



BMPs to SCMs

Cary's Adaptive Approach to
Post-Construction

Charles Brown & Emily Cochran

Town of Cary
Stormwater Division



What we'll talk about today:

- A. Background: Cary & its SCMs**
- B. Regulatory requirements**
- C. Cary's Post-Construction Program**
 - A. Construction Site Turnover**
 - B. Inventory**
 - C. Inspections**
 - D. Tracking & Enforcement**
- D. Why has Cary's program been successful?**

All About Cary

SIZE

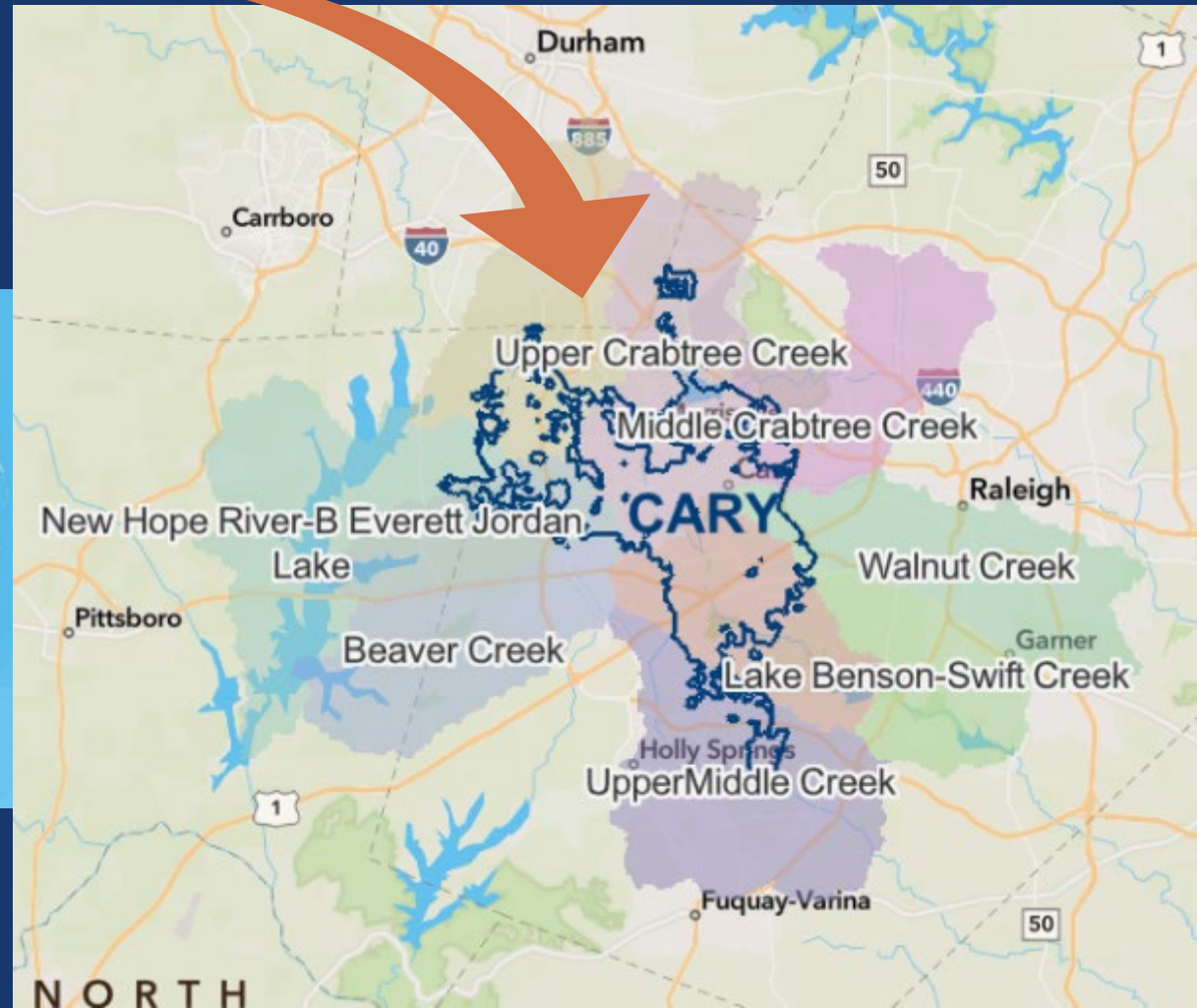
- City limits are 61.9 sq. miles
- ETJ is 58 sq. miles
- Population is 174,888
- 7th largest municipality in NC

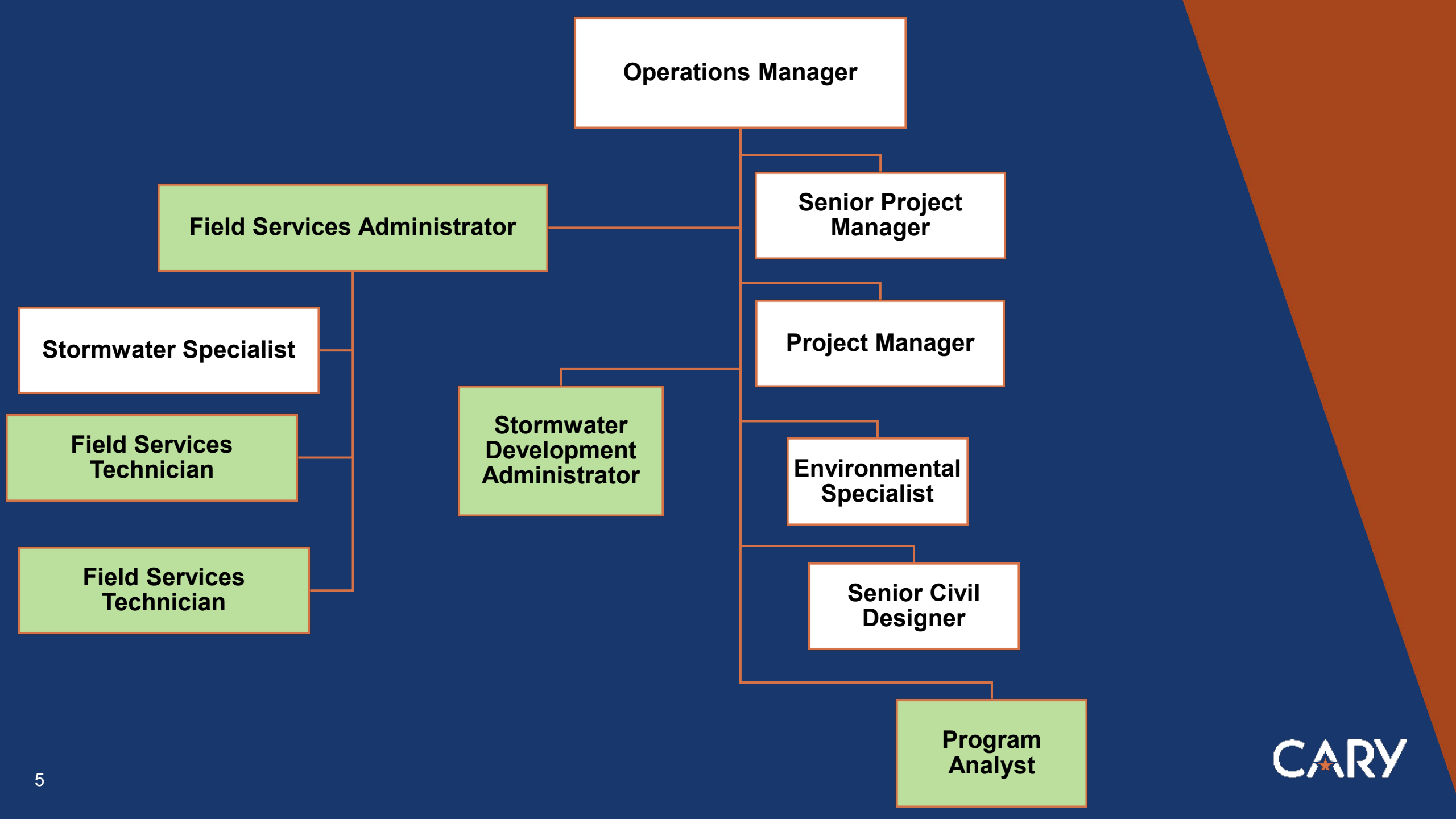
LOCATION

- Primarily in Wake County, partially in Durham and Chatham Counties
- Surrounded by Raleigh, RTP, Morrisville, Apex and Holly Springs

WATERSHEDS

- Split between Neuse River Basin and Cape Fear River Basin
- Two water supply watersheds (Jordan Lake and Swift Creek)

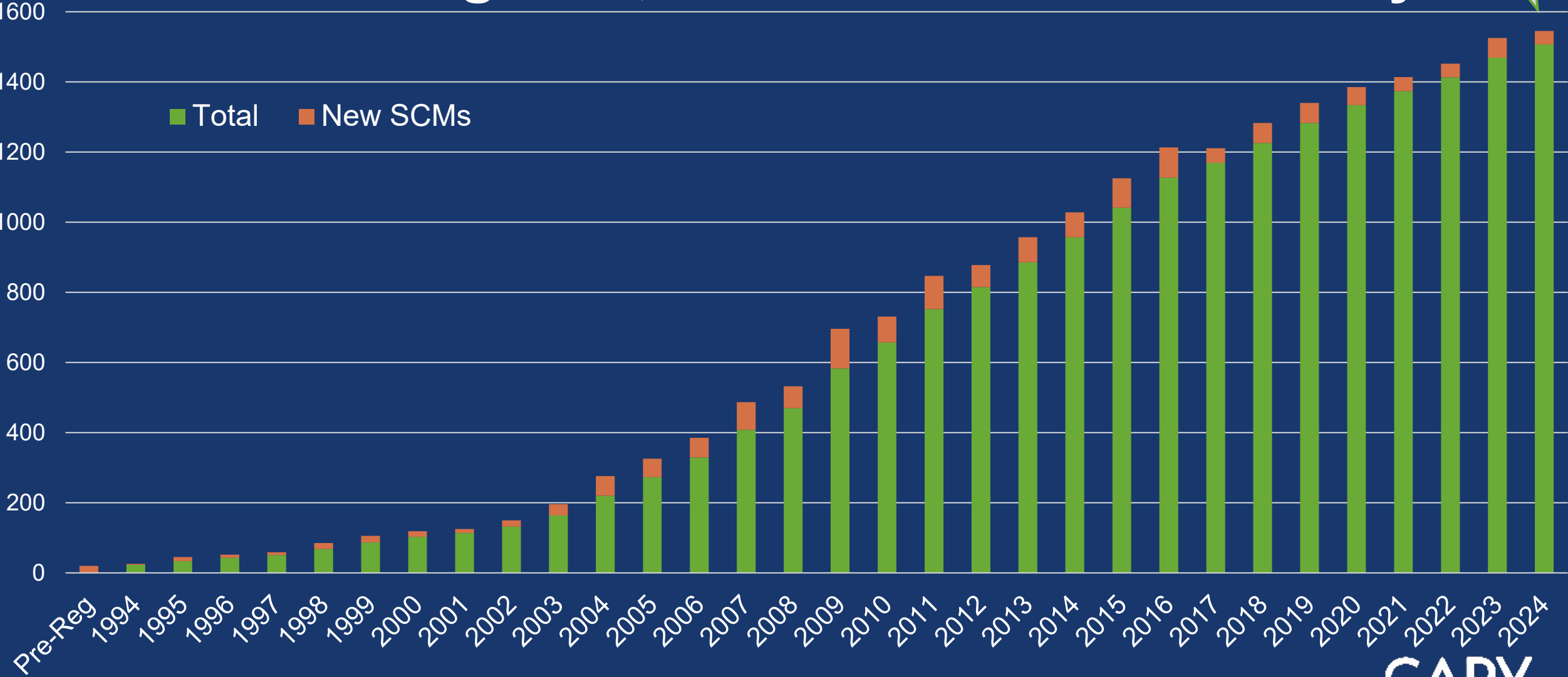




As a Town grows, so does its SCM inventory

1509

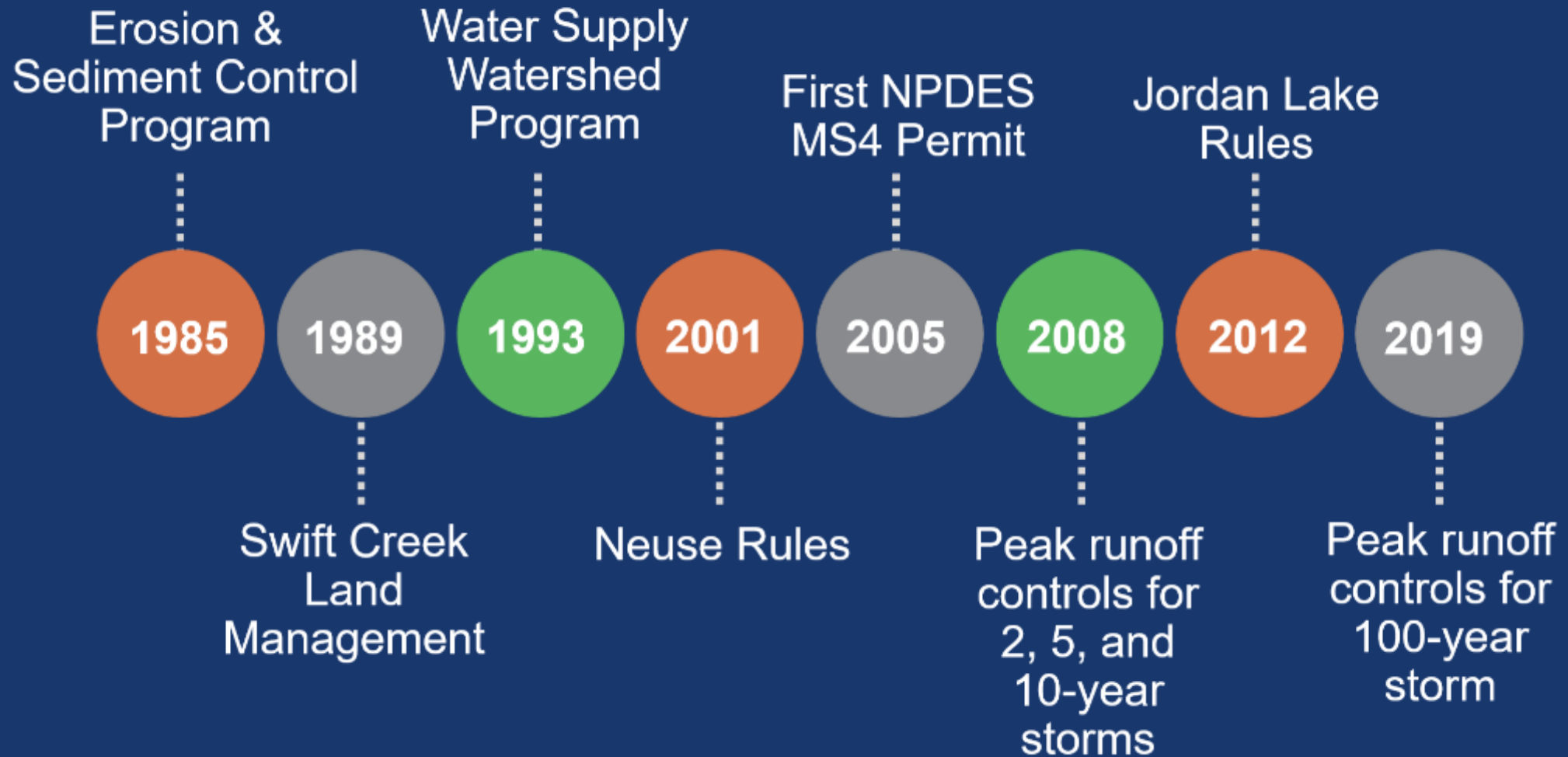
■ Total ■ New SCMs



SCMs by Type

	Privately-Owned	Town-Owned	Grand Total
Bioretention	187	21	208
Constructed Wetland	281	22	303
Dry Pond	112	14	126
Grass Swale	37	2	39
Level Spreader	191	9	200
Permeable Pavement	3	0	3
Proprietary Devices	23	1	24
Riparian Buffer	3	0	3
Sand Filter	77	2	79
Scour Hole	3	9	12
Step Pool	1	0	1
Underground Detention	86	2	88
Unregulated	18	3	21
Wet Pond	383	11	402
Grand Total	1414	95	1509

Post-Construction Regulatory Requirements



Cary's Post-Construction Program

- A. Construction Site Turnover**
- B. Inventory**
- C. Inspections**
- D. Tracking & Enforcement**



A. Construction Site Turnover

- 1995 – required paperwork at device installation (Water Supply Watershed Program)
- 2001 – access easement agreement (Neuse Rules and subsequent LDO changes)
- 2009 – PE Certification within 30 days of conversion from construction to post construction.
- Collaboration with site/field inspectors

Owners List	Date Received
1. Executed Deed (Property Description)	
2. Operations & Maintenance Manual	
3. Maintenance Agreement (notarized)	
4. Survey Plot of Structure recorded with the County Register of Deeds showing the related Stormwater Control Structure and Access Easement (all pages)	
5. Establishment of Dedicated Maintenance Account (per LDO Chap. 4.4.6 (G)(7)) <ul style="list-style-type: none"> • Engineer's estimate for 10% of the total cost of SCM construction • SCM Dedicated Maintenance Account Certification form 	
6. Stormwater Control Structure and Access Easement Agreement recorded with the County Register of Deeds.	
7. Certification (sealed by PE) stating that structure is complete and complies fully with approved plans and specifications for each stormwater control measure	
8. Reproducible as-built plans for all SCM structures and storm drain infrastructure following Cary Standard Specification Section 10000 Record Drawing Checklist	
9. For bioretention devices only, Soil Report showing media mix and P-index of media used meet requirements of NCDEQ Minimum Design Criteria manual.	
10. Closed Circuit Television (CCTV) video files of all public and private storm drain infrastructure for staff review; identified punch list items rectified.	

In the beginning... there was paper

- Paper files mailed or faxed
- Handwritten checklists
- Scanned & uploaded to Laserfiche

WITHERS & RAVENEL Engineering & Surveying
211 Mackinnon Drive • Cary, N.C. 27511

JOB NO. 20
SHEET NO. 1
DATE 1/26/96
COMPUTED BY AS-BUILT
CHECKED BY

JOB NAME CEMENT O-L Dam-2
SUBJECT

I. Compute WEIGHING % IMPROVEMENT

DESCRIPTION	AREA	%IMP	EXTENSION
CONCRETE	13.6	80	10.88
21 - EMB	7.1	400%	28.40
21 - W/IMP	5.3	58	3.07
	26.0		42.35
% IMP = $10.88 / 26.0 = 41.8\%$			

II. Compute RUNOFF. W/IMP FOR 1" RAINFALL

Vol = $26.0 \text{ K} \times 43560 \text{ SF} \times 0.10 \text{ K} \times \frac{1}{12} \text{ IN} = 92,000 \text{ LF}$

III. DETERMINE ST. FOR STORAGE + GRADE/SURFACE AREA

RELATIONSHIP FOR W/IMP POINTS AS-BUILT 2 VOL

FEET	AREA SF	AVOL CF	2 VOL CF	AREA SF	Δ VOL CF
370	667	5067	5067	15,508	5067
372	4400	16,714	21,781	11,108	20,575
374	12,314	56,755	56,576	17,870	49,153
376	22,481	52,284	108,860	23,650	90,277
378	28,803	67,932	176,772	30,254	144,185
380	38,129	40,114	216,906		78,254
381	42,100	44,909	266,815	48,000	222,939
382	57,718				

box

Search files and folders

2016 > Pipers Grove 16-SB-001 > SCM

NAME ↑

As-Built

00 Pipers Grove Townhomes Certificate of Watershed Compliance Letter.pdf

01 executed deed.pdf

02 maintenance agreement.pdf

03 OM manual.pdf

04 recorded plat.pdf

05 maintenance security.pdf

06 SCSAEA.pdf

07 PipersGrove Engineering Cert.pdf

07 PipersGrove Soil Report.pdf

Pipers Grove Townhomes 16-SB-001.p

My Collections

02. Stormwater

GG6518 - Swift Cr...

Post Construction

Sharing Folder

SWPA

Stormwater Regulat...

Permits

Development Review Activities

Permit

Wet Pond #1

Fee Line Items (0)

Required Documentation (9)

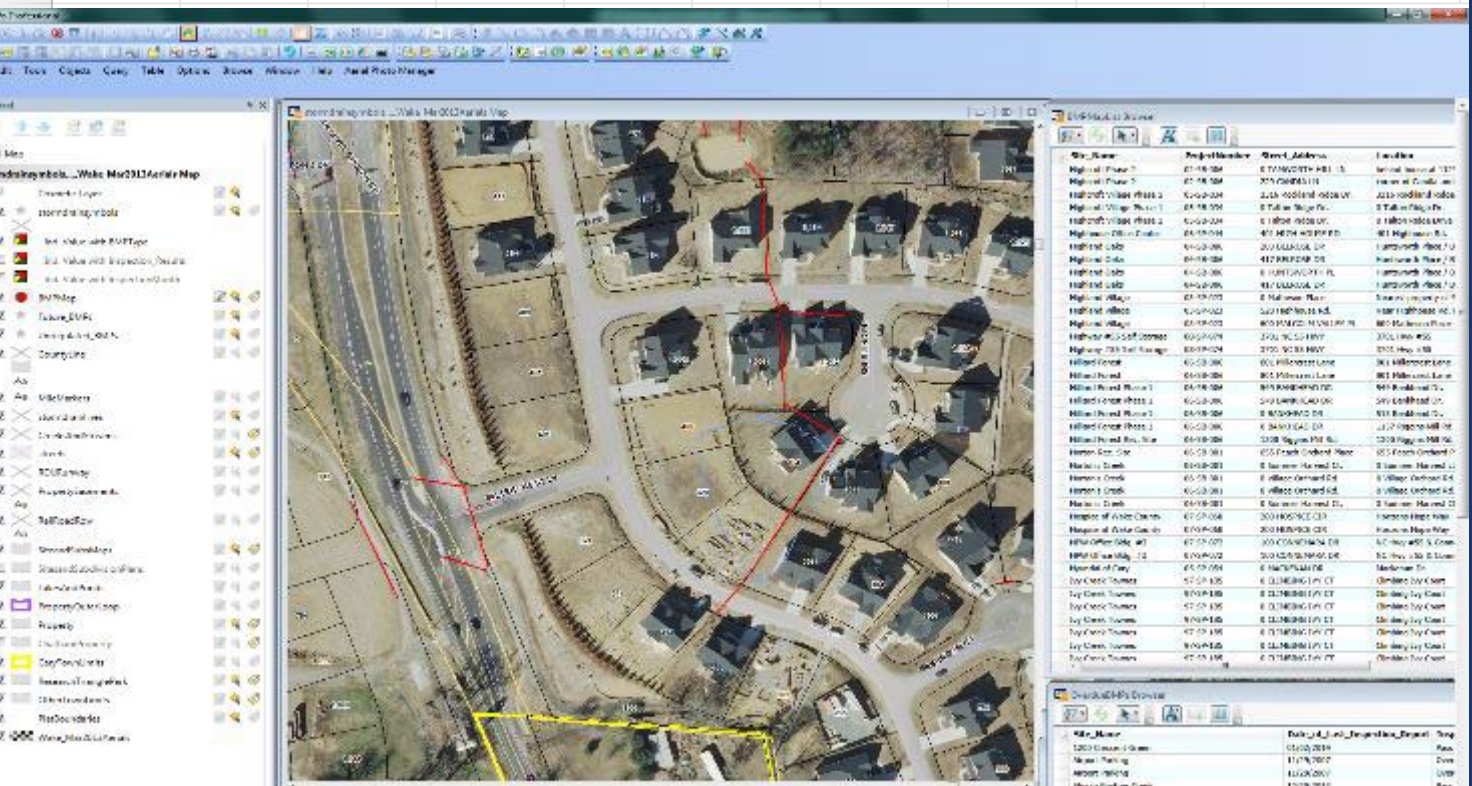
9 items • Updated a few seconds ago

	<input type="checkbox"/> Line Item Name	Type of Line Item
1	<input type="checkbox"/> Maintenance Agreement	Maintenance Agreement
2	<input type="checkbox"/> Plat	Plat
3	<input type="checkbox"/> Deed	Deed
4	<input type="checkbox"/> O&M Manual	Operations and Maintenance Manual
5	<input type="checkbox"/> As-Built	As-Built
6	<input type="checkbox"/> Engineer's Estimate	Engineer's Estimate
7	<input type="checkbox"/> Easement Agreement	Easement Agreement
8	<input type="checkbox"/> PE Certification	PE Certification
9	<input type="checkbox"/> Landscaping Agreement	Landscape Agreement

A. Construction Site Turnover

- Shared digital systems:
 - Emailed PDFs
 - DocuSign
 - Box folder (shared online network drive)
 - Salesforce – stormwater permits
- Laserfiche & paper files still used for permanent storage
- Allows multiple staff to upload/edit/review documents

	A	B	C	D	E	F	G	H	I	J	K
1	OBJECTID	SiteName	ProjectNu	Location	ProjectCit	OwnersNa	OwnerAd	OwnerCity	OwnerPhc	OwnerEm	SiteManag
2	3128	MacKenan	99-SP-196	111 MacKe	Cary, NC 2	111 Macke	P.O. Box 3	Raleigh, N	919-	bpa	111 Macke
3	3129	1200 Cres	96-SP-175	1200 Cres	Cary, NC 2	GH Cresce	3433 Peac	Atlanta, GA	303	12	BrightView
4	3130	A+ Self Sto	99-SP-130	160 Haven	Cary, NC 2	Sovran Acc	6467 Main	Williamsville, N		1	Extra Spac
5	3131	Advance A	07-SP-086	205 Grand	Cary, NC 2	Stella Kala	326 Bamp	Mt. Pleasant, SC		4	Insight Fac
6	3132	Airport Pa	01-SP-140	251 Airgat	Morrisville	Airgate CH	5975 Cava	Raleigh, N	919-	chk	@gmail.com
7	3133	ALDI, Inc.	06-SP-062	2303 NW I	Cary, NC 2	ALDI, Inc.	1985 Old L	Salisbury, I	704-	stua	od@aldi.us
8	3134	ARS Buildr	03-SP-155	1631 NW I	Cary, NC 2	Triangle Re	113 Dunca	Cary, NC 27511			Accident R
9	3135	Best West	96-SP-112	1722 Waln	Cary, NC 2	GSS Raleigh	5640 Dillar	Cary, NC 2 919-		susa	nas@cmchc
10	3136	Bishops G	03-SP-021	Behind 22	Cary, NC 2	Bishops G	1612 Milit	Wilmington	919-	bpe	amsmgt.com
11	3137	Bishops G	03-SP-036	330 Westh	Cary, NC 2	Bishops G	1612 Milit	Wilmington	919-	bpe	amsmgt.com
12	3138	Cary Comr	96-SP-114	SE Corner	Cary, NC 2	Town of C	316 N Aca	Cary, NC 27513			
13	3139	Faculty Av	01-SP-155	408 Facult	Cary, NC 2	Town of C	316 N. Aca	Cary, NC 2 919-		931	
14	3140	Cary Good	08-SP-001	220 Kilmay	Cary, NC 2	Goodwill I	4721 Empe	Durham, N	919-	sco	odwillInc.com
15	3141	Cornerstor	05-SP-130	200 Corne	Cary, NC 2	200 Corne	2509 Victo	Raleigh, NC 276			York Prop
16	3142	Coventry V	97-SP-263	Behind 11	Cary, NC 2	Coventry V	P.O. Box 9	Raleigh, N	919-	llan	charlestonr



B. Inventory

- Started with spreadsheet of sites
- MapInfo (2010) > ArcGIS Online (2017) > ArcPro (2023)
- Schema update – SCM assets separate from inspections and compliance (related table)

SCM

- Bioretention
- Constructed Wetland
- Detention
- Dry Pond
- Grass Swale
- Level Spreader
- Permeable Pavement
- Plunge Pool
- Proprietary Devices
- Riparian Buffer
- Sand Filter
- Scour Hole
- Step Pool
- Underground Detention
- Unregulated
- Wet Pond

Carolina Preserve Phase 6

Carolina Preserve Phase 6

Carolina Preserve Phase 6

Carolina Preserve Phase 6

SiteName	Carolina Preserve Phase 3B
ProjectNumber	06-SP-079
Location	Behind 982 Tompkins Loop
ProjectCityStateZip	Cary, NC 27511
OwnersName	Carolina Preserve HOA
OwnerAddress	115 Allforth Place
OwnerCityStateZip	Cary, NC 27519
OwnerPhone	
OwnerEmail	
SiteManager	Carolina Preserve HOA
ContactPerson	Christine Hast
ContactAddress	115 Allforth Place, Cary, NC 27519
ContactPhone	
ContactEmail	
CertificateDate	7/5/2012
InspectionMonth	July
LastInspectionDate	7/16/2016
InspectionResults	Pass
InspectionFirm	Harris Engineering
Inspector	Brian King
InspectorPhone	
InspectorEmail	
BMPTYPE	Constructed Wetland
Comments_	BMP #2
OwnershipType	Private
AreaType	Residential
RIVBASIN_N	CAPE FEAR
TOCInspectDate	
TOCInspectionYR	0
Code	3

DELETE

CLOSE

SCM Editing Map Project Command Search (Alt+Q) Emily.Cochran_carync - Town of Cary EC

Map Insert Analysis View Edit Imagery Share Help Table Time

Reset Catalog Pane Geoprocessing Workflow Manager Create Add Enable Location Illumination Visual Mode Distance

Catalog View Python Window Aviation Color Vision Simulator Remove X Remove Animation Device L... Effects Scene View Clipping Navi...

Contents

Link Link Views Cursors Link

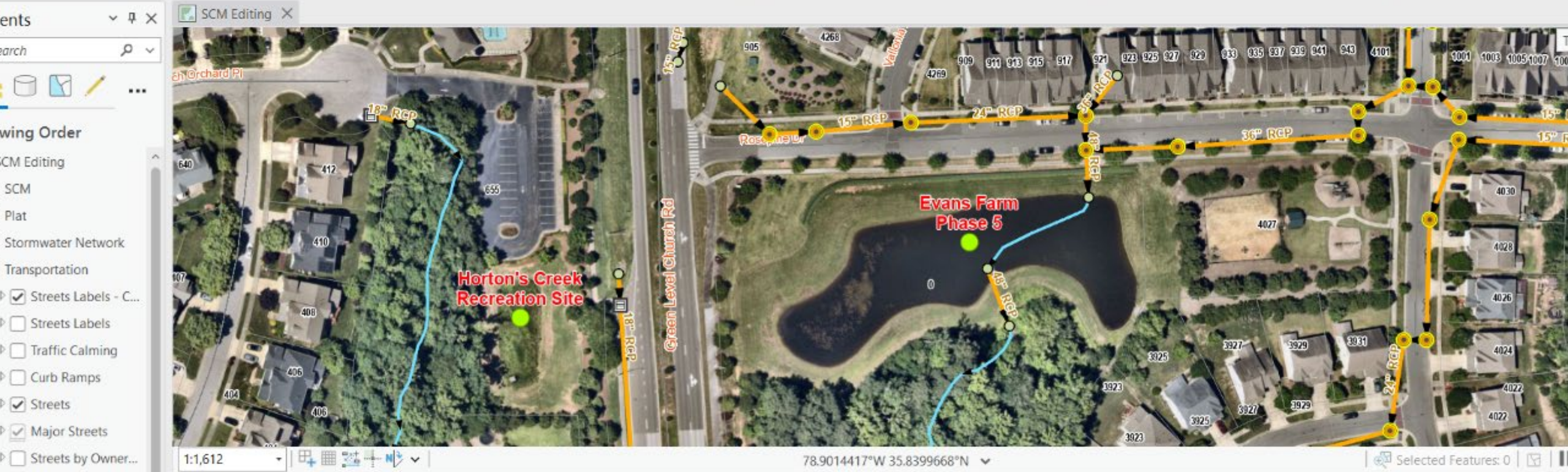
Windows

Thumbnail Accessibility

Scene

View Clipping

Navi...



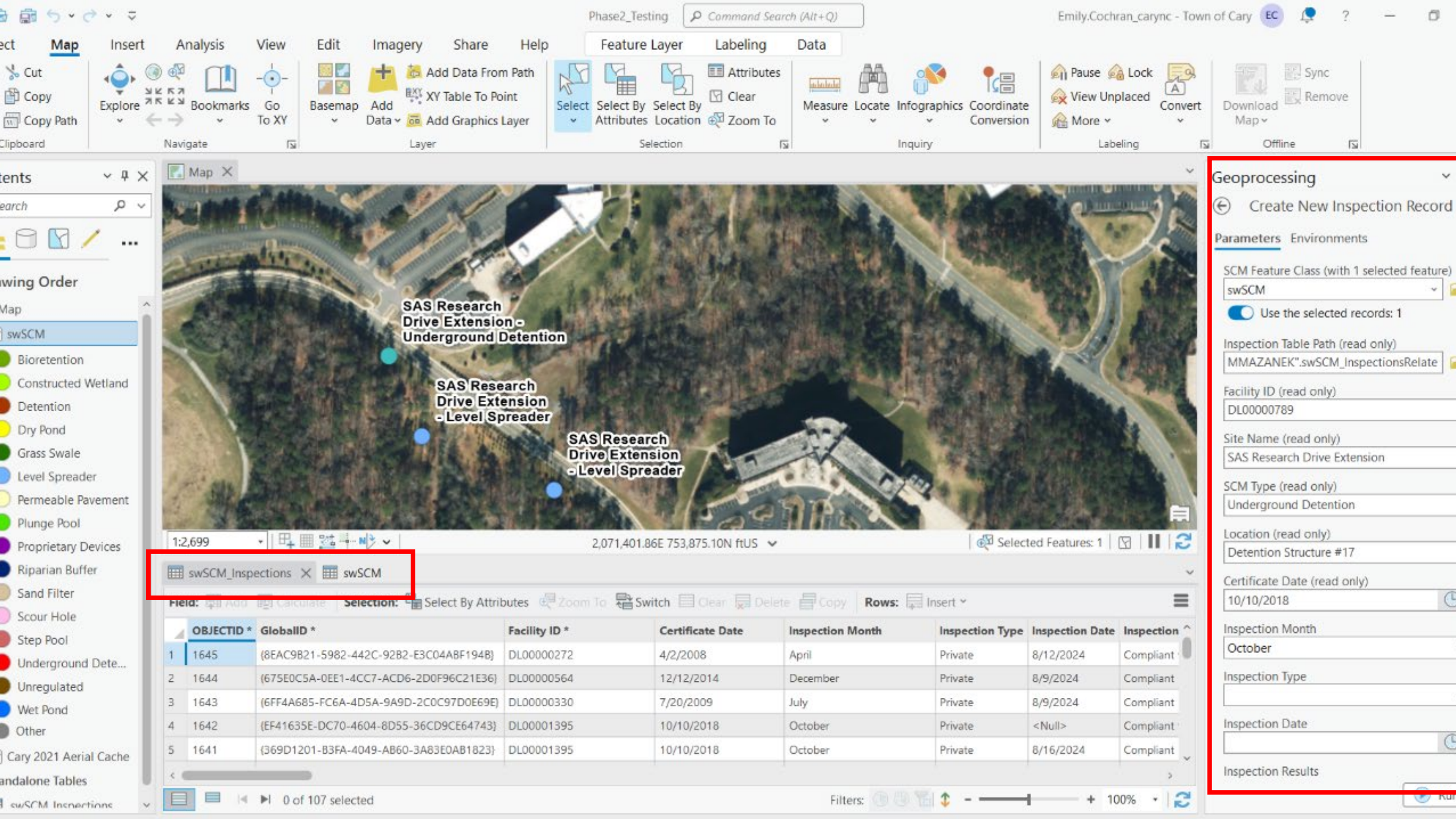
SCM

Field: Add Calculate Selection: Select By Attributes Zoom To Switch Clear Delete Copy

	SiteName	ProjectNumber	Location	ProjectCityStateZip	OwnersName	OwnerAddress	OwnerCityStateZip	Owner
1	1100 Crescent Green	99-SP-001	off Crescent Commons Drive	Cary, NC 27511	GH Crescent Green Inc., Attn: John Ginle...	3433 Peach	Atlanta, GA 30326-1112	<N...
2	11000 Regency Pkwy Parking Expansion	18-DP-0476	11000 Regency Parkway	Cary NC 27518	Regency Lakeview GL LP	5310 South	Durham, NC 27713	<N...
3	11000 Regency Pkwy Parking Expansion	18-DP-0476	11000 Regency Parkway	Cary NC 27518	Regency Lakeview GL LP	5310 South	Durham, NC 27713	<N...


0 of 1,507 selected

Filters: 110%



C. Inspections

- 2001 – Staff inspected all devices
- 2007 – Required owners to hire PE/PLS/CLA to inspect
- Monthly notification letters



ENGINEERING DEPARTMENT

December 31, 2003

Ivy Creek Townhomes Association, Inc.
Matthew, President
Cary, NC 27523

Subject: Ivy Creek Townhomes Watershed Protection Device

Dear Representative:

On December 31, 2003 the annual inspection of the above referenced project was performed for compliance with the Reservoir Watershed Protection Ordinance of the Town of Cary. A copy of that inspection is included with this letter. If the inspection report indicates work needs to be performed please ensure the work is completed within 30 days.


Your project is in the **Neuse River** Watershed and was approved under the condition that you would maintain the watershed protection device. Maintenance of the Watershed protection measure is important to ensure that we continue to have a safe and clean drinking water supply. Please contact me at (919)460-4934 when referenced work is completed, or if you have questions.

Sincerely,

Ethan A. Brodnick
Erosion Control Inspector
Engineering

#washlet

TOWN OF CARY
318 North Academy Street • Cary, NC 27513 • PO Box 8005 • Cary, NC 27512-8005
tel 919-469-4030 • fax 919-460-4935 • www.townofcary.org



ENGINEERING DEPARTMENT

Sand Filter Inspection Report

Project Name: Ivy Creek Townhomes
Location: East of Cambridge Woods and South of Briarcliff West
Owner: Association
ly, President
Address: out
Watershed: Neuse River
Inspection Purpose: Annual 12-31-2003
Observations: No problems noted during inspection.
Recent Rainfall Event: No
Discolored Sand at 2-3 inches deep in sand chamber: No
Replacement Sand Needed in Chamber: No
Remove Sediment from Sediment Chamber: No
Weirs free from obstruction: Yes
Overflow Inlet at functioning elevations: No
Stormwater reaches sand chamber as sheet flow: Yes
Outfall pipe is free from obstruction: Yes
Other Comments: Recent service to device looks to be effective with maintaining A functional BMP. Continue to keep sediment chambers free of debris To reduce maintenance needs long term. Thank You.
Town of Cary Engineering Department.
watershedinspectionform.doc

TOWN OF CARY
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tel 919-469-4030 • fax 919-460-4935 • www.townofcary.org

C. Inspections

- 2016 – inspection template updated
- 2019 – Pass/Fail to Compliant, Compliant with Maintenance or Non-Compliant
- Establishment of repair periods

STORMWATER SCM ANNUAL MAINTENANCE INSPECTION REPORT Post-Construction Maintenance Report Form (Revised July 1, 2016)

(All previous versions of this form are invalid)

Town of Cary, North Carolina

Inspection Date: _____

The Town of Cary Land Development Ordinance (4.4.6) requires that Stormwater SCM runoff control devices/structures be inspected annually to certify they are being maintained properly and are functioning as originally designed and intended.

- A. **General Information: (Fill out ALL information)** *USE ONLY ONE INSPECTION FORM PER SITE WITH AS MANY ACCOMPANYING SCM CHECKLIST ATTACHMENT SHEETS AS NEEDED. IF MULTIPLE SCM'S EXIST AT A SITE, SUBMIT MULTIPLE CHECK-OFF ATTACHMENT SHEETS ALONG WITH THE STANDARD 2-PAGE FORM. ALSO, ATTACH DIGITAL PHOTOGRAPHS OF THE SITE, STRUCTURES, AND DEVICES AS APPLICABLE. COMPLETE ALL BOXES – LEAVE NOTHING BLANK Boxes

Project Name: (as found in Town of Cary Files)	Legal Owner of Record: (Name from County Real Estate/Tax Website or from the owner if more recently updated):
Alternate Name if applicable:	Legal Owner of Record Address: (from County Real Estate/Tax Website or from the owner if more recently updated):
Physical Address/Location of SCM:	Owner Name:
Town of Cary Site Plan # or Subdivision Plan #	Owner Telephone Number w/ Area Code: ()
Site Contact Entity: (Owner, Management Company, or HOA)	Name of Inspection Company:
Site Contact Person Name/Title:	SCM Inspector Name: (a person's name - not a company name)
Site Contact Entity Mailing Address:	Mailing Address of Inspection Company:
Site Contact Person Telephone Number:	Qualification/Credentials of Inspector: Type _____ Name of Entity _____ State _____ # _____ Registration: _____

C. The results of this inspection are as follows:

- ☐ **NON-COMPLIANT**
VISUAL INSPECTION FOUND APPARENT ISSUES WHICH NEED IMMEDIATE ATTENTION. COMPLETE THE REPAIR ITEMS INDICATED ON THE ATTACHED CHECKLISTS WITHIN 60-DAYS OF THE DATE OF THIS REPORT. RE-INSPECTION AND CERTIFICATION PRIOR TO OR AT THE 60-DAY INTERVAL WILL FOLLOW SATISFACTORY COMPLETION OF ALL REPAIRS. REPORTS NOT RECEIVED WITHIN 60-DAYS WILL LEAD INTO ENFORCEMENT ACTIONS. SEE ITEM "D" BELOW REGARDING ENFORCEMENT.
- ☐ **COMPLIANT WITH MAINTENANCE**
VISUAL INSPECTION FOUND DEFICIENCIES THAT NEED ATTENTION. COMPLETE THE MAINTENANCE ITEMS INDICATED ON THE ATTACHED CHECKLISTS WITHIN 30-DAYS OF THE DATE OF THIS REPORT. THE TOWN SHALL BE NOTIFIED OF THE REPAIRS HAVE BEEN PERFORMED WITH PHOTOS OF MAINTENANCE PERFORMED. IF NOTIFICATION HAS NOT BEEN RECEIVED WITHIN 30-DAYS THIS WILL BE CONSIDERED A VIOLATION. SEE ITEM "D" BELOW.
- ☐ **COMPLIANT** (CHECK HERE IF INITIAL INSPECTION WAS NON COMPLIANT AND THIS IS A RE-INSPECTION)
VISUAL INSPECTION FOUND NO APPARENT ISSUES, (CERTIFICATION BELOW; SEE ITEM "E").

_____ nce and Inspection Seminar
_____ Certification # _____
_____ hone Number: ()
_____ l Address: _____

CARY

C. Inspections

- Town must inspect all privately-owned SCMs once per permit cycle
- Inspect about 20% per year
- 2 days per month, about 9 months of the year
- Field Maps for inspections
- Export GIS data and use MailMerge to send out reports



D. Tracking & Enforcement

- 2010 – MapInfo allowed us to see sites with most recent inspection date and identify overdue reports
- Outlook calendar with events to remember when due dates were
- Excel spreadsheet
- Schema update – historical data

	A	B	C	D	E	F	G	H	I	J	K	L
1	SiteName	Dev. Plan #	Inspectio	LastInspectionDate	Complia	Need	Contacted I	Via	Compliance Action	Next Action	Action Date	Note
3	Alsto	19-DP-0082	March	3/14/2024	NC	Repair and reinspection	3/26/2024	Email	Request repair and reins	Overdue letter	7/24/2024	called 8/9
4	Amb	06-SP-032	July & Dec	11/20/2023 0:00	NC	Repair and reinspection	3/26/2024	Email, mai	Overdue letter	NOV	7/24/2024	called 8/9
5	Ame		September	10/11/2019	On hold	#N/A				#N/A		On hold due to redevelopment
6	Bee	16-SP-069	June	6/17/2024	NC	Repair and reinspection	7/9/2024	Email, mai	Request repair and reins	Overdue letter	9/7/2024	
7	BSN	Bikes)	March	7/10/2024	NC	Repair and reinspection	7/12/2024	Email	Request repair and reins	Overdue letter	9/10/2024	
8	Carr	04-SB-012	August	8/5/2024	CWM	Repair photos	8/9/2024	Email	Request repair photos	Overdue letter	9/8/2024	
9	Cary	01-SP-139	September	8/13/2024	CWM	Repair photos	8/15/2024	Email	Request repair photos	Overdue letter	9/14/2024	WP #1 only
10	Chai	07-SP-099	September	10/7/2022	NC	Repair and reinspection	5/31/2024	Email, mai	Overdue letter	NOV	7/30/2024	emailed 8/9. previous retrofit -- n
11	Chat	16-DP-031	april	7/18/2024	CWM	Repair photos	7/25/2024	Email	Request repair photos	Overdue letter	8/24/2024	
12	Chri	13-SP-058	April	4/15/2024	NC	Repair and reinspection	5/13/2024	Email	Request repair and reins	Overdue letter	8/11/2024	should be done soon 7/16
13	Cop	05-SB-016	March	3/21/2024	NC	Repair and reinspection	4/15/2024	Email	Request repair and reins	Overdue letter	8/13/2024	work should be done by 7/26

Stormwater Project Status Dashboard

Filter Assets By Date

Predefined Calendar

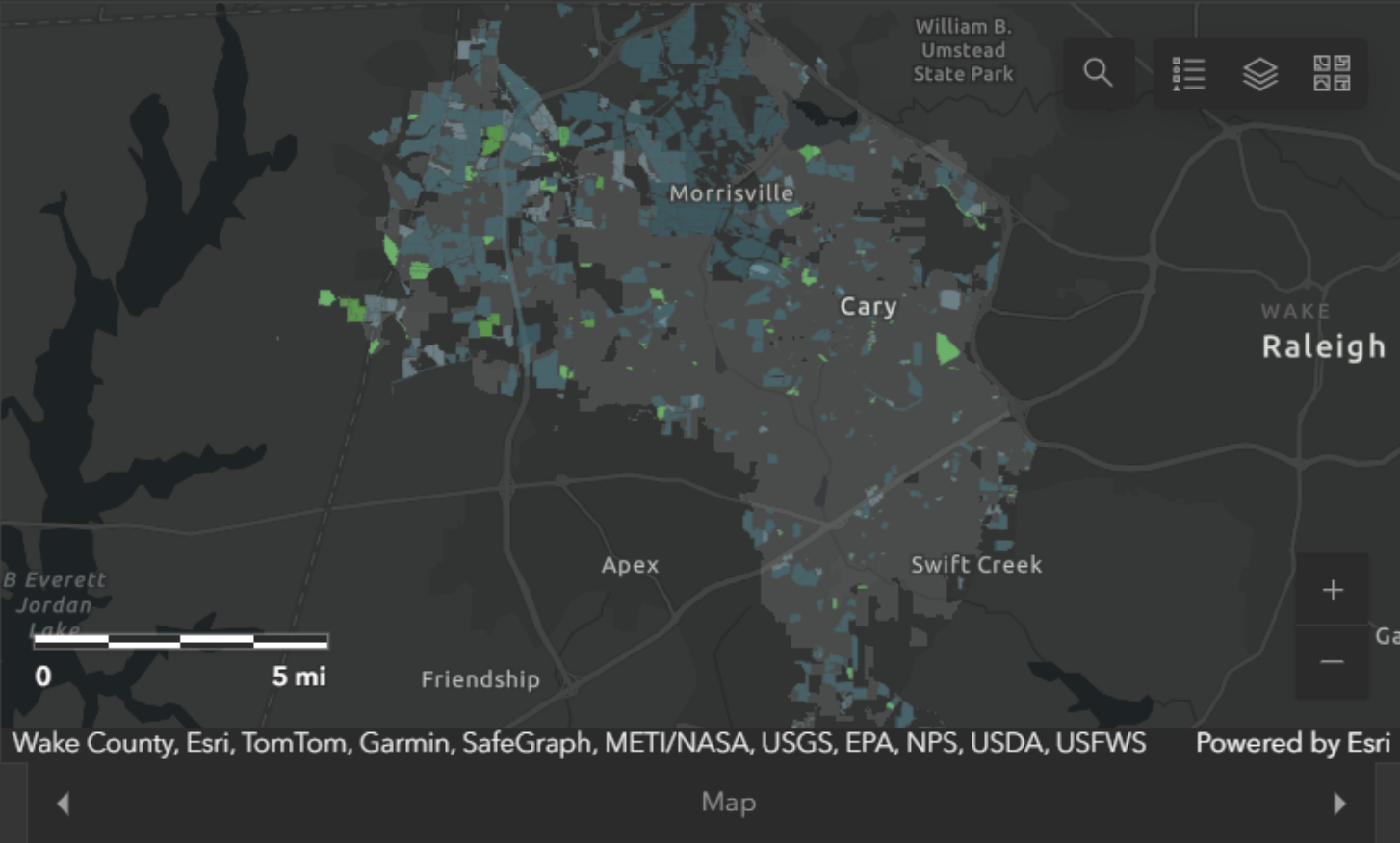
- All Time
- This Week
- Last Week
- This Month
- Last Month
- Last Year
- This Year

Reset

Filter Completed Projects By Date

Predefined Calendar

Today



46

Record Plans in Progress
(currently being edited or queued)

Projects In

- 11000 Regency Parkway Parking Expansion
- Alston Village PH 1
- Bee Safe Storage at

150 of 262

Record Plans (1/1/2018+) Digitized (Backlog)

2018+ All Time

1,997
Inlets Added

157,299 LF
Gravity Mains Added

Gravity Mains
186
Unknown Materials

Culverts (Missing)
7
Unknown Materials

334
Junctions Added

4,128
LF of Culverts Added

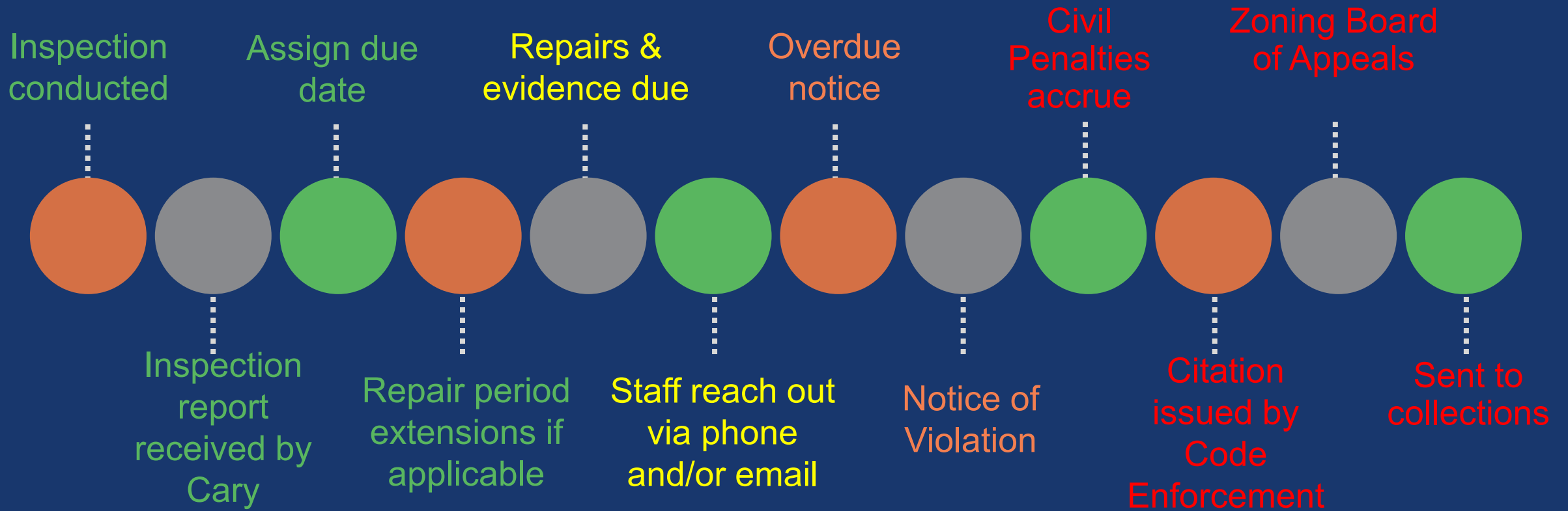
118
Unknown Diameters

13
Unknown Diameters

Projects Recently

- One Walker & One Walnut Mixed Use Phase 1
- FMC Morrisville
- Johnson Subaru

D. Tracking & Enforcement



How do we measure success?

Current compliance rates (in percentage of sites):

Non-Compliant	6.1%
Compliant with Maintenance	3.6%
Overdue	0.9%
Active enforcement (overdue letter, NOV and beyond)	0.7%

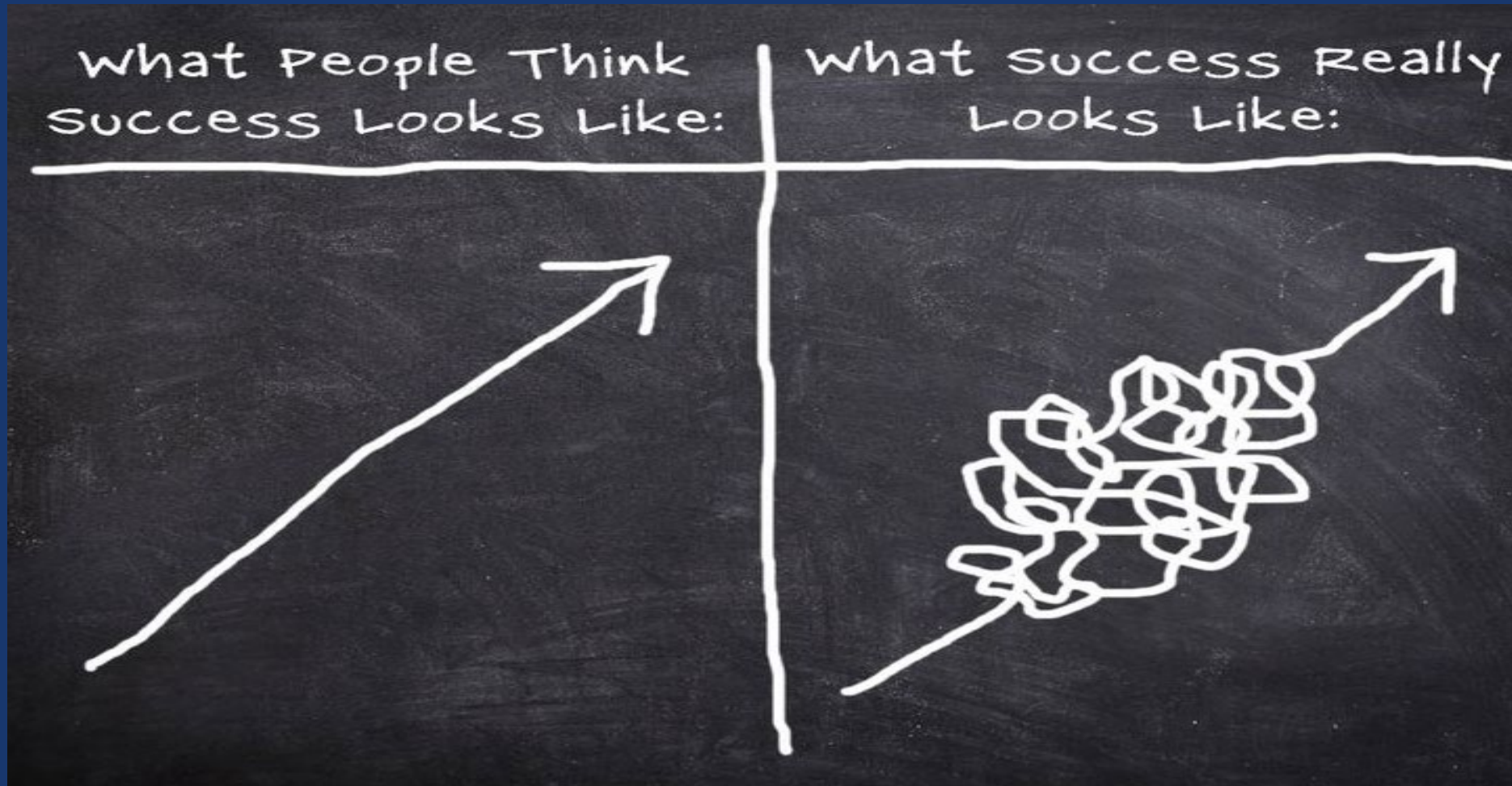
Why do we care?

Protect our water
quality and
downstream
neighbors

Compliance &
enforcement are
enormous time
sinks

Culture of pride
and stewardship

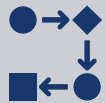
Why has Cary's program been successful?



Institutional Knowledge



Historical site and compliance information



Understanding why & how our processes came to be



Sometimes there just isn't a paper trail

Processes



Monthly notification letters



Using new technology as it becomes available (and feasible)



Bi-annual SCM workshop

Cooperation



Work with property owners to get devices back into compliance



Repair period extensions



Recognizing unusual situations



Patience with HOA boards especially

Communication



Working relationships with inspectors/contractors



Collaboration with erosion control inspectors during turnover



Phone, mail and email



Cultivate owner stewardship of devices

Step Back and Evaluate the Program

- Get up on the balcony to look at the dance floor
 - What are recurring issues/sticking points?
 - What is taking up too much time?
 - How do things fall through the cracks?
 - Who else can I ask for perspective and feedback?



Thank You!

Charles Brown

Stormwater Field Services Administrator

919-469-4038

Charles.brown@carync.gov

Emily Cochran

Stormwater Program Analyst

919-469-4032

Emily.Cochran@carync.gov