



LANGAN

**Quantified Efficiency and Enhancements of
Day-to Day Operations Utilizing an
Enterprise Geographic Information System –
“A Regional Authority’s Perspective”**

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Tony Yates, GISP – Langan Engineering & Environmental Services, Inc.

January 30, 2019

Agenda

- Take Away Message
- Background
- Technology Used / Enterprise Central Data Model
- Solutions / Impact
- Return on Investment (ROI)
- Future Implementations

Take Away

- What a GIS Enterprise system is and how it is incorporated
- The benefits of a central database model as it relates to your business processes and how it assists increasing efficiencies
- How this technology provides the ability to become more agile and responsive
- Overall how this impacts the bottom line!



Greater New Haven Water Pollution Control Authority

WWW.GNHWPCA.COM

- Four Member Communities
 - Hamden
 - East Haven
 - Woodbridge
 - New Haven
- 555 Miles of Sewer Pipes
- 30 Pump Stations
- East Shore Treatment Plant
 - 29 MGD – Average Daily Flow
 - 40 MGD – Design Flow - Secondary Treatment
 - 100 MGD – Wet Weather Flow Primary Treatment



Hamden
POPULATION
60,960

Woodbridge
POPULATION
8,890

New Haven
POPULATION
130,282

East Haven
POPULATION
29,257

CUSTOMERS 47,912
Population served 200k

Legend

GNHWPCA Sanitary Sewer Area
*Existing Preserved Open Space

History of GNHWPCA GIS Use

- 1964 City Planimetric Maps created to add all Sewer and Storm Sewer records
- 1997-2001 City of New Haven – GIS Layers - LTCP Hydraulic Models
- 2006-2008 Hamden, East Haven and Woodbridge GIS layers - Record Drawings
- 2009 GIS upgraded to use File Geodatabases
- 2010 Implemented use of centralized data model
- 2012 Implemented web and mobile environment for viewing and inspections

This was just the beginning!

What is a GIS Enterprise System

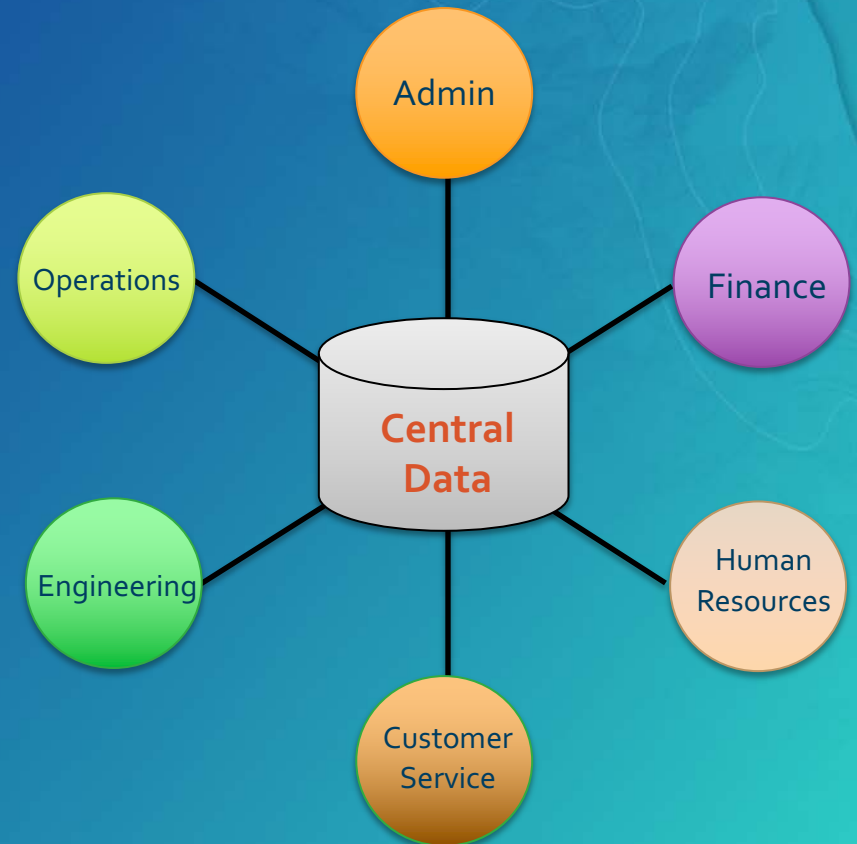
Centralization ≈ One database

- Reduced Risk
- Better Insight & Access
 - Real-time updates
 - Existing System Integration
- Highly Collaborative
 - Multi-User
- Increased Productivity
- Cost Effective
- Not All or Nothing

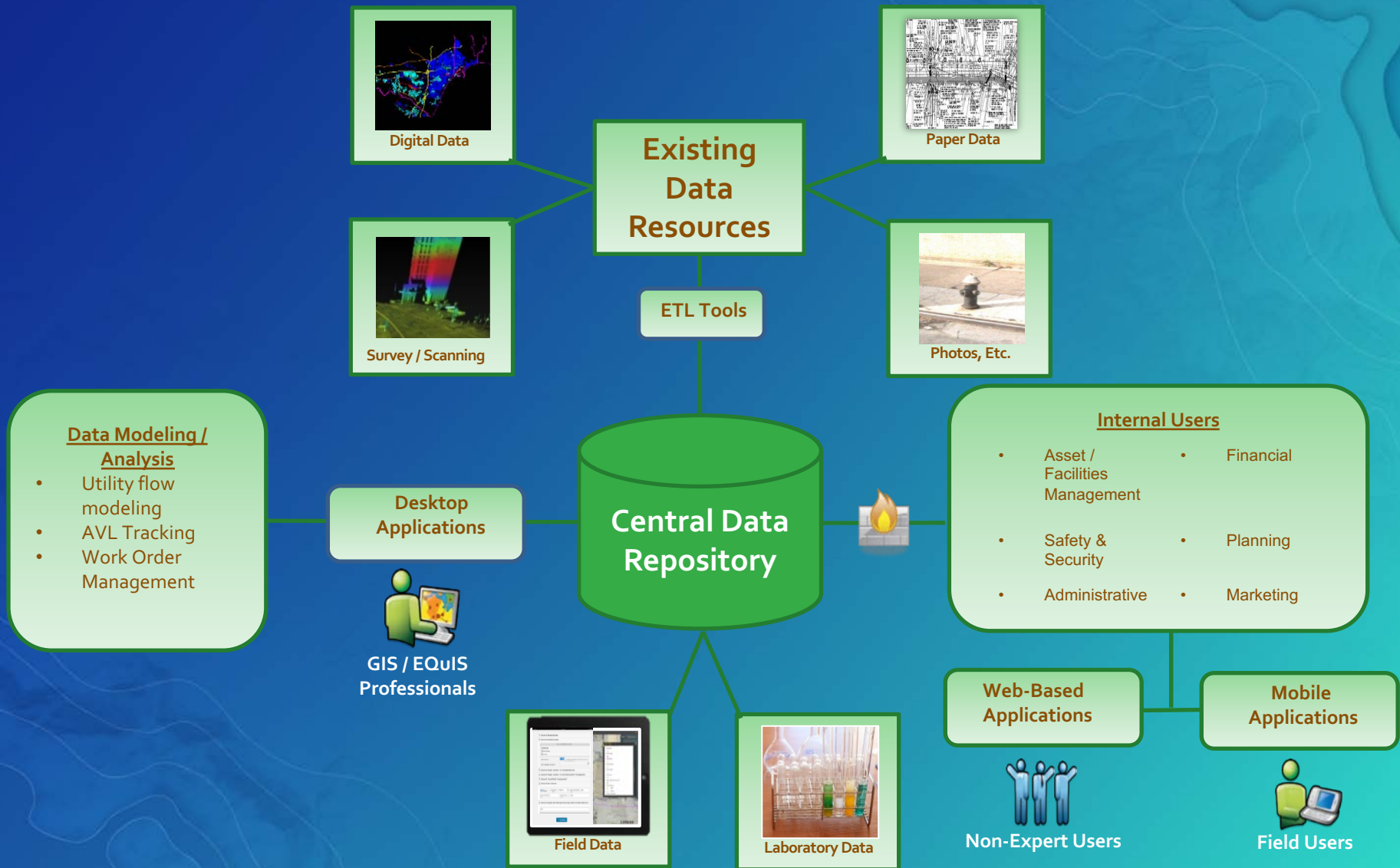


How Can a GIS Enterprise Be Applied

- **Multi-Departmental**
 - Shared costs / efforts
- **Central Data Location**
 - No data redundancies
 - Pool resources



Enterprise Central Data Model



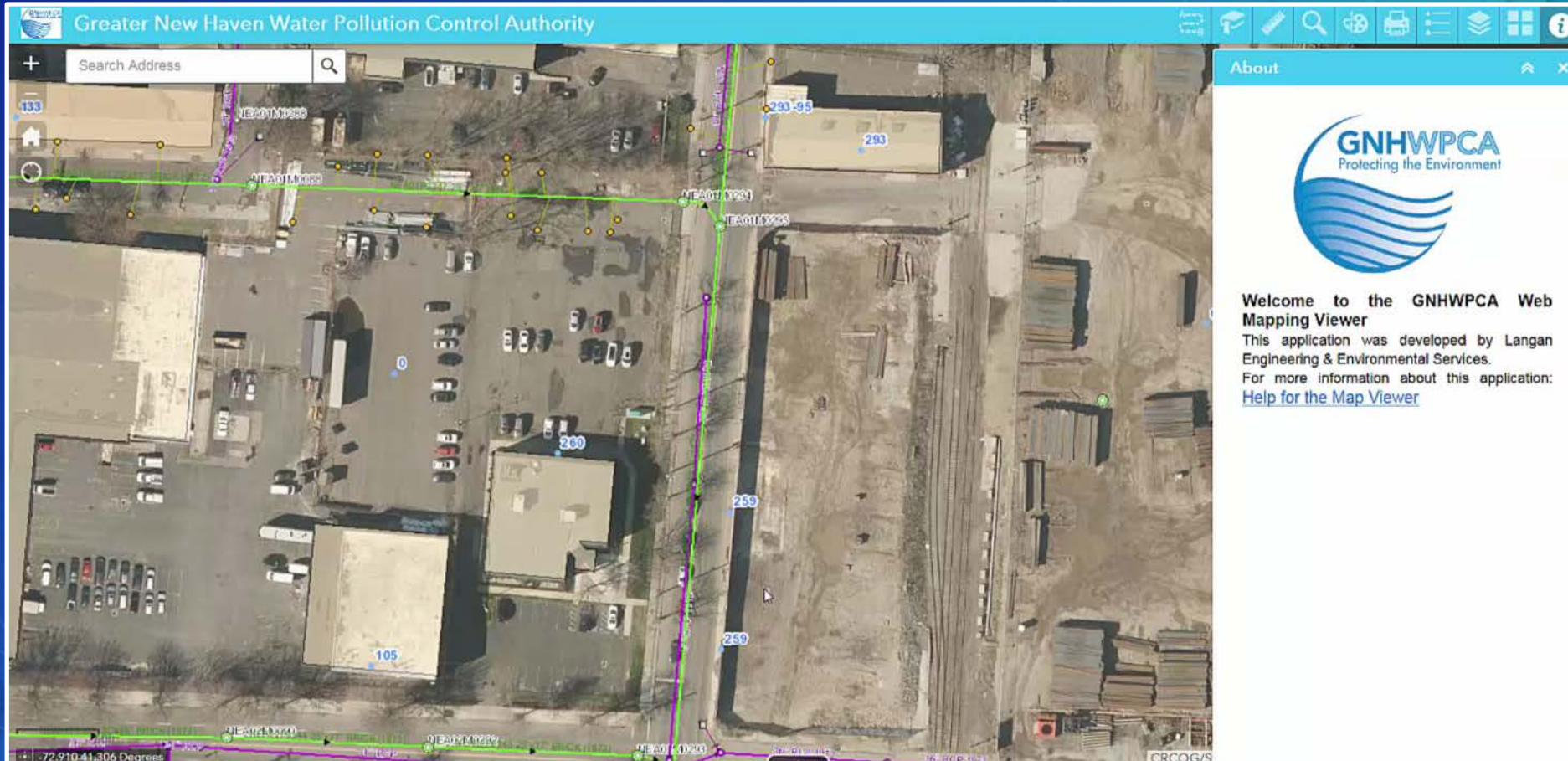
Central Data Model Population

- Existing GIS system files from previous consultants and internal staff
- Constant stream of modified paper drawings
- Field inspections and verification activities
- Traditional survey activities for new utilities / roadway improvements

User-Friendly Web Application

Greater New Haven Water Pollution Control Authority

Search Address



133

TEA0110988

TEA0110989

TEA0110991

TEA0110993

293

293-95

105

200

259

259

NEA0224460


NEA0110989

NEA0110990

72.91041306 Degrees

CRCOG/S

About



Welcome to the GNHWPCA Web Mapping Viewer

This application was developed by Langan Engineering & Environmental Services.

For more information about this application: [Help for the Map Viewer](#)

Mobile Manhole Inspections Forms

Greater New Haven Water Pollution Control Authority

Search Address

Sewer Manholes

To Edit Manhole: [Click Here](#)
Manhole ID: NEA02M0293
City, Town: New Haven
Rim Elev: 15.65000076
Bottom Elev: 3.50000019

Zoom to

41.307 -72.913 Degrees

GNHWPCA
Protecting the Environment

GNHWPCA Manhole Inspection Form

* required fields

Operator's Name: John Vuolo * **Date:** 3/21/2017 *

City/Town: HAMDEN **Location(Street):** Bradley ave

Sewershed: DX 04 **Manhole Number:** HDX04M0117

Cover Size: 22.5 inches **Cover Vented:** No **Potential for Runoff:** No

Cover Condition: Good **Evidence of Surcharge:** No

Depth (Rim to Inv.): 88 inches **Additional Information:** (Max Characters: 200)

Frame Condition: Sound

Wall Material: Brick

Wall Condition: Sound

I&I: (N) None

Bench Material: Brick

Bench Condition: Sound **MH Structural Rating:** 1 *

Inspection Status: (S) Surface Inspection **MH O/M Rating:** 1 *

Sheet Picture #: 6 **MH Picture #:** 7

Pipe Rating:

Picture #:	Pipe Number:	Pipe Material:	Pipe Diameter:	Structural:	O/M:
Out: 8	HDX04P0119	Clay/VCP/Tile	8 inches	1 *	1 *
In 1:			inches		
In 2:			inches		
In 3:			inches		

Submit

Development Plan Reviews

Greater New Haven Water Pollution Control Authority

Flow Test and Plan Review Forms

Search Address

Legend

- Flow Tests
 - Active Manholes
- Plan Review
 - Plan Review
- Sewer Manholes
 - Inactive Manholes
 - Active Manholes
- CIPP Sewer Mains
 - CIPP
 - Future CIPP
 - Abandoned CIPP
- Sewer
 - Sewer
 - Utility
 - Private
 - Sewer Connection
 - Sewer Lateral

72.911 41.305 Degrees

Flow Test Data Analysis

Greater New Haven Water Pollution Control Authority **Flow Test and Plan Review Forms**

Search Address

(1 of 3) **Flow Tests**

ID: 76
 Town: New Haven
 Street1: 213 Crown Street
 Street2:
 ProjectDesc: 280 Crown Street
 FlowMeterLocation: NUN04M0713
 LocX: 950811
 LocY: 672176
 Start Date: 10/17/2014, 8:00 PM
 End Date: 11/6/2014, 7:00 PM
 Conducted By: EST
 PlanReviewNumber: 2014-115
 MeterNotes:
 ReviewedBy: RCEBALLOS
 ReviewDate: 12/4/2014, 7:00 PM
 TVInspectionSubmitted: 0
 ReviewComments:
 LinkData:
X:\DevelopmentReview\2014-115\2014-115_Crown.pdf
 Zoom to

600ft 41.305172931 Degrees

6/24/2009	2:17:00	AM	84.14	2.26	2.96	0.00
6/24/2009	2:32:00	AM	81.94	2.20	2.96	0.00
6/24/2009	2:47:00	AM	81.75	2.20	2.96	0.00
6/24/2009	3:02:00	AM	82.30	2.22	2.95	0.00
6/24/2009	3:17:00	AM	85.34	2.29	2.96	0.00
6/24/2009	3:32:00	AM	86.18	2.32	2.96	0.00
6/24/2009	3:47:00	AM	84.08	2.26	2.95	0.00
6/24/2009	4:02:00	AM	81.23	2.19	2.94	0.00
6/24/2009	4:17:00	AM	80.10	2.17	2.92	0.00
6/24/2009	4:32:00	AM	80.41	2.19	2.91	0.00
6/24/2009	4:47:00	AM	80.54	2.18	2.93	0.00
6/24/2009	5:02:00	AM	81.62	2.20	2.96	0.00
6/24/2009	5:17:00	AM	81.34	2.19	2.96	0.00
6/24/2009	5:32:00	AM	80.70	2.17	2.96	0.00
6/24/2009	5:47:00	AM	81.69	2.19	2.97	0.00
6/24/2009	6:02:00	AM	83.86	2.24	2.98	0.00
6/24/2009	6:17:00	AM	87.86	2.33	3.00	0.00
6/24/2009	6:32:00	AM	89.28	2.35	3.02	0.00
6/24/2009	6:47:00	AM	92.03	2.40	3.06	0.00
6/24/2009	7:02:00	AM	93.56	2.42	3.10	0.00
6/24/2009	7:17:00	AM	98.47	2.49	3.18	0.00
6/24/2009	7:32:00	AM	88.55	2.59	3.31	0.00
6/24/2009	7:47:00	AM	95.82	2.60	3.37	0.00
6/24/2009	8:02:00	AM	88.22	2.54	3.32	0.00
6/24/2009	8:17:00	AM	88.19	2.59	3.31	0.00
6/24/2009	8:32:00	AM	92.94	2.59	3.35	0.00
6/24/2009	8:47:00	AM	92.42	2.56	3.35	0.00
6/24/2009	9:02:00	AM	83.69	2.54	3.28	0.00
6/24/2009	9:17:00	AM	82.31	2.52	3.27	0.00
6/24/2009	9:32:00	AM	82.45	2.50	3.28	0.00
6/24/2009	9:47:00	AM	75.20	2.43	3.23	0.00
6/24/2009	10:02:00	AM	94.86	2.40	3.17	0.00
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6/24/2009	10:32:00	AM	97.19	2.47	3.16	0.00
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6/24/2009	11:47:00	AM	94.26	2.41	3.14	0.00
6/24/2009	12:02:00	PM	97.30	2.48	3.15	0.00
6/24/2009	12:17:00	PM	110.42	2.72	3.46	0.00
6/24/2009	12:32:00	PM	153.53	2.90	3.76	0.00
6/24/2009	12:47:00	PM	198.59	3.05	3.99	0.00
6/24/2009	1:02:00	PM	460.78	3.94	5.27	0.00
6/24/2009	1:17:00	PM	253.80	3.40	4.61	0.00
6/24/2009	1:32:00	PM	134.95	2.74	3.67	0.00
6/24/2009	1:47:00	PM	98.75	2.58	3.41	0.00
6/24/2009	2:02:00	PM	89.75	2.51	3.35	0.00
6/24/2009	2:17:00	PM	86.90	2.49	3.33	0.00
6/24/2009	2:32:00	PM	176.86	2.85	3.83	0.00
6/24/2009	2:47:00	PM	439.00	3.75	5.27	0.00
6/24/2009	3:02:00	PM	266.80	3.48	4.64	0.00

Emergency Repairs Tracking

Greater New Haven Water Pollution Control Authority

Emergency Repairs

ArcGIS World Geocoding Service

New Haven

Yale University

Yale-New Haven Hospital

Emergency Repairs

- Click Add Repair button
- Click on the map to create a repair job

Add repair

Select an job to edit or delete.

72.924 41.306 Degrees

CRCOG/State of CT, New

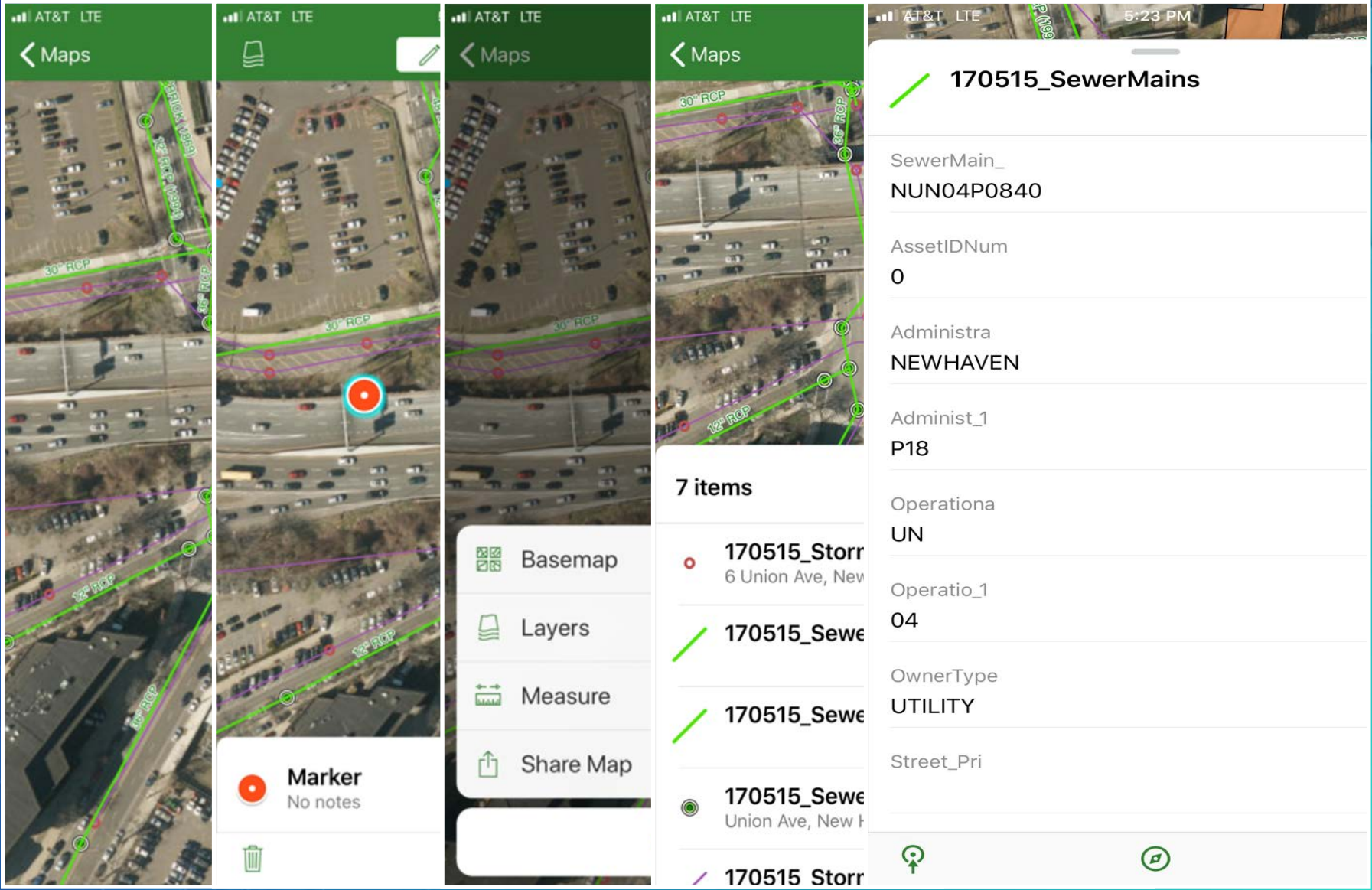
Pipe Editing & Rehabilitation Planning

The screenshot displays the 'Pipe Editor' software interface for the Greater New Haven Water Pollution Control Authority. The main map area shows an aerial view of New Haven, CT, with various streets and landmarks labeled, including Yale University and New Haven. Overlaid on the map are several sewer mains and manholes. The legend on the right side of the interface provides details about the symbols used:

- Manhole Form**
 - Inactive Manholes (represented by a grey circle)
 - Active Manholes (represented by a green circle)
- Sewer Mains - CIPP**
 - Future CIPP (represented by a blue line)
 - CIPP (represented by a red line)
 - <all other values>
- World Imagery Metadata**
- Sewer Mains**
 - Sewer**
 - Pump Stations
 - Utility (represented by a yellow square)
 - Private (represented by a grey square)
 - Sewer Main
 - Low pressure, Active (represented by a blue line with a cross)
 - Abandoned Main (represented by a grey line with a cross)
 - Active Gravity Main (represented by a green line with a cross)

The interface also includes a search bar at the top left labeled 'ArcGIS World Geocoding Service' and a title bar at the top with the text 'Greater New Haven Water Pollution Control Authority' and 'Pipe Editor'.

Mobile Apps



Call Before You Dig - 811



Request Date: 05/10/15
Town: WOODBRIDGE
Address: 25 New

Dear Ms Deborah
Thank you for contacting us to affect the sanitary



Disclaimer

The information highlighted in your request is defined when submitted to GNHWPCA sewer mapping data or you have received this message in error please resubmit your request or contact CBYD.

This information is given for your private use only. Although compiled from record plans, there is no guarantee that this data is free from errors or omissions.

For further enquiries or assistance with interpretation of plans and search content, or to report any obvious errors with the data provided, please contact our GNHWPCA support team via email at diglist@gnhwpc.com.

Thank you for contacting us to affect the sanitary

Best Regards,
Sewer Support Team
GNHWPCA

Please note: Any damage to GNHWPCA sewer infrastructure shall be reported immediately to our emergency number (24 hours, 7 days) at 203-466-5260.

Neither Greater New Haven Water Pollution Control Authority (GNHWPCA) or PelicanCorp makes representation or warranty as to the accuracy or completeness, or fitness for purpose of the information or data set out in this document. This asset plan is not advice. Before taking action, you need to make your own independent assessment, including whether to obtain specific professional advice. Use of such information is subject to and constitutes acceptance of these terms.



Request Date: 05/10/15
Town: NEW HAVEN
Address: Humphrey

Dear Mr Joe Sefcik,
Thank you for contacting us to affect the sanitary



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Greater New Haven Water Pollution Control Authority
260 East Street, New Haven, CT 06511 203.466.5280 p 203.772.2027 f www.gnhwpc.com

Call Before You Dig (CBYD) Request No. 20153102163

Request Date: 07/29/2015
Town: ct.new haven
Address: long wharf dr



Know what's below.
Call before you dig.

Dear jim knell,

Thank you for contacting Call Before You Dig (CBYD) prior to engaging in work or activities that may affect the sanitary sewer infrastructure of the Greater New Haven WPCA (GNHWPCA.)



Critical GNHWPCA sewer force mains or pressure sewer assets have been identified within your marked search area. GNHWPCA personnel will visit the site to mark the location of our sewer infrastructure and to provide additional information. The enclosed map shows the approximate location of our sewer infrastructure in the area of your project.

Disclaimer

The information and plans provided have been generated by an automated system based on the area highlighted in your CBYD request. It is your responsibility to ensure that the excavation site is properly defined when submitting your CBYD request and it is your responsibility to **field verify** the location of all GNHWPCA sewer infrastructure prior to the start of work. If the information does not match the excavation site or you have received this message in error please resubmit your request or contact CBYD.

This information is given for your private use only. GNHWPCA sewer mapping data is for planning purposes only. Although compiled from record plans, there is no guarantee that this data is free from errors or omissions.

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Thank you for contacting CBYD service.

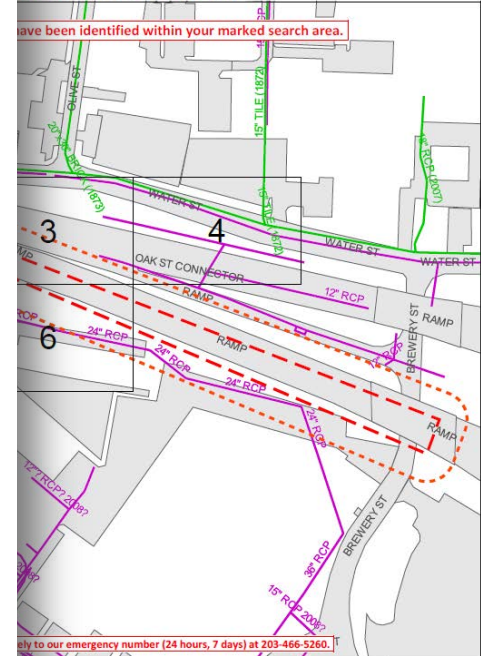
Best Regards,

Call Before You Dig Support Team
GNHWPCA

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Structure (Forced Main)



Sanitary Sewer CCTV Inspections

Greater New Haven Water Pollution Control Authority

Search Address

NEA01M0288
NEA01M0088
NEA01M0293
NEA01M0292
NEA01M0291
NEA01M0290

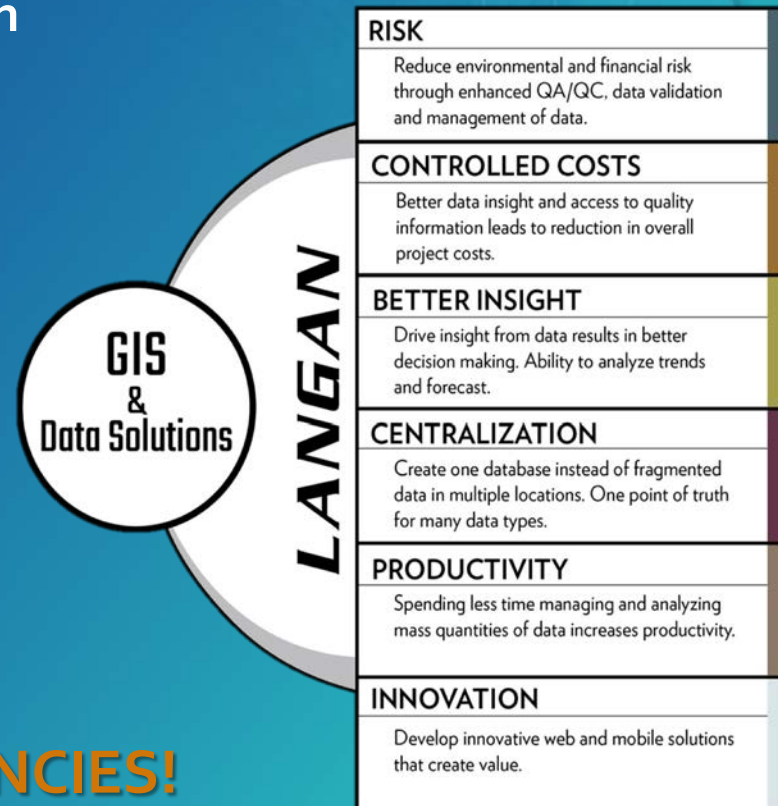
105
260
259

10.0 FT
0.0 H52

CRCOG/State of CT, New York State, USDA FSA, Microsoft
POWERED BY esri

Benefits of Central Data Model

- **Greater Inter-Organizational Cooperation ≈ Lessen Costs**
 - Increased Communications / Collaboration
 - Quicker Access to Information
- **Reduction of Duplication of Efforts**
 - Provides ability to make better decisions
 - Respond to emergencies better
- **Long-Term Sustainable System**



OVERALL INCREASED EFFICIENCIES!

Return on Investment (ROI)

Thousands of organizations have incorporated GIS technology into their daily operations. Many can't imagine working without it and the uses for this technology continue to evolve at a rapid rate.

Generally accepted that the payback for mapping alone is greater than 1:1

The incremental costs for new applications is small and the ability to save time and money and improve quality and decision making increases significantly.

The ROI continues to increase as the applications expand.



Capital Investment Required

GIS Implementation (3 Years):

- Esri Software
- Computer Hardware
- Staff GIS Manager
- Mapping Data Inputs
- GIS Enterprise

GNHWPCA:

Initial Capital
Investment \approx \$700,000*

Investment
Cost Per Person \approx \$3.50
Cost Per Customer \approx \$14.00

* Topo Map & Flyover not
included – not required today

GIS Applications:

- Software Applications
 - WebViewers
 - Inspection Forms
 - Mobile Apps
 - CBYD Automated Platform

GNHWPCA:

Typical Capital Cost
Per Application \approx \$10,000

Total Investment \approx \$80,000

APP Cost Per Person \approx \$0.40

Total GIS Capital Investment Per Mile of Sewers \approx \$1,400

Operation and Maintenance Costs

GIS Enterprise O&M:

- Licensing Fees
- Contracted Services – Data Updates, Computer and Server Maintenance

GNHWPCA:

GIS Enterprise
Annual O&M \approx \$70,500
O&M Cost Per CCF \approx \$0.01
O&M Per Customer \approx \$1.41

Incremental Application O&M:

- Licensing Fees (CBYD)

GNHWPCA:

GIS Enterprise
Incremental O&M \approx \$12,500
O&M Cost Per CCF \approx \$0.001
O&M Per Customer \approx \$0.25

Total Annual GIS O&M Cost Per Mile \approx \$150

Cost Savings

GIS Enterprise enables the GNHWPCA to provide the benefit of high quality services to its executive board, staff, customers, contractors, service utilities and other entities in the region.

Inherent benefits and direct cost savings accrue to the GNHWPCA and the region through:

- Labor and processing time savings which also increases personal health and efficiency and results in direct annual cost savings
- Better decision making which provides time savings, confidence and ability to respond during emergencies, and reduces capital investment expenditures
- Increased quality which improves communications, provides time savings and cost avoidance through rework or mistakes

Cost Savings

GNHWPCA Savings:

- Number of Staff
- Staff Labor Hours
- Labor Overtime
- Travel Costs for Site Inspections
- Permit Compliance
- Consultant Costs
- Construction Costs
- Legal Costs*
- Data Record Keeping, Processing and Copying Costs

Estimated Savings:

GIS Annual Savings \approx \$743,000

Annual Savings Net of Expenses \approx \$660,000

Annual Net Savings Per CCF \approx \$0.08

Annual Net Savings Per Customer \approx \$13

Annual O&M ROI \approx 795%

Capital ROI (10yr) \approx 282%

Capital ROI (20yr) \approx 476%

Total Annual GNHWPCA Savings Per Mile \approx \$1189

Cost Savings

Contractors and Other Agency Savings:

- Planning Time Savings
- Reduced Permitting Costs
- Reduced Construction Costs
- Reduced Data Record Search, Filing, and Copying Costs
- Avoidance of Costly Mistakes

Customer Savings:

- Time
- Reduced sewer bills
- Reduced home improvement costs
- Reduced Data Record Search, Filing, and Copying Costs
- Cost avoidance

GNHWPCA net annual savings are passed directly on to customers.

Customer, contractor and other agency savings are in addition to, and will vary depending on economic development activities.

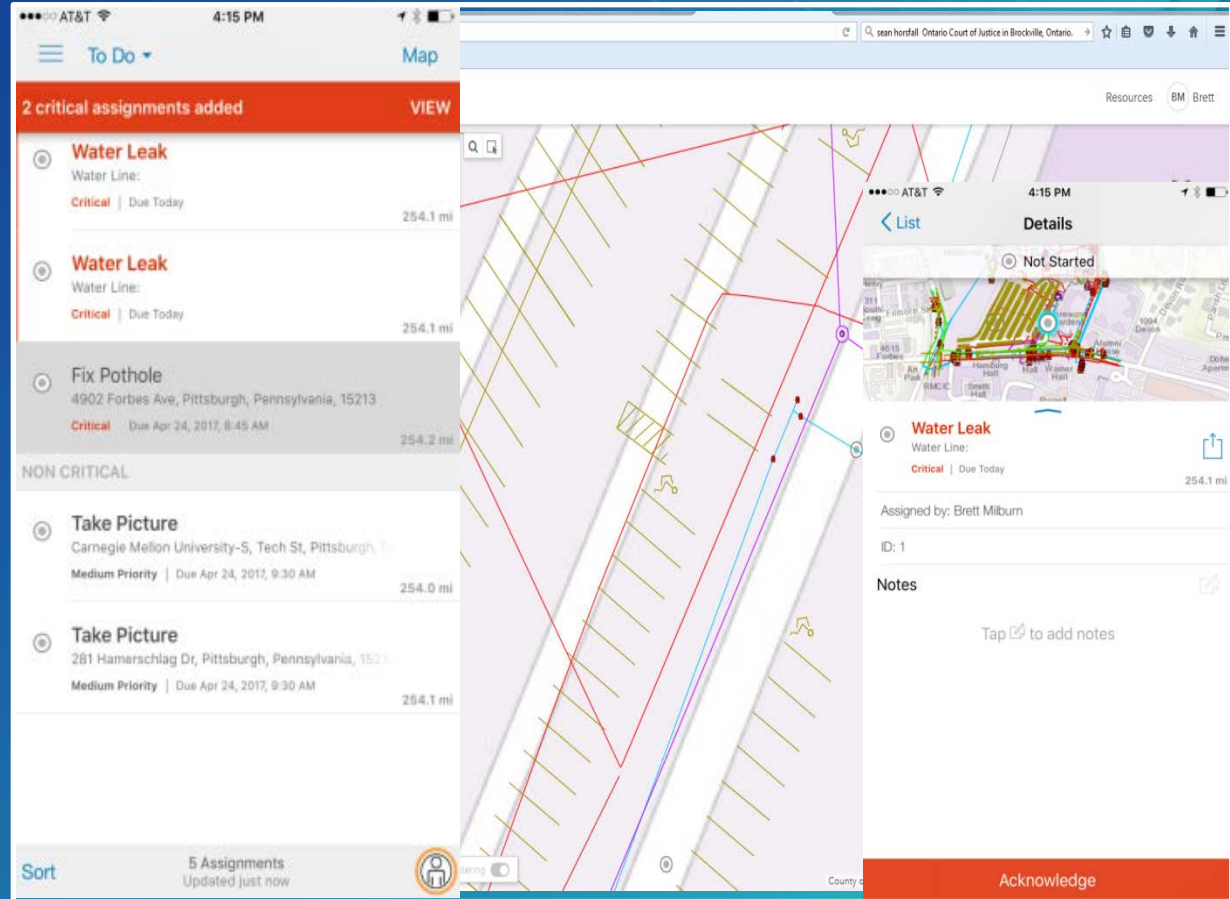
These additional savings could double the GNHWPCA direct savings.

Future Implementations

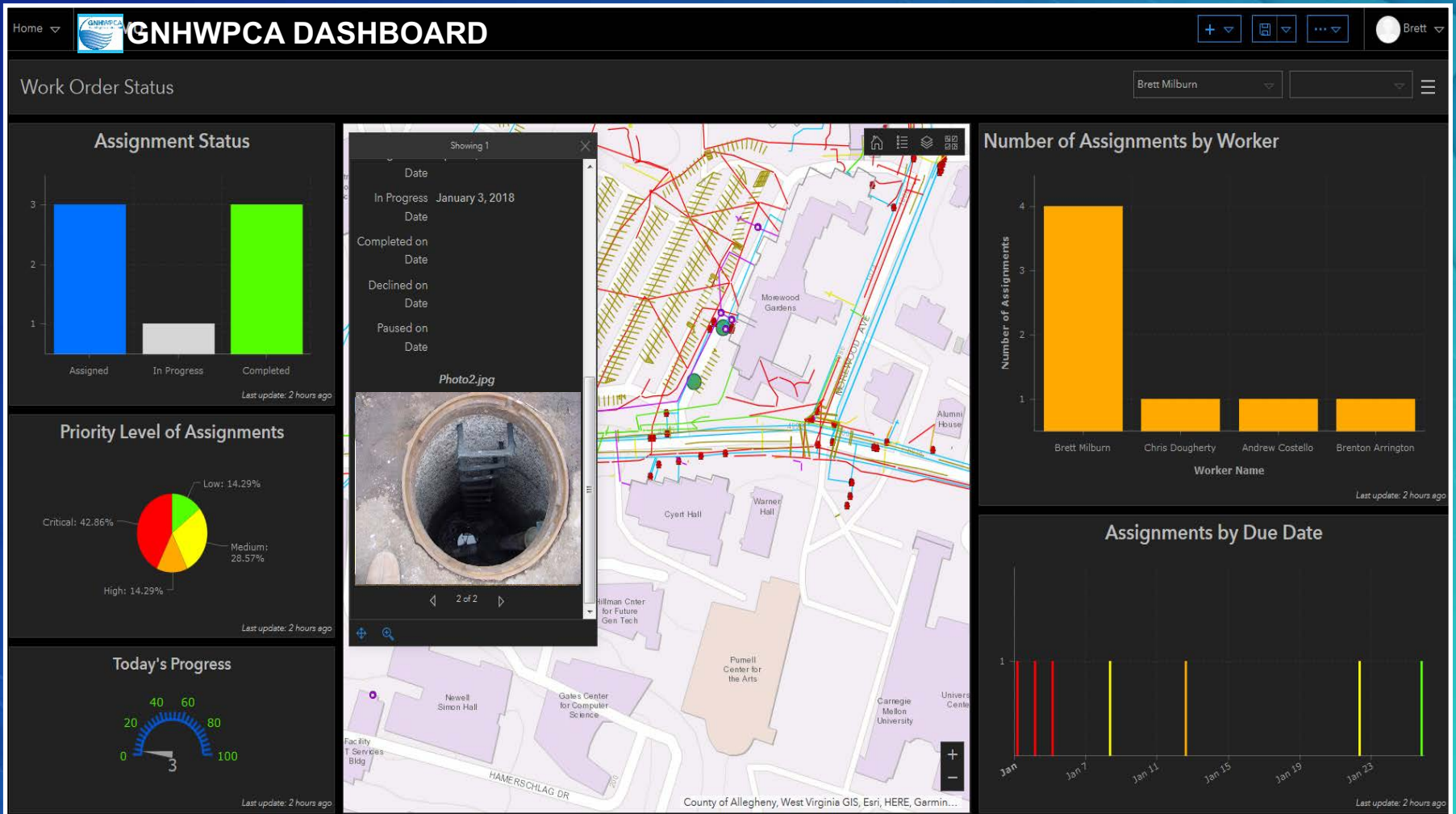
- Laboratory analysis information
- DMR Report
- Additional application roll-out
 - Work Order Management
 - Esri Collector and Survey123
- Impervious Coverage / Storm water Billing

Work Order Management

- Assign task orders/maintenance items
- Locate, dispatch and route workers
- Progress tracking
- Integrate with mobile collection applications
- Ability to capture photos and notes
- Single enterprise asset model



Work Order Management



Questions

Ricardo Ceballos, PE

Greater New Haven WPCA

rceballos@gnhwpca.com

Tony Yates, GISP

Langan Engineering & Environmental Services, Inc.

tyates@langan.com