CITY OF DAYTON
DEPARTMENT OF WATER
42-INCH SANITARY SEWER REHABILITATION
42-INCH SANITARY SEWER REHABILITATION

WHAT WE WILL DISCUSS TODAY:

• Project Justification & Evolution (high level/not a chemistry class) - Aaron

• Large Diameter Industrial Cleaning - Aaron

• Large Diameter Gravity Sewer and Manhole Rehabilitation - Cory

• Alternatives to Reduce Odors Within the Wastewater Collection System - Aaron
PROJECT JUSTIFICATION AND EVOLUTION

- Location of Industrial Users/Customers
  - Location of Dayton Wastewater Treatment Plant

- Phase 1 Liner – 4,255-ft (16 spans – $1.5 million)

- Phase 2 Liner – 10,129-ft (27 spans - $3.2 million)
Many Odor Complaints within the wastewater collection system and at the WWTP.

OEPA looked to Dayton to provide a solution.

Many years & discussions regarding possible solutions with many stakeholders. High Profile Project.

Goal pH @ (9) to keep H2S in solution. New opportunities for revenue: sell lime to industrial users.

Lime was chosen to combat odor (initially) - 2 point application (customers site + location downstream).
PROJECT JUSTIFICATION AND EVOLUTION

- Capital Project identified to line 42-inch from Needmore Road to Triangle Park.
- Phase 1 liner installed 2010. Phase 2 in design-planned to be bid in 2012.
- 2-point application worked well to remove odors.
- In Oct 2011-something changed!
- Point 1 application modified from lime to caustic.
Inpark Circle was a problem area and needed to be addressed immediately due to frequent SSO’s.

- Performed sonar investigation to evaluate and develop a plan of action until commencement of Phase 2 liner.

- Initially, we chose to remove debris in select portions of the system in hopes to temporarily restore capacity at select locations.
H2S levels have been observed @ 1,000 ppm
LARGE DIAMETER INDUSTRIAL CLEANING

- Received Notice of Violation for number of SSO's at Inpark Circle. Total of 8 within 3-month period.
- Re-evaluated decision to spot clean.
- Entered into $650,000 emergency cleaning PO with contractor to perform cleaning ahead of Phase II Liner Project.
• Met with contractor and developed a “work plan” with no formal specifications.

• Dashed line represents 18-inch HDPE by-pass line.

• 2-part by-pass set up. 1st consisted of 3,050-ft (shown). 2nd consisted of 7,080-ft.
LARGE DIAMETER INDUSTRIAL CLEANING

PHASE 2 BY-PASS SET-UP
7,080-ft
LARGE DIAMETER
INDUSTRIAL
CLEANING – BY PASS SETUP

Photo Location 1 – Pumps (3~Ea) (10 MGD total capacity) & manhole cone section removed to accept suction.
Photo 3 and 4 – Road Ramps to provide continued service to business & 18-inch HDPE discharge alignment

LARGE DIAMETER
INDUSTRIAL
CLEANING – BY PASS SETUP
Photo of debris removed from the Brentlinger Rd Cleaning/By-pass pumping operation that was completed by Robinson Pipe Cleaning Company on February 10, 2012. On left – debris typical of what is encountered on bottom of pipe. Middle is typical of the “crusting” material removed from the sides of the 42-inch sanitary sewer. Right is typical of “bright white” material encountered at pipe entrances to manholes.
LARGE DIAMETER
INDUSTRIAL
CLEANING

CITY OF DAYTON
SURFACE REINFORCEMENT VISIBLE, AT 12 O’CLOCK, WITHIN 8 INCH: YES, REMARK: REBAR SHOWING
DISTANCE: 352.6 FT

CITY OF DAYTON
SURFACE REINFORCEMENT VISIBLE, FROM 02 TO 10 O’CLOCK, WITHIN 8 INCH: YES, END, REMARK: REBAR SHOWING
DISTANCE: 186 FT

Photo: 9_4a, Tape/Media No.: DAYTON #2, 01:16:03
352.6FT, Surface Reinforcement Visible, at 12 o’clock, within 8 inch: YES, Remark: REBAR SHOWING

Photo: 11_4a, Tape/Media No.: DAYTON #2, 01:36:21
186FT, Surface Reinforcement Visible, from 02 to 10 o’clock, within 8 inch: YES, end, Remark: REBAR SHOWING
LARGE DIAMETER INDUSTRIAL CLEANING

- Cost of Cleaning (Phase 2 only) = **$883,409.00**
- Utilized internal forces to reduce overall estimated cost to **$576,659.00**.
- Spent $30,000.00 (not included above) on debris removal @ $38/ton.
- 790 tons of debris!

COST PROPOSAL

RPC will provide mobilization, labor and equipment to perform work as specified for the following prices:

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
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<tr>
<td>Bypass Pumping Equipment &amp; Installation MHV000M0180 to MHU000M0040</td>
<td>$16,000.00</td>
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<tr>
<td>Mobilization of Pumps &amp; piping, estimated 1 @ $16,000=</td>
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<tr>
<td>Installation and fusing of pipes, estimated 7 days</td>
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<tr>
<td>Monthly Rental of Pumps &amp; Equipment, estimated 1 mo @ $51,380=</td>
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<td>Operation and Maintenance of Set-up, estimated 20 days @ $4,975=</td>
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<tr>
<td>Teardown &amp; Removal of bypass setup, estimated 3 days</td>
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<td>Cleaning and Inspection Equipment &amp; Installation</td>
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<tr>
<td>Mobilization of Trucks and Operators, estimated 1 @ $3,250=</td>
<td>$3,250.00</td>
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<tr>
<td>Daily Jetting and CCTV Equipment, estimated 20 days @ $4,740=</td>
<td>$94,800.00</td>
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<tr>
<td>Total Estimated Project Cost</td>
<td><strong>$301,440.00</strong></td>
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</table>

COST PROPOSAL

RPC will provide mobilization, labor and equipment to perform work as specified for the following prices:

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<th>Description</th>
<th>Cost</th>
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<td>Bypass Pumping Equipment &amp; Installation MH302411 to MHV000M0170</td>
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<td>Monthly Rental of Pumps &amp; Equipment, estimated 2 mo @ $43,010=</td>
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<td>Operation and Maintenance of Set-up, estimated 50 days @ $4,145=</td>
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<td>Teardown &amp; Removal of bypass setup, estimated 3 days</td>
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<td>Cleaning and Inspection Equipment &amp; Installation</td>
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<tr>
<td>Mobilization of Trucks and Operators, estimated 2 @ $3,250=</td>
<td>$6,500.00</td>
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<tr>
<td>Daily Jetting and CCTV Equipment, estimated 50 days @ $4,740=</td>
<td>$237,000.00</td>
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<tr>
<td>Total Estimated Project Cost</td>
<td><strong>$581,969.00</strong></td>
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Large Diameter Gravity Sewer and Manhole Rehabilitation - Construction

Project Summary – Phase I

• Project Limits: Needmore Road to Chuck Wagner Lane
• NTP December 27, 2010
• Start work January 3, 2011
• Completed work July 25, 2011
• 4,255 linear feet of 42” sanitary liner
• 16 spans & 18 manholes
Project Bid Price

- $206/ft includes cleaning, bypass pumping, video before and after
- Price does not include manhole rehab
- Resin was a high grade corrosion resistant enhanced thixotropic epoxy vinyl ester
- Heat deflection temp greater than 220 degrees F
- ASTM D2990, D5813, and F1216
- Tube-non woven felt fabric (ASTM F1216)
Large Diameter Gravity Sewer and Manhole Rehabilitation - Construction

**Liner Thickness**

- Designed for full deteriorated gravity pipe
- AASHTO H-20 live load with 2-truck passing (16k #)
- Short term flexural modulus of 300,000 psi and long term of 200,000 psi
- Flexural strength of 4,500 psi
- Service temperature of 40 to 140 degrees F
Traffic Control

- Had to Cross 5 Lanes of traffic on Needmore Rd and maintain two way traffic on Wagner Ford Rd.
  - 29,000 vehicles per day on Needmore
  - 9,000 vehicles per day on Wagner Ford
  - Bike Path access had to be maintained
  - Several manholes in the bike path
Bypass pumping

- Waste stream composition – lime slurry is used to raise the pH of generally acidic wastewater from the production of citric acid for fermentation.

- Air pollution control equipment uses ammonia and hydrochloric acid scrubbers. Caustic soda used for backup pH control.

- Second major user performs wet corn milling for the preparation and packaging of non-food grade corn starch and the preparation and bulk shipping of gluten, germ, fiber and sweeteners.

- The waste stream consists of by-products from the processing operation, sucrose and fructose. Sulfur dioxide is used to steep the corn to remove the kernel. Hydrochloric acid and enzymes are used in the process of making starch. A coal burner used to make steam generates water, solids, and sulfates, with sulfur dioxide (SO2) scrubbers are used in the air pollution control equipment.

- Effluent temperature approximately 100F, with a pH around 11
Large Diameter Gravity Sewer and Manhole Rehabilitation - Construction
PLANS for bypass pumping

- Bypass pumping set up to handle 10 MGD, 7900 GPM per pump curve
- Two pumps – a primary 18” pump with a backup 18” pump at upstream manhole
- Both pumps connected to 18” fused HDPE pipe
- Cross under Wagner Ford Road on the east side of intersection, then south along Wagner Ford. Crossed under WF from east to west perpendicular to centerline. Then the bypass line ran above ground to an abandoned 36” concrete pipe, approximately 1000 feet downstream.
- Crossing under Wagner Ford Road was left in place for future use.
PLANS for bypass pumping

• Picked up approximately 4,700 feet downstream from the 36” line (primary pump and backup pump) and discharged approximately 75 feet downstream of the last manhole on the sanitary sewer main being lined.

• A fifth pump held in reserve in case of breakdown.

• Pump operators stayed with the pumps whenever bypass was in operation.

• This setup remained in place for the length of the phase 1 project.
PROBLEM

- Two of the manholes on the abandoned 36” main were plugged and had to be opened.
- Required closure of the roadway, (2 lane road, one lane each direction) for 3 weeks.
- 15 foot depth of manholes, pipe plugged with concrete
- Can you say extra?
City of Dayton Water
Regional • Reliable • Renewable

Large Diameter Gravity Sewer and Manhole Rehabilitation - Construction
Cleaning issues

- Pipe cleaned in 2005 with heavy sediment removed by mechanical and hydraulic methods.
- Specifications called for removal of debris, sediment, protrusions, lime/calcium carbonate scale.
- Grit removal from the side of the pipe was a problem, bench cut in grit by cleaning head.
- Water for operations was provided by the City of Dayton from a metered fire hydrant.
- Disposal at COD drying pad.
Large Diameter Gravity Sewer and Manhole Rehabilitation - Construction

Pipe

- Installation per manufacturer’s recommendations
- Contractor verify pipe lengths and dimensions
- Confined space entry
- Manhole cones had to be removed to allow installation of the pipe liner, cant bend
- Water cure to set resin, 6 hours to heat up, 6 hours to cure, 6 hours cool down
- Wrinkles in pipe
- Testing requirements – flexural strength, flexural modulus, and wall thickness
- One test per line segment
- Test results 7495 psi, 416615 psi, 23.2 mm
Large Diameter Gravity Sewer and Manhole Rehabilitation - Construction
**Unique items**

- Pipe average 15 feet deep, adjacent to roadway, under bike path
- Factory bends attached to the outside of manholes, flow direction straight through manholes
- Did sonar mapping prior to project, information provided to bidders
Large Diameter Gravity Sewer and Manhole Rehabilitation - Construction

Project Summary – Phase 2

• Project Limits: Chuck Wagner Lane to Triangle Park

• NTP  May 15, 2012

• Start work June 20, 2012

• Completed work September 7, 2012

• 10,129 linear feet of 42” sanitary liner

• 27 spans, 28 manholes, 17 additional MH from phase 1
Large Diameter Gravity Sewer and Manhole Rehabilitation - Construction

Project Bid Price

- $300/ft includes cleaning, bypass pumping, video before and after
- Manhole rehab $160.00 per vertical foot
- Resin was a high grade corrosion resistant enhanced thixotropic epoxy vinyl ester
  - Heat deflection temp greater than 220 degrees F
- ASTM D2990, D5813, and F1216
- Tube-non woven felt fabric (ASTM F1216)
Bypass Pumping
Similar to Phase 1 with two pumps and a backup
Two setups, south section (lower elevation) in flood plain first, north section second
In the event of heavy rain, all bypass pumping equipment had to be removed to allow normal flow in the sewer.
If the river level was anticipated to be over the manholes, all equipment had to be removed to prevent inflow.
Fortunately, we did not have any problems with elevated river levels.

They bypass piping followed the bike path and was secured in place with staking.

The bypass crossed the bike path twice and road ramps were installed for bicycle and pedestrian traffic.
Manhole Rehabilitation
Manholes in good structural condition
Slime growth on walls
New cone/top sections installed after liner installation
Pressure wash, patching as needed
Coated from top to bottom with a spray applied cement based lining system while under bypass
Manholes from phase 1 were also lined as part of this project.
Flow in sewer main prevented rehab below the water line.
Rapid Seal was specified around the exterior joints of the new barrel sections
Water tight lids and frames were installed in phase 2 because manholes are in the flood plain for the river.
One last surprise
Remember the abandoned 36” main from Phase 1?
The active 42” main crosses the 36” main at almost the identical elevation
A vault was constructed that encompassed both mains.
The 42” pipe alignment was offset approximately 4 feet within the vault, creating turbulent flow and loss of energy.
Large Diameter Gravity Sewer and Manhole Rehabilitation - Construction

- 36” main plugged at both ends and protruded into vault
- Contractor was confident that liner could be installed through the vault, with modification
- 36” pipe removed and replugged
- New flow channel created
- Pipe installed and new bench poured around pipe liner.
Slight compression of liner at bends
Liner removed inside vault to allow for expansion/contraction of pipe from differential heating
Testing results

Requirements same as phase 1

Results 7495 psi flexural

416615 psi flexural modulus

23.2 mm wall thickness
Clean up
- Pipe and pumps flushed with clean water from fire hydrant
- HDPE pipe cut into flat bed truck lengths and hauled out
- Bike path repaired and disturbed areas seeded.
Large Diameter Gravity Sewer and Manhole Rehabilitation - Construction
ALTERNATIVES TO REDUCE ODORS
ALTERNATIVES TO REDUCE ODORS

• Dayton WWTP – IPT championed bioxide trial. Initial indications were that the bioxide would be an economical alternative.

• Utilized same locations for a 2-point application but used bioxide instead of lime.

• Bioxide “on-line” mid February. Results pending…..we are hopeful!
Questions?

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Cory Kinnison (email=donald.kinnison@daytonohio.gov)