WPI WATER RESOURCE OUTREACH CENTER IQP 2021

COOPERATIVE GIS MAPPING FOR MASSACHUSETTS COMMUNITIES AND THE MASSDOT

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CENTRAL MASSACHUSETTS REGIONAL STORMWATER COALITION

THE UNDERLYING ISSUE

CONTAMINATED STORMWATER RUNOFF IS

POLLUTING OUR WATERS

STORMWATER RUNOFF

THE ECONOMY

STANDING WATER

CHEMICALS

LEFTOVER SEDIMENT

THE ENVIRONMENT

PROPERTY DESTRUCTION

OILS

TOXINS

BACTERIA

CONTAMINANTS

FERTILIZERS

PUBLIC HEALTH

LAND-BASED HABITATS AT RISK

LESSENED WATER QUALITY

TRASH

ROAD REPAIRS

DISEASE

NONPOINT SOURCE POLLUTION

EROSION

TRASH

POLLUTANT DISCHARGE

AQUATIC HABITATS AT RISK

PROJECT GOAL

To facilitate the collaboration of geospatial data between CMRSWC communities and the MassDOT to meet requirements of the MS4 permit

CMRSWC

CENTRAL MASSACHUSETTS REGIONAL STORMWATER COALITION

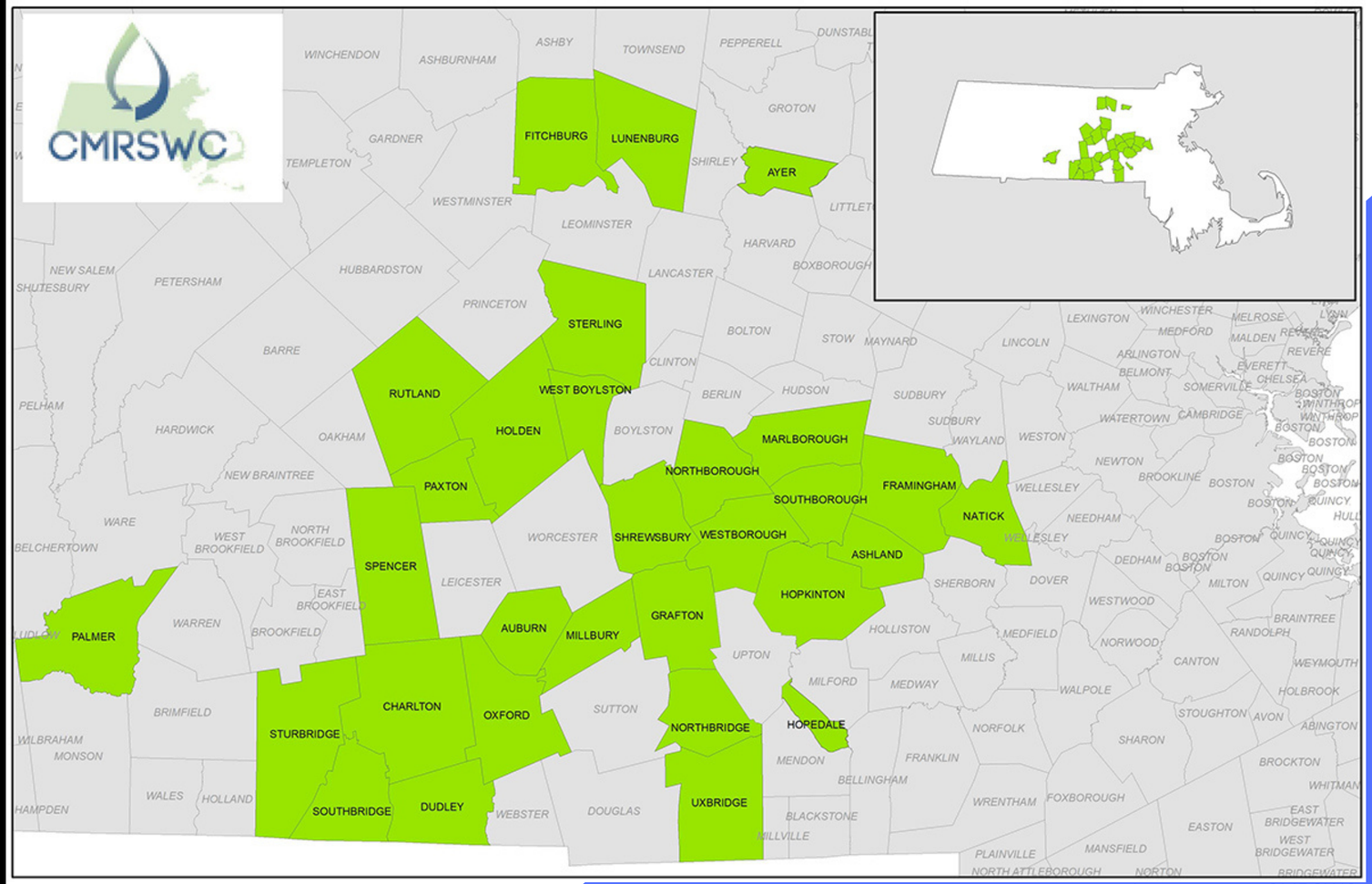


Image source: CMRSWC

MISSION

TO PROMOTE MUNICIPAL STORMWATER MANAGEMENT IN CENTRAL MASSACHUSETTS

MASSDOT

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION

MISSION

TO ENSURE THAT MASSACHUSETTS' TRANSPORTATION INFRASTRUCTURE IS SECURE, DEPENDABLE, AND DURABLE

Image source: Wikipedia

AUBURN, MA

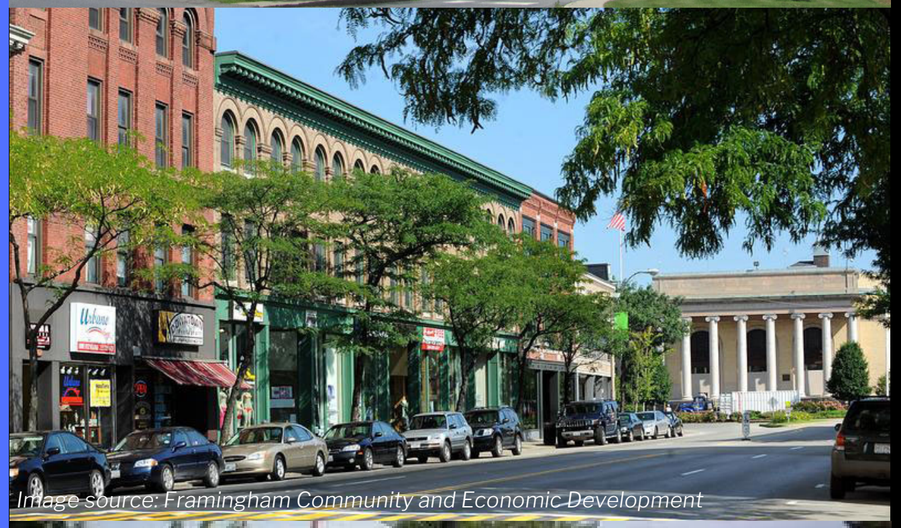


Image source: Framingham Community and Economic Development

FRAMINGHAM, MA

HOLDEN, MA

OUR MUNICIPALITIES

Image source: Wikipedia

BACKGROUND

THE **MS4 PERMIT** & **GEOSPATIAL DATA**

THE MS4 PERMIT

FAST FACTS

TWO PHASE NATIONAL STORMWATER PROGRAM POLLUTANT DISCH
WATER QUALITY ACT OF 1987
CT OF 1972 STORMWATER MANA
DISCHARGE ELIMINATION SYSTEM
RONMENTAL PROTECTION MS4 P

PHASE II IS AN **UNFUNDED FEDERAL MANDATE:**

MUNICIPALITIES MUST FIND THE MEANS WITHIN THEIR **BUDGET** OR **TAXATION** TO SUPPORT THE PROGRAM - PUTTING A STRAIN ON A LOT OF MUNICIPALITIES TRYING TO UNDERSTAND THE COMPLEXITY OF THE PERMIT AND COMPLY WITH IT

THE CURRENT REGULATION IN **MASSACHUSETTS** IS THE **2016 SMALL MS4 GENERAL PERMIT**

A CRUCIAL FACTOR OF THE REGULATION IS **SYSTEM MAPPING**

GEOSPATIAL DATA & GIS

AN APPLICATION OF GEOSPATIAL DATA:

MAPPING **STORMWATER SEWER SYSTEMS**

A NECESSITY FOR EFFECTIVE STORMWATER MANAGEMENT

GIS -

AN INTREGRATION TOOL FOR GATHERING, INTEGRATING, AND ANALYZING GEOSPATIAL DATA

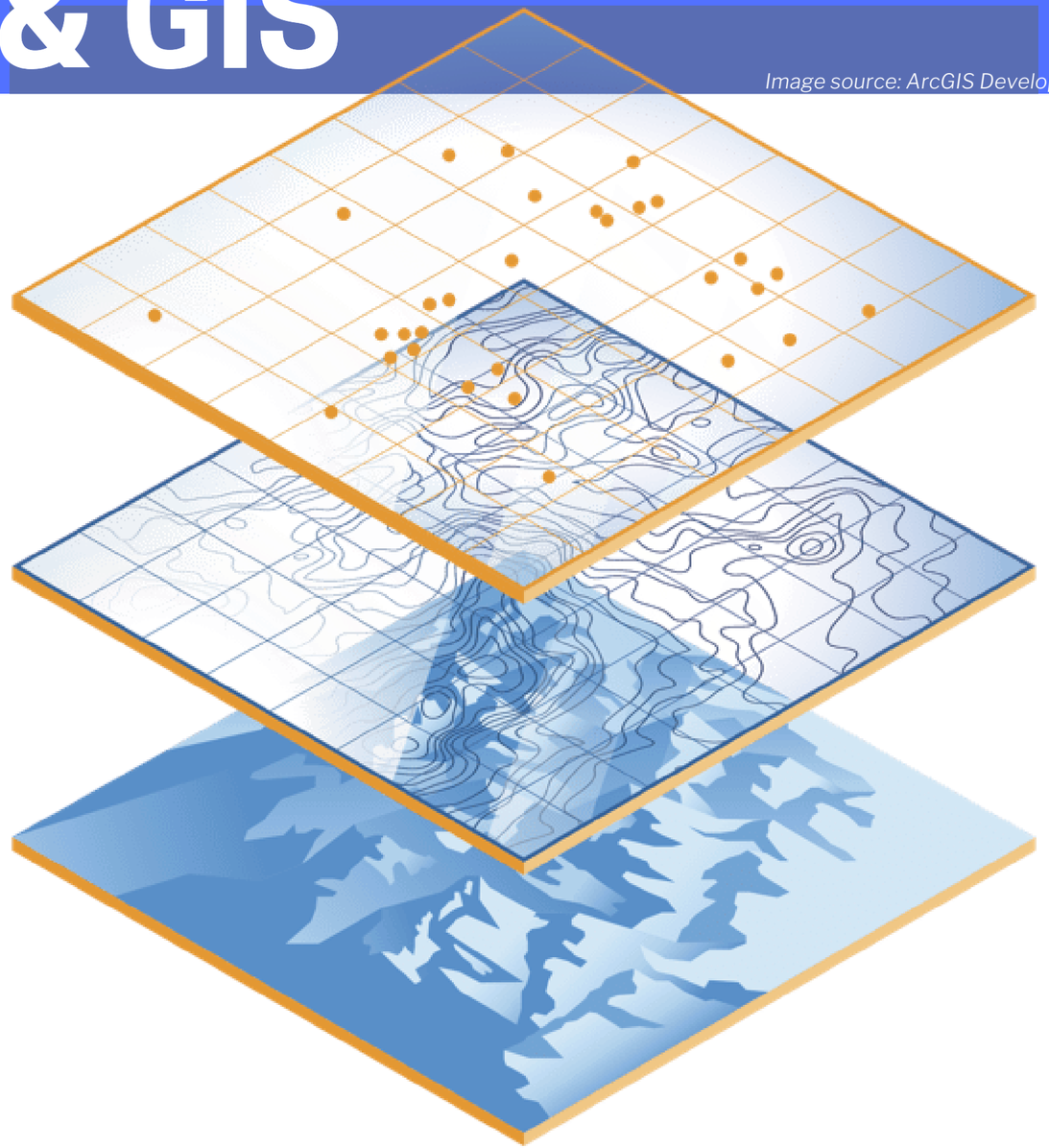
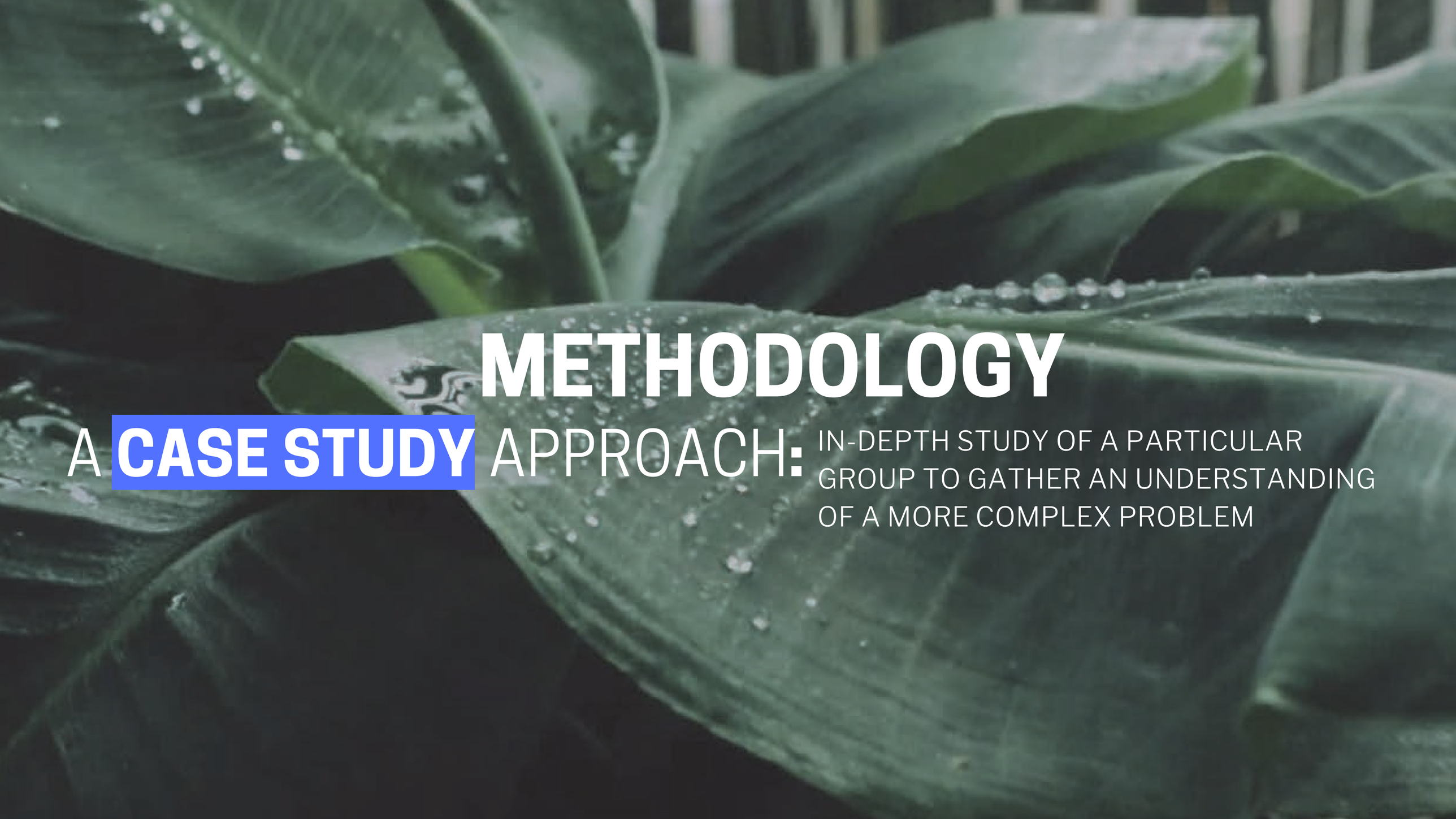


Image source: ArcGIS Developers



METHODOLOGY

A **CASE STUDY** APPROACH:

IN-DEPTH STUDY OF A PARTICULAR GROUP TO GATHER AN UNDERSTANDING OF A MORE COMPLEX PROBLEM

PROJECT OBJECTIVES

01 IDENTIFY CURRENT STANDING OF MS4 MAPS

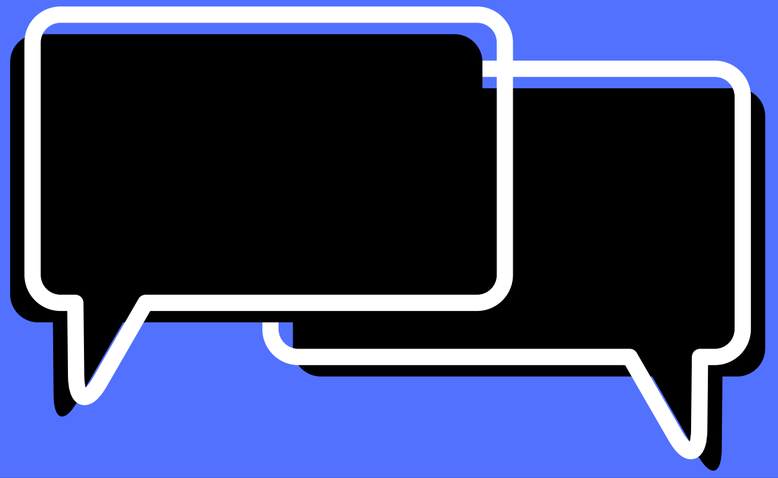
02 IDENTIFY HOW DATA IS SHARED

03 IDENTIFY DATA GAPS

04 DEVELOP AN APPROACH TO ADDRESS GAPS

OBJECTIVE 01

IDENTIFY THE DEGREE OF INFORMATION INCLUDED IN THE MUNICIPALITIES' AND MASSDOT'S GEOSPATIAL DATA AND HOW IT IS MANAGED

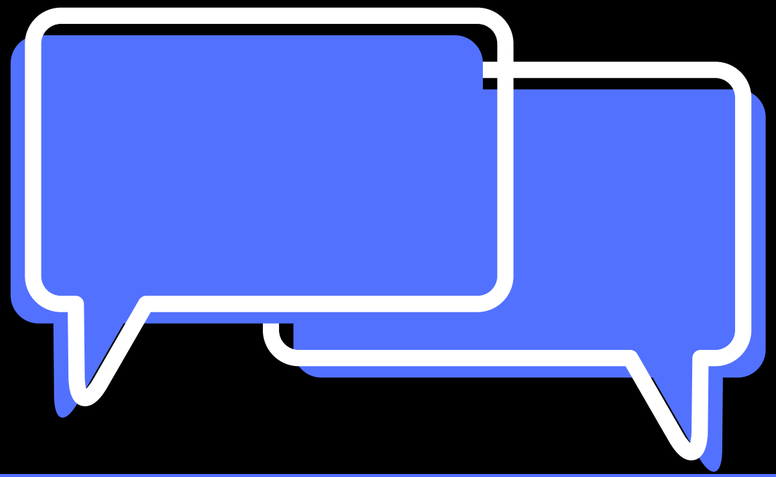


INTERVIEWS & GATHERING DATA

OBJECTIVE

02

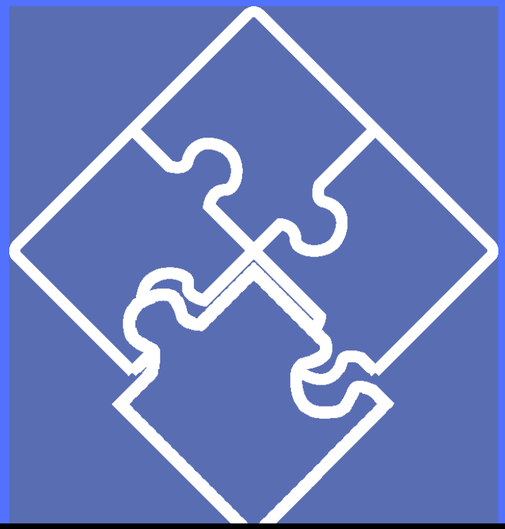
IDENTIFY HOW GEOSPATIAL DATA IS SHARED BETWEEN ORGANIZATIONS



INTERVIEWS

OBJECTIVE 03

IDENTIFY WHAT DATA GAPS OR CONSTRAINTS EXIST IN THE INTEGRATION OF STORMWATER SEWER SYSTEM GEOSPATIAL DATA

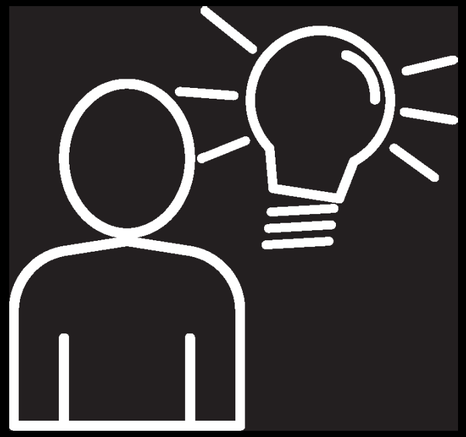


COMPARATIVE DATA ANALYSIS

OBJECTIVE

04

DEVELOP AN APPROACH TO ADDRESS DATA GAPS AND TO FACILITATE INTERORGANIZATIONAL COLLABORATION



ARCHIVAL RESEARCH

EXPECTED OUTCOMES

IMPROVED  COLLABORATION

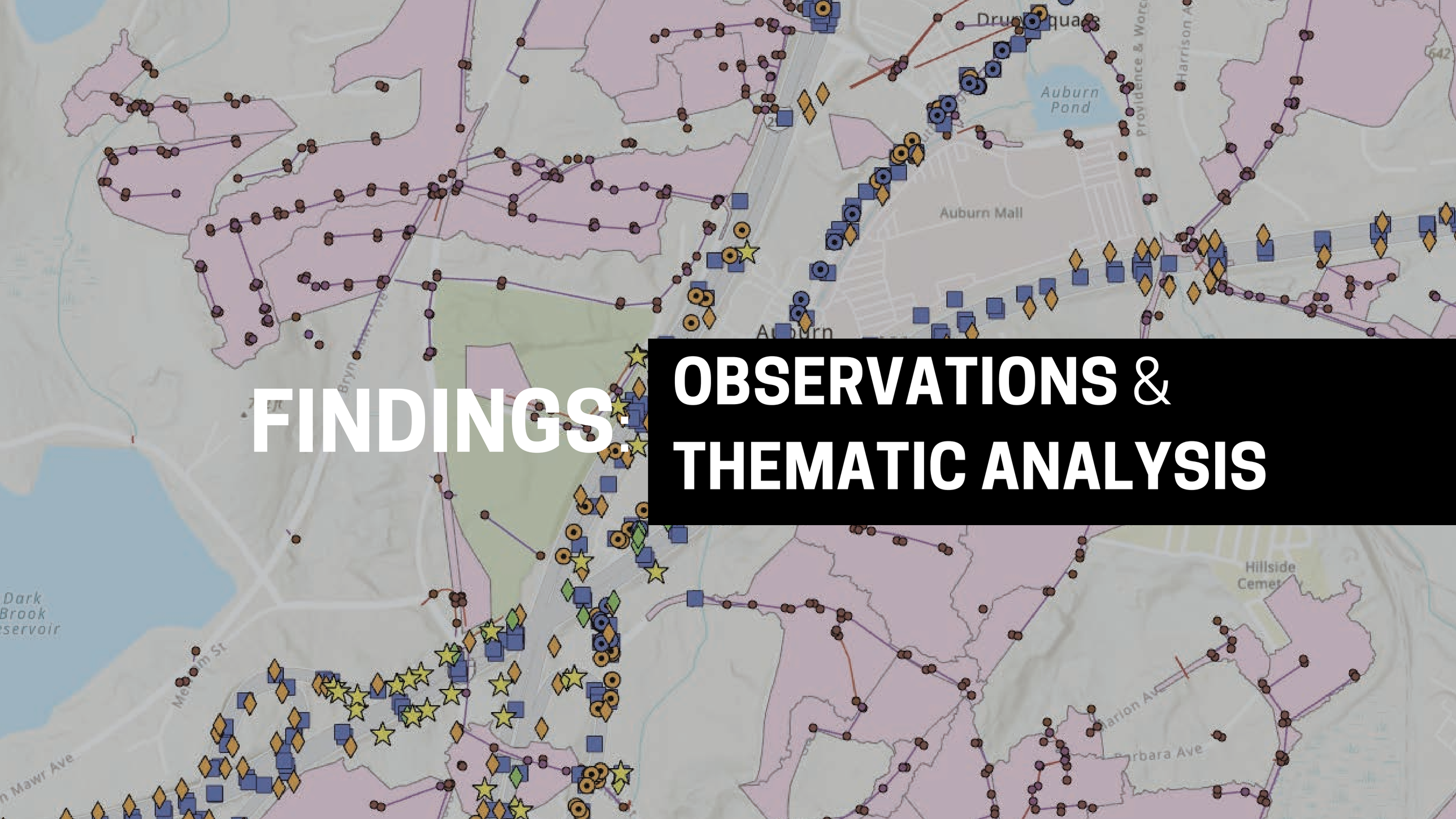
& DELIVERABLES

GUIDANCE DOCUMENT

FINAL REPORT

VIDEO

PROJECT TIMELINE



FINDINGS:

OBSERVATIONS & THEMATIC ANALYSIS

AUBURN

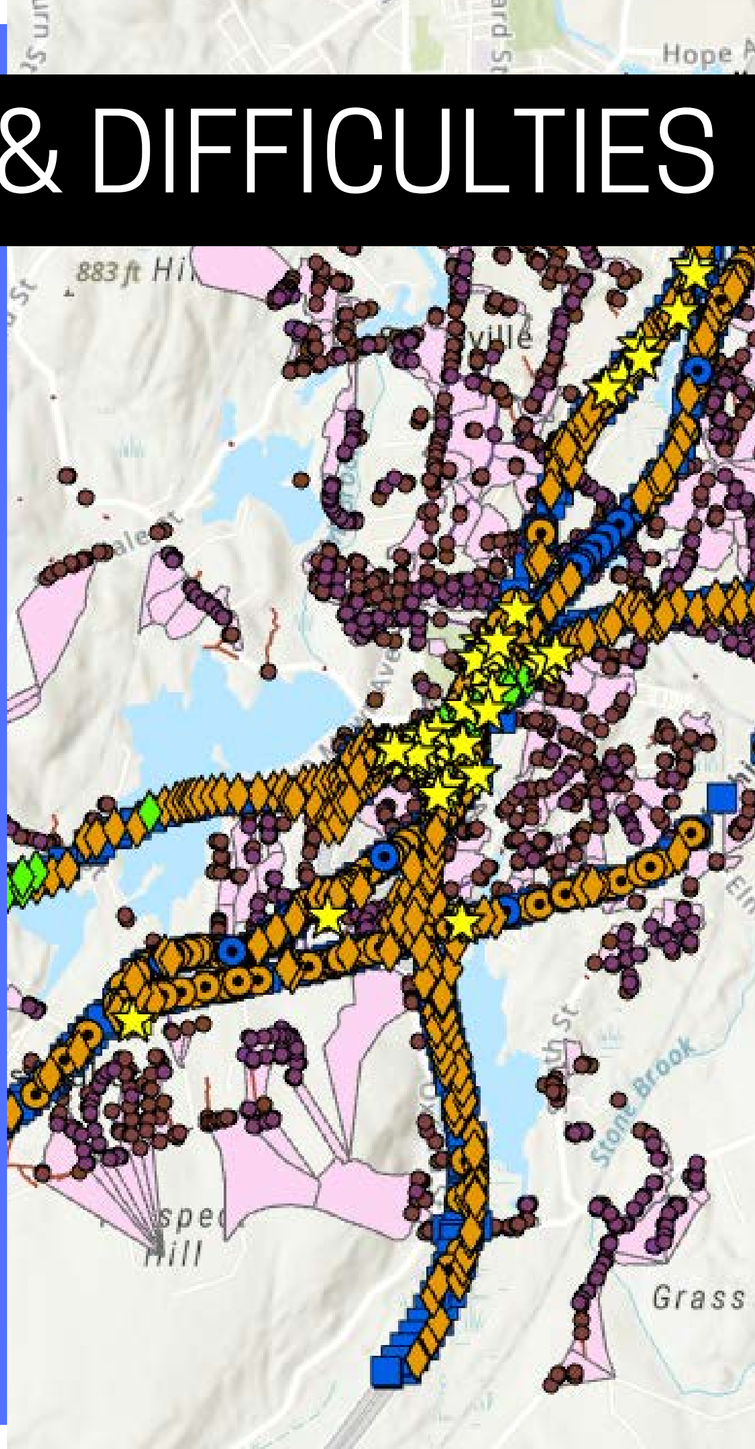
NEEDS & DIFFICULTIES

Needs

- To identify gaps between Auburn and DOT
  - Would require extensive field work
- To develop a comprehensive system that includes the MassDOT and private development
- Point person within the MassDOT to contact

Difficulties

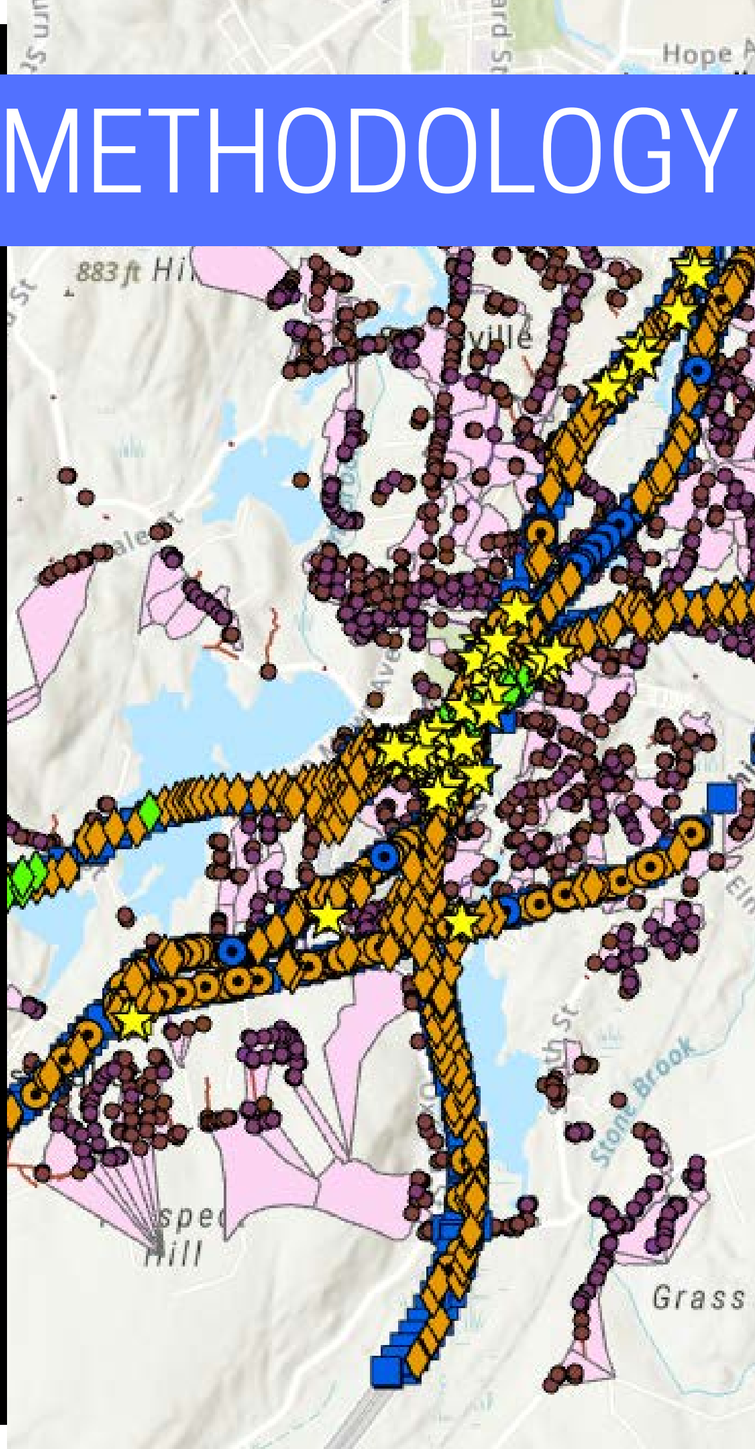
- Staffing
  - Availability and technical knowledge - no dedicated GIS person
- Other priorities
  - Updating the bylaw, phosphorus control plan, & private development take up a lot of time
- Budget
  - A lot of residents do not understand stormwater and do not want to pay for it



AUBURN

MAPPING METHODOLOGY

- Mapping is done off of record drawings
- Original mapping was done through a consultant in 2010
  - Possible some was field verified using consultants
- Data is stored in PeopleGIS
- Edits are made through ArcMap
- GIS is updated based on field work done related to MS4 permit
  - New infrastructure is being found which is an immediate issue because it should have been mapped in the past year
- No global initiative to update the entire system



FRAMINGHAM NEEDS & DIFFICULTIES

Needs

- To develop an inclusive system with the MassDOT and private property
- Point person within the MassDOT to contact

Difficulties

- Reliability of MassDOT’s data and communication
- Differing priorities for stormwater management from MassDOT
  - Concerned with catchments delineations primarily
- Budget
  - A lot of residents do not understand stormwater and do not want to pay for its management

FRAMINGHAM MAPPING METHODOLOGY

- Started initial stormwater mapping initiatives in 2005
- A lot of original mapping data existed on paper
- Edits and changes are made through ArcGIS
- GIS is updated based on field work done related to MS4 permit and private construction
- Delineating outfall catchments are main priority

HOLDEN

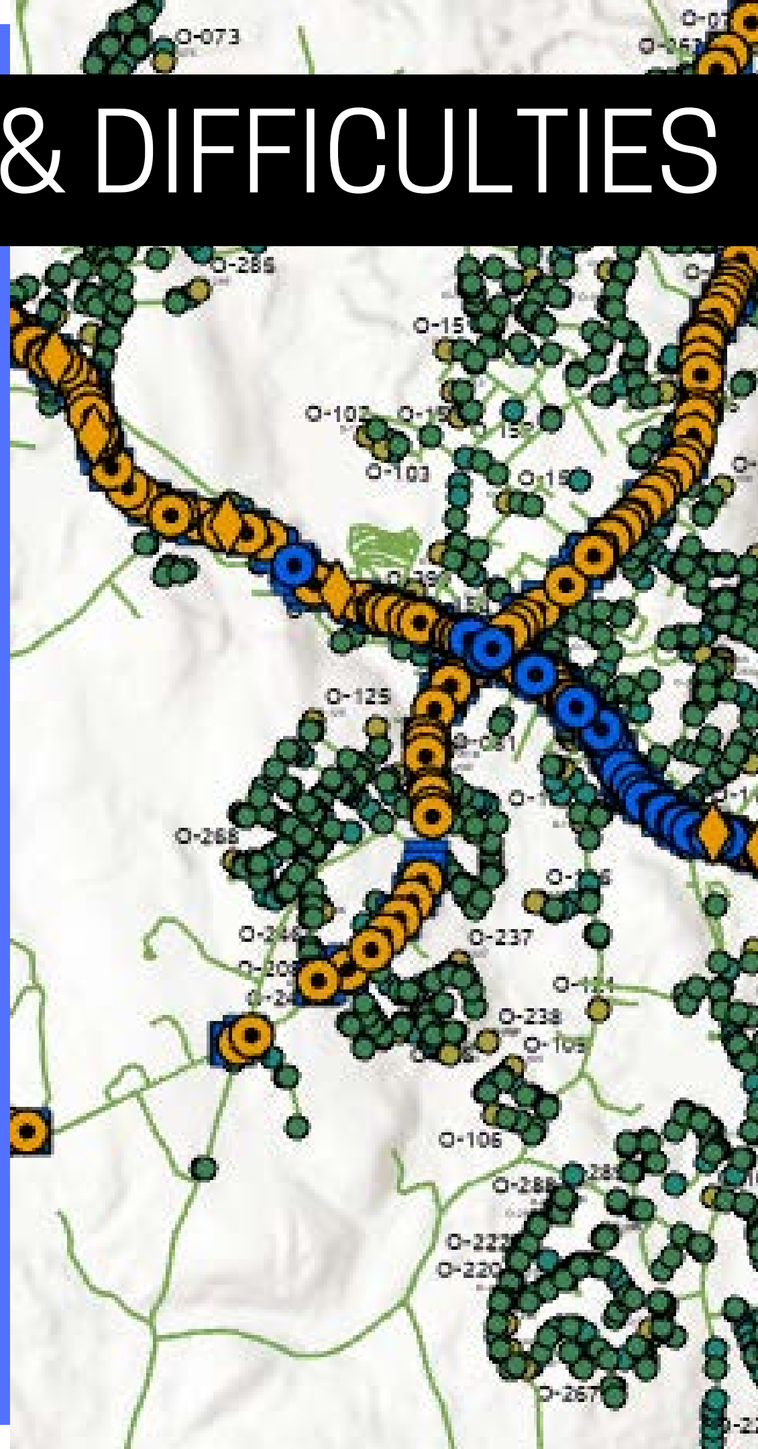
NEEDS & DIFFICULTIES

Needs

- Need a complete view of drainage piping
  - Interconnections are not fully mapped

Difficulties

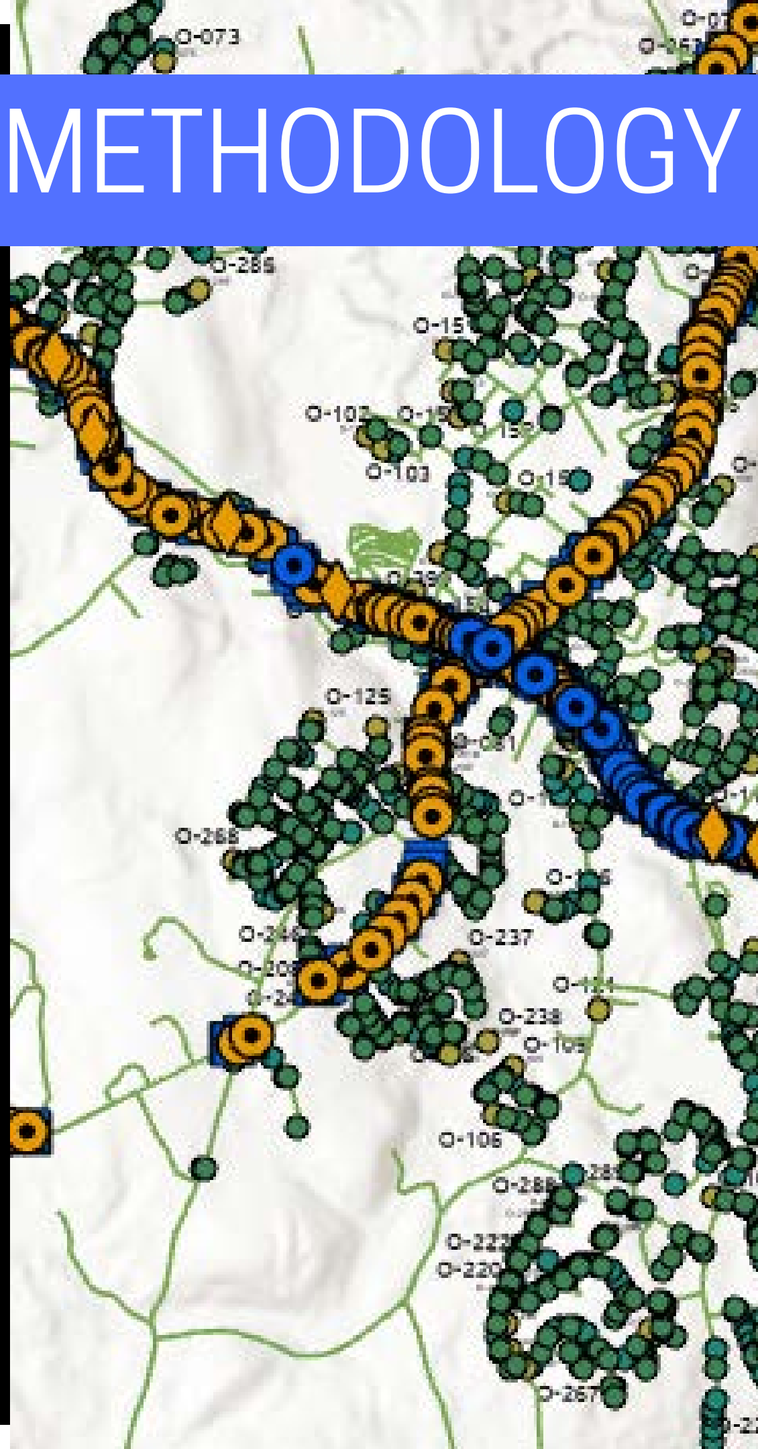
- There is not a good handle on the maps for drainage system on older areas of town
  - Record drawings are not good
- Town cannot afford extensive mapping efforts



HOLDEN

MAPPING METHODOLOGY

- Mapping is a continuous, ongoing effort
  - Updated as needed or as infrastructure is found
- Consultants have digitized records/plans/as builts and georeferenced the stormwater system
- Industry standard is used for symbology
- Has a good relationship with DCR and exchanging data



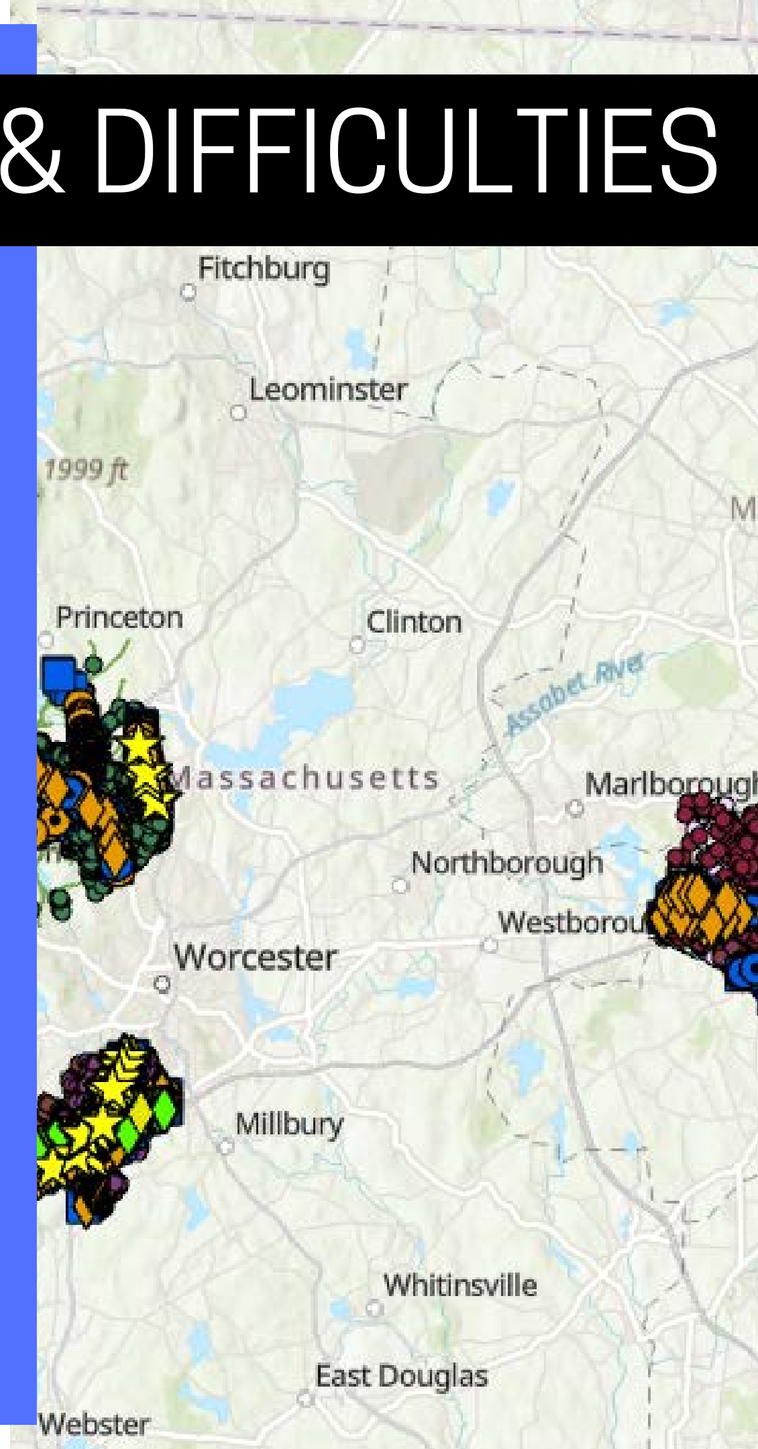
MASSDOT NEEDS & DIFFICULTIES

Needs

- To have a complete picture of drainage infrastructure
  - Need interconnections between DOT, municipalities, and private developers
- Having a map for IDDE program will be helpful

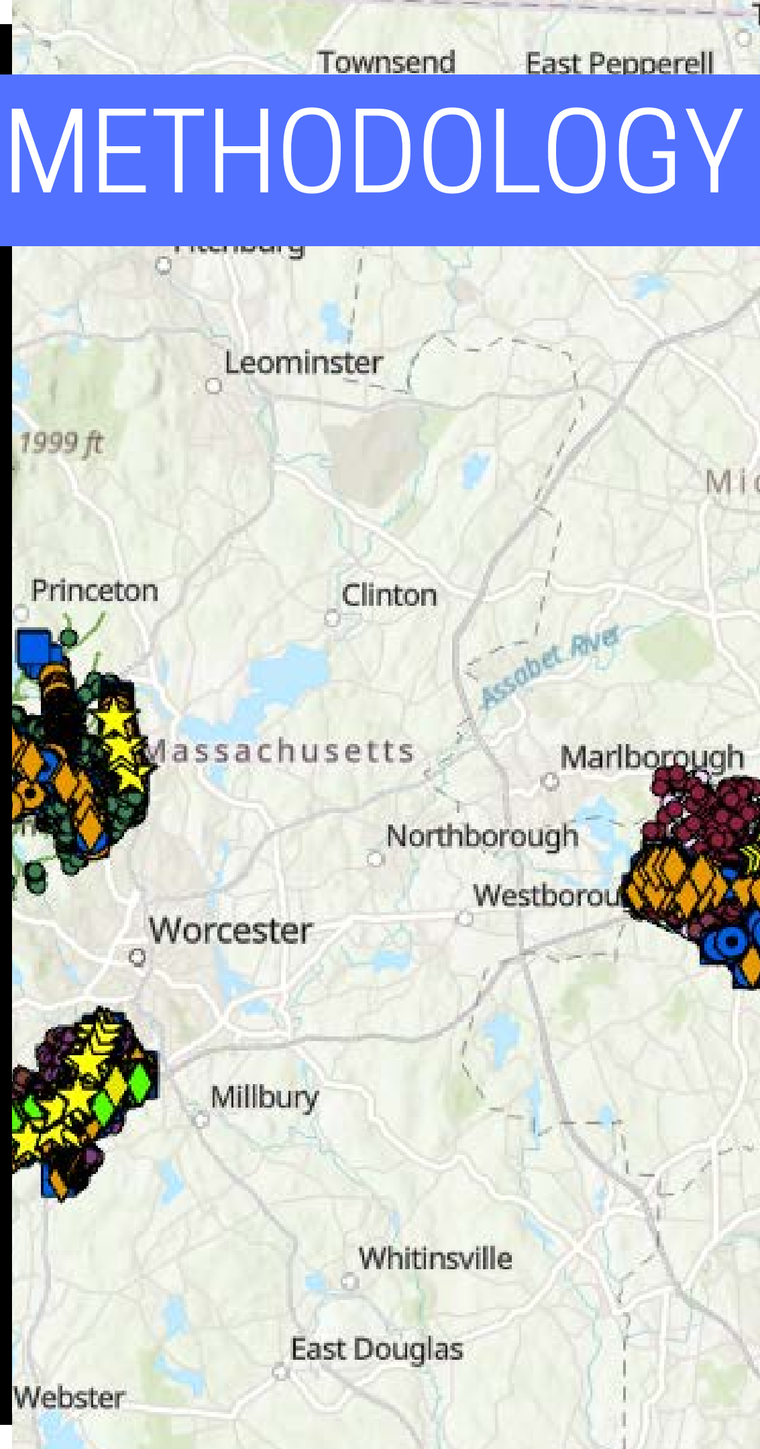
Difficulties

- Manpower/staffing is an obstacle
  - Especially in maintaining all infrastructure statewide
  - Instead of hiring designated staff, people are overworked
- Worried that being the point person for municipalities to contact would take time away from core responsibilities
- MassDOT is a large system with 6 districts varying in needs



MASSDOT MAPPING METHODOLOGY

- LiDAR effort initiated in 2014/2015 to collect data
- Uses ArcGIS
- In depth guidance document of their mapping processes along with a key for symbols used on the maps
- Collector app used for field personnel to input inspection data
- Data is now mapped by georeferencing as built plans
- Cheaper approach as opposed to surveying/ground proofing
- Maps are updated annually



STAFF ISSUE

- Designated stormwater staff is not hired
  - Responsibilities that come with stormwater management is placed on an existing staff member

the result?

Leaves member overwhelmed and overworked and stormwater runoff managed in a less effective manner

Manpower and technical knowledge is insufficient to meet desired mapping goals

FUNDING ISSUE

- MS4 regulation is a federally **unfunded** mandate
- Municipalities scramble to enact even the most basic efforts for stormwater management
- Residents lack a fundamental understanding of the effects of stormwater runoff

the result?

Education program is needed but requires time and money that municipalities do not have

Constant cycle of inadequacy

MASSDOT RELATIONS

- Municipalities have minimal or nonexistent relationship with the MassDOT
- Municipalities are unaware of GeoDOT - The MassDOT's database

the result?

The size of the MassDOT would put a lot of pressure on an appointed contact

GeoDOT needs to be utilized

MAPS & METHODS

- Municipalities' maps are far more detailed
- MassDOT's symbology is condensed and standardized
- All organizations use ArcGIS or other Esri products

the result?

Field verification or georeferencing need to be performed to verify interconnections

Detail in municipality maps affects readability

RECOMMENDATIONS

FOR **MUNICIPALITIES** INTEGRATING DATA WITH THE **MASSDOT**

ACQUIRE MASSDOT DATA

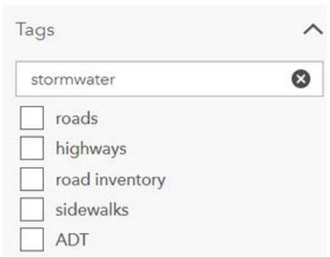
GEODOT: THE **MASSDOT'S** PUBLIC GIS DATABASE

VISIT THE WEBSITE

https://geo-massdot.opendata.arcgis.com/

NAVIGATE TO HIGHWAY ASSETS

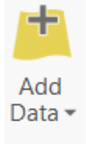
APPLY "STORMWATER" TAG



DOWNLOAD THE FILES:

- Stormwater Control Measure
- Inlet
- Stormwater Discharge Point
- Conveyance
- Miscellaneous Structure
- Manhole

IMPORT FILES INTO ARCGIS



INCREASE MAP READABILITY

STEP 1: CONDENSE INFRASTRUCTURE **SYMBOLOGY**

STEP 2: COLOR CODE INFRASTRUCTURE BY **OWNERSHIP**

INFRASTRUCTURE	SYMBOL	TOWN HTML COLOR CODE	STATE HTML COLOR CODE
STORMWATER CONTROL MEASURE		#FF1616	#FFFF00
INLET			
INLET		#77C3EC	#005CE6
OUTLET CONTROL STRUCTURE		#FF1616	#FFFF00
MANHOLE			
DRAINAGE		#77C3EC	#005CE6
COMBINED SEWER		#689F38	#267300
OTHER		#FFBD59	#689F38
STORMWATER DISCHARGE POINTS			
STANDARD OUTFALL		#CCFF90	#55FF00
OUTLET TO SCM		#FF1616	#FFFF00
OTHER		#FFBD59	#689F38

COMMUNICATING WITH MASSDOT

DEFINING THE **POINT OF CONTACT**

THE POINT OF CONTACT

HUNG PHAM
STORMWATER PROGRAM
COORDINATOR

EMAIL:
HUNG.PHAM@STATE.MA.US

THANKS!

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SWMAPS