Report.HW.704031.2010.05.04_Sewer_Line_repair_~~AA~~
Alternative_Analysis

ARCADIS

ARCADIS of New York, Inc.
6723 Towpath Road
P.O. Box 66
Syracuse
New York 13214-0066
Tel 315.446.9120
Fax 315.449.0017

MEMO

To:
Tracy Blazicek, Energy East

Copies:
Keith A. White, P.G., ARCADIS
Mark Gravelding, P.E., ARCADIS
Jason Brien, P.E., ARCADIS
Scott Carey, P.E., ARCADIS

From:
Margaret Carrillo-Sheridan, P.E

Date:
May 4, 2010

ARCADIS Project No.:
B0013041.0002

Subject:
Court Street Former MGP Site
Binghamton, NY
66-Inch Storm Sewer Rehabilitation Alternatives Evaluation

This memorandum presents the results of an evaluation conducted by ARCADIS to address the potential infiltration of groundwater and non-aqueous phase liquid (NAPL) into a 66-inch diameter storm sewer. The sewer is located beneath New York State Electric & Gas Corporation's (NYSEG's) Court Street Former Manufactured Gas Plant (MGP) site in Binghamton, New York.

The purpose of this evaluation was to identify technologies and recommend cost effective alternatives for providing a water-and-NAPL-tight (zero-leakage) storm sewer across the site. For the purpose of this evaluation, zero-leakage is defined as having no visible fluids leakage.

Background

The site is located in an industrial section of Binghamton, New York and occupies approximately 4.3 acres identified as 271 - 291, and 293 Court Street (Figure 1). The site formerly housed an MGP that manufactured gas from 1888 to approximately 1939, during which time operations gradually expanded west from the eastern portion of the site, eventually occupying the entire site. By 1969, all aboveground structures associated with the MGP had been dismantled. The site is currently used as a storage area by NYSEG.

An active storm sewer that collects runoff from a large portion of the City of Binghamton (City) traverses the site from north to south and empties into the Susquehanna River (River). Historical drawings indicate

that the onsite portion of the storm sewer was constructed between 1885 and 1924 within the former bed of Brandywine Creek. The storm sewer is owned and maintained by the City.

The storm sewer consists of a buried 66-inch diameter reinforced concrete pipe (RCP) that conveys stormwater north to south across the western portion of the site. The section of the storm sewer under evaluation is approximately 420 feet long extending between upstream manhole (MH-2), located immediately north of the site property limits on Norfolk and Southern Railroad property, and the downstream manhole (MH-1), located immediately south of the site property limits and on the north side of Court Street in the road right-of-way. This section of sewer conveys storm water from the storm sewer located under the railroad property north of the property to the Tompkins Street Pump Station (pump station) located on the south side of Court Street.

Site soils near the pipe contain nonaqueous-phase liquid (NAPL), a byproduct of former gas-making operations. Site investigations previously identified that potentially-impacted groundwater and/or NAPL was infiltrating into the storm sewer. In 2003, the 66-inch storm sewer was lined for NYSEG by Sevenson, Inc. and their subcontractors. The sewer was lined using a polyvinyl chloride (PVC) liner system manufactured by Danby of North America, Inc. (Danby). As part of the Danby liner system, the annular space between the PVC liner and original pipe was grouted to seal the liner to the original pipe.

Since the installation of the liner, ARCADIS personnel have performed routine (annual) visual inspections of the storm sewer pipe on behalf of NYSEG to monitor the condition of the liner.

During the 2008 storm sewer inspection event (conducted on October 24, 2008), ARCADIS observed that the PVC storm sewer liner system appeared to be leaking in several locations along its continuous joint, potentially allowing groundwater and/or NAPL to enter the sewer. Based on the findings of the 2008 storm sewer monitoring event, NYSEG increased the sewer inspection frequency to three times per year. The spring 2009 inspection noted similar observations.

Based on discussions between NYSDEC and NYSEG during an April 2009 meeting, ARCADIS subcontracted Lash Contracting, Inc. (Lash) to perform destructive testing of the liner system in an attempt to assess the potential cause of observed leakage. Lash completed the testing in July 2009. Based on the results of the destructive testing, ARCADIS determined that the existing liner was compromised and was no longer capable of providing a leak-free barrier to prevent infiltration of groundwater and NAPL into the storm sewer. ARCADIS visually inspected samples of grout material, noting the quality and consistency of the grout within each sample. Based on the visual inspection, one of the grout samples had several air bubbles evident and was stained with NAPL, where other grout samples appeared to be solid (i.e., no air bubble) with no visible staining.

Although the direct reason for failure of the liner system is not known potential causes have been identified based on an overall review of the grout and pipe conditions. These potential causes consist of the following:

- Variability in the grout structure due to poor control during grout installation, which may in part have been due to the very narrow (approximately 1-inch) annular space between the liner and the existing pipe wall.

- The internal staining of the grout may indicate that NAPL-impacted groundwater was not adequately controlled during placement of the grout and may have mixed with the grout affecting the structural competency of the grout or that the grout was not compatible with site-related MGP residual materials.

- Potential movement (settlement of the storm sewer pipe, which could have caused the liner to shift or be loaded or stressed in an unanticipated way, causing leaks at the joint.

- A potential change in the tightness or strength of the continuous joint due to a change in material properties caused by age, weather conditions (freeze thaw cycles resulting thermal expansion or contraction within the lined pipe).

ARCADIS considered these potential causes of failure when evaluating the storm sewer rehabilitation alternatives presented below.

Storm Sewer Rehabilitation Alternatives

ARCADIS evaluated potential technologies to rehabilitate the storm sewer. The following technologies were considered:

- **Option 1 - Groundwater Diversion – Not Retained:** This technology consists of diverting groundwater flow around the existing pipe, into a separate groundwater collection and conveyance system. This technology was not retained because of the technical difficulty of maintaining the hydraulic controls for the life of the stormwater conveyance system and the difficulties associated with treating and discharging the groundwater flow following collection.

- **Option 2 - Encapsulation of the Storm Sewer Exterior – Not Retained:** This technology consists of grouting the exterior of the storm sewer pipe and bedding to provide a low permeability zone around the sewer. This technology was not retained because of the implementation challenges associated with creating a competent (i.e., no voids or cracks) 360 degree low permeability zone around the entire storm sewer, and maintaining that low permeability zone for the life of the conveyance system. Options for grouting around the storm sewer included jet

grouting (which is a soil replacement technology) and injecting a polyurethane grout (which would expand to fill the pore space around the storm sewer). In addition, verification that the entire pipeline was completely sealed would be difficult to accomplish during construction.

- **Option 3 - Install an Open Conveyance Ditch – Not Retained:** This technology consists of constructing an open ditch system to convey the water thru the site via a lined waterway. This technology was not retained because an open ditch was not consistent with the current site uses, and excavation of an open ditch could potential expose additional impacted soils, creating odors and other short term impacts to the community. In addition, a lined open ditch could be susceptible to leaks or tears over time due to animal burrowing, vegetation, vandalism, or hydrostatic pressures on the liner.

- **Option 4 - Slip-lining the Existing Storm Sewer – Retained:** This technology consists of installing a new pipe of smaller diameter is either pushed or pulled through the existing pipe. Slip-lining the existing storm sewer is an "in-pipe" rehabilitation solution which refers to a process where the new pipe is installed from a launching pit that is excavated around the existing pipe at either a bend or the midpoint of the pipe (Figure 2 presents a conceptual plan for implementation of the slip lining alternative).

  Once the launching pit is excavated, the existing pipe is cut and removed to allow for new pipe sections to be lowered into place and installed in the existing pipe. A variety of materials can be utilized for this technology as described below and shown on Table 1. The main advantage of this alternative is the utilization of the existing pipe as a carrier pipe, which requires little excavation and subsequent handling of impacted soil and groundwater. However, under most applications, the carrier pipe must be cleaned prior to installation of the new pipe, and be free of flowing water during installation, both generally require bypass pumping to maintain storm water flows during the cleaning and installation process (with the exceptions described below).

  Slip lining of the existing storm sewer could require 2–3 months to construct.

- **Option 5 - Replacement of the Existing Storm Sewer – Retained:** This technology consists of installing a new storm sewer parallel to the existing storm sewer as shown on Figure 3. The new storm sewer could be constructed while the existing storm sewer remains in service. After completion of the new storm sewer, the existing manholes at the site (MH-1 and MH-2) would be replaced with new structures and the storm sewer flows would be diverted into the new storm sewer. The existing storm sewer would be capped and abandoned in place.

  An advantage of this alternative is that bypass pumping during a majority of construction is not required. The new upstream and downstream (replace MH-1 and MH-2) cast-in-place connecting structures could be built around existing manholes while the existing storm sewer remains in

service until the new storm sewer installation is completed. Two additional manholes would be required to allow for the transition of the new parallel pipe section into the existing locations of MH-1 and MH-2.

The handling and disposal of the excavated material as well as the trench support requirements (sheeting) present several short-term impacts to the construction workers and surrounding community. Short term impacts would be addressed thru implementation of a site-specific Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP). Several historical MGP subsurface structures and abandoned utilities may be present along the proposed alignment that may require excavation, handling and disposal as a MGP waste. However, proper contingency planning and predesign investigation activities can mitigate these potential short term impacts.

Replacement of the existing storm sewer would likely require 3 – 4 months to complete.

Both retained technologies (Options 4 and 5) could be implemented for the storm sewer rehabilitation using a variety of pipe materials. However, a number of common pipe types were excluded from consideration initially because the material was not compatible with site-related MGP residuals or pipe materials are not manufactured with a sufficiently large diameter (including ductile iron and PVC pipe).

Based on our preliminary review, certain pipe and joint materials were identified as viable materials that could be used under either technology because they are manufactured in the size range required for this project. These pipe materials alternatives are anticipated to be compatible with site-related MGP-residuals and have adequate strength for the proposed burial depth, they include:

- High density polyethylene (HDPE) – HDPE can be installed as either smooth wall or corrugated, with a two different joint configurations (butt-fused and extrusion weld) that will meet the design objective of "zero leakage". For both joint configuration types, the ambient temperature within the launching pit must be at least 50 degrees Fahrenheit.

- Centrifugally cast fiber reinforced polymer mortar (CCFRPM) – Based on discussions with the manufacturer, this material would not require bypass pumping if selected as the slip lining material, temperature control is not required during installation, and the associated launch pit would be smaller than required if HDPE is used as the pipe material..

Based on this evaluation, both of the retained technologies would achieve the design objective of eliminating the potential for MGP-impacted groundwater infiltrating the storm sewer. NYSEG has elected to replace the existing storm sewer (Option 5) and anticipates that HDPE will be the selected replacement pipe material. However, if based on the results of predesign investigation activities slip lining appears to be the more feasible technology, NYSEG may elect to revise their approach prior to submitting a final design to the NYSDEC.

Schedule/Next Steps

NYSEG has retained Sevenson Environmental Services, Inc. (Sevenson) to conduct the pipeline replacement activities. ARCADIS will be retained by Sevenson to provide the engineering services for the storm sewer replacement design. During the remainder of 2010 the following activities are anticipated to be completed:

- Development of a PDI Work Plan (in memorandum format)
- Data acquisition
- Design

The storm sewer replacement activities are anticipated to be conducted in 2011.

ARCADIS

Table

Table 1
Technology Screening Evaluation for Storm Sewer Rehabilitation

NYSEG - Court Street 66-inch Diameter Storm Sewer Rehabilitation - Binghamton, New York

General Rehabilitation Alternative	Pipe Joint Type	Pipe Material	Description	Constructability	Bypass Pumping Costs	Material and Installation Cost
No Action	No further action	No further action	Alternative would not include any rehabilitation action. A No Action alternative serves as a baseline for comparison of the overall effectiveness of other rehabilitation alternatives.	N/A - No construction.	None	No material and no construction costs.
Slip-lining of Existing 66-inch Storm Sewer	Full Depth Butt Fusion (Fusion eliminates joints and creates continuous pipe)	Solid Wall or Profile Wall High Density Polyethylene (HDPE) Pipe	HDPE pipe sections joined by full depth butt fusion joints slip lined through the existing storm sewer. The ends of slip lined pipe would be sealed into the existing upstream and down stream manholes. The annular space around the slip lined pipe would be filled with grout that is compatible with existing site conditions. Internal pressure ratings: Solid wall pipe is rated up to 51 PSI (DR 32.5), Profile wall pipe is rated up to 22.5 PSI.	Difficult. A large excavation with significant trench support is required to place the fusion machine below grade, inline with the pipe to be slip lined. Fusion time approximately doubled when working in a launching pit below grade. Removal of the internal bead to eliminate flow obstruction required.	High	High material and high installation costs.
	Extrusion Weld (Full depth on solid wall, inside and outside on profile wall)	Solid Wall or Profile Wall (bell and spigot) HDPE Pipe (Snap-lock joints available with solid wall HDPE)	HDPE pipe sections with inside extrusion welded joints slip lined through the existing storm sewer. The ends of slip lined pipe would be sealed in the existing upstream and down stream manholes and the annular space would be filled by pumping a grout compatible with existing site conditions. Internal pressure ratings: Solid wall pipe is rated up to 22.5 PSI, Profile wall pipe is rated up to 22.5 PSI.	Moderate difficulty. A large excavation with significant trench support is required to perform extrusion welding below grade, inline with the pipe to be slip lined. The outside welds can be performed from the pipe launching pit, the inner welds need to be performed from the inside of the pipe.	High	Moderate material and installation costs.
	Gasket sealed Bell and Spigot or Coupling	Solid Wall of Profile Wall HDPE/PVC Pipe	HDPE/PVC pipe sections with bell and spigot or coupling joints which contain gaskets to provide zero leak seal. This pipe is pushed "slip lined" into he existing storm sewer. The ends of slip lined pipe would be sealed into the existing upstream and down stream manholes. and the annular space around the slip lined pipe would be filled with grout that is compatible with existing site conditions. Internal pressure ratings: Solid wall pipe is rated up to 10 PSI, Profile wall pipe is rated up to 10 PSI.	Moderate difficulty. Installing HDPE/PVC with bell and spigot joints would require a pit excavation with support to provide access for the installation of new pipe into the existing storm sewer. Previous experience has identified concerns over the tightness of the joints due to movement of the HDPE/PVC during slip lining and grouting, which may compromise the zero leak joint. Past experience indicated that bell and spigot HDPE/PVC pipe may not provided a zero leak joint. The properties of HDPE may contribute to joint leaks, which includes high thermal expansion and creep, low rigidity or hoop strength, and material properties can be affected by petroleum and organics.	High	Moderate material and installation costs.
	Flush Bell and Spigot	Centrifugally Cast Fiberglass Reinforced Polymer Mortar (CCFRPM) Pipe	CCFRPM pipe sections with bell and spigot joints slip lined through the existing storm sewer. The ends of slip lined pipe would be sealed in the existing upstream and down stream manholes and the annular space would be filled by pumping a grout compatible with existing site conditions. CCFRPM pipe has been tested to 100 PSI of external pressure for 15 minutes. Manufacturer guarantees leak free joints at 15-feet of cover.	Moderate difficulty. Installing CCFRPM pipe with bell and spigot joints would require a pit excavation with support to provide access for the installation of new pipe into the existing storm sewer. Fiberglass composite pipe is very rigid material with high hoop strength, has low thermal expansion and no creep, with inert material properties that are not generally affected by petroleum or organics.	High	Moderate material and installation costs.

Table 1
Technology Screening Evaluation for Storm Sewer Rehabilitation

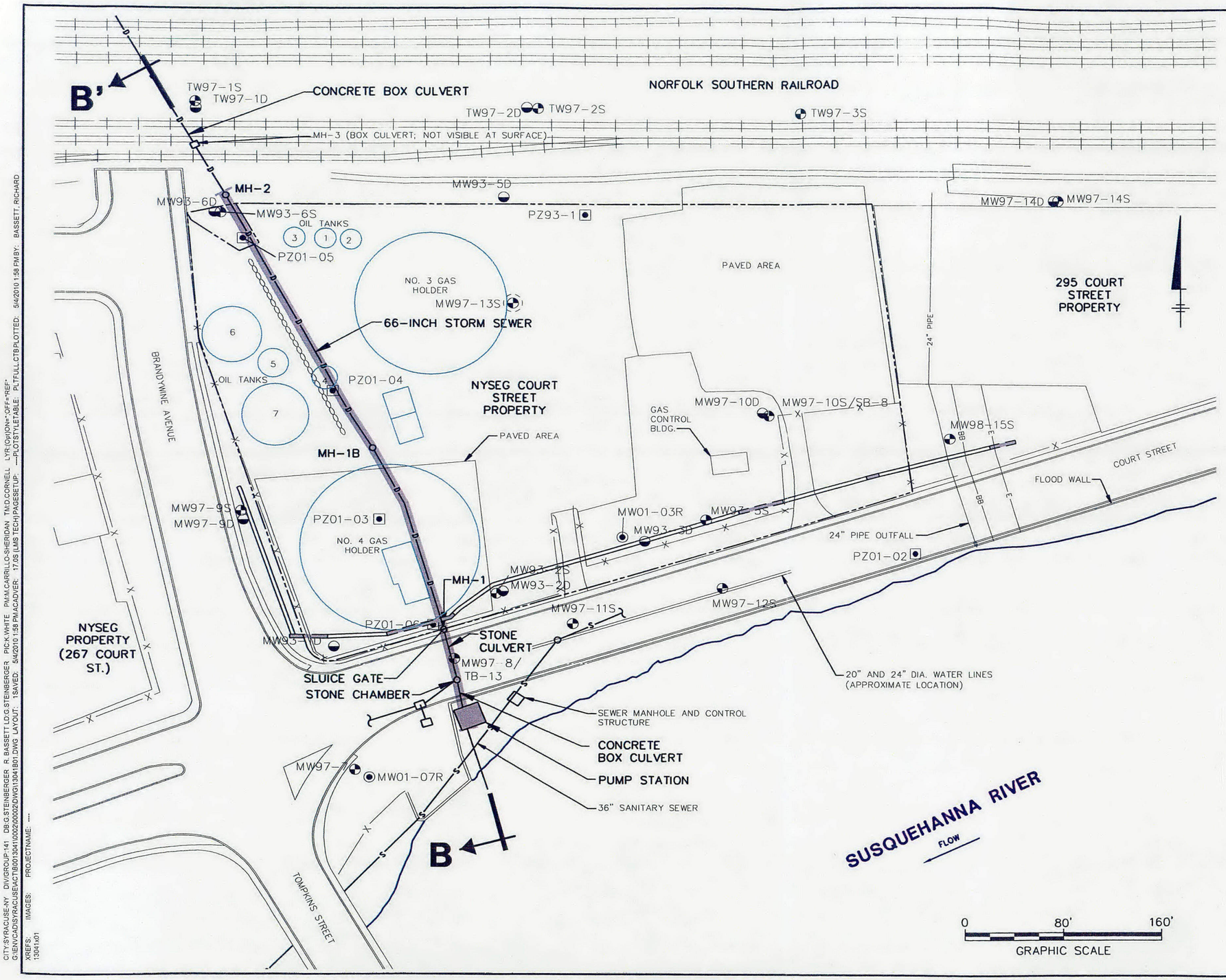
NYSEG - Court Street 66-inch Diameter Storm Sewer Rehabilitation - Binghamton, New York

General Rehabilitation Alternative	Pipe Joint Type	Pipe Material	Description	Constructability	Bypass Pumping Costs	Material and Installation Cost
Slip-lining of Existing 66-inch Storm Sewer (cont.)	Jointless Cured In Place Pipe (CIPP) Liner	CIPP Epoxy Resin Liner Material	A CIPP liner is a continuous liner pipe that is pulled into place then filled with water to expand the liner material against the existing pipe and cured with heated water. Once cured, a joint less pipe section is formed and bonds to the interior of the existing pipe that the CIPP liner is cured in. CIPP liner is rated up to 25 PSI of internal pressure.	Difficult. Installing a CIPP liner would require modification of upstream, and down stream manholes and removal of intermediate manhole. CIPP liner may not bond to the existing PVC liner which would cause quality control issues during installation, if the CIPP liner fails/collapses a blockage of flow may occur. Requires large volumes of heated water or steam with water disposal concerns. Potential impacts due to inflow of NAPL on the curing/bonding of CIPP liner to existing storm sewer.	High	High material and installation costs.
Replacement of Existing 66-inch Storm Sewer Open Cut Installation	Storm Sewer Pipe Installation Along Parallel Alignment	Alternatives; HDPE/PVC (Sold or Profile Wall) or CCFRPM	Complete replacement of the existing storm sewer pipe and existing manholes installed in a new alignment parallel to the existing pipe. Once installed and tested, the existing storm sewer pipe would be capped, filled with grout and abandoned in place. Testing pressures are dependant on selected pipe material and joint type.	Difficult. Installing a new pipe along a parallel alignment would require replacement of the upstream and downstream manholes with cast in place concrete structures, potentially demolition a portion of the existing gas holder foundation, excavation and disposal of a large quantity of potentially contaminated soil. Potentially difficult connection between pipe and the new concrete manholes. Difficult trench excavation and installation of trench wall support system due to subsurface materials, obstructions, and proximity to the existing storm sewer pipe. Temporary pipe through existing manholes to convey flow during construction of new manhole structures	None	Moderate material and high installation costs.
	Storm Sewer Pipe Installation Along Existing Alignment	Alternatives; HDPE/PVC (Sold or Profile Wall) or CCFRPM	Complete replacement of the existing storm sewer pipe and existing manholes in the existing alignment. Open cut construction and backfilled once new pipe is installed. Testing pressures are dependant on selected pipe material and joint type.	Difficult. Installing a new pipe along the same alignment would require: excessive bypass pumping, removal and disposal of impacted pipe / construction materials, replacement of the upstream and down stream manhole with cast in place concrete structures, demolition of a portion of the existing gas holder foundation, excavation and disposal of a large quantity of potentially contaminated soil. Difficult trench excavation and installation of trench wall support system due to potentially unstable subsurface materials and removing existing storm sewer pipe.	High	Modcrate material and high installation costs.

Notes:

1. Shading indicates that rehabilitation technology will not been retained for development of a rehabilitation alternative.
2. Pipe testing shall be performed in accordance with ASTM D 3212 for HDPE pipe and ASTM D 513 and ASTM F 1216 for CIPP liner.
3. Compatibility of pipe or gasket material with NAPL may affect performance, recommend conducting material compatibility testing.

Figures



LEGEND:

- RAILROAD TRACK
- FENCE
- SITE PROPERTY LINES (APPROXIMATE)
- PORTION OF STORM SEWER SUBJECT TO IRM
- STORM SEWER LINE (APPROXIMATE)
- SANITARY SEWER LINE (APPROXIMATE)
- HISTORICAL FEATURE
- BURIED CONCRETE WALL
- MONITORING WELL (SHALLOW)
- MONITORING WELL (DEEP)
- MONITORING WELL (BEDROCK)
- PIEZOMETER
- DECOMMISSIONED MONITORING WELL
- CATCH BASIN

NOTES:

1. BASE MAP PROVIDED BY NYSEG (JUNE 12, 1997).
2. ALL INVESTIGATION LOCATIONS SHOWN SURVEYED BY HAWK ENGINEERING, P.C. BINGHAMTON, N.Y.
3. STORM SEWER LOCATION DIGITIZED FROM CITY OF BINGHAMTON MAP, SHEET 303, ENTITLED: PRELIMINARY REPORT, COMPREHENSIVE STORM DRAINAGE, EXISTING FACILITIES. PREPARED BY VERNON O. SHUMAKER, CONSULTING ENGINEER, VESTAL, NEW YORK, DATE NOT PROVIDED.
4. APPROXIMATE LOCATION OF THE TWO UNMARKED CATCH BASINS AND ASSOCIATED PIPING LOCATED NORTHEAST AND EAST OF THE PUMP STATION BASED ON VISUAL OBSERVATIONS MADE BY BBL ON AUGUST 16, 2002.
5. SELECT HISTORICAL FEATURES NOT SHOWN FOR CLARITY.

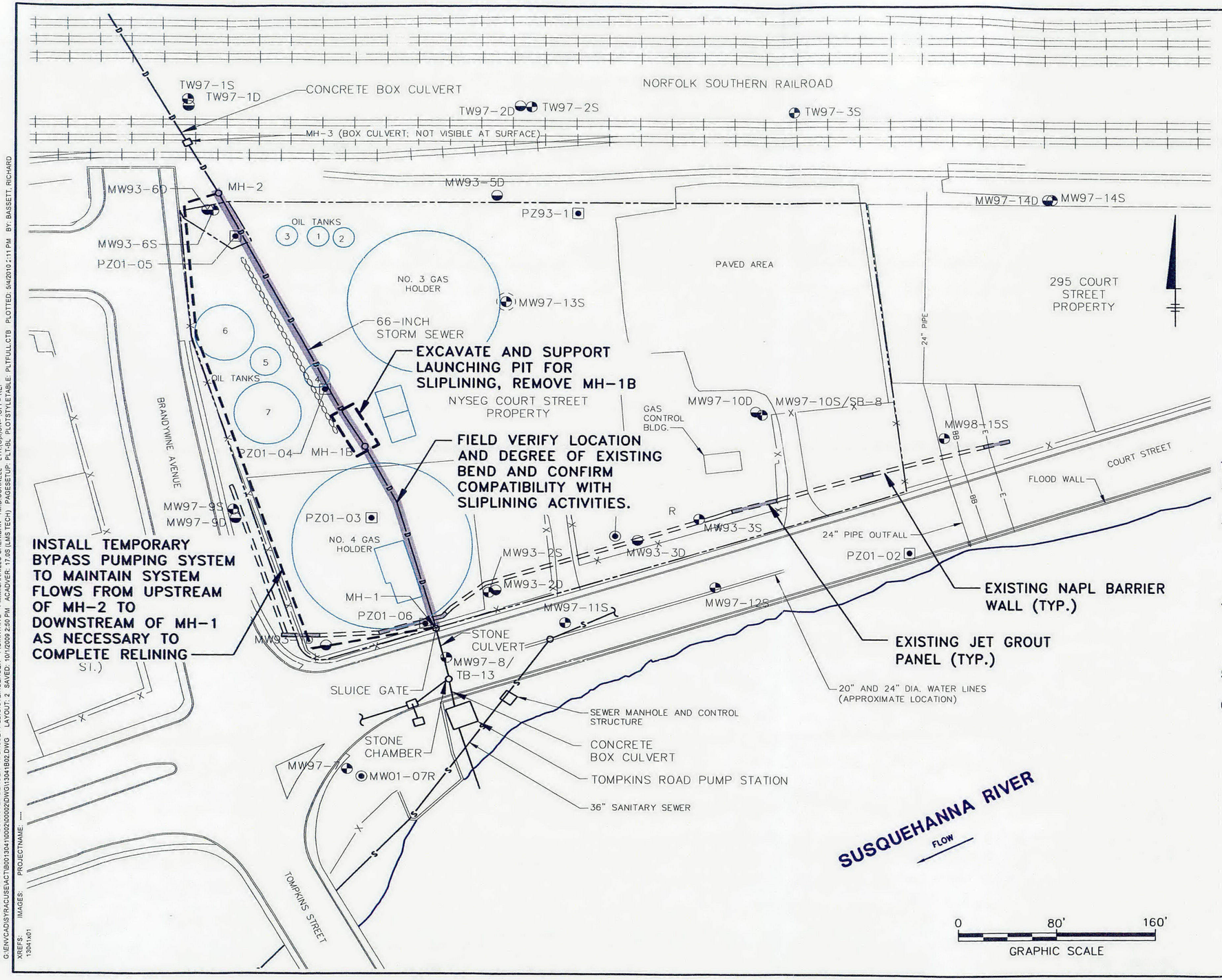
NYSEG COURT STREET SITE
BINGHAMTON, NEW YORK
66-INCH STORM SEWER REHABILITATION ALTERNATIVES EVALUATION MEMORANDUM

SITE PLAN

ARCADIS

FIGURE 1

CITY:SYRACUSE-NY DIV/GROUP:141 DB:G.STEINBERGER R. BASSETT LD:G.STEINBERGER PIC:K.WHITE PM:M.CARRILLO-SHERIDAN TM:D.CORNELL LYR:D.CORNELL LYR:(O)(F)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACTIB\00130411000200002\DWG\130411B01.DWG LAYOUT: 1SAVED: 5/4/2010 1:58 PM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 5/4/2010 1:58 PM BY: BASSETT, RICHARD
XREFS: IMAGES: PROJECTNAME: ---
13041x01



LEGEND:

- RAILROAD TRACK
- FENCE
- SITE PROPERTY LINES (APPROXIMATE)
- PORTION OF STORM SEWER SUBJECT TO IRM
- STORM SEWER LINE (APPROXIMATE)
- SANITARY SEWER LINE (APPROXIMATE)
- HISTORICAL FEATURE
- BURIED CONCRETE WALL
- MONITORING WELL (SHALLOW)
- MONITORING WELL (DEEP)
- MONITORING WELL (BEDROCK)
- PIEZOMETER
- DECOMMISSIONED MONITORING WELL
- CATCH BASIN

NOTES:

1. BASE MAP PROVIDED BY NYSEG (JUNE 12, 1997).
2. ALL INVESTIGATION LOCATIONS SHOWN SURVEYED BY HAWK ENGINEERING, P.C. BINGHAMTON, N.Y.
3. STORM SEWER LOCATION DIGITIZED FROM CITY OF BINGHAMTON MAP, SHEET 303, ENTITLED: PRELIMINARY REPORT, COMPREHENSIVE STORM DRAINAGE, EXISTING FACILITIES. PREPARED BY VERNON O. SHUMAKER, CONSULTING ENGINEER, VESTAL, NEW YORK, DATE NOT PROVIDED.
4. APPROXIMATE LOCATION OF THE TWO UNMARKED CATCH BASINS AND ASSOCIATED PIPING LOCATED NORTHEAST AND EAST OF THE PUMP STATION BASED ON VISUAL OBSERVATIONS MADE BY BBL ON AUGUST 16, 2002.
5. SELECT HISTORICAL FEATURES NOT SHOWN FOR CLARITY.
6. SLIPLINING INFORMATION IS CONCEPTUAL AND USED FOR PURPOSES OF CONDUCTING THE EVALUATION.

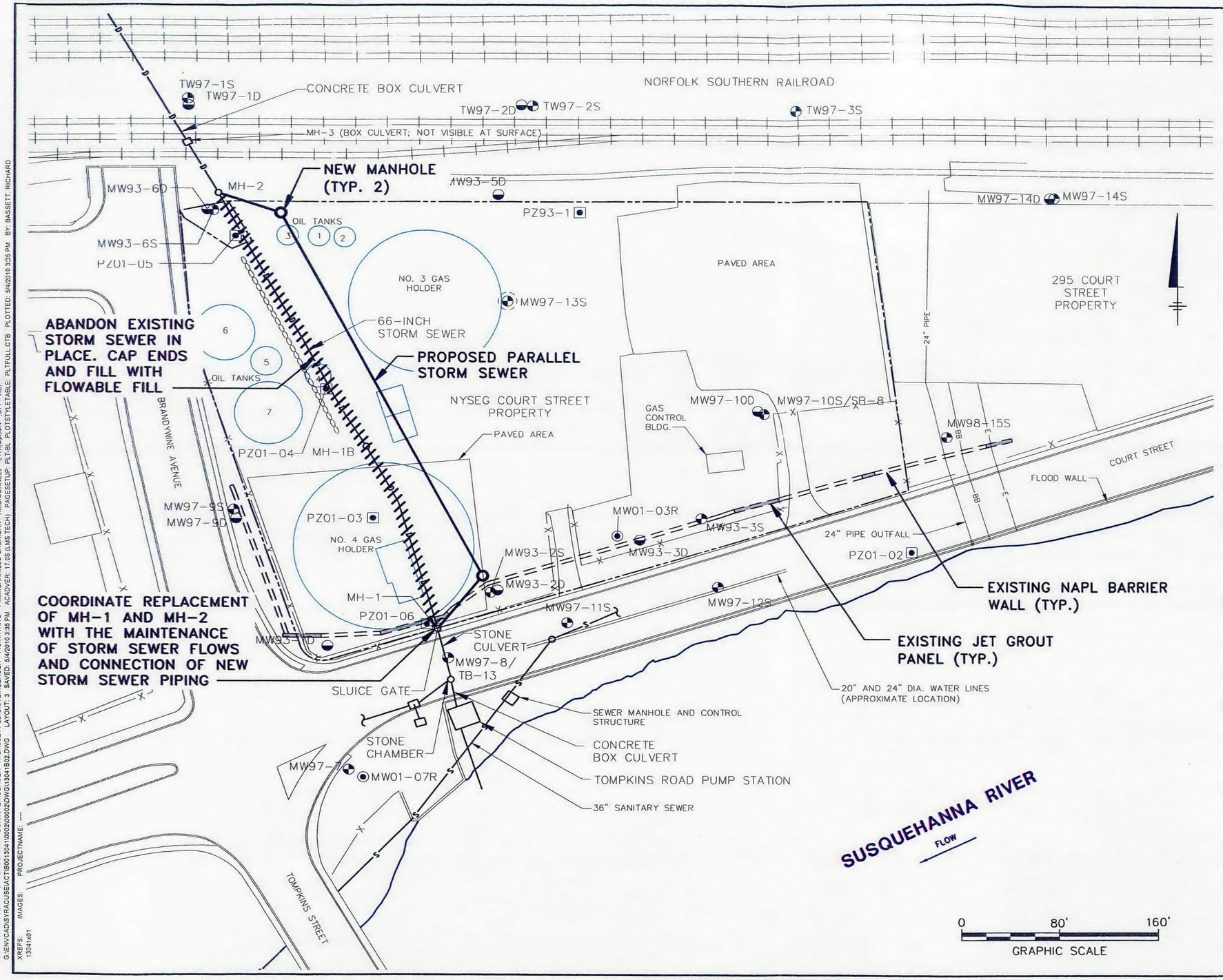
NYSEG COURT STREET SITE
BINGHAMTON, NEW YORK
66-INCH STORM SEWER REHABILITATION ALTERNATIVES EVALUATION MEMORANDUM

SLIPLINING OF EXISTING STORM SEWER PIPE

ARCADIS

FIGURE 2

CITY:SYRACUSE-NY DIV/GROUP:141 DB:G.STEINBERGER R. BASSETT LD:G.STEINBERGER PIC:K.WHITE PM:M.CARRILLO-SHERIDAN TM:D.CORNELL LYR:(On)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACTIVE\00130411\000\26\0002\DWG\130411B02.DWG LAYOUT: 2 SAVED: 10/1/2009 2:50 PM ACADVER: 17.0S (LMS TECH) PAGESETUP: PLT-BL PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 5/4/2010 2:11 PM BY: BASSETT, RICHARD
XREFS: IMAGES: PROJECTNAME: ----
13041x01



LEGEND:

- RAILROAD TRACK
- FENCE
- SITE PROPERTY LINES (APPROXIMATE)
- STORM SEWER LINE (APPROXIMATE)
- SANITARY SEWER LINE (APPROXIMATE)
- HISTORICAL FEATURE
- BURIED CONCRETE WALL
- MONITORING WELL (SHALLOW)
- MONITORING WELL (DEEP)
- MONITORING WELL (BEDROCK)
- PIEZOMETER
- DECOMMISSIONED MONITORING WELL
- CATCH BASIN

NOTES:

1. BASE MAP PROVIDED BY NYSEG (JUNE 12, 1997).
2. ALL INVESTIGATION LOCATIONS SHOWN SURVEYED BY HAWK ENGINEERING, P.C. BINGHAMTON, N.Y.
3. STORM SEWER LOCATION DIGITIZED FROM CITY OF BINGHAMTON MAP, SHEET 303, ENTITLED: PRELIMINARY REPORT, COMPREHENSIVE STORM DRAINAGE, EXISTING FACILITIES. PREPARED BY VERNON O. SHUMAKER, CONSULTING ENGINEER, VESTAL, NEW YORK, DATE NOT PROVIDED.
4. APPROXIMATE LOCATION OF THE TWO UNMARKED CATCH BASINS AND ASSOCIATED PIPING LOCATED NORTHEAST AND EAST OF THE PUMP STATION BASED ON VISUAL OBSERVATIONS MADE BY BBL ON AUGUST 16, 2002.
5. SELECT HISTORICAL FEATURES NOT SHOWN FOR CLARITY.
6. STORM SEWER PIPE INSTALLATION LOCATION IS CONCEPTUAL AND USED FOR PURPOSES OF CONDUCTING THE EVALUATION. THE FINAL DESIGN WILL DETERMINE THE ACTUAL LOCATION OF THE NEW PIPE AND ASSOCIATED FEATURES.

NYSEG COURT STREET SITE
BINGHAMTON, NEW YORK
66-INCH STORM SEWER REHABILITATION ALTERNATIVES EVALUATION MEMORANDUM

PARALLEL STORM SEWER PIPE INSTALLATION

ARCADIS

FIGURE 3

CITY:SYRACUSE-NY DIV/GROUP:141 DB:G.STEINBERGER R. BASSETT LD:G.STEINBERGER PIC:K.WHITE PM:M.CARRILLO-SHERIDAN TM:D.CORNELL LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACTIB\0130411\000200002\DWG\130411B02.DWG LAYOUT: 3 SAVED: 5/4/2010 3:35 PM ACADVER: 17.0S (LMS TECH) PAGESETUP: PLT-BL PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 5/4/2010 3:35 PM BY: BASSETT RICHARD
XREFS: PROJECTNAME: ----
IMAGES: 130411x01