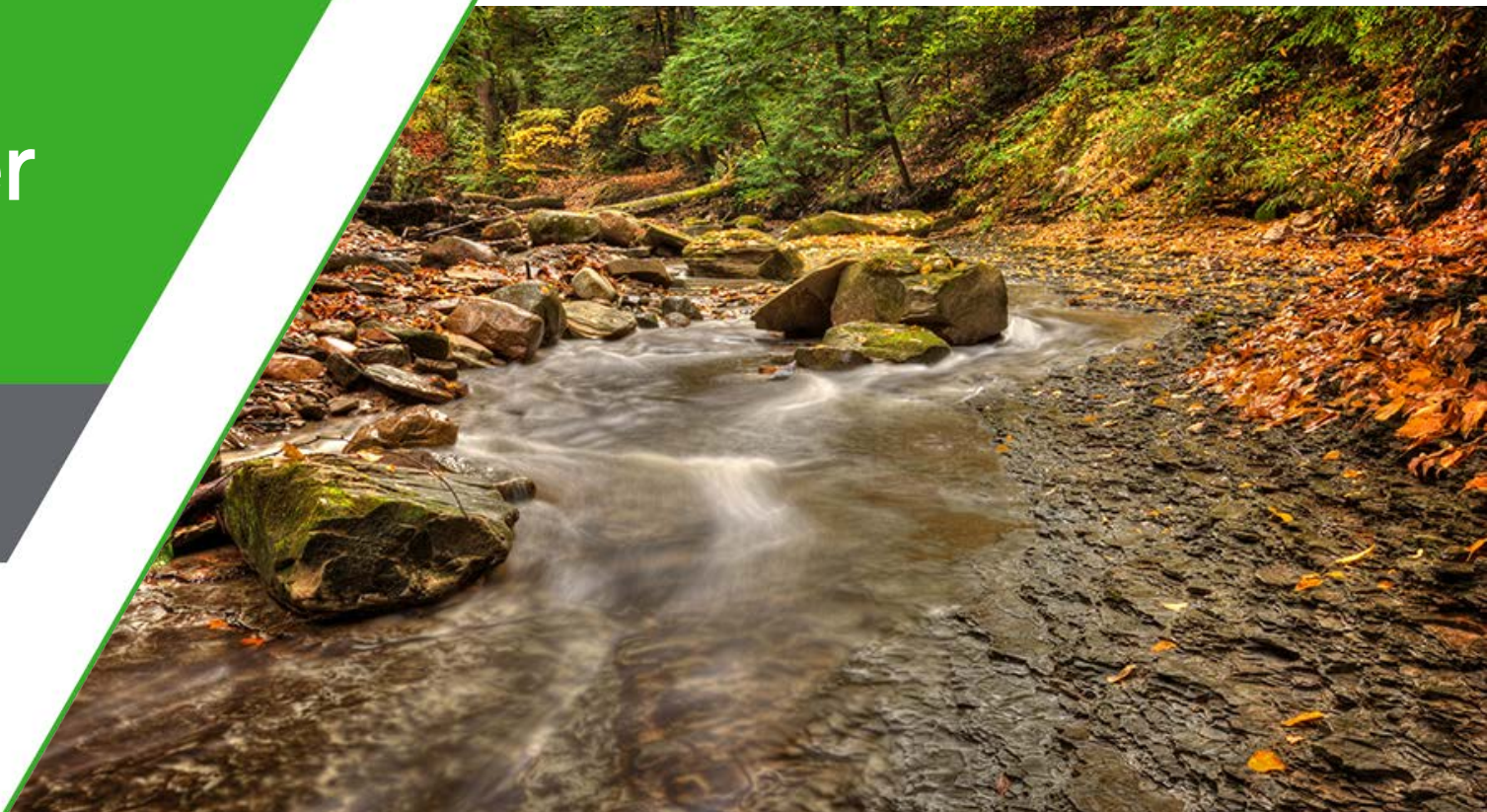


Cameras, iPads, and Other Things you Shouldn't Drop in Water

Joe Blackwell, EIT

June 9, 2020



Introduction

About me

- B.S. in Civil Engineering from Ohio State University
- Wade Trim in Cleveland since March 2018
- Water Resources project focus



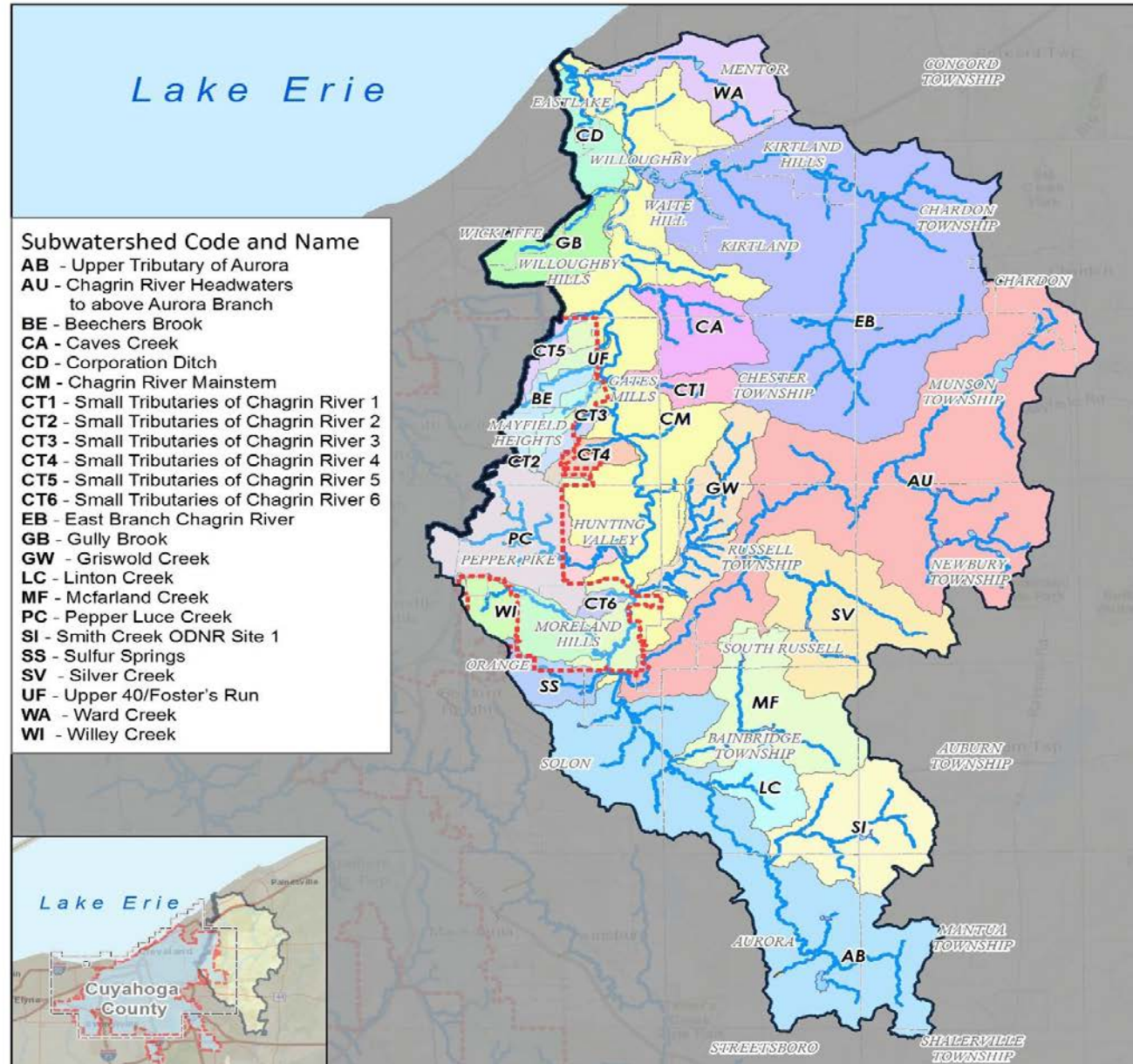
NEORSD's Stormwater Program Overview

- Evaluation of flooding, erosion, and water quality issues on the Regional Stormwater System (RSS)
- Problem Identification
- Construction Recommendations



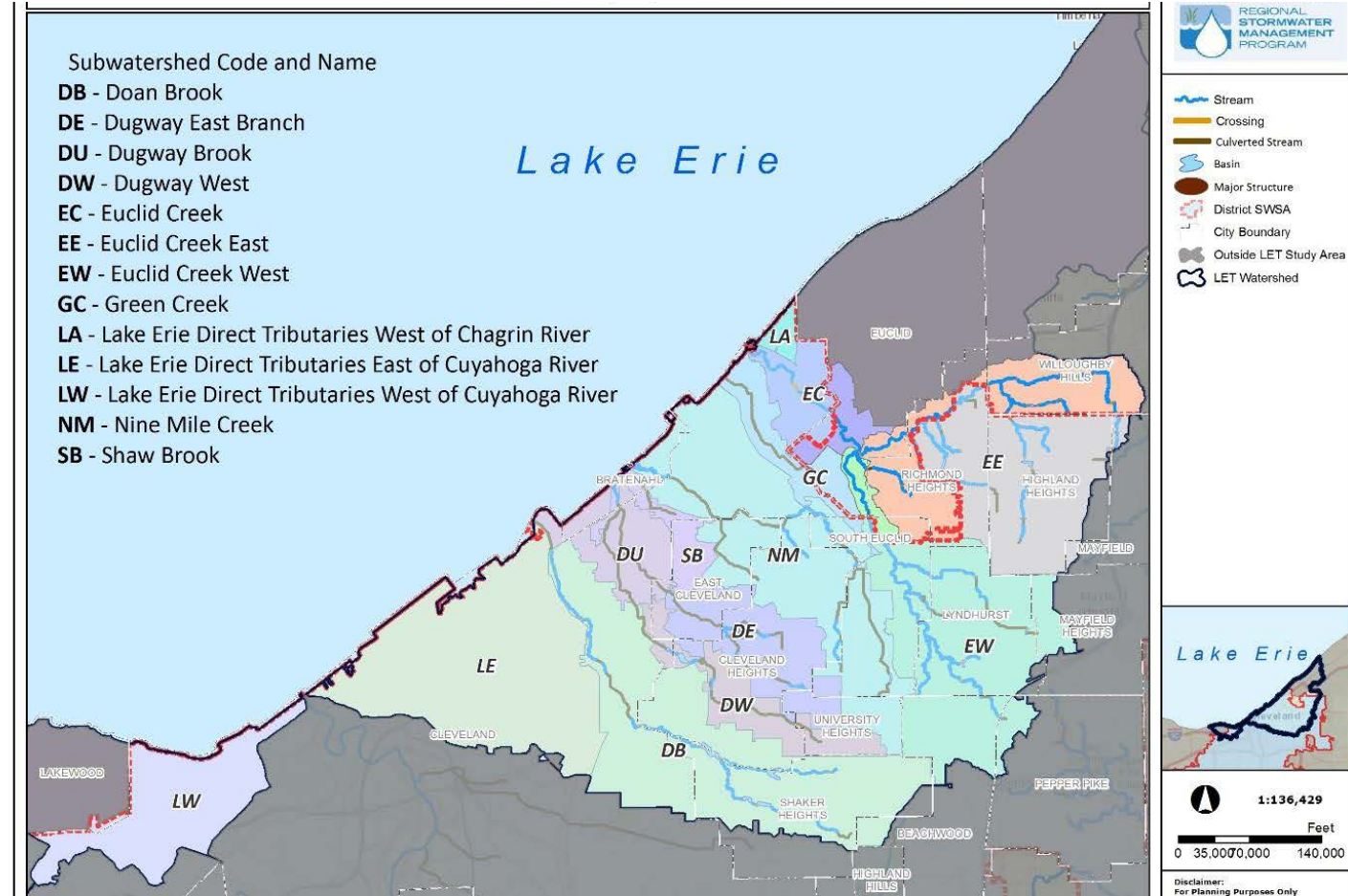
Watershed Overview - Chagrin River

- Includes 24 subwatersheds, 11 of which are in District's SWSA, and 10 communities
- 26.25 miles of assets within the SWSA
- Watershed Overview
 - Separate sewers
 - 269.72 mi² outside of the District's SWSA



Watershed Overview – Lake Erie Direct Tributaries

- Includes 13 subwatersheds and 17 communities
- 70.6 miles of Regional Stormwater assets within the Stormwater Service Area (SWSA)
- Watershed Overview
 - 35 mi² drained by Combined Sewer Systems
 - 59.82 mi² outside of the District's SWSA



Introduction to the CHALET Project

- B.S. in Civil Engineering from Ohio State University
- Wade Trim in Cleveland since March 2018
- Water Resources project focus



Introduction

What are ways we can effectively utilize affordable and widely available technology sources to more efficiently deliver for our clients?

1

Can we provide a source of supplemental data that will enhance all areas of a multi-year, multi-million dollar project?

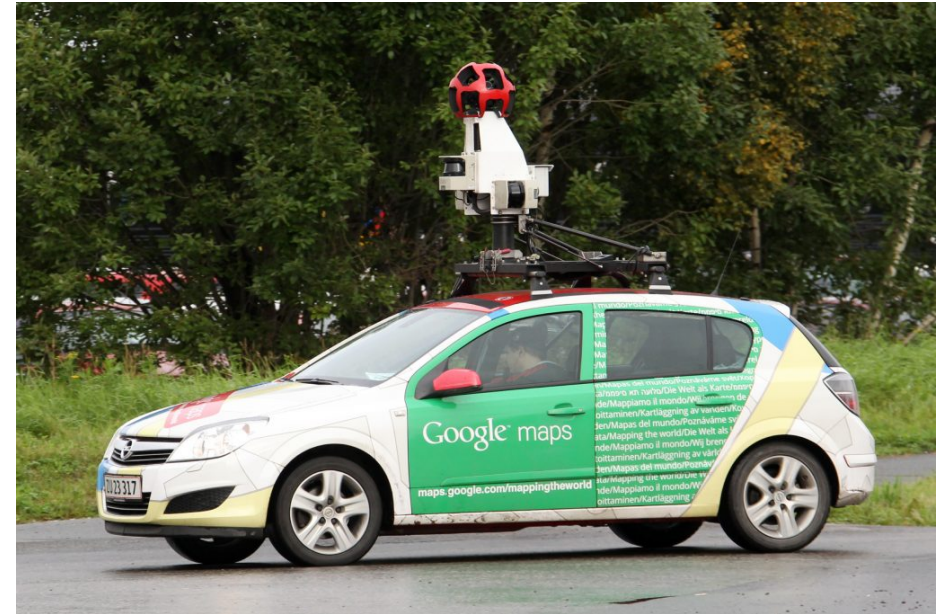
2

Can we utilize available technology to make field data collection processes faster, and more efficient?

Spherical Imagery – What is it?

What is it?

- Modular Immersive Mapping System (MIMS) collected down the center of a stream, channel or river
- Common data source: Google Streetview



Spherical Imagery – Data Collection and Equipment

Equipment and Components

Commercial Off The Shelf (COTS)
Equipment:

- Platform – ‘vehicle’ of collection (backpack, kayak, automobile etc.)
- LG 360 Camera
- Positioning device – GPS antenna/receiver
- Time source – android phone equipped with QPython to synchronize camera and GPS unit
- Equipment powered by portable battery

Data Collection Attire:

- Chest waders, safety vest, face mask

Additional Attire/Equipment:

- Hiking poles, pruners, food/water



Equipment cont.

Main Components for Data Collection:

- Platform – ‘vehicle’ of collection (backpack, kayak, automobile etc.)
- LG 360 Camera
- Positioning device – GPS antenna/receiver
- Time source – android phone equipped with QPython to synchronize camera and GPS unit



Emlid Reach GPS Units

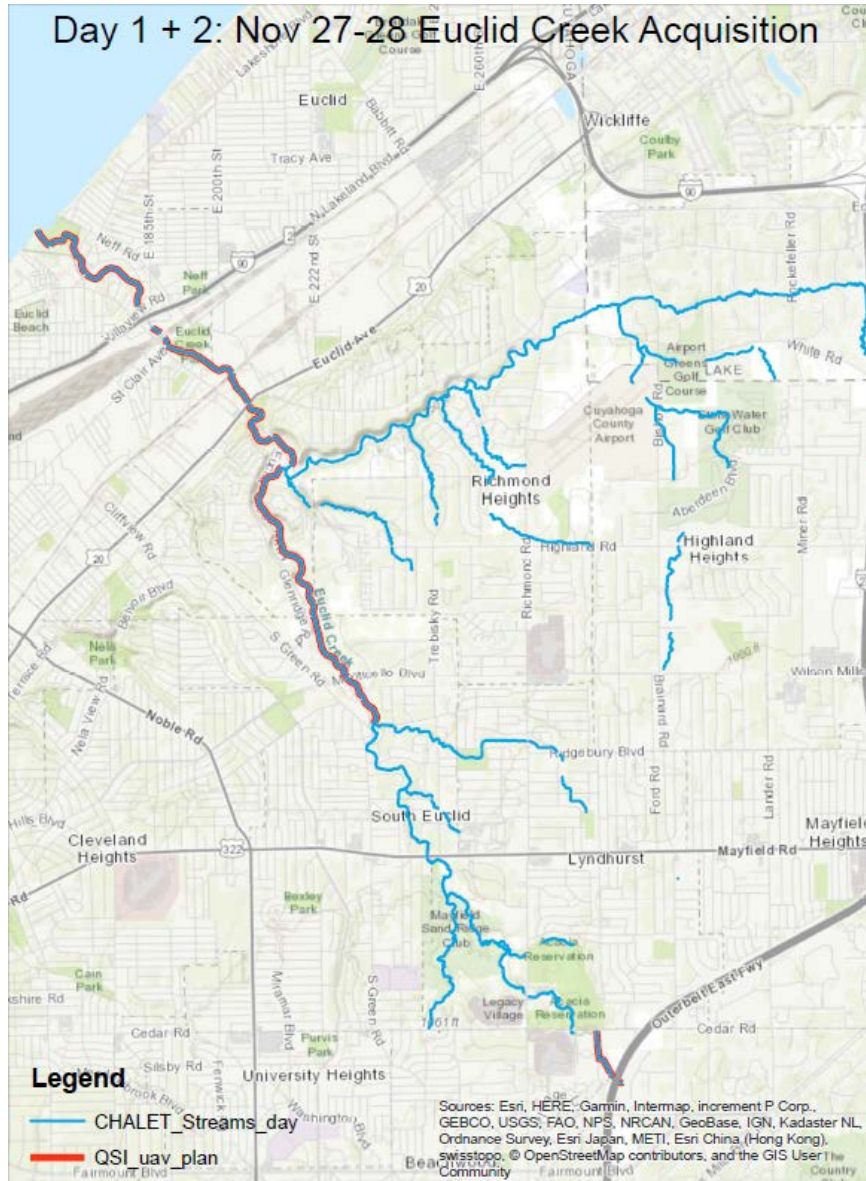


LG 360 Camera



Backpack Unit

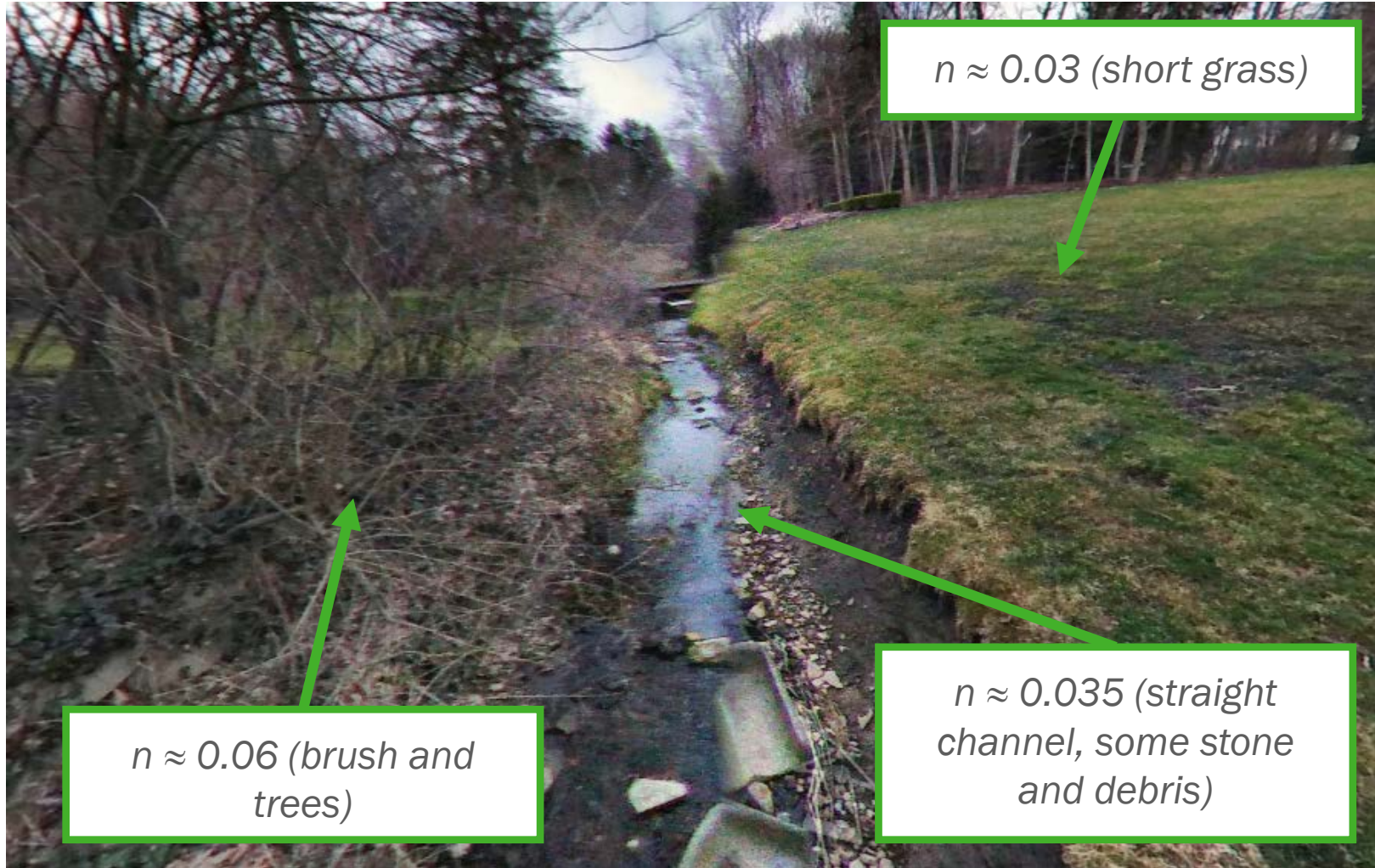
Collection



- Clean/fully charged equipment
- Cord connections are secure
- Camera and GPS are “talking”
- Have a plan for poor weather/lighting, irate property owners etc.

Spherical Imagery – How is it Utilized?

Stormwater Model Development



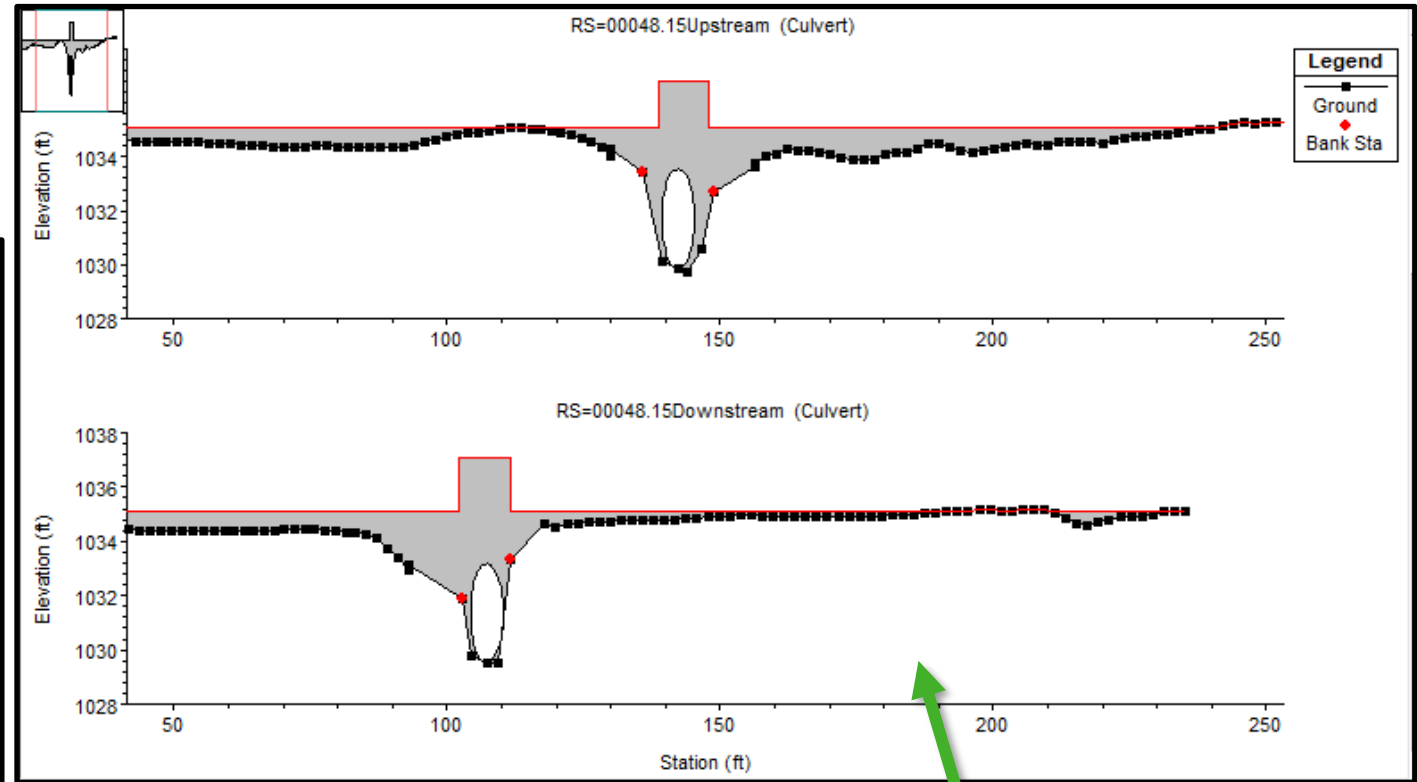
- Roughness value assignment for stream channel and banks

Stormwater Model Development cont.

- Assisting in modeling of hydraulic structures



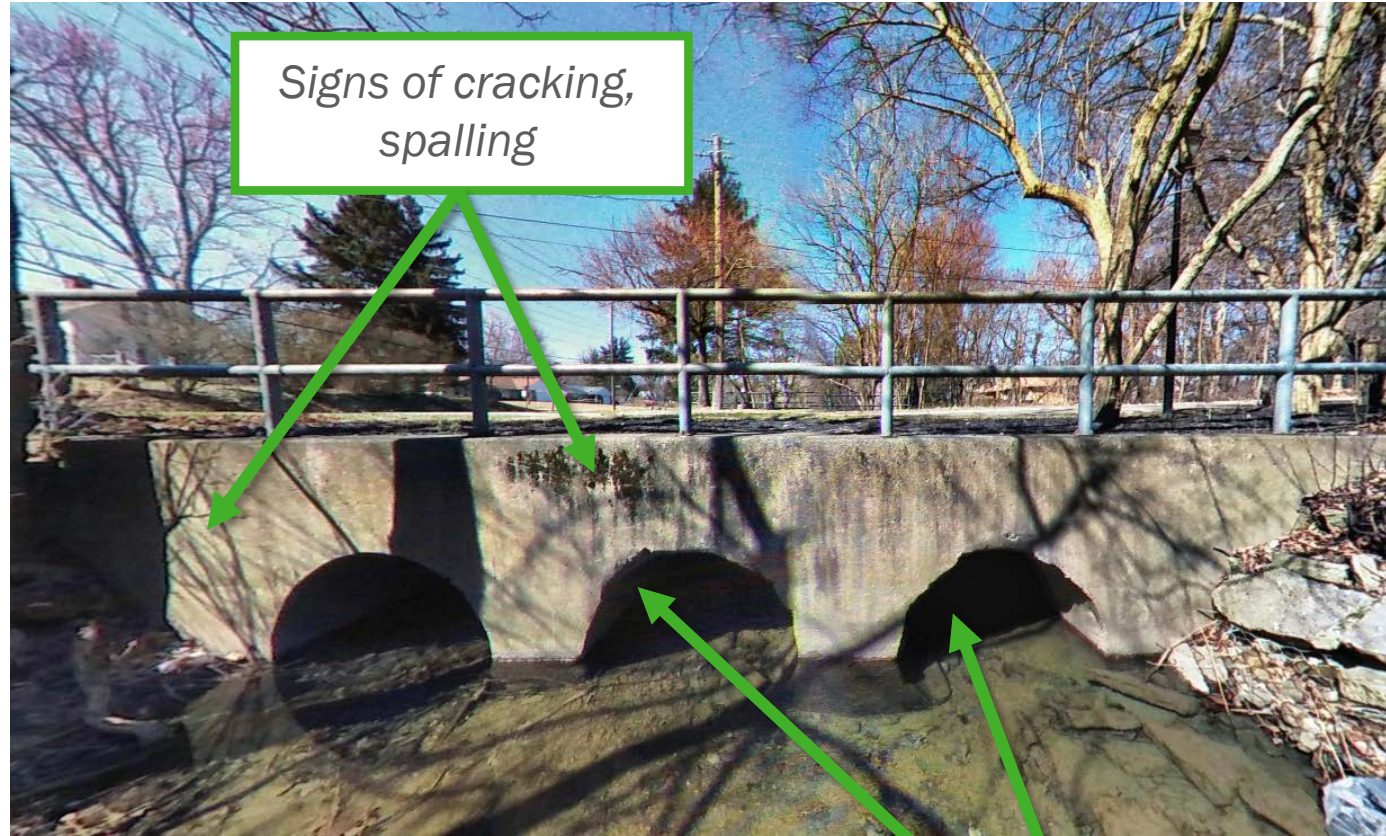
Spherical Imagery of culvert



HEC-RAS Model of the same culvert

Asset Inspections

- Preliminary condition assessments for client stormwater assets from desktop



Streambank Erosion

Weathering of concrete

Spherical Imagery – What Does the Data Look Like?

Spherical Imagery Data

- Raw data- individual images and GPS location points
- Final dataset a shapefile
- Images are paired with GPS location data by timestamp



Spherical Imagery Data cont.



- Unprocessed imagery “rolled out” in 2D space
- Processed Imagery hosted online
- Each point has own URL stored in attribute field

Processed imagery:

[https://dp4479dqtum7u.cloudfront.net/home/WadeTrim/201904/tour1510.html?startscene=313&startactions=lookat\(87.47,21.45,140,0,0\);](https://dp4479dqtum7u.cloudfront.net/home/WadeTrim/201904/tour1510.html?startscene=313&startactions=lookat(87.47,21.45,140,0,0);)

Lessons Learned

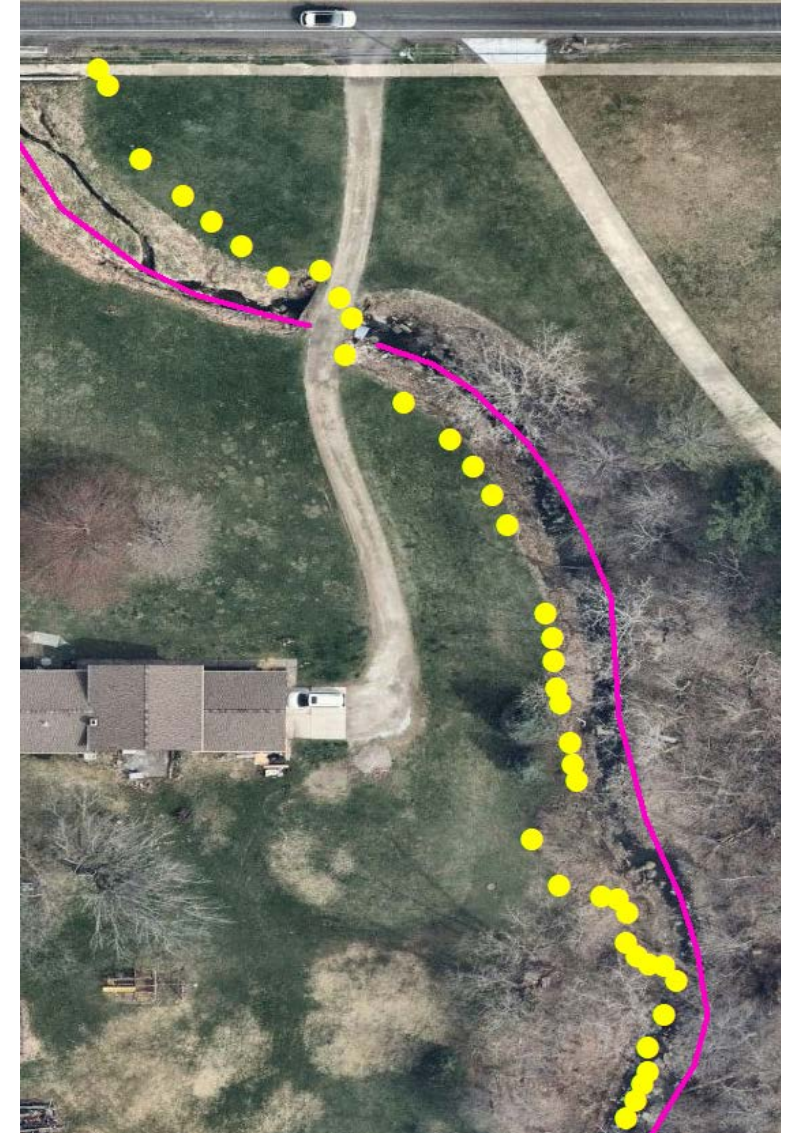
Lessons Learned – Data Quality Considerations



*Image blurriness due to
dirty camera lens or
poor stream walking
technique*

Lessons Learned – Data Quality Considerations

Images taken along stream banks

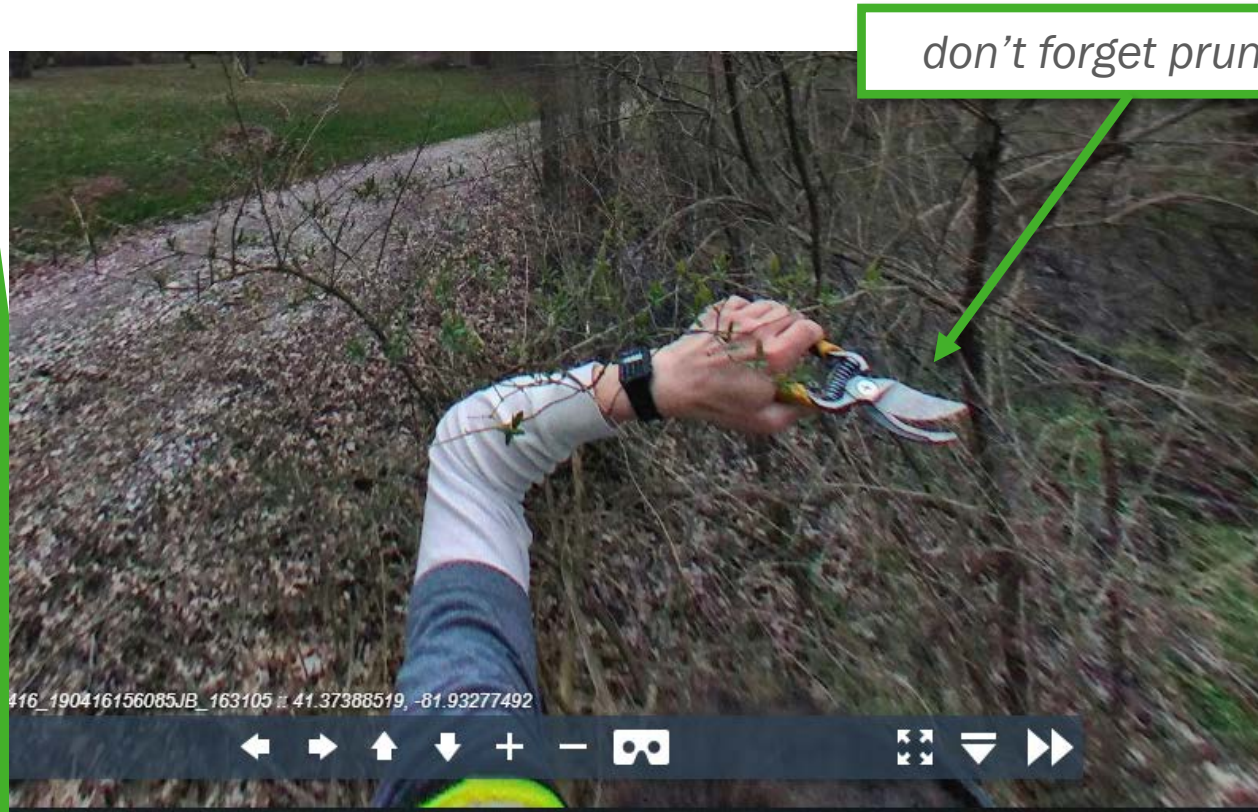


Lessons Learned – Data Quality Considerations



Stream Split not completely collected

Lessons Learned Cont.



don't forget pruners

This would have been easier to climb over



Innovative Data Collection and Management – Introduction

Innovative Data Collection and Management - Introduction



2a. How can we more efficiently collect and manage masterplan data during field activities?

2b. How can we allow field engineers to access client stormwater asset data in the field in real time without slowing down field activities?

Innovative Data Collection and Management – Introduction cont.

How can we
avoid this?



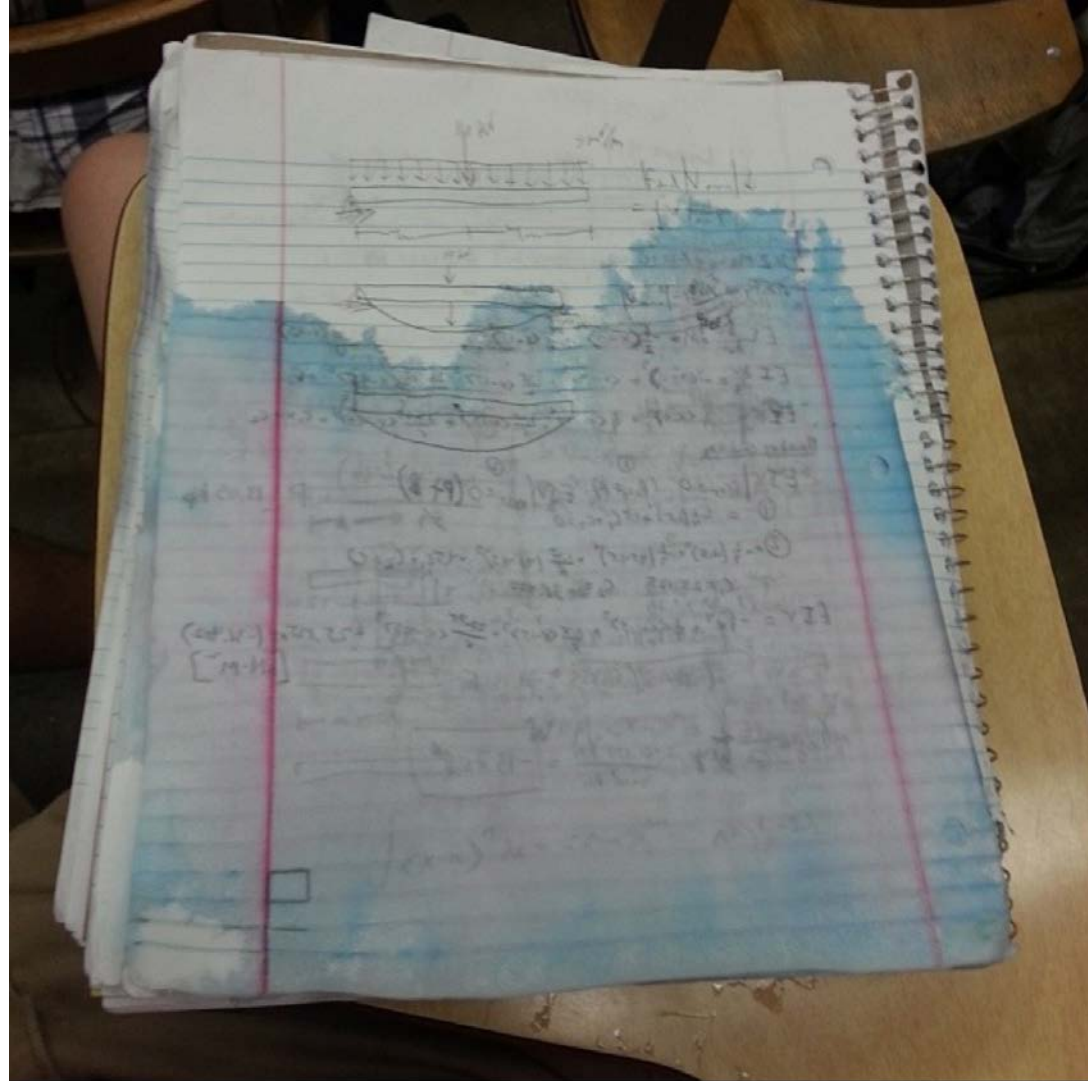
Innovative Data Collection and Management - Introduction cont.

...and this



Innovative Data Collection and Management - Introduction cont.

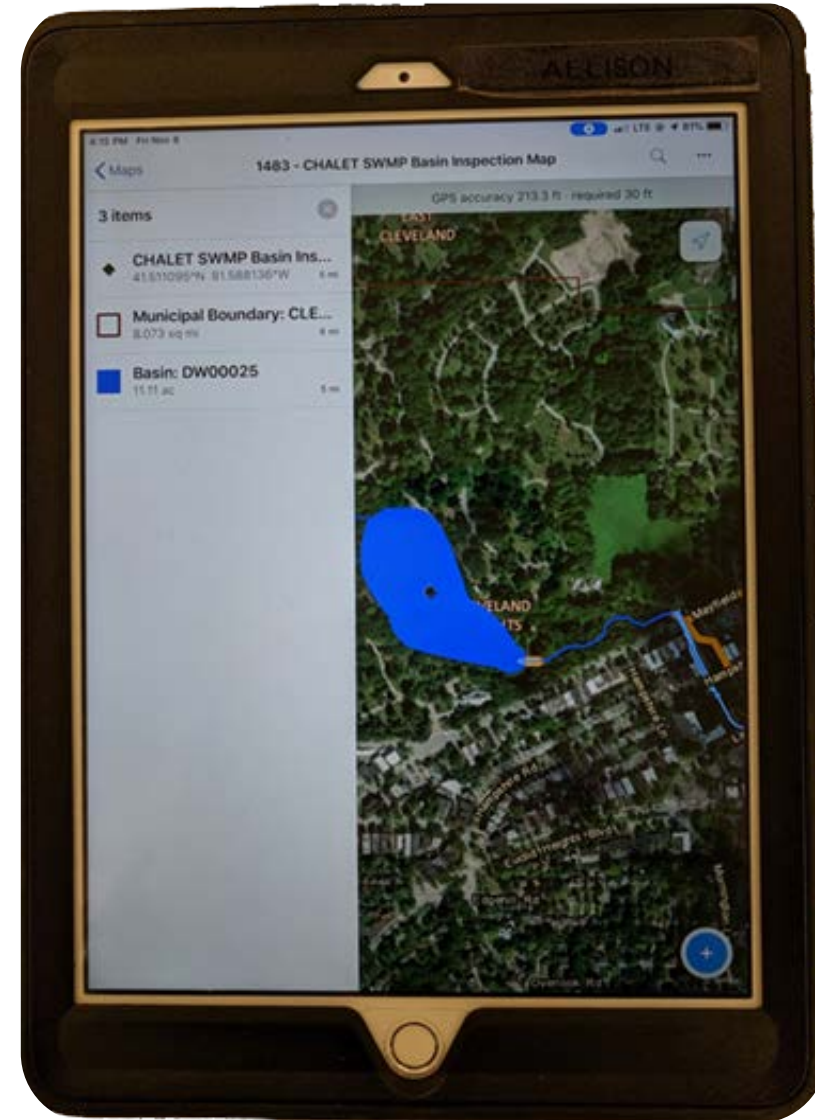
...and this



Innovative Data Collection and Management – Use of iPads for Field Data Collection and Access to Existing Datasets

Innovative Data Collection and Management - iPad

- iPads with mobile data and waterproof cases provided to field staff for asset inspections
- Stormwater asset data accessible during site visits through *Collector* app



Innovative Data Collection and Management

- Field forms created in *Survey123* app tailored to each type of field activity
- Digital forms optimized for quick and efficient assessments in the field
- Seamless upload to ArcGIS Online for viewing by the project team
- Automated generation of reports

The screenshot shows a mobile application interface for a survey form. The title bar is green and contains a close button (X), the text 'CHALET SWMP Basin Inspection Form', a location pin icon, and a menu icon (three horizontal lines). The form is divided into sections with expandable headers. The first section is 'General Inspection Information', which includes: 'RSS Asset?' with radio buttons for 'Regional' and 'Local'; 'Inspectors:' with a text input field; 'Weather:' with a text input field; 'Basin Type:' with radio buttons for 'Wet' and 'Dry'; and 'General Notes:' with a text input field. The second section is 'Forebay Assessment', which is partially visible. At the bottom right of the form, there is a green bar with a white checkmark icon.

Innovative Data Collection and Management - Introduction

- Field photos taken by iPads embedded in field forms



Wrap Up

Wrap Up

- Affordable, and widely accessible technology is utilized to provide invaluable data and faster, more efficient methods for field data collection
- High quality field data effortlessly collected and managed through high tech tools supports problem area definition and engineering alternatives for mitigating them

Questions