Introductions:

- Ed White – Chairman/CEO
  - RTP Based technology company, founded in 2002
    - Patented technology
    - Software products and services focused on collecting and sending information from the field
  - Experience with NGA members
    - Works with a number of NGA members and contractors to eliminate paper in key processes such as DIGSAFE, EAM, Construction, Safety, Time / Materials Management, QA-QC

- David Poore – GIS Manager
  - Norwich Public Utilities (NPU) provides four utilities to the City of Norwich, CT
    - Natural gas
    - Electricity
    - Water
    - Wastewater collection
Objectives of NGA

- Standardize construction / operation procedures for LDCs
- Standardize / improve training
- Standardize forms to capture data that can be used to determine failure trends and perform root cause analysis of failures
- Improve accuracy of inspections with full validation of data when captured
- Reduce costs
- Provide a SINGLE platform for all contractors to use when performing compliance inspections
- Build to support PHMSA Standards
Inspection Challenges

- Increased regulatory pressure at state/federal level.
- Inconsistent data capture approach impedes analytics, potentially increases risk.
- Multiple independent contractors, each working for multiple utilities.
- Inconsistent training reduces data quality.
- Incomplete or inaccurate asset data.
Issues / challenges to deploy multi-utility solution

Sharing of Data Between Utilities

• No customer or premise data to be shared
• Data to be shared would be limited to material / processes

Security

• Integrity of mobile technology solution
• Cloud based hosting

Some level of mobile technology deployment by most member utilities

• Leverage existing mobile technology
• Complement software already in use

Standardization of data model

• Common formats
• Mapping where required
SOLVING THE FIELD DATA COLLECTION PROBLEM
The Solution

- Asset and Information Sharing Service that:
  - Extracts and delivers inspection forms to and from the field.
  - Provides all required business rule validations.
  - Enables workflow and approvals.
  - Provides inspection analysis.
  - Provides updated forms based on regulatory changes.
  - Provides long-term storage of inspection data for analysis for on-going improvement.
  - Provides long-term vault of the inspection forms to meet regulatory requirements.
  - Provides asset and inspection performance.
The Benefits

Collection of the Right Data:
• Intuitive user interface guides the collection of critical data (paper eliminated).
• Common form based on industry established standards used across member companies.

Enhanced Data Quality and Content:
• Data captured at the point of work performance.
• Capture images, video, audio notes and GPS coordinates.
• Comprehensive approvals process.
• Creation and/or augmentation of asset record.
• As-installed asset condition associated to specific assets and asset classes.

Integrated Unstructured Data (e.g. Sketches)

Resilient Solution that works on or off-line

Data Analysis Capabilities Enable Work Performance Benchmarking

Service fees include upgrades to support new regulatory requirements
What does it look like? Digital vs Paper
How do we do it? The technology architecture

- PC based software to create digital form templates
- Mobile device application used to complete digital forms with 256bit AES Encryption
- SAS70 SSAE16 Certified Data Centers
- Base Package Email Delivery (PDF)
- Workflow
- Data Analytics
- ODBC / OLEDB / Web Service / API / CSV / Other
- Customer Firewall
- F2B Integration Software
- Customer Business Systems:
  - Payroll
  - Accounting
  - CRM
  - ERP
  - CRM

Base Package Email Delivery (PDF)
Hardware considerations

- **Tablet Computers and Smart Phones**
  - Form size / complexity may dictate hardware

- **Operating Systems**
  - Windows, Android, iOS

- **Environmental Considerations**
  - Weather (Rain, temperature)
  - Direct sunlight (outdoor use)
  - Intrinsically safe

- **Connectivity**
  - Digital Cellular (i.e. Verizon Wireless)
  - Wi-Fi
Implementation doesn’t have to be complicated

<table>
<thead>
<tr>
<th>STEP 1</th>
<th>STEP 2</th>
<th>STEP 3</th>
<th>STEP 4 (optional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easily create customized digital form templates including advanced business logic with our forms designer software.</td>
<td>Complete blank forms / dispatched work orders to the field and capture enhanced media such as GPS, barcodes, signatures, calculations, photos, and much more.</td>
<td>Get your data back as an email (PDF) or have Field2base host the data for you in a secure web based portal.</td>
<td>Integrate the form with your current business systems using ODBC/OLEDB, API WebService, CSV or XML format.</td>
</tr>
</tbody>
</table>

3 – 10 business days

2-4 weeks
Forms Designer

- Easy-to-use desktop application
- Create & maintain an unlimited number of forms
- Use **existing** paper forms as the digital form background
- Incorporate digital media such as photos, videos, GPS, barcodes
- Use JavaScript to create business rules and workflows to ensure form accuracy
Mobile Forms™

- Android, Apple, and Windows compatible
- Complete forms, save drafts, respond to dispatched work orders, or access archived forms
- Supports dispatching with turn-by-turn directions
- On-site credit card processing for customers
- Prevent issues by capturing photos, videos, GPS, barcodes, and signatures in the field
- Submitted forms are delivered via email with a PDF attachment
Online Documents

- Store completed forms in our secure SAS70, SSAE16 certified data centers
- 256bit AES encryption
- Accessible via PC or Mobile device browsers
- Ensures customer records are available at any time, anywhere
- Forms are stored in two primary ways: PDF and CSV
Workflow

- Allows managers and decision-makers to review, edit and approve data before it’s delivered to the final destination.
- Data can be further modified based on predetermined rules defined by the customer.
Integration

Enterprise Integration

Our integration solutions allow our large customers the flexibility to map and populate form data fields automatically with existing applications using the following formats: SQL, API & Web services plug-ins, and file exports (CSV, PDF).

Small Business Integration

Don’t have an IT department? We get it. Field2Base offers the ability to integrate bi-directionally with small and medium-sized business applications as well using CSV files.
Data Analytics

- Lets users access dynamic, real-time data to gain insights and create customized reports.
- Reports may include pivot tables, pie charts, line graphs, heat maps (via GPS), and bar charts.
- All reports are accessible online from any authorized user or device.
Field2Base Data Analytics provides you with powerful tools to gain insight and report on your digital form data.

- Reports can include pivot tables, pie charts, line graphs, heat maps (based on the GPS locations of where the forms were completed) bar charts, interactive charts and much more.

- All reports are online and accessible from any authorized user/device. Reports are permission based so only specific groups within your organization can view specific reports.
Case Study: Enterprise Asset Management - Metering

Vertical: Utilities

Problem: Major utility contractor installed meters for electric utilities under service contracts using a combination of systems from meter suppliers and other systems suppliers. Major issues with data validation, reconciliation of meter inventory, and repeat trips to verify or correct meter installations.

Field2Base Resolution: Field2Base designed digital meter change out forms for the service company. Full integration with the utility business systems allow the forms to be prefilled with scheduled work order information each day. Any pre-existing meter data that was incorrect can now easily be corrected by the workers in the field and subsequently updated in the business systems. Java scripting was used to build out complete validation of as-found meter data and validation of meter readings. Dynamic dispatch of work orders throughout the day allows crews to do off-cycle meter readings while in proximity to the customer with the read request.

Project Timeline: Field2base was able to build and deploy this solution in less than 2 months.
Case Study: Enterprise Asset Management – Gas Inspections

**Vertical:** Utilities

**Problem:** Major utility has to inspect all claims for damage from gas pipeline leaks due to third party activity such as construction, installation of underground cable, fiber, etc.

**Field2Base Resolution:** Field2Base designed digital inspection forms for the utility based on forms that were already in use by the utility. Addition of GPS Coordinates, photos, video, and time/date stamps can now be used to provide a total picture of what happened with validation of time and location.

**Project Timeline:** Field2Base was able to build and deploy this solution in less than 1 month.
Case Study: Enterprise Asset Management – Power Plant Inspections

Vertical: Utilities

Problem: Major utility has to inspect LNG power plants each day on a three shift basis using paper forms. Missing inspection reports and delays in reporting are creating issues with regulators.

Field2Base Resolution: Field2Base designed digital LNG plant inspection forms for the utility. Forms can now be filled out with full validation of all data including date/time of the inspections for compliance purposes.

Project Timeline: Field2base was able to build and deploy this solution in less than 1 month.
Case Study: Enterprise Asset Management – Fleet Inspections

Vertical: Utilities

Problem: Major utility has to inspect all vehicles using public roads on an annual basis. Each type of vehicle (light truck, bucket trucks, trailers, etc.) have unique inspection criteria resulting in a large array of inspection forms.

Field2Base Resolution: Field2Base designed digital fleet inspection forms for the utility. All data in the forms can now be validated at the time of the inspection so that incomplete forms or forms with incorrect data cannot be submitted.

Project Timeline: Field2base was able to build and deploy this solution in less than 1 month.
Case Study: Enterprise Asset Management – Street Lights

Vertical: Utilities

Problem: Major utility is replacing 2 million mercury vapor streetlights with LED lights. Each morning, workers were handed paper forms with “known” data for the streetlight assets such as location, fixture type, pole type, etc. Often times the information is incorrect and the worker simply scribbles over it as part of the work process. It takes weeks for work orders to get entered into business systems and project leadership had no immediate visibility into the overall project progress.

Field2Base Resolution: Field2Base designed digital LED streetlight change out forms for the utility. Full integration with the utility business systems allow the forms to be prefilled with scheduled work order information each day. Any pre-existing asset data that was incorrect is now easily corrected by the workers in the field and subsequently updated in the business systems. Project leadership now has real time access to overall project progress, a detailed report of inventory used, and all associated labor costs.

Project Timeline: Field2base was able to build and deploy this solution in less than 3 months.
Case Study: Operations – Damage Assessment

Vertical: Utilities

Problem: Major utility has developed a very well defined process for damage assessment and restoration coordination for major events such as hurricanes. The process was to have crews visit an operation center, pick up geographical and feeder maps, then drive to a designated area to start the assessment process. After paper forms are filled out for the feeder and maps have been annotated using color markers, the assessment crew drives back to the operations center and faxes the information to the operations center.

Field2Base Resolution: Field2Base designed digital Damage Assessment forms for the utility with GPS validation of assessment areas, capture of photos and video, annotation of feeder maps, etc. so that a complete assessment of the site damage can be captured and uploaded wirelessly to central response centers.

Project Timeline: Field2base was able to build and deploy this solution in less than 3 months.
• David Poore – GIS Manager

• Norwich Public Utilities (NPU) provides four utilities to the City of Norwich, CT
  • Natural gas
  • Electricity
  • Water
  • Wastewater collection
Digital Inspection Transition

Drivers

- Reinforce Quality Assurance Program
  - Started using Contracted inspectors
- Improve internal and external (regulators) inspection review
- Increase oversight and accountability
- Easier documentation retrieval
- Tracking\traceability
- Pipeline Safety!

Solution Requirements

- **Easy to use!**
- Cross-platform
- Cost effective
- In-house form development
- Easy to administrate
- Onsite data storage

Field2Base and ESRI Collector solutions for our inspection needs
Field2Base Deployment Strategy

Phase 1: Form Development
• Three inspections targeted
  • Daily Inspection, Pressure Test, Exposed Pipe Report
• Introduce tablets to the field users
• Completed inspections received via email and organized in document management software. Very manual!
• Started in March 2015

Phase 2: Integration
• Integrate between F2B and NPU
• Provide tool for Gas Operations to
  • Review\approve inspections
  • Reporting (audits)
• Inspections automatically stored and organized in NPU systems (Database, File Server, GIS)
• Started in March 2016
Gas Daily Inspection

- Deployed March 2015
- Complete redesign
- Started with contracted inspectors
- Data quality rules
  - only one box per line can be checked
- Required fields
  - GPS Coordinates
- Attach photos
Pressure Test

- Deployed August 2015
- Complete redesign
- First form to internal crews
- Data quality rules
  - Lists
  - Auto-Calculate fields
  - Required Fields
- Logic to refuse form submission if certain conditions are not met.
  - Starting\Ending Pressure < Min Pressure
  - Duration times < Min times
- GPS Coordinates
- Foreman & Inspector sign-off
Exposed Pipe Reports

- Deployed August 2015
- Deployed to internal crews
- Similar to paper form
- Logic to refuse form submission if certain conditions are not met.
  - All required fields filled
- GPS Coordinates
- Additional integration with GIS
  - GIS data validation
  - Pipe replacement analysis
Phase 2: Data Integration

- Deployed March 2016
- Installed F2B DIM (Data Integration Module)
  - Assisted by F2B Partner
- Integrated into SQL Database
- NPU IT built web-based dashboard
- Review\approvals
- Reporting
## Phase 2: Data Accessibility

### Gas Inspection Manager

![Gas Inspection Manager](image)

### Service Log

<table>
<thead>
<tr>
<th>Date</th>
<th>Service Address</th>
<th>Service</th>
<th>Image</th>
<th>Foreman</th>
<th>Contractor</th>
<th>Work Type</th>
<th>Service Order</th>
<th>Inspector</th>
<th>CBYD</th>
<th>Approver</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/1/2019</td>
<td>15 Page St</td>
<td>Service</td>
<td>Y</td>
<td>Gaska, Krzysztof</td>
<td>RHW</td>
<td>Renew</td>
<td>Steve Lee</td>
<td>20192084765</td>
<td>bhedler</td>
<td></td>
</tr>
<tr>
<td>8/1/2019</td>
<td>7 HAMILTON CT</td>
<td>Service</td>
<td>Y</td>
<td>Wallace, Matt</td>
<td>NPU</td>
<td>Renew</td>
<td>Steve Lee</td>
<td>20192094135</td>
<td>bhedler</td>
<td></td>
</tr>
<tr>
<td>8/2/2019</td>
<td>12 JOHN GEORGE DR</td>
<td>Service</td>
<td>Y</td>
<td>Wallace, Matt</td>
<td>NPU</td>
<td>New</td>
<td>Steve Lee</td>
<td>20192084133</td>
<td>bhedler</td>
<td></td>
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<tr>
<td>8/2/2019</td>
<td>160 PROSPECT ST</td>
<td>Service</td>
<td>Y</td>
<td>Gaska, Krzysztof</td>
<td>RHW</td>
<td>Renew</td>
<td>Steve Lee</td>
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<td></td>
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<tr>
<td>6/5/2019</td>
<td>123 Hamilton Ave</td>
<td>Service</td>
<td>Y</td>
<td>LeFrancois, Joel</td>
<td>NPU</td>
<td>Renew</td>
<td>Steve Lee</td>
<td>20192084113</td>
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<tr>
<td>6/5/2019</td>
<td>361-365 Hamilton Ave</td>
<td>Main</td>
<td>N</td>
<td>Wallace, Matt</td>
<td>NPU</td>
<td>Renew</td>
<td>Steve Lee</td>
<td>20192084135</td>
<td>bhedler</td>
<td></td>
</tr>
<tr>
<td>5/5/2019</td>
<td>56-58 Page St</td>
<td>Service</td>
<td>Y</td>
<td>RHW</td>
<td>NPU</td>
<td>Renew</td>
<td>Steve Lee</td>
<td>20191002877</td>
<td>bhedler</td>
<td></td>
</tr>
<tr>
<td>5/6/2019</td>
<td>111 HAMILTON AVE</td>
<td>Service</td>
<td>Y</td>
<td>LeFrancois, Joel</td>
<td>NPU</td>
<td>Renew</td>
<td>Steve Lee</td>
<td>20192084104</td>
<td>bhedler</td>
<td></td>
</tr>
<tr>
<td>5/6/2019</td>
<td>367 HAMILTON AVE</td>
<td>Service</td>
<td>Y</td>
<td>Wallace, Matt</td>
<td>NPU</td>
<td>Renew</td>
<td>Steve Lee</td>
<td>20191001323</td>
<td>bhedler</td>
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</tr>
<tr>
<td>5/6/2019</td>
<td>72 Page St</td>
<td>Service</td>
<td>N</td>
<td>Sny, Mike</td>
<td>RHW</td>
<td>Renew</td>
<td>Steve Lee</td>
<td>2019000753</td>
<td>bhedler</td>
<td></td>
</tr>
<tr>
<td>5/6/2019</td>
<td>96 BEECH DR</td>
<td>Main</td>
<td>Y</td>
<td>Bohara, Dan</td>
<td>RHW</td>
<td>Repair</td>
<td>Steve Lee</td>
<td>2019208287</td>
<td>bhedler</td>
<td></td>
</tr>
<tr>
<td>5/7/2019</td>
<td>375 HAMILTON AVE</td>
<td>Service</td>
<td>Y</td>
<td>Wallace, Matt</td>
<td>NPU</td>
<td>Renew</td>
<td>Steve Lee</td>
<td>20190101323</td>
<td>bhedler</td>
<td></td>
</tr>
<tr>
<td>5/7/2019</td>
<td>HAMILTON AVE @ PALMER ST</td>
<td>Main</td>
<td>Y</td>
<td>LeFrancois, Joel</td>
<td>NPU</td>
<td>Renew</td>
<td>Steve Lee</td>
<td>2019208354</td>
<td>bhedler</td>
<td></td>
</tr>
<tr>
<td>6/8/2019</td>
<td>250 HAMILTON AVE</td>
<td>Service</td>
<td>Y</td>
<td>Wallace, Matt</td>
<td>NPU</td>
<td>Renew</td>
<td>Steve Lee</td>
<td>20192084120</td>
<td>bhedler</td>
<td></td>
</tr>
</tbody>
</table>
## Phase 2: Data Accessibility

### Norwich Public Utilities

**Gas Construction Daily Inspection Form**

Every line item should have one check box marked (Yes, No or N/A).

- **Dates**: 8/3/2019
- **Project No.**
- **Arrival Time**: 10:03:00 AM
- **Service Order Number**: 
- **Address**: 15 Page St
- **Contractor**: NH
- **Crew Foreman**: Oasis, Kyrasof
- **Facility Service**: 
- **Work Type**: Routine

### Operator Qualification

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td>Operator Qualifications Verified (Q Complianceitten Plan) Total Qualified Persons on Site: 3 Total Qualified Persons on Site: 1</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>Excavation Area</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>All underground facilities located and verified via GIS mapping before excavation begins</td>
</tr>
</tbody>
</table>

### Safety Inspection

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Proper PPE on site (SO-116)</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>Annually Inspected Fire Extinguisher On-site (SO-116)</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td>In Work on State Road</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td>Proper Traffic Control Measures Flaggers, Lane layout, barriers, signage and construction vehicle placement (23 CFR 655.605)</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td>Do not Excavate, Trench must meet NPU Safety Guidelines (SO-116/SO's 9)</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td>Do not use electrical equipment on ground</td>
</tr>
</tbody>
</table>

### Plastic/Pipe Work

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td></td>
<td></td>
<td>Does plastic pipe meet 2 year exposure limit (CH 2-1)</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td>Pressure Test &amp; Leak Requirements (OGSM 18-1 for MAIN, OSM 18-2 for Service)</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td>Is the foreman aware of NHP conditions</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td>Is there (2) qualified fusion operators on-site (CH 2-1)</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td>Where all fusions performed and inspected by qualified personal (CH 2-1)</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td>Fusion Performed By: Lee</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td>Did any Fusions fail inspections inspection (CH 2-1)</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td>If yes Fusion Performed By:</td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td>Ownersiete properly installed 3/4” pipe from CH 2-1</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td>Ownersiete continuity test performed and verified</td>
</tr>
<tr>
<td>21</td>
<td></td>
<td></td>
<td>Existing Plastic Pipe Inspected for Leaks 10% sample or gauge (NOA Task C716)</td>
</tr>
<tr>
<td>22</td>
<td></td>
<td></td>
<td>Underground cleanness adequate (15&quot;) from main structure (CH 2-1, 7-1)</td>
</tr>
<tr>
<td>23</td>
<td></td>
<td></td>
<td>Min 6” of sand surrounding pipe (CM 2-3, 9-1, 7-1)</td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td>Pipe installed at required depth (CH 2-3, 7-1)</td>
</tr>
</tbody>
</table>

### Steel Work

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td></td>
<td></td>
<td>New steel pipe meets manufacturing requirements (CH 2-1)</td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td>Qualified Liner on site (CH 2)</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td>Pressure Test &amp; Leak Requirements (OGSM 18-1 for MAIN, OSM 18-2 for Service)</td>
</tr>
<tr>
<td>26</td>
<td></td>
<td></td>
<td>Did you observe pressure test?</td>
</tr>
</tbody>
</table>

### Backfilling

- **Suitable backfill material and procedure used (CH 6.7)**
- **Soil Work**
- **Header Painted**
- **Excavation Area**
- **All underground facilities located and verified via GIS mapping before excavation begins**
- **If none marked in these new line and sketch**

### Damages

- **Any damages witnessed, if yes please explain damage and repair below**

---

**Inspector Name**: Steve Let

**Inspector Signature**: 

**Departure Time**: 12:45:00 PM

**GPS Coordinates**: 41.532977, 72.00419

**Approval Information**

**Approver**: 

**Approval Date**: 8/16/2019 12:45:00 PM

**Comments**: 

---

**Work Performed**

- **Inspector Observation**
- **Inspection Image**
- **Inspection Information**

---

**34**
Wrap-up

- Expansion of F2B use since 2015
  - 31 Devices using F2B (started with 6)
  - 20 Forms in production
  - Average 1775 completed forms a year
    - This year will be near 2750
  - Internal and external contactors
  - Leverage workflow (LOTO)
- Various methods of data delivery based on need
  - Email pdf
  - Pdf directly into file server (auto name)
  - Data inserts into sql database
- ESRI Collector used for more asset-based inspections
  - Valve inspections, Hydrant flushing, MS4 inspections etc.

### F2B Forms

**Gas Distribution**
- Daily Inspection
- Pressure Test
- Exposed Pipe Report
- ROW Inspections
- Weekly Rectifier Readings
- Annual Peak Shaver
- Monthly Service Meter Readings
- Weekly CNG Readings
- Weekly LNG Readings
- Monthly LNG Maintenance
- Bridge Inspections

**Other Utilities**
- Job Briefing Form (Pre-fill)
- Confined Space
- Lock-out Tag Out
- Sewer Air Test
- Sewer Pump Sta Checks
- Field Inspection Form
- Water Main Disinfection