

Northeast Interceptor Rehabilitation (Lining Project) (Far East Interceptor to Southeast Interceptor)



Project Purpose:

The purpose of this project is to correct condition defects and extend the service life of the Northeast Interceptor between the Southeast Interceptor and the Far East Interceptor (see highlighted line on map above).

Project Proposer/Champion: Todd Gebert

Department: Engineering

Project Involvement:

The Engineering Department will provide overall management of the project, including preparation of plans and specifications, contract administration, and construction management.

Project History and Status:

The Northeast Interceptor system provides service to the northerly and easterly areas of the collection system, including the City of Madison, the villages of Cottage Grove, DeForest and Waunakee and other municipalities. It was built in several phases throughout the period from 1964-1971 and was constructed entirely of reinforced concrete pipe. While concrete serves as a robust and durable pipe material, it is susceptible to water infiltration at its joints and to corrosion of the interior pipe surfaces due to the presence of hydrogen sulfide gas. Hydrogen sulfide is produced in the sewer as the wastewater decomposes. As the gas is released into the atmosphere and contacts exposed surfaces of the pipe, bacteria converts it to sulfuric acid. The concrete corrodes due to the sulfuric acid that collects on the pipe surfaces.

All segments of the original concrete pipe in the Northeast Interceptor system have been inspected via closed circuit television within the last seven years from its junction with the Southeast Interceptor to its junction with the Pump Station 14 force main. These inspections have revealed many pipe segments that are in various stages of corrosion. A summary of the general condition of the Northeast Interceptor system (within the limits stated above) with regard to corrosion can be found in attached Table 1.

As shown in attached Table 1, approximately 50,000 feet of concrete pipe was installed in the Northeast Interceptor system from the Southeast Interceptor to Pump Station 14 between 1964 and 1971. Of that total, approximately 26,000 feet, or 52%, remains in service. The remaining 24,000 feet has either been replaced or rehabilitated with a cured-in-place liner due to issues of corrosion and/or capacity.

The Northeast Interceptor between the Southeast Interceptor and the Far East Interceptor was constructed in 1964 and was comprised at that time of approximately 5,600 feet of 48" diameter reinforced concrete pipe. It was televised in 2010 and 2011 and was found to be suffering from corrosion similar to that experienced in the rest of the system. This section of sewer was also identified as requiring an increase in capacity in CARPC's *MMSD Collection System Evaluation (2009)*. In 2011 the District began the design of new relief and replacement sewers to upgrade the capacity of this section and construction was completed in 2013. The new sewers leave approximately 3,300 feet of the original Northeast Interceptor section in service between the Southeast and Far East interceptors (manhole MH18-004 to manhole MH18-014).

Based on television inspection and corrosion noticed elsewhere throughout the Northeast Interceptor system, those sections of interceptor still in service between manhole MH18-004 and manhole MH18-014 should be considered for rehabilitation with a cured-in-place liner prior to 2025. For purposes of the Capital Improvements Plan it will be assumed that this rehabilitation project will be undertaken in 2023. Deterioration due to corrosion in this section does not appear to be as severe as in other portions of the Northeast Interceptor system. The schedule for this project could be postponed as other rehabilitation priorities in the collection system are identified.

Options:

- a. **Description:** The original Northeast Interceptor between the Southeast Interceptor and the Far East Interceptor consisted of approximately 5,600 feet of 48” diameter reinforced concrete sewer. Approximately 2,300 feet of this interceptor was abandoned in 2013 upon completion of new relief/replacement sewers. The remaining 3,300 feet of sewer requires rehabilitation or replacement due to corrosion of the interior pipe walls.

- b. **Alternatives**

Alternative 1 – Rehabilitate the existing sewer with a cured-in-place liner

Under this alternative the 48” reinforced concrete sewer will be rehabilitated with a cured-in-place liner. All manholes will also be lined as part of the rehabilitation (see attached Figure 1).

Alternative 2 – Construct a new sewer with open cut excavation

This alternative consists of constructing a replacement sewer parallel to the existing sewer. Many direct connections to this interceptor exist along Femrite Drive so the replacement sewer will have to closely follow the alignment of the existing sewer.

Alternative 3 – Do nothing

Under this alternative the existing sewer would not be rehabilitated or replaced. Due to the age of the sewer and the condition defects present, this alternative is not considered feasible and was not advanced for further economic analysis.

c. Key Risks and Issues

Alternative 1. Rehabilitation of the existing sewer with a cured-in-place liner will cause minimal disruption to the environment and the general public. Some bypassing of wastewater around the sections to be lined will be required during insertion of the liner although the amount of bypassing required will be minimized due to the new relief and replacement sewers that were installed in 2013. These new sewers will allow flow to be diverted from the existing interceptor and will reduce the expense and time needed to bypass flow. Lining the interceptor will cause some minor disruption to residential homes in the project area during the installation process as lateral connections will be temporarily removed from service. These service outages will be limited in duration and will not result in great inconvenience to the user.

The project area is located in a heavily congested traffic area near the intersection of U.S. Highway 51 and U.S. Highway 12/18. There is good access to manholes, however, and it is not expected that major disruptions to traffic will be needed as a result of the lining operation.

Alternative 2. Construction of a replacement sewer with open cut excavation will be much more costly and disruptive as compared to Alternative 1. As mentioned in the previous section, the project area is located in a heavily congested traffic corridor. A costly underground crossing of U.S. Highway 51 will be required as part of this alternative as well as major impacts to regional traffic along East Broadway, Progress Road, and U.S. Highway 51.

d. Economic Analysis

Please see the attached 50-year life cycle cost estimate. A summary of present worth costs is provided in the following table:

	Capital Cost	O&M Cost	Salvage Value	Total Present Worth
Alternative 1	\$1,796,000	N/A	\$28,000	\$1,768,000
Alternative 2	\$4,144,000	N/A	\$311,000	\$3,833,000

Recommended Option

Staff recommends Alternative 1 due to its cost effectiveness and its overall ability to better meet the triple bottom line relative to Alternative 2. Rehabilitation of the sewer with a cured-in-place liner will cause significantly less disruption to the environment and the general public than construction of a replacement sewer by traditional cut and cover methods.

Project Schedule:

	Start Date	Completion Date
Planning	2013	2022
Design	July 2022	February 2023
Bid Date	March 2023	April 2023
Construction	May 2023	December 2023

Financial Summary (2019 dollars):

Total Project Cost	
District Staff	\$85,000
Consultant	\$20,000
Contractor	\$1,735,000
Total	\$1,840,000

Fiscal Year Allocation (2019 dollars):

	2022	2023
District staff	\$35,000	\$50,000
Consultant	\$10,000	\$10,000
Construction	\$0	\$1,735,000
Total	\$45,000	\$1,795,000

Fiscal Year Allocation (actual dollars):

	2022	2023
District staff	\$40,000	\$60,000
Consultant	\$10,000	\$10,000
Construction	\$0	\$1,955,000
Total	\$50,000	\$2,025,000

Table 1 - Summary of Pipe Condition for Original Northeast Interceptor System (Southeast Interceptor to junction with Pump Station 14 force main)

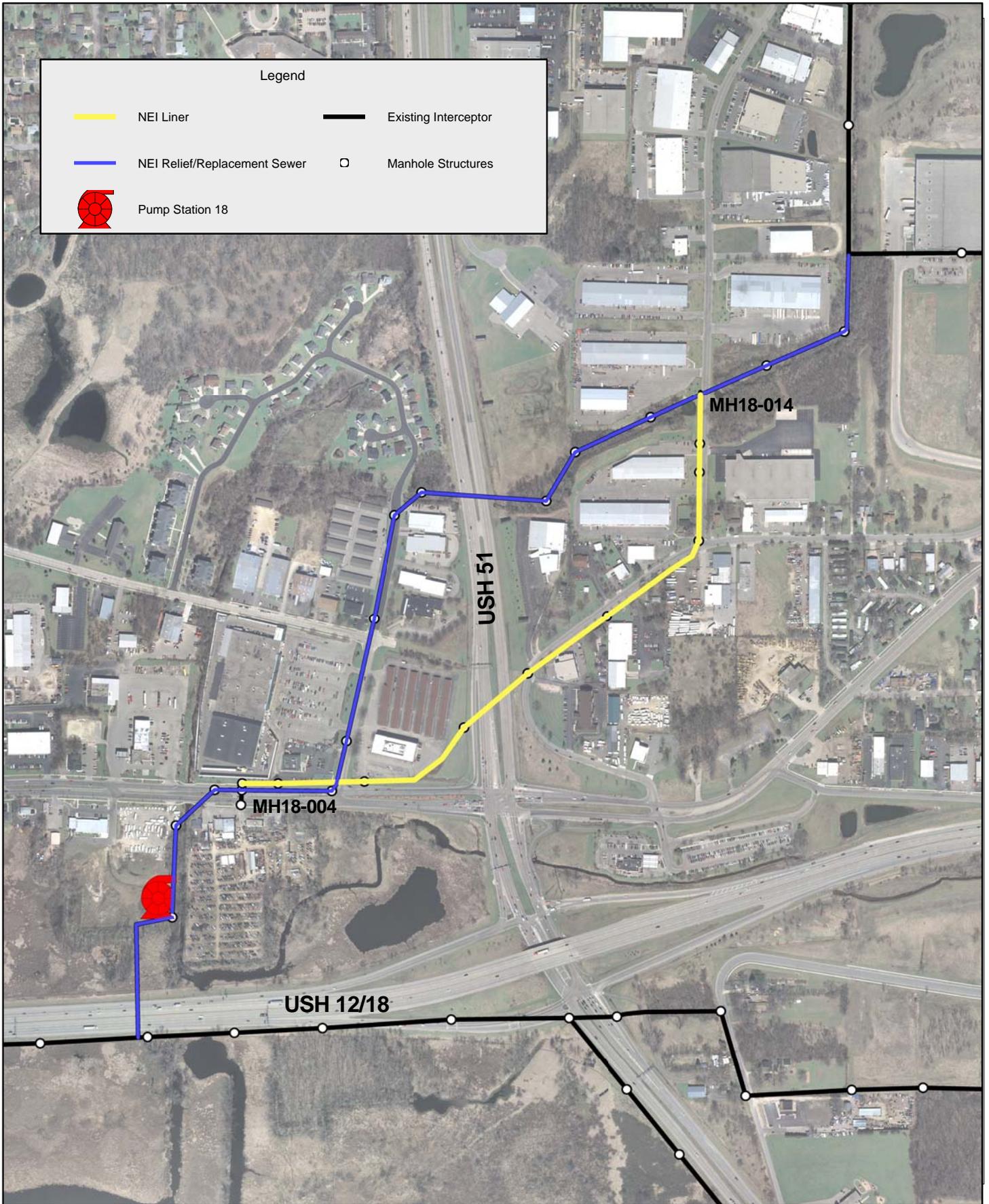
Interceptor Section	From Manhole	To Manhole	Installation Year	Age in 2019 (yrs)	Original Installed Length (ft)	Original Remaining Length (ft)	Existing Sewer Material	Existing Corrosion Condition	Rehabilitation History	Comments	
Northeast	MH07-215	MH07-313	1964	55	5,591	3,333	RCP	Poor to moderate	None	Original sewer requires rehab by 2025. Relief and replacement sewers were constructed in 2013 for capacity. Approximately 2,250 feet of original sewer was abandoned with 2013 project.	
Northeast	MH07-313	MH07-955	1964	55	7,337	0	FRP	Good	Replacement sewer constructed in 2005	Original sewer had segments of severe corrosion. All segments replaced.	
Northeast	PS10	MH10-426	1964	55	9,200	5,181	RCP	Moderate	9,220 feet of new sewer installed in 2010 to provide capacity relief and replace severely corroded sections	Remaining segments to be televised on periodic basis to monitor corrosion.	
Northeast - Truax Ext	MH10-426	MH10-145	1969	50	10,973	10,973	RCP	Poor to moderate	None	Original sewer requires rehab by 2023.	
Northeast - Truax Ext	PS13	MH13-105	1969	50	1,758	1,758	RCP	Moderate	None	Sewer normally fully submerged upstream of PS 13.	
Northeast - Truax Ext	MH13-105	MH13-116A	1969	50	5,293	0	RCP (L)	Good	Entire section lined in 2008		
Northeast - W/D Ext	MH13-116A	MH13-116H	1971	48	2,463	0	FRP	Good	Entire section replaced in 2008	Section replaced as part of airport improvements.	
Northeast W/D Ext	MH13-116H	MH13-127	1971	48	2,095	0	RCP (L)	Good	Entire section lined in 2014	Sewer lined from MH13-127 to MH13-116H in 2014.	
Northeast W/D Ext	MH13-127	MH13-137	1971	48	4,514	4,514	RCP	Moderate	None		
TOTALS					49,224	25,759					

Notes/abbreviations:

(1). RCP = Reinforced concrete pipe; RCP(L) = Reinforced concrete pipe with cured-in-place liner; FRP = Fiberglass reinforced mortar pipe.

(2). Northeast W/D Ext = Northeast Interceptor - Waunaukee/DeForest Extension

Percent Rehabilitated: 48%
 Percent No Rehab: 52%



**Madison Metropolitan
Sewerage District**

**Figure 1: Northeast Interceptor
Rehabilitation (SEI to FEI)**

Prepared by: TWG
Date: 2/6/14

**50-YEAR PRESENT WORTH COST ANALYSIS
FOR NORTHEAST INTERCEPTOR REHABILITATION (SEI TO FEI)**

Present-Worth Analysis Year 2019
 Analysis Period (yrs) 50
 End of Analysis Year 2069

Project Description	Year	Capital Cost		O&M Costs	Salvage Value		Total 2019 Present Worth
		Cost in Year Constructed	2019 Present Worth	2019 Present Worth	Year 2069	2019 Present Worth	
<u>Alternative 1 - Rehabilitate existing sewer</u>							
Install cured-in-place pipe and manholes	2023	2,071,000	1,796,000	0	166,000	28,000	1,768,000
<u>Alternative 2 - Replacement sewer</u>							
Replacement sewer	2023	4,778,000	4,144,000	0	1,847,000	311,000	3,833,000

Assumptions and Notes:

- (1). Base interest rate = 3.625%
- (2). Construction cost escalation rate = 3.00%
- (3). Interceptor & Forcemain Service Life (yrs) = 75
- (4). Pipe liner life (yrs) = 50
- (5). Annual O&M interceptor cost (\$/ft) = 0.25
- (6). Annual O&M forcemain cost (\$/ft) = 0.25
- (7). Base interest rate excludes rate of inflation. Assume construction costs do not escalate beyond those due to inflation.
- (8). Annual O&M costs similar for both alternatives due to equivalent length of sewer required.

**50-YEAR PRESENT WORTH COST ANALYSIS
FOR NORTHEAST INTERCEPTOR REHABILITATION (SEI TO FEI)**

Capital Costs for Northeast Interceptor Rehabilitation (SEI to FEI)						
No.	Description	Footnote	Estimated Quantity	Units	2019 Unit Cost	2019 Total Cost
Alternative 1 - Rehabilitate existing sewer with cured-in-place liner						
	48" cured-in-place liner	(2)	3,330	L.F.	\$375	\$1,249,000
	Rehabilitate manhole		9	EACH	\$5,500	\$50,000
	Bypass pumping	(3)	1	LUMP SUM	\$250,000	\$250,000
	Reinstate services		5	EACH	\$500	\$2,500
	Traffic control		1	L.S.	\$25,000	\$25,000
				Sub-total		\$1,577,000
				Contingencies	10.0%	\$158,000
				Construction Total		\$1,735,000
				Engineering	6.0%	\$104,000
				2019	Project Total	\$1,840,000
Alternative 2 - Replacement sewer						
	48" sewer	(4)	3,330	L.F.	\$1,275	\$4,245,000
				2019	Project Total	\$4,245,000
Notes:						
(1). All unit costs in 2019 dollars.						
(2). Unit price for liner based on District's rehabilitation of 48" Northeast Interceptor west of Dane County Airport in 2014.						
(3). Cost of bypass pumping reduced by approximately 50% to reflect presence of parallel sewer system.						
(4). Unit price based on <i>Northeast Interceptor Relief/Replacement - PS 10 to Lien Road</i> , adjusted by ENR's construction cost index.						