LESSONS LEARNED DURING INSTALLATION OF LARGE DIAMETER CIPP LINING IN AN ENVIRONMENTAL MITIGATION AREA

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NASTT’s 2016 No-Dig Show
Agenda

- Project Background
- Design Considerations
- Construction Challenges & Lessons Learned
- Conclusion
City of Santa Rosa

- Sonoma County, California
- Population: ~175,000
- Largest city in California’s North Coast and Wine Country
- 535 miles of sewer main from 4” to 66”
Project Background

• Fast-tracked design and construction

• Rehabilitation of ~2,600 feet of 39, 45, and 48 inch RCP trunk sewers – originally constructed in 1968-1971.

• Rehabilitation of 7 manholes

• Located within the Santa Rosa Plain Conservation Strategy Area

• Located within a declared California Department of Fish and Wildlife Mitigation Bank Wetland

Female California Tiger Salamander
Existing Condition of Trunk Sewer

CCTV inspection conducted in 2010 revealed significantly deteriorated pipes

- Exposed rebar
- Loss of aggregate in crown from 8 o'clock to 4 o'clock position

A Structural Rehabilitation Solution Would be Required
Why CIPP?

Project Goals:
- Maintain hydraulic capacity of the City’s trunk sewer backbone
- Provide a structural solution
- Limit excavation within the Mitigation Bank
Design Considerations
Site Access and Environmental Considerations

A CADFW “Incidental Take” permit was required.

Establishing access restrictions & construction limitations critical to obtaining regulatory acceptance…

- Specific ingress/egress corridors
- Limited square footage of earth disturbance allowed within mitigation area
  - Insertion manholes selected by designer
- Steel plates to span vernal pools & wetland areas
- Defined bypass alignment
- Fencing to delineate off-limit areas
- On-site biologist during construction
Bypass Pumping

- During pipe cleaning, CIPP lining, and post lining inspection.
- 9.6 MGD dry weather flow
- Located to minimize impacts to endangered and listed animal and plant species in the Mitigation Area.

Options:
1. Route outside Mitigation Area on City streets: Too long
2. Route outside Mitigation Area through private property: Too risky
Bypass Pumping

Strategy: Prepare drawings that identify a required bypass route.
- Routed to environmental agencies for approval prior to bid
- Designed to:
  - Avoid vernal pools
  - Limit excavation
Manhole Rehabilitation

- Existing manholes actually small structures not manholes
  - 102” barrel
  - Top slab
  - 48” cone
- Non-structural: Spray on epoxy lining
- Structural: CIPP manhole lining
  - Small void at top
  - Epoxy lining at bench and in void
  - Jetted grout in annular space
Schedule - 2015

53 Days for Project Completion
• Inspection
• Cleaning
• Lining Design/Submittals
• Material Procurement
• Rehabilitation Construction

Start Project Design

Complete Project Design

Contractor Mobilizes

Bids Opened

Bypass Set-Up Complete

Mandatory Project Completion Date

$4,000/day Early Incentive.
Max: $40,000

$4,000/day Late Disincentive.
No cap.
Plus Liquidated Damages

Feb 23
Bypass Set-Up Complete

Contractor Mobilizes

Bids Opened

Start Project Design

Complete Project Design

Aug 23

Feb 3

May 12

Aug 3

Early

Oct 15

Late
Schedule

• Work Hours: 24 hours per day/7 days per week
• Bypass plan: 10 working days from NTP
• Host pipe inspection required prior to CIPP liner design and acceptance
  – Past issues with actual versus designed internal host pipe diameter due to corrosion
• Early completion incentive to assure CIPP liner provided prior to October 15 deadline
Construction Challenges and Lessons Learned

But....................
it wasn’t all fun and games....
Pre-Construction Cleaning

The Challenge:

• Large volume of debris removed from sewers.
• Trunk sewers had not been cleaned in 40+ years!
• During original CCTV inspection, pipe was flowing 1/3 to 1/2 full. No debris noted in inspection.
• One day cleaning per pipe segment planned vs one week on avg. in actual time per segment.
The Solution:
- 2\textsuperscript{nd} Vac Truck brought on site to make October 15\textsuperscript{th} deadline.
- No claims or change orders issued.

Bottom Line:
- What you can’t see, can hurt your schedule.
- Determine the cleaning history of your system and account for anticipated debris in the contract documents.
CIPP Liner Wrinkles

**The Challenge:**
- Presence of large wrinkles in CIPP lined pipe.

**The Solution:**
- If grinding does not compromise liner structural integrity:
  1. Grind wrinkles to req’d tolerance.
     - <5% of pipe diameter outside 120 degree invert arc
     - <2% of pipe diameter inside 120 degree invert arc
  2. And, spray exposed areas with epoxy
- If it does, remove and replace liner
- No claims or change orders
CIPP Liner Wrinkles

**Bottom Line:**
- Wrinkles are common in large diameter CIPP lining.
- Craft contract documents to clearly outline what is acceptable and what is not.
- Clearly state how to fix what is not acceptable and who is to pay for the repair.
CIPP Liner Lifts

The Challenge:
Longitudinal lifts in 650 foot long 45” dia trunk sewer with a 23.1mm thick CIPP liner (designed)
• Three lifts
• 3” to 8” wide X 26 feet long X 1” tall
• 5 o’clock, 6 o’clock, and 7 o’clock positions
• Hard to the touch
• Sounded hollow when tapped with a hammer
CIPP Liner Lifts

**The Solution:**
Investigate lifts’ impacts to:

1. Structural integrity of lined pipe
   - Hoop shape and ring compression not compromised if voids filled under the lifts with epoxy grout to ensure solid liner at invert.

2. Hydraulic capacity
   - 1.6% loss in design capacity over 4% of the pipe

3. Future maintenance issues
   - Lifts running parallel to flow
   - Grind wrinkles down to tolerance & coat with epoxy
CIPP Liner Lifts

**Bottom Line:**
A lift is unacceptable if it compromises:

1. The liner’s structural integrity (hoop shape and ring compression)
2. Hydraulic capacity of the lined pipe
3. Ease of future maintenance
But, everyone was happy in the end.
Thank you!

Questions?

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Photos courtesy of Coastland Civil Engineering, CM/Inspection Consultant for the project.