

Section 5

Manhole Inspection Report



**Ypsilanti Community Utilities Authority
Huron River Interceptor I/I Study**

**Manhole Inspection Report
Technical Memorandum
December, 2008**

Introduction

Several manholes within the Huron River Interceptor (HRI) sewer district are located near or within the floodplains of the Huron River and Paint Creek. The HRI, which runs parallel to the Huron River, crosses the river at five locations before discharging to the Factory Street Pump Station. Manholes closest to the Huron River were inspected in the spring of 2008 as a priority to identify defects with high river inflow and infiltration (I/I) potential. This report summarizes the findings of the manhole inspections performed in the spring of 2008, including estimated costs for repairing deficient manholes.

Inspection Results

Appendix A contains a detailed summary of the inspection data collected for each manhole, including the individual recommendations for rehabilitation. Appendix B contains one page of inspection photographs and the mapped location of each manhole.

Each manhole inspected was assigned a rating in the field for I/I related and structural related problems. The manholes were assigned an estimated I/I removal rate based on the potential sources and the ratings. Table 1 is a summary of the results of the cost-effective analysis for each manhole inspection. A repair was considered to be cost-effective if the repair cost to remove the I/I was less than the corresponding I/I transport and treatment costs. The manhole numbers are highlighted red, yellow, and green in Table 1 to indicate general manhole condition as poor, fair, and good, respectively.

The transport and treatment cost used in this analysis (\$640,000 per cubic feet per second of peak flow) was based on estimates used in the recent North Huron Valley / Rouge Valley (NHV/RV) sanitary system SSES. The transport and treatment cost was based on a study prepared by a technical sub-committee of the NHV/RV System that evaluated potential transfer of Western Townships Utility Authority (WTUA) capacity.

Table 2 is a summary of the rehabilitation cost estimates for all manholes inspected. The total opinion of probable cost to repair cost-effective and non-cost-effective defects is \$105,235, as shown in Table 2. Cost-effective repairs are \$86,747. These cost opinions include 35% of the total construction costs for engineering, legal, and contingencies.

Table 3 is a detailed summary of field data collected for each manhole that was inspected.

Table 1. Inflow and Infiltration Cost-Effective Analysis Summary

Manhole Number	Manhole Type	I/I Sum 480 gpm	Rehab Costs	Additional Contract Capacity Cost (@ \$640,000/cfs)	Cost-Effective Rehab?
s_9_109	San MH	13.6	\$ 1,782	\$ 19,328	Yes
s_9_110	San MH	14.0	\$ 2,079	\$ 20,012	Yes
s_9_123	San MH	16.3	\$ 1,175	\$ 23,163	Yes
s_9_136	San MH	26.1	\$ 1,107	\$ 37,146	Yes
s_9_137	San MH	26.5	\$ 1,782	\$ 37,830	Yes
s_9_139	San MH	26.5	\$ 2,930	\$ 37,830	Yes
s_9_140	San MH	17.3	\$ 1,337	\$ 24,616	Yes
s_9_141	San MH	16.8	\$ 1,350	\$ 23,932	Yes
s_9_142		0.0	\$ -	\$ -	NA
s_9_143	San MH	15.6	\$ 1,323	\$ 22,179	Yes
s_9_148	San MH	14.5	\$ 1,175	\$ 20,725	Yes
s_9_158	San MH	16.0	\$ 1,337	\$ 22,863	Yes
s_9_159	San MH	16.5	\$ 1,998	\$ 23,547	Yes
s_9_160	San MH	15.6	\$ 1,283	\$ 22,179	Yes
s_9_161	San MH	0.0	\$ -	\$ -	NA
s_9_214	San MH	13.6	\$ 1,769	\$ 19,328	Yes
s_9_89	San MH	3.1	\$ 716	\$ 4,362	Yes
s_9_90	San MH	0.0	\$ 473	\$ -	No
s_9_90a	San MH	23.6	\$ 3,726	\$ 33,582	Yes
s_9_90b	San MH	2.0	\$ 473	\$ 2,851	Yes
s_9_90c	San MH	14.8	\$ 1,350	\$ 21,110	Yes
s_4_114	San MH	4.6	\$ 1,053	\$ 6,500	Yes
s_4_17	San MH	16.3	\$ 1,512	\$ 23,163	Yes
s_4_28	San MH	0.0	\$ -	\$ -	NA
s_4_30	San MH	1.8	\$ -	\$ 2,608	NA
s_4_32	San MH	17.5	\$ 11,138	\$ 24,944	Yes
s_4_34	San MH	0.1	\$ 243	\$ 143	Yes
s_4_34a	San MH	27.0	\$ 11,043	\$ 38,514	Yes
s_4_34b	San MH	5.8	\$ 1,192	\$ 8,253	Yes
s_4_57	San MH	0.0	\$ -	\$ -	NA
s_9_111	San MH	2.5	\$ 932	\$ 3,506	Yes
s_9_162	San MH	5.5	\$ 1,258	\$ 7,783	Yes
s_9_163	San MH	7.9	\$ 2,147	\$ 11,289	Yes
s_9_164	San MH	11.9	\$ 1,998	\$ 17,005	Yes
s_9_165	San MH	2.4	\$ -	\$ 3,421	NA
s_9_166	San MH	0.0	\$ -	\$ -	NA
s_9_167	San MH	2.6	\$ 1,690	\$ 3,678	Yes
s_9_168	San MH	3.4	\$ 338	\$ 4,861	Yes
s_9_211	San MH	0.0	\$ -	\$ -	NA
s_9_170	San MH	0.4	\$ -	\$ 570	NA
s_9_209	San MH	15.0	\$ 3,740	\$ 21,324	Yes
s_9_210	San MH	25.0	\$ 2,538	\$ 35,635	Yes
s_9_86	San MH	0.0	\$ -	\$ -	NA
s_9_87	San MH	2.9	\$ 972	\$ 4,062	Yes
s_4_169	San MH	2.2	\$ 1,080	\$ 3,122	Yes
s_4_171	San MH	7.8	\$ 2,977	\$ 11,075	Yes
s_5_74	San MH	0.0	\$ 716	\$ -	No
s_5_179a	San MH	0.0	\$ 2,464	\$ -	No
s_5_180	San MH	2.9	\$ 540	\$ 4,091	Yes
s_5_181	San MH	2.5	\$ 716	\$ 3,620	Yes
s_5_181a	San MH	2.0	\$ 3,308	\$ 2,837	Yes
s_5_183	San MH	5.3	\$ 1,863	\$ 7,583	Yes
s_5_184	San MH	10.0	\$ 2,410	\$ 14,282	Yes
s_5_179	San MH	1.8	\$ 540	\$ 2,623	Yes
s_4_170	San MH	13.9	\$ 2,835	\$ 19,841	Yes

Table 2. Manhole Rehabilitation Cost Estimate

	Category	Repair Timeline	Number of MHs
7	Priority Replacement/Repair	Immediately	22
6	Priority Repair	Immediately	7
5	Priority Repair	< 1 Year	6
4	Priority Repair	1-2 Years	6
3	Plan to Repair	0-5 Years	4
2	Monitor Again	@ 5 Years	2
1	Monitor Again	@ 10 Years	5

	Rehab	Construction Cost	Number of MHs	Manhole Depth (vft)	Total Cost
1	Remove & Replace Lid	\$286.00	19		\$ 5,434
2	Remove & Reset Frame (Vegetation/Gravel)	\$242.00	2		\$ 484
3	Remove & Reset Frame (Pavement)	\$700.00	1		\$ 700
4	Remove & Replace Frame (Vegetation/Gravel)	\$370.00	5		\$ 1,850
5	Remove & Replace Frame (Pavement)	\$810.00	3		\$ 2,430
6	Replace Adjusting Rings (< 2 ft, Vegetation/Gravel)	\$600.00	2		\$ 1,200
7	Replace Adjusting Rings (> 2 ft, Vegetation/Gravel)	\$900.00	0		\$ -
8	Replace Adjusting Rings (< 2 ft, Pavement)	\$1,050.00	0		\$ -
9	Replace Adjusting Rings (> 2 ft, Pavement)	\$1,650.00	1		\$ 1,650
10	Apply Calcium Aluminate (CA) Cement Lining ¹	\$100.00 / vft	29	288.62	\$ 28,862
11	Seal Leak(s) With Mortar	\$400.00	13		\$ 5,200
12	Apply Heat Shrinkable Manhole Wrap ³	\$594.00	3		\$ 1,782
13	Adjust Elevation (< 2 ft)	\$880.00	2		\$ 1,760
14	Replace Corbel (Pavement)	\$550.00	0		\$ -
15	Replace Corbel (Veg/Gravel)	\$500.00	1		\$ 500
16	Rebuild Manhole	\$8,000.00	3		\$ 24,000
17	Mortar Adjusting Rings	\$350.00	5		\$ 1,750
18	Seal Leak(s) With Injectable Polyurethane Grout ²	\$350.00	1		\$ 350

¹ \$100 per vertical foot (vft); application assumes entire MH

² Assumes an average of 5 cartridges per application

³ Assumes Chimney height of 2'

Construction Total =	\$ 77,952
25% Engineering and Legal =	\$ 19,488
10% Contingency =	\$ 7,795
TOTAL =	\$ 105,235
Cost-Effective Rehab TOTAL =	\$ 86,747

Table 3. Summary of Field Data Collected During the 2008 HRI Manhole Inspections

Manhole Number	Manhole Type	I/ Sum 493 gpm	Cover Condition	Frame Condition	Ring Type	Ring Depth (ft)	Ring Condition	Corbel Type	Corbel Depth (ft)	Corbel Condition	Wall Type	Wall Condition	Notes	Date	Crew	Structure Diameter (ft)	Step Condition	Flow Depth (ft)	Channel Condition	Surface Material MH Set In	Type of Surface	Structure Rating	Inflow Rating	Infiltration Rating	Inflow Notes	Infiltration Notes	Misc. MH Rehab	Rehab Method #(s)	Action	
s_4_114	San MH	4.6	Good	Good		0		None	0		Brick	Fair		4/17/2008 10:43	--OHM--	6	Missing	0.5	Good	Bituminous	Road Way	S-3	I-4	F-4			10		Plan to Repair in 0-5	
s_4_169	San MH	2.2	Good	Good	Brick/Block	0.67	Good	Precast	4	Good	Precast	Good		5/21/2008 11:29	bt dk	6	Good	0.5	Good	Bituminous	Road Way	S-2	I-2	F-5	2 leaks		11 11	Priority Repair in less than		
s_4_170	San MH	13.9	Good	Good	Brick/Block	1	Fair	Block	6	Fair	Brick	Fair		5/21/2008 11:16	bt dk	4	Fair	0.5	Good	Bituminous	Road Way	S-6	I-6	F-6		2 holes	5 10 1	Immediate Priority Repair		
s_4_171	San MH	16.3	Good	Good	Brick/Block	4	Good	Precast	4	Good	Precast	Good		4/17/2008 8:58	--OHM--	6	Fair	0.2	Fair	Bituminous	Road Way	S-7	I-3	F-7		very	10		Plan to Repair in 0-5	
s_4_171	San MH	7.8	Good	Good	Brick	1.5	Fair	Brick	3	Fair	Brick	Fair		5/20/2008 16:41	bt dk	4	Poor	0.5	Good	Bituminous	Road Way	S-4	I-5	F-6	2 holes		5 10 1	Immediate Priority Repair		
s_4_28	San MH	0.0	Good	Good	Brick	0.5	Good	None	0		Block	Good		4/17/2008 9:10	--OHM--	6	Good	1	Good	Bituminous	Road Way	S-1	I-1	F-1					Monitor Again in 10	
s_4_30	San MH	1.8	Good	Good	Brick	1	Good	None	0		Block	Good		4/17/2008 9:52	--OHM--	6	Good	0	Poor	Bituminous	Road Way	S-1	I-3	F-3		Cleaning			Plan to Repair in 0-5	
s_4_32	San MH	17.5	Good	Poor	Brick	1	Poor	None	0		Block	Poor		4/17/2008 9:59	--OHM--	6	Fair	0	Poor	Vegetation	Wooded Area	S-7	I-6	F-7			2 16		Immediate Priority Repair	
s_4_34	San MH	0.1	Good	Good	None	0		Block	4	Good	Block	Good		4/17/2008 10:17	--OHM--	4	Good	0.75	Good	Bituminous	Parking Lot	S-1	I-1	F-2			1		Monitor Again in 5 Years	
s_4_34a	San MH	27.0	Good	Good	None	0		None	0		Brick	Fair		4/17/2008 10:32	--OHM--	4		0.5	Good	Bituminous	Parking Lot	S-7	I-7	F-6			16 1		Immediate Priority Repair	
s_4_34b	San MH	5.8	Good	Fair	None	0		None	0		Brick	Fair		4/17/2008 10:38	--OHM--	4	Good	0.5	Good	Bituminous	Parking Lot	S-3	I-5	F-5			10		Priority Repair in less than	
s_4_57	San MH	0.0	Fair			0			0				buried under trailer in parking lot																	Buried
s_5_74	San MH	0.0	Good	Good	Brick/Block	1	Good	Precast	3	Good	Precast	Good		5/21/2008 12:43	bt dk	4	Good	0.5	Good	Vegetation	Field	S-2	I-2	F-3			13		Plan to Repair in 0-5	
s_5_179a	San MH	0.0	Good	Good	Brick/Block	3	Good	Precast	3	Good	Precast	Good		5/21/2008 13:20	bt dk	6	Good	0.5	Good	Vegetation	Field	S-2	I-3	F-6	4 leaks		11 11 11 11		Immediate Priority Repair	
s_5_180	San MH	2.9	Good	Good	Brick/Block	3	Good	Precast	3	Good	Precast	Good		5/21/2008 12:50	bt dk	4	Good	0.5	Good	Vegetation	Lawn Area	S-1	I-3	F-6	joint leak		11		Immediate Priority Repair	
s_5_181	San MH	2.5	Good	Good	Brick/Block	1.33	Fair	Precast	5	Good	Precast	Good		5/21/2008 13:11	bt dk	6	Good	0.5	Good	Vegetation	Lawn Area	S-2	I-3	F-5	damp		6		Priority Repair in less than	
s_5_181a	San MH	2.0	Good	Good	None	0		Precast	3	Good	Precast	Good		5/21/2008 12:59	bt dk	6	Good	0.5	Good	Vegetation	Lawn Area	S-2	I-2	F-5	pick holes minor leaking		11 11 11 11 11	5 leaks	Priority Repair in less than	
s_5_183	San MH	5.3	Good	Good	Block	5	Fair	None	0		Brick	Fair		5/21/2008 11:49	bt dk	6	Missing	0.5	Good	Vegetation	Lawn Area	S-4	I-2	F-6	at least one active leak		10 1		Immediate Priority Repair	
s_5_184	San MH	10.0	Good	Good	Brick/Block	5.5	Poor	None	0		Brick	Fair		5/21/2008 11:39	bt dk	6	Missing	0.5	Good	Bituminous	Road Way	S-5	I-6	F-6			3 10		Immediate Priority Repair	
s_5_179	San MH	1.8	Good	Good	Brick	1	Good	Precast	3.5	Good	Precast	Good		5/21/2008 11:56	bt dk	4	Good	0.5	Good	Vegetation	Field	S-1	I-2	F-5	pick hole leaking		11		Priority Repair in less than	
s_9_109	San MH	13.6	Good	Good	ladtech	3	Good	Brick	3	Fair	Brick	Fair		4/16/2008 13:31	Dk bt	4	Missing	0.3	Good	Vegetation	Field	S-7	I-1	F-4			10		Monitor Again in 10	
s_9_110	San MH	14.0	Broken	Fair	Block	2.5	Good	None	0		Brick	Fair		4/16/2008 13:41	Dk bt	4	Missing	1	Good	Vegetation	Wooded Area	S-7	I-1	F-5			4 10		Priority Repair in less than	
s_9_111	San MH	2.5	Good	Good	None	2	Fair	None	0		Brick	Good		4/17/2008 13:10	--OHM--	6	Fair	0.5		Gravel	Wooded Area	S-2	I-3	F-4			10		Plan to Repair in 0-5	
s_9_123	San MH	16.3	Good	Good	Brick	0.5	Fair	Brick	3	Fair	Brick	Fair		4/16/2008 15:36	Dk bt	6	Rusty	0		Bituminous	Road Way	S-7	I-3	F-7	active leak		10		Plan to Repair in 0-5	
s_9_136	San MH	26.1	Good	Good	Brick/Block	1.5	Poor	Brick	2	Fair	Brick	Fair		4/16/2008 14:31	Dk bt	4	Missing	0.4	Good	Bituminous	Road Way	S-7	I-7	F-4			10		Monitor Again in 10	
s_9_137	San MH	26.5	Good	Good	Brick/Block	1.33	Poor	Brick	2	Poor	Brick	Fair	adj/corbel damaged	4/16/2008 14:21	Dk bt	4	Missing	0.5	Good	Bituminous	Road Way	S-7	I-7	F-5			10 15		Priority Repair in less than	
s_9_139	San MH	26.5	Good	Good	Block	1.5	Fair		0		Brick	Fair		4/16/2008 14:39	Dk bt	4	Missing	0.7	Good	Bituminous	Road Way	S-7	I-7	F-5			1 9 10		Priority Repair in less than	
s_9_140	San MH	17.3	Good	Good	Brick	1	Fair	Brick	2	Fair	Brick	Fair		3/25/2008 15:20	Dk bt	4	Missing	0.2	Good	Bituminous	Road Way	S-7	I-5	F-6	4 holes		1 10		Immediate Priority Repair	
s_9_141	San MH	16.8	Good	Good	Brick	2	Fair	Brick	3	Fair	Brick	Fair		4/16/2008 12:51	Dk bt	4	Missing	0.2	Good	Bituminous	Road Way	S-7	I-5	F-5	2 holes		1 10		Priority Repair in less than	
s_9_142		0.0				0			0				cnf	4/16/2008 12:59	Dk bt			0												Unable to locate
s_9_143	San MH	15.6	Fair	Good	Brick	2	Fair	Brick	2	Fair	Brick	Fair		4/16/2008 13:18	Dk bt	4	Missing	0.2	Good	Bituminous	Road Way	S-7	I-4	F-4			1 10		Monitor Again in 10	
s_9_148	San MH	14.5	Good	Good	Brick	1	Fair	None	0		Brick	Fair		4/16/2008 14:10	Dk bt	4	Missing	0.4	Fair	Bituminous	Road Way	S-7	I-2	F-5	has boot		10		Priority Repair in less than	
s_9_158	San MH	16.0	Good	Good	Brick	1	Fair	None	0		Brick	Fair		4/16/2008 13:44	Dk bt	4	Missing	0.5	Good	Gravel	Road Way	S-7	I-4	F-5		Cleaning	10		Priority Repair in less than	
s_9_159	San MH	16.5	Fair	Good	Brick	2	Fair	None	0		Brick	Fair		4/16/2008 13:55	Dk bt	4	Missing	0.7	Good	Gravel	Road Way	S-7	I-4	F-6			10 1		Immediate Priority Repair	
s_9_160	San MH	15.6	Good	Good	Brick	2	Fair	None	0		Brick	Fair		4/16/2008 14:03	Dk bt	4	Missing	0.4		Bituminous	Parking Lot	S-7	I-4	F-4			10 1		Monitor Again in 10	
s_9_161	San MH	0.0				0			0				dnf	4/16/2008 14:51	Dk bt			0												Unable to locate
s_9_162	San MH	5.5	Good	Fair	None	0		None	0		Brick	Good		4/17/2008 11:17	--OHM--	6	Missing	0.8	Good	Vegetation	Lawn Area	S-4	I-4	F-4			10 1		Monitor Again in 10	
s_9_163	San MH	7.9	Good	Good	Brick/Block	1.5	Fair	None	0		Block	Good		4/17/2008 11:26	--OHM--	6	Missing	0.5	Good	Vegetation	Lawn Area	S-5	I-4	F-6			10 13 17 1		Immediate Priority Repair	
s_9_164	San MH	11.9	Good	Good	None	0		None	0		Block	Good		4/17/2008 11:37	--OHM--	4		0		Vegetation	Lawn Area	S-2	I-7	F-3			4 12 17 1		Plan to Repair in 0-5	
s_9_165	San MH	2.4	Good	Good	None	0		None	0		Block	Good		4/17/2008 11:51	--OHM--	6		1	Good	Vegetation	Lawn Area	S-1	I-1	F-1					Monitor Again in 10	
s_9_166	San MH	0.0	Good	Good		0			0				bolted shut																	Monitor Again in 10
s_9_167	San MH	2.6	Good	Good	None	0		None	0		Brick	Fair		4/17/2008 12:50	--OHM--	6	Good	0.5	Good	Gravel	Wooded Area	S-3	I-2	F-3			4 10		Plan to Repair in 0-5	
s_9_168	San MH	3.4	Good	Good	None	0		Block	4	Good	Block	Good		4/17/2008 12:57	--OHM--	6	Missing	0.7	Good	Vegetation	Wooded Area	S-3	I-3	F-4			2		Plan to Repair in 0-5	
s_9_211	San MH	0.0	Good	Good	Brick	1	Good	Precast	4	Good	Precast	Good		4/17/2008 12:03	--OHM--	6	Good	0.25	Good	Bituminous	Drive Way	S-1	I-1	F-1		Cleaning			Monitor Again in 10	
s_9_170	San MH	0.4	Good	Good	None	0		None	0		Brick	Fair		4/17/2008 13:04	--OHM--	6	Fair	0.3	Good	Vegetation	Wooded Area	S-1	I-2	F-2					Monitor Again in 5 Years	
s_9_209	San MH	15.0	Good	Good	None	0		None	0		Brick	Good		4/17/2008 10:56	--OHM--	6	Missing	0.5	Good	Vegetation	Side Walk	S-7	I-4	F-4			10 18 1		Monitor Again in 10	
s_9_210	San MH	25.0	Good	Good	None	0		None	0		Brick	Poor		4/17/2008 11:44	--OHM--	4		0.4	Fair	Vegetation	Lawn Area	S-7	I-7	F-7	leaking major leaks		4 10 12 16		Monitor Again in 10	
s_9_214	San MH	13.6	Good	Good	Precast	2.5	Good	Brick	1.5	Fair	Brick	Fair		4/16/2008 15:10	Dk bt	4	Missing	1	Good	Vegetation	Lawn Area	S-7	I-1	F-4			10 1		Monitor Again in 10	
s_9_86	San MH	0.0	Good	Good	Brick/Block	1.5	Good	Precast	4	Good	Precast	Good		4/17/2008 13:16	--OHM--	4	Good	0.1	Good	Bituminous	Road Way	S-1	I-1	F-1						