NPV and TBL) of investments in GI/LID to the public, developers, and building owners.

Identifying co-benefits received by specific stakeholders may provide incentive for cost-sharing or co-investment. Departments whose goals are shown to be met in the TBL-CBA might contribute to sharing costs, as might members of the private sector.

The City of Phoenix has identified short and long-term sustainability goals. Table 43 identifies sustainability goals, achievement of which may be aided by the application of GI/LID.

Table 43: TBL: Sustainability Goals related to the GI/LID

Related 2050 Sustainability Goal(s)
Having all residents within a five-minute walk of a park or open space by reducing the urban heat island effect through green infrastructure as well as doubling the current tree and shade canopy to 25% and adding 150 miles of paths, greenways.
Reduce carbon pollution from vehicles, buildings, and waste by 80%-90%.
Provide a clean and reliable 100-year supply of water by reducing dependence on potable water supplies for irrigation and improving water quality downstream of stormwater outfalls
Phoenix will achieve a level of air quality that is healthy for humans and the environment. This includes outperforming all federal standards and achieving a visibility index of good or excellent on 90% of days or more.

6.2 Ensure asset management processes incorporate a broad range of benefits and costs from a TBL perspective in evaluating project alternatives

Many leading utilities and municipalities now explicitly incorporate a range of costs and potential financial, social, and environmental benefits (TBL) when identifying and evaluating project alternatives. Incorporating TBL into asset management has allowed municipalities to deliver projects with amenities and services desired by the public. Two measures the City could implement to incorporate a TBL philosophy are:

- Investigate options for GI/LID early in the planning phase of CIP projects. Cultivate a shift from opportunity-based to need-based projects that will provide the largest TBL benefits. Prioritization of project types and identification of suitable locations for those project types can help with this shift.
- Develop a mechanism for combining revenue sources across departments to encourage implementation of alternatives that provide a greater value when the multiple benefits are calculated. In consultation with the benefiting departments, the City may consider creating an interdepartmental team charged with assembling such a mechanism with accountability to the city manager or council.

6.3 Prioritize by project type and suitability

Based on the results of this study and others in the southwest (i.e., Watershed Management Group studies of Tucson's Airport Wash Area and Sierra Vista) it is clear that the most sustainable and cost-effective GI/LID retrofit projects have minimal impacts on existing concrete and asphalt. The results show that infrastructure and new projects that utilize natural systems like swales, infiltration basins and trenches have a higher TBL value and avoiding pervious pavers, porous concrete and asphalt is recommended unless they provide an irrigation benefit for shade-producing landscapes or the flood mitigation benefits are required for the project. As such, it is recommended that the City adopt the following prioritization policy when identifying GI/LID project opportunities to maximize the triple bottom line benefits:

- Prioritize natural GI/LID systems (swales, infiltration basins and trenches) in new development
- Prioritize open space and parks for GI/LID retrofits[4] to minimize the need for hardscape removal
- For GI/LID retrofit projects that involve hardscape removal, prioritize projects where there are already plans to fully reconstruct and rebuild the hardscape infrastructure.

6.4 Consider revisions to existing codes and plans

The following is a brief outline of general opportunities to promote GI/LID more broadly throughout a range of City policies, plans, standards and codes. Additional study is needed to refine and prioritize these recommendations:

- *General Plan*
    - In Stormwater section include planning to identify, prioritize, and target areas for new and retrofit GI/LID opportunities
- *Tree and Shade Masterplan*
    - Integrate GI/LID as critical infrastructure to reduce or eliminate outdoor water use in native landscapes while creating a more robust tree canopy
    - Move beyond iTree stormwater benefits of trees by using GI/LID
- *2013 COP Stormwater Policies and Standards*
    - Consider incentives to distribute retention across site
    - The drainage plan design phase for a project should include goals to incorporate GI/LID (e.g., using runoff from impervious surfaces to support vegetation, percent canopy cover for the project area, and utility planning to avoid landscape drainage areas).
    - Emphasize natural channel design practices (not hardening channels but allowing infiltration)

[4] Utilizing stormwater runoff from adjacent landscapes, roads and hardscapes in open spaces and parks (because they don't require hardscape removal) with GI/LID features

6.5 Create a Roadmap

The table below provides a roadmap with general recommendations for mainstreaming GI/LID projects with multiple benefits.

Table 44: Recommended Action and Steps

1. Consult resources, especially EPA's "Case Studies Analyzing the Economic Benefits of Low Impact Development and Green Infrastructure Programs".
2. Involve stakeholders: Clearly communicate the results of the study and address questions of City staff and stakeholders that are answered by the study.
3. Determine whether co-benefits are shared by specific stakeholders and whether those stakeholders may have interest in cost-sharing or co-investment. Consider developing a reserve to provide incentives to implement GI/LID based on site context.
4. Decision-makers at the project level should consider life-cycle costs and net present value from a TBL perspective including community benefits such as flood risk reduction, water quality improvements, air pollution reduction, and heat island mitigation.
5. Work across relevant departments to identify and implement GI/LID in CIP projects, including their maintenance, utilizing the reserve fund (if instituted) to ensure successful implementation. Identify and accommodate new maintenance activities for GI/LID to provide improved NPV, cost-savings, and TBL benefits, including equipment and skill sets.
6. Identify and remove barriers to installation of features that provide a specific threshold for public services or positive NPV (See City of Phoenix Code Review to Promote Green Infrastructure – Case Study)[5]
7. Implement procedure for easy or fast-tracked permitting of private projects with GI/LID components that deliver benefits to the broader community
8. Develop technical guides for residents, businesses, etc. on incorporation of GI/LID into designs, calculation of net present value of benefits. Include information on resources to assist with implementation.
9. Measure and assess performance and costs: Continue to track annual maintenance costs of specific features. Measure performance of installed features for heat reduction, flood mitigation, water quality improvements, and other benefits described in the study. Apply cost-benefit data from the Cost Benefit Analysis to Stormwater Management Models of distributed LID to assess TBL for achieving specific goals related to air quality, flood mitigation, and heat risk reduction.
10. Investigate options for GI/LID options as early as possible in the planning phase of CIP projects. Cultivate a shift from implementing projects which are strictly opportunity-based to integrating need-based projects that will provide the largest benefits. Develop a list of priority areas for LID projects, such as in areas with high heat vulnerability or in areas with localized flooding.

[5] https://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/PHX_Code review to promote green infrastructure case study.pdf

6.6 Resources:

The following resources are available on how other cities have initiated a GI program and managed their assets, which may provide useful information for the City:

1. EPA Case Studies Analyzing the Economic Benefits of Low Impact Development and Green Infrastructure Programs (2013)[6]
2. Philadelphia Combined Sewer Overflow Long Term Control Plan Update, Supplemental Documentation Volume 2, Triple Bottom Line Analysis[7]
3. Urban Land Institute. Harvesting the Value of Water: Stormwater, Green Infrastructure, and Real Estate [8]
4. Seattle Public Utilities Triple Bottom Line Analysis Guidebook[9]
5. Forthcoming study on developing a Green Infrastructure Fund for the City of Tucson

Existing and upcoming documents that provide information on the state of GI policy in Phoenix (in addition to this cost-benefit study) include:

1. City of Phoenix Code Review to Promote Green Infrastructure – Case Study[10] (complete)
2. Green Infrastructure Barriers and Opportunities in Phoenix, Arizona[11] (complete)
3. GI/LID Effectiveness Study (in progress as of June 2018)
4. Identifying Key Areas in the City of Phoenix for Infiltration and Retention Using Low Impact Development – The Nature Conservancy and Bureau of Reclamation (in progress as of June 2018)
5. Guidelines and specifications for GI/LID in Maricopa County – Sustainable Cities Network (in progress as of June 2018)

[6] https://www.epa.gov/sites/production/files/2015-10/documents/lid-gi-programs_report_8-6-13_combined.pdf
[7] http://www.phillywatersheds.org/ltcpu/Vol02_TBL.pdf
[8] https://americas.uli.org/wp-content/uploads/sites/125/ULI-Documents/HarvestingtheValueofWater.pdf
[9] https://tnc.app.box.com/s/hylxegjvfxsl11o8dhqw8gdoktpte01h
[10] https://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/PHX_Code review to promote green infrastructure case study.pdf
[11] https://www.epa.gov/sites/production/files/2015-10/documents/phoenix_gi_evaluation.pdf

7 Conclusions and Caveats

7.1 Conclusion

This short discussion is meant to start the longer conversation of understanding *who* may benefit from GI/LID and *how* these types of multi-account analyses can be used as a tool to galvanize stronger stakeholder buy-in. Breaking down the costs and benefits of GI/LID by each impact type – whether that impact is purely financial or not – provides valuable insights.

Firstly, it enables greater understanding of who may be benefiting from non-traditional forms of capital planning. By thinking of which stakeholders would benefit from each impact, it allows the City to:

1) Assess what existing policies can be leveraged to support GI/LID, as well as how GI/LID may promote the goals of those policies, and
2) Communicate results in a way that gets maximum buy-in from various agencies and external stakeholders. By showing that these projects are aligned with the broader goals of each respective stakeholder, the potential hurdles that often come with more cost-intensive projects can be addressed early.

Multi-account results not only answer the question of "Who benefits?" but equally important, "How much do they benefit?". Providing monetized results across the financial, social, and environmental spectrum enables users to look at projects in a more holistic way, and crucially allowing that holistic analysis to be on an apples-to-apples basis i.e. in dollar terms. Whereas before, we may have only been able to qualitatively state that urban heat island benefits would be generated, we can now put a dollar value to that benefit and compare it against any financial impact. The ability of knowing who benefits and how much they benefit is a powerful tool to build consensus to the delivery of projects and creates an evidence base to promote a shared responsibility to capital planning for these non-traditional projects. The ability to see that the burden of operations and maintenance of a project may fall upon one agency, while creating savings for another agency may provide the impetus for cost sharing.

Finally, these types of analyses give visibility into which features are providing the greatest benefits in terms of the city's priorities. It offers a quick breakdown of where the greatest impacts (whether a cost or benefit) are occurring and enables the City to start thinking of how those impacts can either be mitigated or improved upon. For example, we can see that replacement cost plays a large factor in the financial dis-benefits of the Central/Civic/Taylor project; therefore, by focusing on ways to reduce this replacement cost may mitigate that financial burden. Alternatively, we can see that swales may provide greater urban heat island benefits than Bioretention Basins. Given the heat stress Phoenix faces, users can utilize these types of results to prioritize projects that have the largest impact on that element.

Ultimately, assessing projects across a spectrum of impacts and valuing them in dollar terms allows the City to map benefits and costs to various stakeholders and is an important step toward consensus-building and developing a business case in a way that everyone can understand.

7.2 Caveats

This report is a starting point that can help focus the City's GI/LID efforts to those features more likely to provide long-term value. There are some limitations that should be noted before making policy decisions:

- There is limited local data on CapEx and O&M costs, since this is a fairly recent initiative in Phoenix. We have used a small sample size for Phoenix-specific costs (and partial data for the Central Station/Civic Space Park/Taylor Mall project which led to more estimation on that site), which were supplemented by national averages. Once additional GI/LID projects are completed, a greater inventory of cost information will be available to be refined and make more informed estimates for improved recommendations.
- Replacement costs are based on US-averages; depending on maintenance of the City, as well as local stressors from weather etc., these replacement costs may vary. Nevertheless, we have included low and high estimates to offer a range to reflect this uncertainty.
- The Concrete base case was based on concrete sidewalk or plaza versus roadway and does not include any costs associated with roadbed, grading, and other elements that the street manual requires. As such, the base case likely underestimated costs, including costs of compliance with other required specifications such as grey stormwater infrastructure. The study attempted to capture this through "CapEx and O&M on additional detention and piping" but it is an estimate that could be refined with further analysis and information.
- The above concern also applies to O&M of concrete; stormwater-related O&M costs of a concrete surface need to be included, such as catch basin cleaning (water quality & flooding purposes), stormwater pipe cleaning (flooding). This has been captured to an extent within the water quality estimate (see Methodology Section 8.3.3.4) but could also be refined with further analysis.

8 Methodologies

8.1 TBL-CBA Framework

This project was conducted using a Triple Bottom Line Cost Benefit Analysis (TBL-CBA) framework. TBL-CBA provides an objective, transparent, and defensible business case framework to assess investments in stormwater infrastructure. The proposed analysis broadens traditional financial analysis to incorporate, and value social and environmental factors within an expanded CBA framework. The intent of these analyses is to determine the social and environmental benefits (and dis-benefits), in addition to the lifecycle financial costs and avoided costs that arise from projects.

CBA is a conceptual framework that quantifies in monetary terms as many of the costs and benefits of a project as possible and converting them all into a present day dollar value. In CBA, a "base case" (the existing conditions) is compared to one or more alternatives (which have some significant improvement compared to the base case). The analysis evaluates incremental differences between the base case and the alternative.

To incorporate uncertainty into the analysis, Autocase runs a Monte Carlo based simulation of the possible outcomes and final project value. Low, Expected, and high values are taken from both user inputs and values in literature to reflect the underlying uncertainty in the values used in the CBA. These values are then defined by a distribution and applied to the benefit-cost analysis. This process is then repeated thousands of times to create a probability distribution of the results in the CBA – or 95% confidence intervals, allowing for a more nuanced assessment of project risks.

8.2 Base case

As always with Cost Benefit Analysis (CBA), it is important to factor in the base case – i.e. what would have been built on this site if this feature type were not built? This is vital so that we can estimate the *incremental* benefit from LID, and not just the total benefit.

After discussion with Phoenix staff, the base case feature type used is concrete to reflect the impervious nature of common infrastructure choices. Therefore, when estimating the value of each GI/LID feature type, we compared the benefits versus this 'concrete' feature type for the general feature analysis. Base cases for the case study sites were specific to each site in collaboration with City of Phoenix staff.

8.3 Valuation Methodologies

Autocase automatically values the triple bottom line benefits (or dis-benefits) of numerous impact types. For this assessment, Autocase was used to value:

- Capital expenditure;
- Operations and maintenance costs;
- Replacement costs;
- Residual value;
- Avoided piping and detention costs (both CapEx and O&M)
- Heat Island Effect on both mortality risk and morbidity risk;
- Flood risk;
- Property value uplift;
- Water quality;
- Avoided carbon emissions from concrete;

- Air pollution and carbon emissions reduced by vegetation; and
- Air pollution and carbon emissions reduced by energy savings.

8.3.1 Financial

8.3.1.1 Capital Expenditure

The capital costs for each of the features were based off City of Phoenix and Watershed Management Group project costs that have either been built or are in design, thus representing a local picture of the upfront costs of each of these feature types. For the general feature analysis, because local data was limited (often to only one project's cost), national data was used to supplement local data as needed using EPA SUSTAIN, and National Stormwater Management Calculator and low, expected, and high estimates were put in for each to allow for a risk assessment. Costs were converted into a standard 'per 1,000 square feet' cost. The case studies used project-specific data wherever possible. There were a few gaps in project cost data for the case studies and national data was used to fill in as needed.

8.3.1.2 Operations and Maintenance

Operations and maintenance (O&M) costs are those that accrue throughout the life of the project. In Autocase, they are discounted to produce a present value of the costs. As with capital costs, local O&M costs were provided by the City of Phoenix and Watershed Management Group wherever possible, and for features that did not have costs, Autocase was supplemented with the Green Values Stormwater Toolbox and low, expected, and high estimates were put in for each to allow for a risk assessment. This method was used for both the general features analysis and the case study analysis.

Watershed Management Group O&M costs in this report were determined with five WMG projects: Primera Iglesia in Phoenix and the 4 demonstration sites in Tucson. WMG has two years of maintenance data at Primera Iglesia from 2014-2015 and three years of data at the Tucson demonstration sites from 2014-2017. Site maintenance activities at all sites include sediment removal, weed removal, pruning vegetation and trees, mulching material onsite by hand and trash removal and plant replacement. Maintenance at all sites is a combination of WMG staff and volunteer labor. At Primera Iglesia, volunteer labor was not quantified. At the 4 WMG sites in Tucson, volunteer and staff labor is tracked electronically. Volunteer labor is quantified at 25% efficiency of a regular trained staff hour, so any volunteer labor hours were converted to an equivalent trained employee hour. Labor hours were tracked and then multiplied by the average City of Phoenix landscape maintenance contractor costs of $75/hr. There was 185 hours of maintenance over three years across the four sites (spanning 38,209 sq ft) – equating to 62 hours per year, or 1.6 per 1,000 sq ft. At $75/hr, this comes to $120 per 1,000 sq ft.

A summary of the CapEx and O&M costs are given in the table below. A detailed description of each cost is given in the description for each feature type and site.

Table 45: Summary of Feature Costs

Feature	Unit		Cost ($)		
			Low	Expected	High
Concrete	CapEx	$ per 1,000 sq ft	$4,500	$5,750	$7,000
	O&M	$ per 1,000 sq ft	$0	$0	$0
Swale	CapEx	$ per 1,000 sq ft	$1,124	$5,527	$11,358
	O&M	$ per 1,000 sq ft	$97	$120.95	$151
Porous concrete	CapEx	$ per 1,000 sq ft	$6,370	$7,000	$10,670
	O&M	$ per 1,000 sq ft	$12	$24	$48
Bioretention basin	CapEx	$ per 1,000 sq ft	$2,000	$3,000	$4,000
	O&M	$ per 1,000 sq ft	$97	$121	$151
Infiltration trench	CapEx	$ per 1,000 sq ft	$400	$1,450	$4,200
	O&M	$ per 1,000 sq ft	$97	$121	$151
Pervious pavers	CapEx	$ per 1,000 sq ft	$7,540	$12,970	$17,800
	O&M	$ per 1,000 sq ft	$12	$24	$48
Underground stormwater storage	CapEx	$ per 1,000 cubic foot	$904	$1,205	$1,506
	O&M	$ per 1,000 cubic foot	$1	$1	$6
Trees	CapEx	$ per tree	$160	$591	$739
	O&M	$ per tree	$12	$16	$20
Planter boxes	CapEx	$ per 1,000 sq ft	$550	$8,000	$24,500
	O&M	$ per 1,000 sq ft	$97	$121	$151
Retention basin	CapEx	$ per 1,000 cubic foot	$4,260	$11,550	$22,710
	O&M	$ per 1,000 cubic foot	$15	$30	$60
Porous asphalt	CapEx	$ per 1,000 sq ft	$2,840	$6,330	$9,470
	O&M	$ per 1,000 sq ft	$12	$24	$48
Shrubs	CapEx	$ per 1,000 sq ft	$109	$218	$355
	O&M	$ per 1,000 sq ft	-	-	-

Notes:

- **O&M for shrubs is included within the O&M cost of other features.**

8.3.1.3 Replacement Costs and Residual Value of Assets

Whether the infrastructure is a tree, a Bioretention Basin, a green or traditional roof, or plain concrete, all elements of an infrastructure project need to be replaced at some point. All features types have different lifespans, as well as different costs of replacement at the end of their operating lives. Autocase quantifies these costs as the lifetime "Replacement Costs" of each feature. Replacement costs for features are estimated whenever the expected operating duration of the project exceeds the lifespan of a feature. Replacement costs are then combined with the expected lifespans of each feature type and the operating life of the project to quantify the expected total replacement costs.

Autocase estimates replacement costs as a percentage of initial capital expenditure (using the values listed above). The percent replacement costs are gathered from the EPA's SUSTAIN database. As for useful lives, they are estimated from a number of sources. These sources are used to create a distribution in duration of useful life for each feature type. Sources used include Center for Neighborhood Technology (2006), Toronto and Region Conservation Authority (2013), and City of Toronto (Belanger, 2008).

Table 46: Replacement Costs and Useful Life of Features

Feature	Replacement Cost (% of original)			Useful Life (years)		
	Low	Expected	Max	Low	Expected	Max
Concrete	24	62	100	20	31	50
Swale	41	64	90	20	35	50
Porous concrete	49	74	100	20	28	30
Bioretention Basin	41	64	90	19.99	20	20.01
Infiltration trench	15	17	20	5	10	15
Pervious pavers	66	78	100	20	25	30
Underground stormwater storage	41	64	90	20	34	50
Trees	100	100	100	25	50	75
Planter boxes	41	64	90	5	20	30
Retention basin	41	64	90	25	38	50
Porous asphalt	46	73	100	15	24	30

When a project's operating life comes to an end, many assets may still have an implicit residual value. Depending on the remaining useful life of the asset for each alternative, at the end of the study period, some site elements have a "residual value". The residual value was calculated by determining the assets' useful lives remaining at the end of the period and determining an appropriate value of the asset based on its remaining useful life. Autocase estimates this residual value by assuming straight-line depreciation in the value of all assets/design features. This value is then discounted into present value terms.

8.3.2 Social

8.3.2.1 Heat Island Effect (Mortality)

Heat waves are an increasing danger across North America, occasionally resulting in large numbers of premature deaths. These events may be more frequent and severe in the future due to climate change. GI/LID can reduce the severity of extreme heat events by creating shade and reducing the amount of heat absorbed by pavement and rooftops. Even a small cooling effect can be sufficient to reduce heat stress-related fatalities during extreme heat wave events.

The Urban Heat Island (UHI) effect compromises human health and comfort by causing respiratory difficulties, exhaustion, heat stroke, and heat-related mortality. Various studies have estimated that trees and other vegetation within building sites can reduce temperatures by 5 °F when compared to outside non-green space. At larger scales, variation between non-green city centers and rural areas has been shown to be as high as 9 °F during the day and up to 22 °F during the night.

To quantify heat risk mitigated in Autocase, the first step is determining reduced temperatures in the area because of the project. Figure 34 shows various feature types and the average temperature reduced caused by changing a hypothetical city of all asphalt to that specific feature instead.

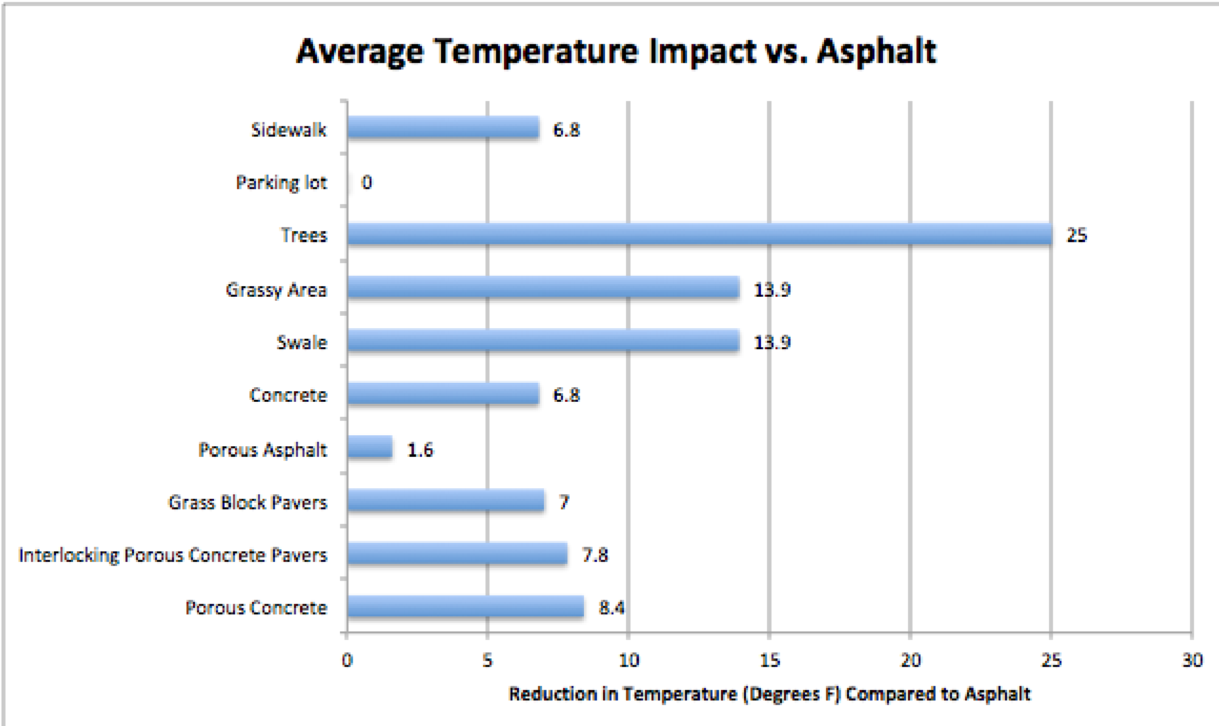


Figure 34: Temperature Changes from Land Cover Change

Using this link, the reduction in temperature is then used to determine avoided death over the life of the project. The reduction in the average annual mortality rate is uses the "higher emissions" scenario mean daily maximum temperature predictions for each month for the 30 years centered around 2050 taken from NOAA for the County[12], the local mortality rate (state-level), and the local (city-level) temperature threshold at which the impacts of heat on mortality can be detected (referred to as the Minimum Mortality Temperature, or MMT). Finally, the Value of Statistical Life, is used to quantify the benefit of reduced heat mortality rates.

8.3.2.2 Value of Statistical Life

The value of a statistical life (VSL) is used when analyzing the risk and reward trade-offs people make. Economists often estimate the VSL by looking at the risks that people take, or say they will take, and how much they are - or must be - paid for taking them. The VSL is widely used in the regulatory impact analysis and cost benefit studies for federal government cost benefit analyses (e.g. safety improvements in rail and roadways). A range of $5m-$13 million with a median around $9 million seems to be accepted. These values are in 2012 US Dollars and are adjusted for inflation depending on the year they are realized.

VSL is not intended to be the value of a specific life. It is the value placed on changes in the likelihood of death, not the price someone would pay to avoid death. Autocase does not place a dollar value on individual lives. Rather, the benefit-cost analysis of infrastructure uses estimates of how much people

[12] Temp in Fahrenheit: Jan = 68.27, Feb = 72.68, Mar = 78.68, Apr = 87.46, May = 96.59, Jun = 105.91, Jul = 108.39, Aug = 106.71, Sep = 102.24, Oct = 92.05, Nov = 78.19, Dec = 69.02

are willing to pay for small reductions in their risks of dying from adverse health conditions that may be caused or improved by the infrastructure.

References Used
(G. B. Anderson & Bell, 2011), (Basu, Feng, & Ostro, 2008), (Curriero et al., 2002), (Mercado, Hudischewskyj, Douglas, & Lundgren), (Medina-Ramon & Schwartz, 2007), (Sailor, 2003), (Zanobetti & Schwartz, 2008), (Voorhees et al., 2011), (NOAA, 2018).

8.3.2.3 Heat Island Effect (Morbidity)

Heat risk does not only affect risk of death, but also heat-related illnesses, which has a social cost in the form of lost productivity in an area. Estimating the value of heat-related illnesses follows a 4-step process:

1. Estimate temperature reduction from change in feature.
2. Estimate avoided heat-related illnesses from the resulting change in temperature.
3. Estimate cost of each heat-related illness
4. Combine, using relevant population for Phoenix.

Firstly, estimating the change in temperature resulting from feature change follows the same process as above for Heat Risk Mortality, details of which can be seen in Figure 34.

Secondly, estimating the change in heat-related illnesses resulting from the temperature change was created using data from Maricopa County. Using daily high temperatures and daily heat related illnesses for Maricopa County, a non-linear relationship between temperature and heat-related illnesses was calculated. From this data, we found that a 1 degree F reduction in temperature (from 102.4F to 101.4F) leads to 96.5 fewer heat-related illnesses per year in Maricopa County (population of roughly 4 million). Using Autocase, we can estimate the temperature reduction from GI/LID, and thus estimate the avoided illnesses per 100,000 people.

Thirdly, we have to calculate the cost of each heat-related illnesses. In order to estimate the social cost of illnesses, we used data from Maricopa County, which gave the percentage breakdown of the number of days spent in hospital due to heat-related illnesses, thus illustrating days out of work. From this, we estimate that the average cost of a heat related illness (in terms of lost wages, and thus lost economic output) is $3,046.

Finally, to calculate the final value, we firstly combine 1) the number of avoided heat-related illnesses per 100,000 people from GI/LID, and 2) the benefit of avoiding each illness, to estimate the value per 100,000 population. Then, applying the population of Phoenix (roughly 1.4 million), we can work out the total annual value for the City as a whole.

8.3.2.4 Avoided Flood Risk

Flood risk is quantified by estimating the percent flood risk mitigated as a result of the project design. As climate change has progressed and rainfall events in some regions have become more extreme, flood risk has become an important consideration in infrastructure development. Autocase quantifies the value of reduced flood risk due to a smaller volume of runoff from the project’s property during storm events. Runoff can be reduced by increased green acreage, stormwater storage capacity, stormwater drainage capacity, or reducing the surface area covered by impervious land.

Flood risk is quantified in Autocase by estimating the percent flood risk mitigated in the city because of the project design. The components to this methodology are explained as follows:

1. The first is estimating the total flood risk damage in any given year.
    a. Flood risk is estimated based on historical property value and historical flood damage in each state in the United States.
2. The second component to the flood risk methodology is determining the flood risk mitigated because of the project.
    a. This uses historical rainfall data from over 6,000 weather stations across the United States and Canada, enabling location-specific rainfall data to estimate the rainfall amounts in large storm events each year. Precipitation trends from climate change predictions are also incorporated into the modeling using NOAA's climate explorer (NOAA, 2018).
    b. Estimated flood risk mitigated by the design is equal to the change in retention and infiltration capacity beyond the site's base capacity, divided by the approximate city-wide flood volume in storm events.
    c. The overall flood risk mitigated each year is calculated by multiplying total city property value by the flood risk mitigated.

Although the value at risk increases linearly when compared with storm repeat rate, this actually implies that risk increases exponentially as rainfall depth goes up. This is due to the fact that rainfall levels off as the storm repeat rate goes up. In other words, going from a 10-year storm to a 40-year storm may double rainfall depth from 2.5 inches to 5 inches, but that same doubling from 5 inches to 10 inches may be extremely improbable, even in a 10,000-year storm. In short, for each extra 0.1 inches of rainfall, flood damage is exponentially more costly.

The Autocase flood risk methodology is a dynamic simulation, meaning that for every year in each iteration of the simulation, it produces different risk values. For example, flood risk mitigated due to a decrease of impervious surfaces might be zero for most years. However, in some years there may be rainfall events that are extraordinarily large, at which point there could be massive flooding and the value of reduced flooding due to higher infiltration rates on the site may have value. This is reflected in the Autocase methodology, as there is an element of randomness applied to the rainfall estimates for each year. This means that Autocase's analysis is a better reflection of reality than assuming constant maximum storm strength each year or simply estimating reduced damage value from synthetic design storms, such as 10-, 20-, 50-, and 100-year storms.

References Used
(Hanson & Vogel, 2008); (Nowak & Greenfield, 2012); (Pielke, Downton, & Miller, 2002); (Cronshey, Roberts, & Miller, 1985), (NOAA, 2018).

8.3.2.5 Property Value Uplift/Aesthetic Value

The use of Green Infrastructure (GI) or Low Impact Development (LID) features can lead to increased property prices in a region. The "Property Uplift" benefit in Autocase provides a value estimate of a project's direct impacts on market prices. Most commonly, this value is derived from variations in housing prices, which in some part reflect the value of local environmental attributes. Increases in property values can result from the use of any of the following:

- Trees;
- Shrubs and other plantings;

- Bioretention;
- Rain gardens
- Dry detention pond;
- Infiltration trench;
- Lawn or grassy area;
- Porous pavement;
- Retention pond;
- Green roof;
- Wetlands.

Increased value can be attributed to improved aesthetic value of the local area, temperature-moderating effects of vegetation (thereby decreasing energy costs), reduced risk of flooding, or improved air quality. Many studies have quantified the potential impacts of LID projects on property prices. To estimate this benefit, city-wide average residential prices are used as the baseline property price. Property uplift is then applied to the baseline price to determine the property uplift value. After estimating the total property value increases, the estimate is then multiplied by 50% to account for possible double counting with other benefits included.

References Used
(Braden & Johnston, 2004); (L. M. Anderson & Cordell, 1988); (E. G. McPherson et al., 2006); (Ward, MacMullan, & Reich, 2008); (Wachter & Wong, 2008).

8.3.3 Environmental

8.3.3.1 Carbon Emissions

Newly planted trees, shrubs, grass, and plants can sequester carbon from the atmosphere, reducing the impacts of climate change. Additionally, growing trees, shrubs, grass, and plants can act as carbon 'sinks', absorbing carbon dioxide from the air and incorporating it into their stems or trunks, branches, and roots, as well as into the soil. As with air pollution, plant life often requires maintenance which emits carbon into the atmosphere.

Avoided CO_2 emissions, as well as increased CO_2 sequestration, is a benefit of investing in green infrastructure development. Relative to traditional gray infrastructure (e.g. pipes and water treatment infrastructure), LID may also have less embodied energy. In particular, the use of concrete is a large contributor to net embodied energy in gray infrastructure projects. However, in some cases - notably for green roofs - the net embodied energy may be higher than for traditional infrastructure due to differences in materials used or because more materials are needed.

Autocase quantifies the carbon sequestration rate for all design features in the software, given the available literature on carbon sequestration. It will then value this reduction in carbon emissions by applying the social cost of carbon to the change in total tonnes of avoided CO_2e emissions due to the project. The social cost of carbon used in this assessment follows the Interagency Working Group on Social Cost of Carbon and is valued at $ 41.68 per tonne.

References Used
(Interagency Working Group on Social Cost of Carbon, 2013), (Nordhaus, 2011), (Stern, 2006), (U.S. Energy Information Administration, 2011), (U.S. Environmental Protection Agency, 2013), (U.S. Environmental Protection Agency, 2014).

8.3.3.2 Air Pollution

For the purposes of this study, Criteria Air Contaminants (CACs) are considered air pollutants emitted by combustion engines, which affect the health of people immediately in their vicinity. Air pollution, or CACs, is removed from the environment by trees and shrubs. As these grow throughout the life of the project they capture air pollutants at an increasing rate.

The air pollutants reduced on site include mono-nitrogen oxides (NOx), sulphur dioxide (SO_2), volatile organic compounds (VOCs), and particulate matter smaller than 2.5 micrometers ($PM_{2.5}$). The air pollution is valued by multiplying by the social cost of each pollutant ranges from $6,730/tonne for NOx to $14,190/tonne for $PM_{2.5}$.

Table 47: Social Cost of Pollutants

Variable	Unit	Value
CO	$ per Metric Ton	$30.48
SO_2	$ per Metric Ton	$48,168
NO_2	$ per Metric Ton	$8,150
$PM_{2.5}$	$ per Metric Ton	$372,815
O_3	$ per Metric Ton	$1,442

References Used
(Cai, Wang, Elgowainy, & Han, 2012), (European Comission, 2005), (Mike Holland, 2002), (Friedrich, Rabl, & Spadaro, 2001), (Matthews & Lave, 2000), (G. E. McPherson, Nowak, & Rowntree, 1994), (Muller & Mendelsohn, 2010), (U.S. Environmental Protection Agency, 2014).

8.3.3.3 Avoided Air Pollution and Carbon Emissions due to Reduced Energy Use

Trees modify climate and conserve building energy use in three principal ways:

1. Shading—reduces the amount of radiant energy absorbed and stored by built surfaces.
2. Transpiration—converts liquid water to water vapor and thus cools by using solar energy that would otherwise result in heating of the air.
3. Wind speed reduction—reduces the infiltration of outside air into interior spaces and conductive heat loss, especially where thermal conductivity is relatively high.

Trees provide greater energy savings in the Desert Southwest region than in milder climate regions because of the long, hot summers. Trees near buildings can reduce the demand for heating and air conditioning, thereby reducing emissions associated with electric power production. Autocase then uses the same principal as above to calculate the avoided emissions and the resulting social benefit from that.

The work by (G. McPherson et al., 2004) estimate that public trees save 77-181 kWh per year in electricity and around 229 kBTU in natural gas.
Applying this to our case study sites:

- For the Central Station LID design, there are 44 trees (44*180 kWh = 7,920 kWh saved per year and 44*229 =10,076 kBTU saved per year). For the traditional design, we assume 34 trees (34*180 kWh = 6,120 kWh and 34*229kBTU = 7,786 kBTU saved per year)

- Primera Iglesia LID design has 15 trees, resulting in an estimated annual saving of 2,700 kWh and 3,435 kBTU. The base case would have had no trees, and thus no resulting energy or natural gas savings.
- The Glendale site has 8 trees, resulting in an estimated annual saving of 1,440 kWh and 1,832 kBTU. The base case would have had no trees, and thus no resulting energy or natural gas savings.

References Used
McPherson E.G., J.R. Simpson, , J.R.; Peper, P.J.; Maco, S.E.; Xiao, Q.; Mulrean, E. 2004. Desert Southwest Community Tree Guide: Benefits, Costs and Strategic Planting. Arizona Community Tree Council, Inc. Phoenix, AZ. 76 p.

8.3.3.4 Water Quality

Increased acres of vegetation, including forests or wetlands, can positively influence the water quality in a local area by reducing surface runoff of pollutants into local waters.

Phoenix has a separate storm sewer system, so runoff does not get treated by a wastewater treatment plant (WWTP). Most stormwater in Phoenix goes directly to a surface water (dry wash, river, or retention basin) untreated. Per Section 6.8 of the City of Phoenix Stormwater Policies and Standards Manual (2013), developments are required to “retain water from the 100-year, 2-hour duration storm falling within property boundaries” or provide “first flush” stormwater treatment. In the latter case, first flush runoff may pass through either a hydrodynamic separator or a filter catch basin insert before going in to the storm system.

Hydrodynamic separators use the energy of flowing water to help separate out sediments, as opposed to more traditional settling chambers, and is designed to capture settleable solids, floatables, oil and grease.

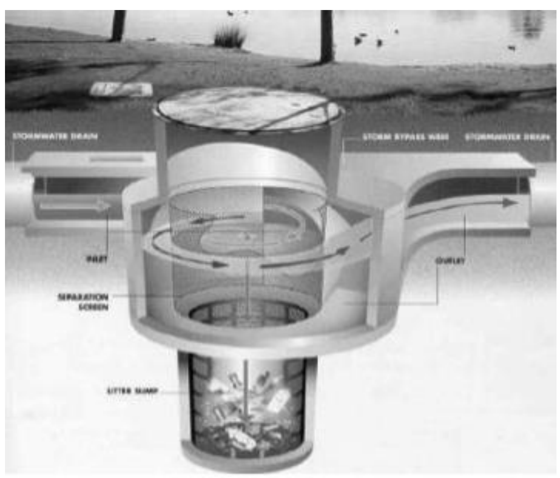


Figure 35: Hydrodynamic Separator
Source: PIMA County, 2015. “Low Impact Development and Green Infrastructure Guidance Manual”.

Filter catch basin inserts consist of a deep basket with a fabric liner that filters the storm water. In addition, oil absorbent pads are placed in the basket for removal of petroleum hydrocarbons. The inserts are held in place by the catch basin grate. Typically, the filter is specifically designed to fit the Maricopa Association of Governments (MAG) catch basin and can be inserted directly into existing catch basins.

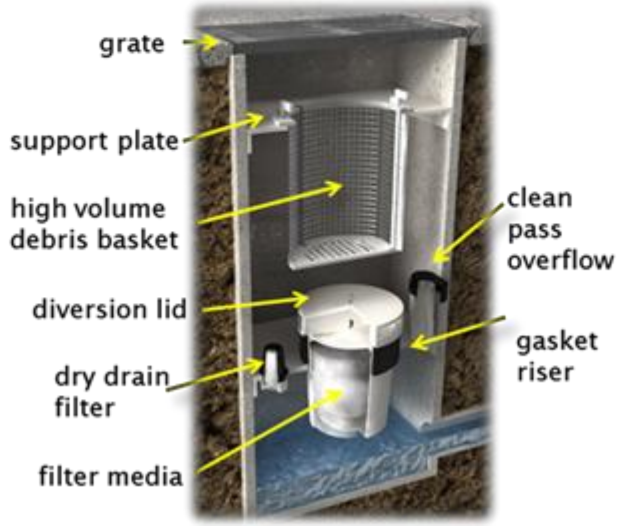


Figure 36: Catch Basin Filter Insert

Source: PIMA County, 2015. "Low Impact Development and Green Infrastructure Guidance Manual".

We model the value of improved water quality by estimating the reduced runoff that would be passing through these gray systems due to having LID present on the site (and the water passing through the LID before reaching these systems) and equate that to the cost avoided in CapEx and O&M for the gray system. Historical rainfall are supplemented by NOAA's RCP8.5 climate predictions (NOAA, 2018).

The model calculations are given in the tables that follow. Cost data was provided by the City of Phoenix for each system, which is given in the table below.

Table 48: Cost Information for Filter Catch Basin Inserts and Hydrodynamic Separator

	Low	**Medium**	**High**
System	No system	Filter catch basin insert	4-foot Hydrodynamic separators
System size acreage	N/A	1.16	1.16
CapEx ($)	$0	-$900	-$16,000
O&M ($ per year)	$0	-$500	-$2000
Useful life (year)	N/A	30	30

Notes:
The lifecycle cost information was provided by the City from a recent project at the City 22nd Ave Service Center, 2441 S 22nd Ave.

From these inputs, we calculated the present value of the lifecycle costs over a 50-year period to estimate the total cost of ownership of each system, results of which are in *Table 49*.

Table 49: Lifecycle Cost (Total Cost of Ownership) of Each System

Lifecycle costs (present value over 50 years)			
	Low	**Medium**	**High**
System	Filter catch basin insert	Filter catch basin insert	4-foot Hydrodynamic separators
CapEx	$0	-$900	-$16,000
O&M	$0	-$12,500	-$24,200
Residual value	$0	$66	$170
Replacement cost	$0	-$360	-$1,960
Total cost	$0	-$13,694	-$41,990

Notes:
The costs are just for the systems themselves and do not include installation, concrete removal or replacement that may be needed on top of that.

After calculating the present value of lifecycle costs, we then determine the size of system needed in the base case. For example, if one system is designed for 1.16 acres, then on a per square foot basis, 0.3 systems are needed for the 15,000 sq ft (0.344 acres) drainage area we are using for the general feature analysis. We then calculate the reduced runoff passing through the system due to each LID being implemented for the 15,000 sq ft drainage area and estimate the resulting number of systems that would be needed. For example, if the LID halves the runoff, we would need half the system. We then find the corresponding system cost for the design case. Finding the difference in cost between the amount of system needed in the base case and the cost for the amount of system needed under the LID scenario is the value of water quality. The results are summarized in Table 50.

The low cost corresponds to no system being put in place, the medium cost is for the filter catch basin insert covering 1.16 acres, and the high estimate is for the 4-foot hydrodynamic separator covering 1.16 acres.

Table 50: Water Quality Valuation Method for Phoenix

		Conc	Swale	Por conc	Bio basin	Inf tren	IPCP	Por asph	PI	Glen	C/C/T trad	C/C/T LID
Number of systems needed for 15,000 sq ft base case.		0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.40	0.49	8.88	8.88
Cost of system for base case	Low	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Med	$4,065	$4,065	$4,065	$4,065	$4,065	$4,065	$4,065	$5,419	$6,775	$121,593	$121,593
	High	$12,465	$12,465	$12,465	$12,465	$12,465	$12,465	$12,465	$16,615	$20,774	$372,842	$372,842
Runoff in LID scenario as a % of runoff in base case		100%	42%	58%	43%	64%	58%	58%	11%	12%	75%	8%
Number of systems needed for 15,000 sq ft with 1,000 sq ft LID.		0.30	0.12	0.17	0.13	0.19	0.17	0.17	0.04	0.06	6.70	0.75
Cost of system with LID	Low	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Med	$4,065	$1,697	$2,377	$1,744	$2,599	$2,377	$2,377	$612	$823	$91,776	$10,269
	High	$12,465	$5,203	$7,289	$5,348	$7,968	$7,290	$7,290	$1,876	$2,523	$281,414	$31,486
Savings from LID	Low	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Med	$0	$2,368	$1,688	$2,321	$1,466	$1,688	$1,688	$4,807	$5,952	$29,817	$111,325
	High	$0	$7,262	$5,175	$7,117	$4,497	$5,175	$5,175	$14,739	$18,252	$91,428	$341,356

Notes:
Conc = Concrete, Swale = Swale, Por conc = Porous Concrete, Bio basin = Bioretention basin, Inf tren = Infiltration trench, ICPC = Pervious pavers, Por asph = Porous Asphalt, PI = Primera Iglesia, Glen = Glendale Community Center, C/C/T trad = Central/Civic/Taylor traditional design, C/C/T LID = Central/Civic/Taylor LID design.

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10 Appendices

10.1 Appendix A: Feature Type Results Breakdown with Design Storm Sensitivity

The following table shows the breakdown by impact type when the 24-hour design storm is varied. As outlined earlier in the report, the results in the body of the report are for a 1-inch 24-hour storm, but the table below also shows results for 0.5-inch and 2-inch storms.

In Autocase, the design storm only affects the additional piping and detention impacts (CapEx and O&M). If a feature type can absorb all three storms, then there should be no change.

As we can see in Table 51, all the feature types have the same savings versus Concrete for CapEx and O&M on additional piping and detention.

Table 51: Storm Sensitivity Results for GI/LID Feature Types

Feature/Site	Design Storm	CapEx on Additional Detention	O&M on Additional Detention	CapEx on Additional Piping	O&M on Additional Piping
Swale	0.5-inch	$24	$6	$505	$76
	1-inch	$24	$6	$505	$76
	2-inch	$24	$6	$505	$76
Bioretention basin	0.5-inch	$24	$6	$505	$76
	1-inch	$24	$6	$505	$76
	2-inch	$24	$6	$505	$76
Infiltration trench	0.5-inch	$24	$6	$505	$76
	1-inch	$24	$6	$505	$76
	2-inch	$24	$6	$505	$76
Pervious pavers	0.5-inch	$24	$6	$505	$76
	1-inch	$24	$6	$505	$76
	2-inch	$24	$6	$505	$76
Porous concrete	0.5-inch	$24	$6	$505	$76
	1-inch	$24	$6	$505	$76
	2-inch	$24	$6	$505	$76
Porous asphalt	0.5-inch	$24	$6	$505	$76
	1-inch	$24	$6	$505	$76
	2-inch	$24	$6	$505	$76

10.2 Appendix B: Case Sites Results Breakdown with Design Storm Sensitivity

The following table shows the breakdown by impact type when the 24-hour design storm is varied. As outlined earlier in the report, the results in the body of the report are for a 1-inch 24-hour storm, but the table below also shows results for 0.5-inch and 2-inch storms.

In Autocase, the design storm only affects the additional piping and detention impacts (CapEx and O&M). If a feature type can absorb all three storms, then there should be no change.

As we can see in Table 52, Primera Iglesia does not have any savings under the 0.5-inch design storm versus its base case. However, under the 1-inch design storm there are savings of roughly $900. This increases to around $3,200 under the 2-inch design storm, indicating the avoided need to use additional piping and detention.

For Glendale Community Center, there are zero savings versus the base case under the 0.5-inch design storm. Under the 1-inch and 2-inch design storms, there is roughly $1,200 and $4,000, respectively in savings from avoiding having to use additional piping and detention.

Lastly, for Central/Civic/Taylor, we can see that there are zero savings under each design storm, indicating that there is already enough capacity under the base case design i.e. the LID design does not avoid any additional piping and detention.

Table 52: Storm Sensitivity Results for Case Study Sites

Feature/Site	Design Storm	CapEx on Additional Detention	O&M on Additional Detention	CapEx on Additional Piping	O&M on Additional Piping
Primera Iglesia	0.5-inch	$0	$0	$1	$0
	1-inch	$36	$9	$769	$114
	2-inch	$237	$60	$2,516	$372
Glendale Community Center	0.5-inch	$0	$0	$1	$0
	1-inch	$46	$12	$973	$144
	2-inch	$301	$76	$3,187	$471
Central/Civic/ Taylor	0.5-inch	$0	$0	$0	$0
	1-inch	$0	$0	$0	$0
	2-inch	$0	$0	$0	$0

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