Memorandum

To: Ramsey-Washington Metro Watershed District
From: Barr Engineering Co.
Subject: 2002 Inspection Battle Creek Interceptor
Date: February 26, 2003

INTRODUCTION

Purpose

The purpose of this memorandum is to summarize the inspection of the Battle Creek Interceptor System performed in December, 2002. This involved an interior inspection of portions of this storm sewer system. On the whole the system begins at Battle Creek Lake and ends in the backwaters of the Mississippi River west of Highway 61. The portions of the system included in the inspection included the reach from the systems outfall upstream to Upper Afton Road, Upper Afton Road upstream to the inlet of the interceptor pipe a few hundred feet upstream (east) of Upper Afton Road, and the outfall pipes for the culvert system at Ruth Street. The remaining portions of the Battle Creek Interceptor System were inspected from above ground and at the ends of culvert pipes in December, 2001. No conditions were observed which indicated that more detailed inspections were warranted in the remaining portions of the system.

The primary objective of the interior inspection of the pipe was to identify locations where deterioration of the pipe has progressed to the point were the structural integrity of the pipe has been or soon will be compromised. The goal of the inspections was to start documenting the condition in the Battle Creek Interceptor System such that the need for future repairs may be anticipated. Another goal of the inspection was to assess the condition of repairs performed in 1995 (see the Background discussion below).

Background

The Battle Creek Interceptor System was constructed in 1982. The Battle Creek ravine had experienced significant degradation due to erosion of the creek channel and ravine slopes. The 1982 project provided storm water drainage while stabilizing and restoring the channel and ravine slopes. Culverts were modified to enhance their flow capacity. In the lower reaches of the system a flood flow pipe was installed below the creek channel to convey the higher flood flows to the base of this steep portion of the ravine. A series of overflow structure were constructed to stabilize the channel and provide a less erosive channel slope. The ravine slopes were restored and vegetated.

In 1995 a portion of the flood flow interceptor pipe below the creek in the lower ravine was repaired. Transient hydraulic pressures had caused some pipe joints to fail. The repaired pipe was reconstructed to eliminate the occurrence of the transient hydraulic pressures.

Routine periodic inspections of the Battle Creek Interceptor System will help assure the system's continued structural integrity and serviceability.

INSPECTION

General

The 2002 interior inspection of the Battle Creek Interceptor System was performed on December 12-13, 2002. The reach from the outfall structure upstream to Upper Afton Road was inspected on December 12. The reaches of pipe under and upstream of Upper Afton Road and Ruth Street were inspected on December 13.

Access to the flood flow pipe under the creek channel is limited and the pipe outlet is submerged in the outfall structure. Since the outfall structure needed to be dewatered for inspection it was determined that the best access to the lower reach of the system (outfall structure to Upper Afton Road) would be via the outfall structure. The best access to the pipe upstream of Upper Afton Road was determined to be via the drop inlet structure just upstream of Upper Afton Road. Access to the culvert outfall pipes (2 parallel pipes) at Ruth Street could be achieved via the exposed outlet ends of

the pipes. The following services were required of a construction contractor to facilitate the access for the inspection:

1. Outfall Structure West of Highway 61
   Lift steel grate to obtain access.
   Furnish and operate pumps to dewater structure and maintain dewatered condition for duration of inspection.
   Replace steel grate.
2. Upstream of Upper Afton Road
   Remove steel grate to obtain access.
   Replace steel grate.
3. Ruth Street
   Furnish and operate pumps to dewater outfall pipes for duration of inspection.

Conditions

The condition of the interior of the interceptor was visually inspected by experienced staff. A numerical priority ranking was assigned to each reach of the interceptor based on the observed conditions and the following range of values. The priority ranking for all reaches of the interceptor are included in the Inspection Details included in this report.

Numerical Priority Ranking for Repairs

0	Emergency repair recommended – failure could be imminent
1 – 2	High priority for repair. Perform repairs within 1 to 2 years. A 1 indicates repairs recommended within about 1 year; 2 indicates repairs to be performed within 2 years.
3 - 4	Medium priority for repair. Repairs may be required within 3 to 5 years. Re-inspect in 2 years. A 3 indicates repairs that may be required within 3 to 4 years: 4 indicates repairs that may be required within 4 to 5 years.
5	Low priority for repair. Repairs are unlikely to be required within foreseeable future (5 years). Re-inspect in 4 years.
6	Repairs may never be required. Re-inspect in 4 years and periodically thereafter to verify that conditions do not change.

Repair Types

Where deterioration of the interior of the interceptor was observed, the type of repair required was recorded. These repair types are based on previous experiences repairing the interceptor and are summarized in the following table. The repair types are also identified in the Inspection Details included in this report.

Typical Repair Types

Type No.	Unit of Measure	Description
1	Sq. Ft.	Crown Patching
2	Sq. Ft.	Invert Patching
3	Lin. Ft.	Epoxy Crack Injection
4	Lin. Ft.	Polyurethane Crack/Joint Injection
5	Lin. Ft.	Epoxy Surface Seal
6	Sq. Ft.	Miscellaneous Mortar Repair
7	Lin.Ft.	Clean Joint and pack with Mortar
8	Cu.Ft.	Pressure grout joint – mortar or chemical grout
9	Joint	Excavate joint; expose, pack with mortar, wrap with geotextile fabric, backfill, restore
10	Lin.Ft.	Excavate, remove pipe, relay with new pipe, wrap with geotextile fabric, backfill, restore

OBSERVATIONS

The observations resulting from the 2002 inspection of the Battle Creek Interceptor System are presented and described below for each of the reaches:

Lower Ravine

This reach is defined as that portion of the Battle Creek Interceptor System from the south (downstream) side of Upper Afton Road to the outfall structure located west of Highway 61 in the

Mississippi River backwaters. The outfall structure is located at Station 0+00 and the reach ends at Station 44+07 at the drop structure at Upper Afton Road. The outfall structure was dewatered and the entire reach was inspected on December 12, 2002.

The general condition of the interceptor in this reach is good. Minor leakage does occur from some plugged lifting holes and from some joints. The condition of the pipe from Station 15+50 to Station 28+41 and from Station 30+70 to Station 44+07 appear to be substantially unchanged from conditions described during a previous inspection in August, 1989. The reach from Station 0+00 to Station 15+50 was not inspected in 1989. The reach from Station 28+41 to Station 30+70 was removed and replaced with new pipe during the 1995 repair project. This lower ravine reach should be re-inspected in 3 to 5 years to help assess the rate of deterioration and identify any possible repairs to be performed at that time.

There were two areas of special interest between the outfall and Upper Afton Road. The first area is located in the vicinity of Station 26+75. The 1989 inspection noted a "significant leak" at Joint 147-148. It was noted that this leak did not appear to be conveying soil materials through the joint although it appeared to have the capability to do so. In recent years two sinkholes have developed on the surface in this same vicinity. These sinkholes have required periodic maintenance. During the 2002 inspection, it was noted that the joint had been partially repaired with only a small leak. The conditions observed in 2002 at other joints in the area appear to be consistent with the conditions observed during the 1989 inspection. Based on the 2002 observations and comparison with the 1989 inspection it appears that conditions in the pipe remain unchanged. No conditions observed in the pipe appear to be responsible for the formation of the two sinkholes. While soil materials could be pulled through a couple of these joints during periods of high flow it is not apparent from the interior of the pipe.

Photographs 1 through 29 show the conditions present in the interceptor pipe in the lower ravine.

Upper Afton Road

This reach is defined as that portion of the Battle Creek Interceptor System from the south (downstream) side of Upper Afton Road to the inlet of the flood flow pipe about 600 feet upstream of the start of the reach. The drop structure at Upper Afton Road is located at Station 0+00 for the cast-

in-place (CIP) concrete box under Upper Afton Road. The CIP concrete box extends upstream to Station 1+20 where, at a drop inlet structure, the pipe changes to a precast reinforced concrete pipe arch (RCPA). The RCPA starts at 0+00 and extends upstream to an inlet at Station 4+80. The trash rack on the drop inlet structure connecting these two pipe sections was removed and the two pipes were inspected on December 13, 2002.

The general condition of the CIP concrete box under Upper Afton Road is fair. Separation of construction joints, cracking, and surface spalling has occurred at some locations in this pipe reach. Sealing of the construction joints and larger cracks should be performed in the near future to forestall further deterioration. Much of the surface spalling is not an immediate structural concern and should be monitored every 3 to 5 years to assure that the deterioration does not accelerate. However, in those locations where spalling has exposed reinforcement bars, the spalling should be repaired. Corrosion of the reinforcement bars reduces the structures strength accelerating the deterioration. Photographs 40 and 41 show an area where spalling has resulted in exposed reinforcement bars. Photographs 30 through 39 and Photograph 42 show the condition of the pipe in this reach.

The general condition of the RCPA pipe upstream of Upper Afton Road is good. The pipe in this reach is very shallow. The occasional joint separation and leaks that were observed do not appear to present any structural concerns regarding this reach of pipe. Photographs 43, 44, and 45 are representative of the conditions present in this reach of the pipe.

Ruth Street Outlet Pipes

A large junction structure west (downstream) of Ruth Street joins the flows of two widely separated culverts under Ruth Street. The Ruth Street Outlet pipes discharge the water collected in the junction structure into Battle Creek. The pipes themselves are reinforced concrete pipe arches installed as part of the 1982 Battle Creek Restoration project. Surface inspection in December of 2001 identified significant subsidence over portions of these pipes. The subsidence may be the result of either infiltration into the pipes through pipe joints or exfiltration of water out of the pipes through the pipe joints during periods of high flow. Examination of the pipes is normally restricted due to high tailwater levels and sediment which almost completely submerge these outlet pipes.

On December 13, 2002 pumps were installed in these pipes and the upstream creek flows were temporarily dammed up in an effort to dewater the outlet pipes. This effort was only partially successful. Relatively high base flow and significant sediment in the pipes limited the effectiveness of the effort. Based on the limited 'in pipe' inspection the pipes appeared to be in generally good condition. However, it appeared that several pipe joints were not tight in the area were the infiltration or exfitration is occurring. The presence of roots hanging out of the inside of the pipe joints indicates that the pipe joints are not tight. The joints need to be sealed from the outside to stop the flow of soil, water, and soil materials through the pipe joints. Partial sealing of the joints from the inside along the crown of the pipe should also be considered. Conditions did not allow for stationing of the pipe or photographing the problematic joints.

CONCLUSIONS AND RECOMMENDATIONS

Overall the interceptor system is in good condition. There are only isolated areas where repairs are recommended. The areas are:

A. The sinkhole area in the lower ravine in the vicinity of Station 26+75. While the formation of sinkholes in this area are not likely to contribute to a catastrophic failure of the interceptor, the sinkholes are forming immediately adjacent to a paved public trail causing a significant public safety hazard. Improvements should be designed and constructed to assure that soil materials cannot be transported through the pipe joints due to infiltration and that water exfiltrating through the joints is intercepted and drained into the creek channel without displacement of soil materials.

B. Existing cracking in the CIP concrete box under Upper Afton Road should be sealed. Continued deterioration of the concrete adjacent to these cracks will gradually reduce the structural integrity of the box and possibly the creation of voids over the pipe due to the transport of soil particles through the cracks.

C. Spalling concrete in the invert of the concrete box under Upper Afton Road has exposed reinforcement bars at select locations. These select locations should be dewatered, chipped to competent concrete, and patched with a cementitious mortar mixture. Corrosion of the exposed reinforcement bars will adversely impact the structural integrity of the concrete box.

D. The outlet pipes at Ruth Street have open joints which have resulted in subsidence over the pipes. The pipes should be uncovered to expose the joints so that they may be patched from the outside with mortar and wrapped with geotextile filter material. Considerations should also be given to the value of patching the interior pipe crown with mortar. These repairs should prevent the transport of soil materials over the pipes by either infiltration or by exfiltration.

Based on the conditions observed in the interceptor system during this inspection, it is recommended that the Battle Creek Interceptor System be inspected in 3 to 5 years (late 2005 to 2007).

PHOTOGRAPHS

PHOTO 1 12/12/02 (Not 2003) dcp_1961.jpg - Station 0+00 - Outfall structure from pipe.

PHOTO 2 12/12/02 (Not 2003) dcp_1960.jpg - Station 4+49 joint #(-146) : Facing upstream, transition from 9’ to 8’.

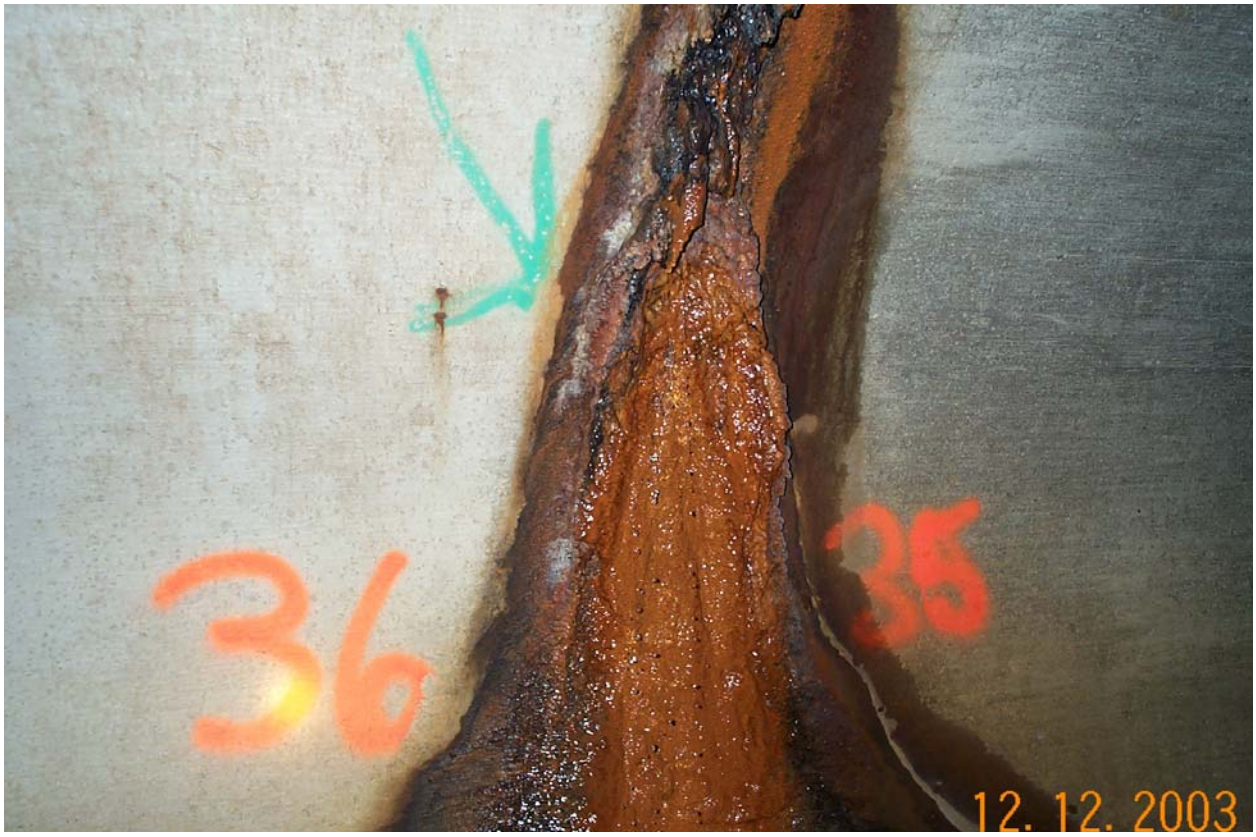

PHOTO 3 12/12/02 (Not 2003) dcp_1959.jpg - Station 18+35 joint #36 - Partially patched, leaking along left side and crown.

PHOTO 4 12/12/02 (Not 2003) dcp_1958.jpg - Station 20+11 joint #58 - Leaking along both right and left sides at about the midpoint.

PHOTO 5 12/12/02 (Not 2003) dcp_1956.jpg - Station 22+15 joint #87 - 2 inch gap along right side.

PHOTO 6 12/12/02 (Not 2003) dcp_1955.jpg - Station 22+59.5 joint #93 - Partially patched above invert.

PHOTO 7 12/12/02 (Not 2003) dcp_1954.jpg - Station 23+31.5 joint #102 - Small leak along crown.

PHOTO 8 12/12/02 (Not 2003) dcp_1953.jpg - Station 25+89.5 joint #136 - 2 inch gap along right side.

PHOTO 9 12/12/02 (Not 2003) dcp_1952.jpg - Station 26+53.5 joint #144 - Previously patched, but leaking slightly from crown.

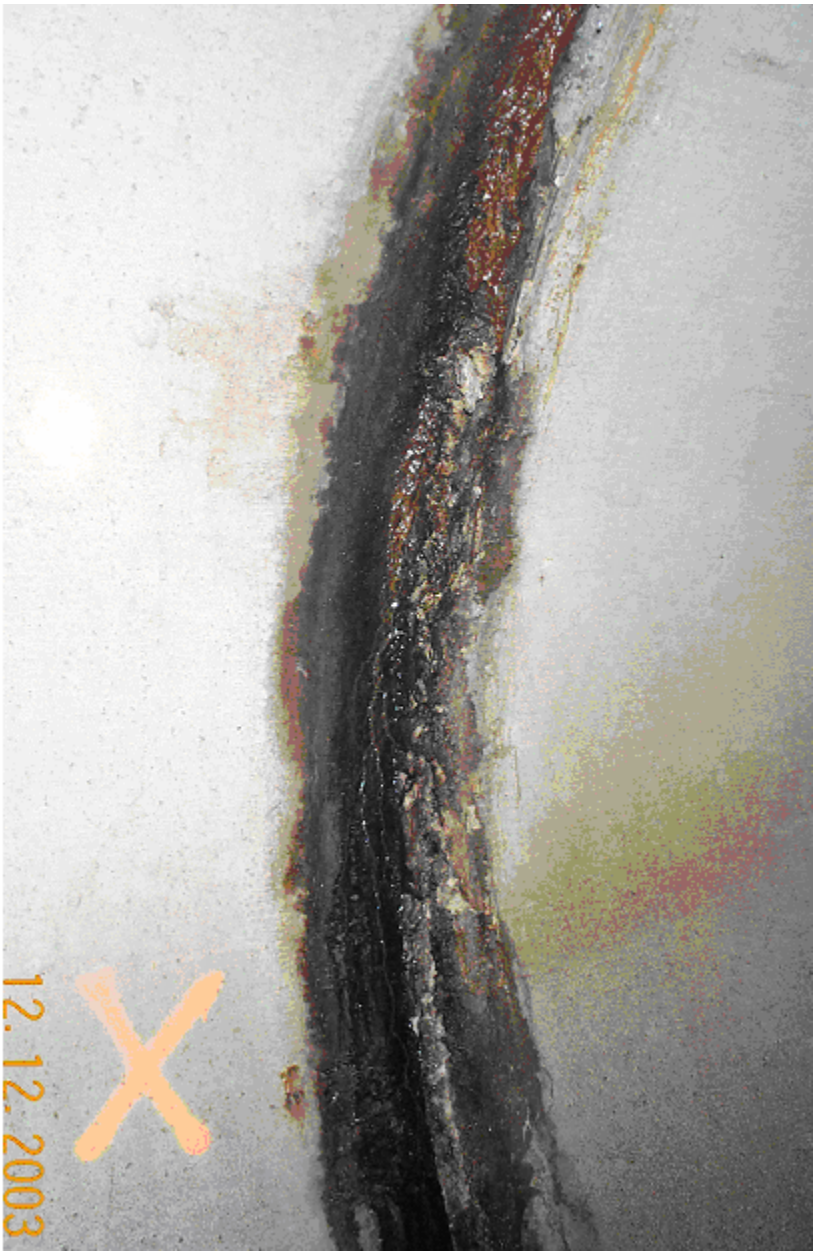

PHOTO 10 12/12/02 (Not 2003) dcp_1951.jpg - Station 27+71.5 joint 161 - Leaking along left side.

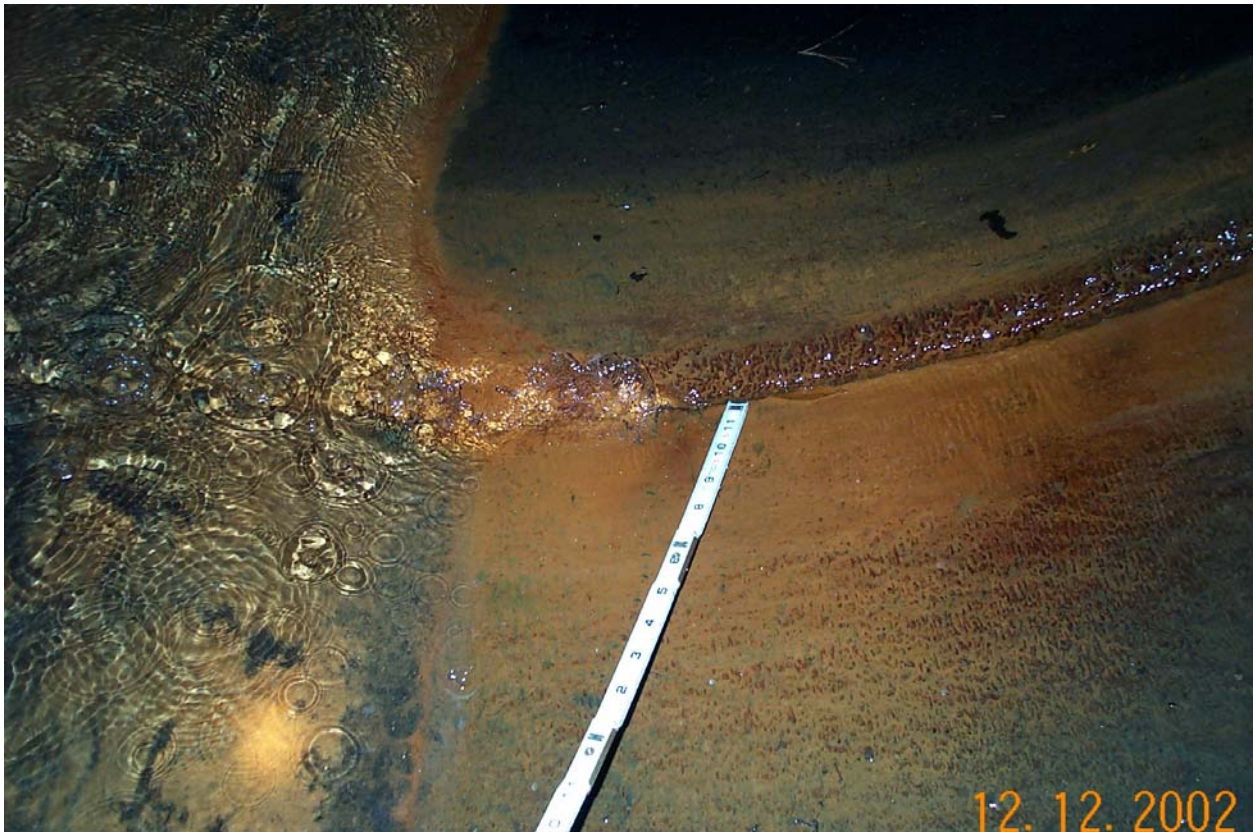

PHOTO 11 12/12/02 dcp_1950.jpg - Station 28+35.5 joint #169 - Leaking along invert (approx. 1 gpm).

PHOTO 12 12/12/02 dcp_1949.jpg - Station 28+41.5 joint #170 - Facing upstream, transition to 8’ pipe.

PHOTO 13 12/12/02 dcp_1948.jpg - Station 28+66.5 joint #175 – Right side.

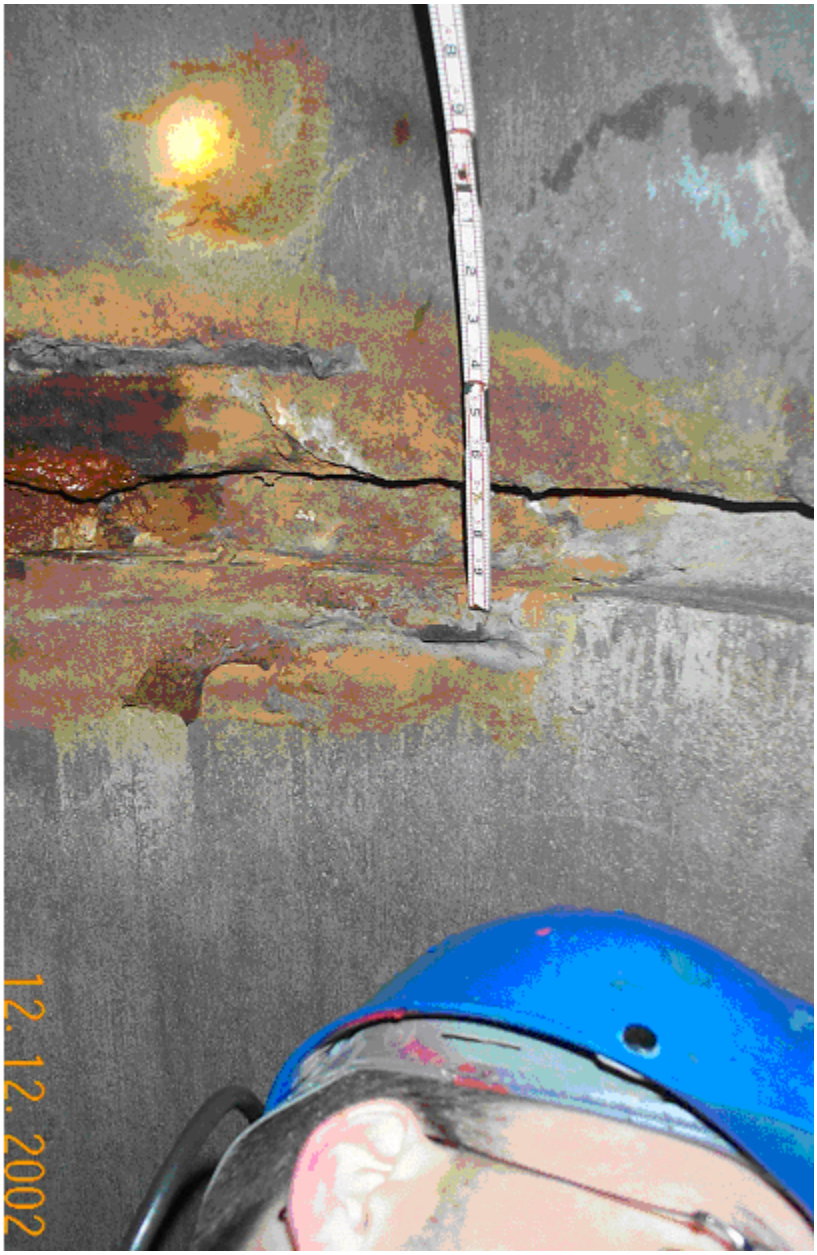

PHOTO 14 12/12/02 dcp_1947.jpg - Station 28+66.5 joint #175 – Partial existing repairs along left side

PHOTO 15 12/12/02 dcp_1946.jpg - Station 30+08.5 joint #199 - Leak along left side.

PHOTO 16 12/12/02 dcp_1945.jpg - Station 30+46 joint #204B - Bend in pipe.

PHOTO 17 12/12/02 dcp_1944.jpg - Station 31+71.5 joint #219 - Small leak along right side toward crown.

PHOTO 18 12/12/02 dcp_1943.jpg - Station 33+96.5 joint #248 - Small cracks around core hole in crown, leaking slightly.

PHOTO 19 12/12/02 dcp_1942.jpg - Station 35+10.5 joint #264 - Crack along left side.

PHOTO 20 12/12/02 dcp_1941.jpg - Station 37+04.5 joint #290 - Manhole entering at crown.

PHOTO 21 12/12/02 dcp_1940.jpg - Station 39+01 joint #315 - Core hole along crown is leaking and has cracked slightly.

PHOTO 22 12/12/02 dcp_ 1939.jpg - Station 40+02.5 - Facing downstream.

PHOTO 23 12/12/02 dcp_1938.jpg - Station 40+98.5 joint #341 – Small leak along right side forming mineral deposit.

PHOTO 24 12/12/02 dcp_1937.jpg - Station 42+22.5 facing downstream - Manhole entering at crown.

PHOTO 25 12/12/02 dcp_1936.jpg - Station 42+96.5 joint #371 - Joint leaking slightly and forming mineral deposit.

PHOTO 26 12/12/02 dcp_1935.jpg - Station 43+45.5 joint #378 - Joint leaking slightly and forming mineral deposit.

PHOTO 27 12/12/02 dcp_1934.jpg - Station 43+92.5 joint #385 - Partial existing joint repair with polyurethane.

PHOTO 28 12/12/02 dcp_1933.jpg - Station 44+06.5 - Start of pipe downstream from drop structure at Afton Road

PHOTO 29 12/12/02 dcp_1932.jpg - Station 44+06.5 - Drop structure at Upper Afton Road (bottom view).

PHOTO 30 12/13/02 dcp_1962.jpg – Station 0+00 Upper Afton Road - Drop structure at downstream end of cast-in-place box section (top view).

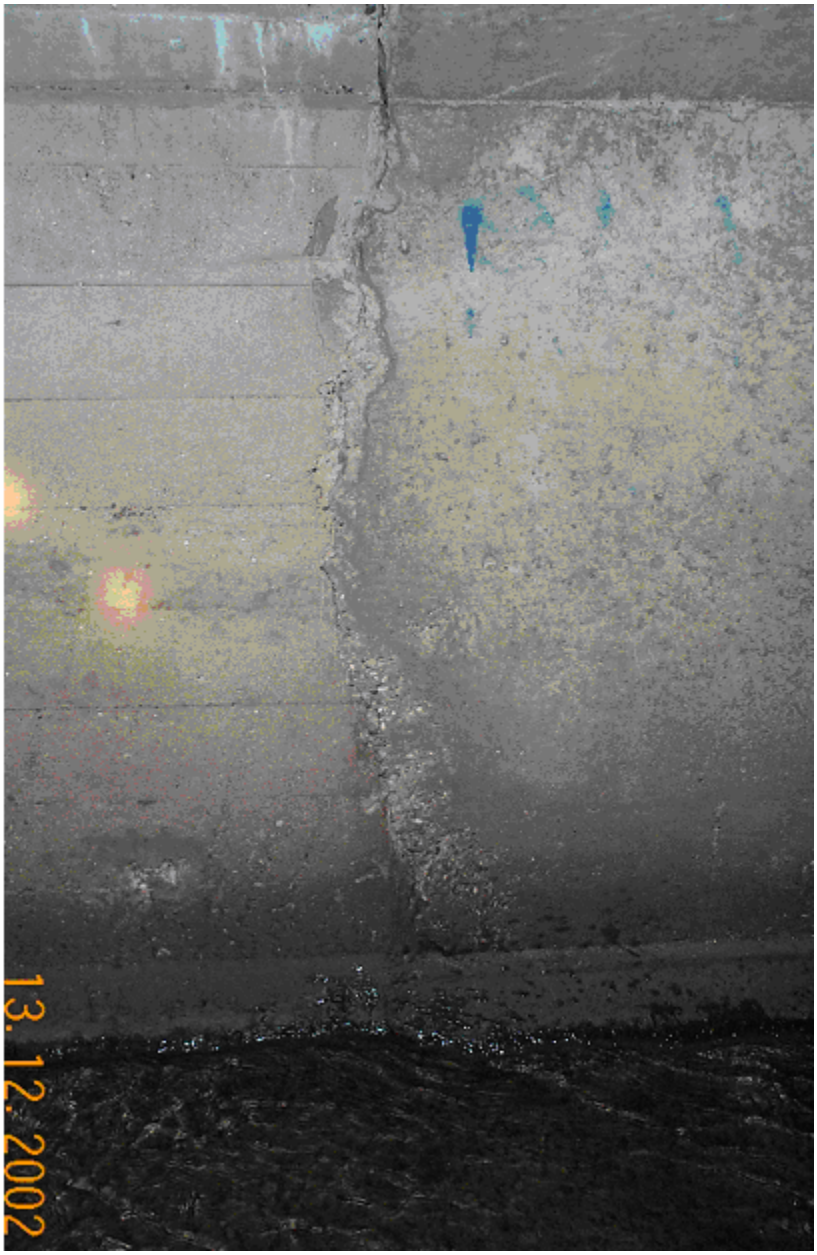

PHOTO 31 12/13/02 dcp_1963.jpg - Station 0+24 - Upper Afton Road cast-in-place box section, separation at construction joint along left side (1/2”).

PHOTO 32 12/13/02 dcp_1964.jpg - Station 0+24 - Upper Afton Road cast-in-place box section - Joint along right side.

PHOTO 33 12/13/02 dcp_1965 - Station 0+42 - Upper Afton Road cast-in-place box section, spalling along lower left side.

PHOTO 34 12/13/02 dcp_1966.jpg - Station 0+53 - Upper Afton Road cast-in-place box section, vertical cracks along right side.

PHOTO 35 12/13/02 dcp_1967.jpg - Station 0+53 - Upper Afton Road cast-in-place box section, cracks along top and left side.

PHOTO 36 12/13/02 dcp_1968.jpg - Station 0+64 - Upper Afton Road cast-in-place box section, cracking around circumference, spalling along lower part.

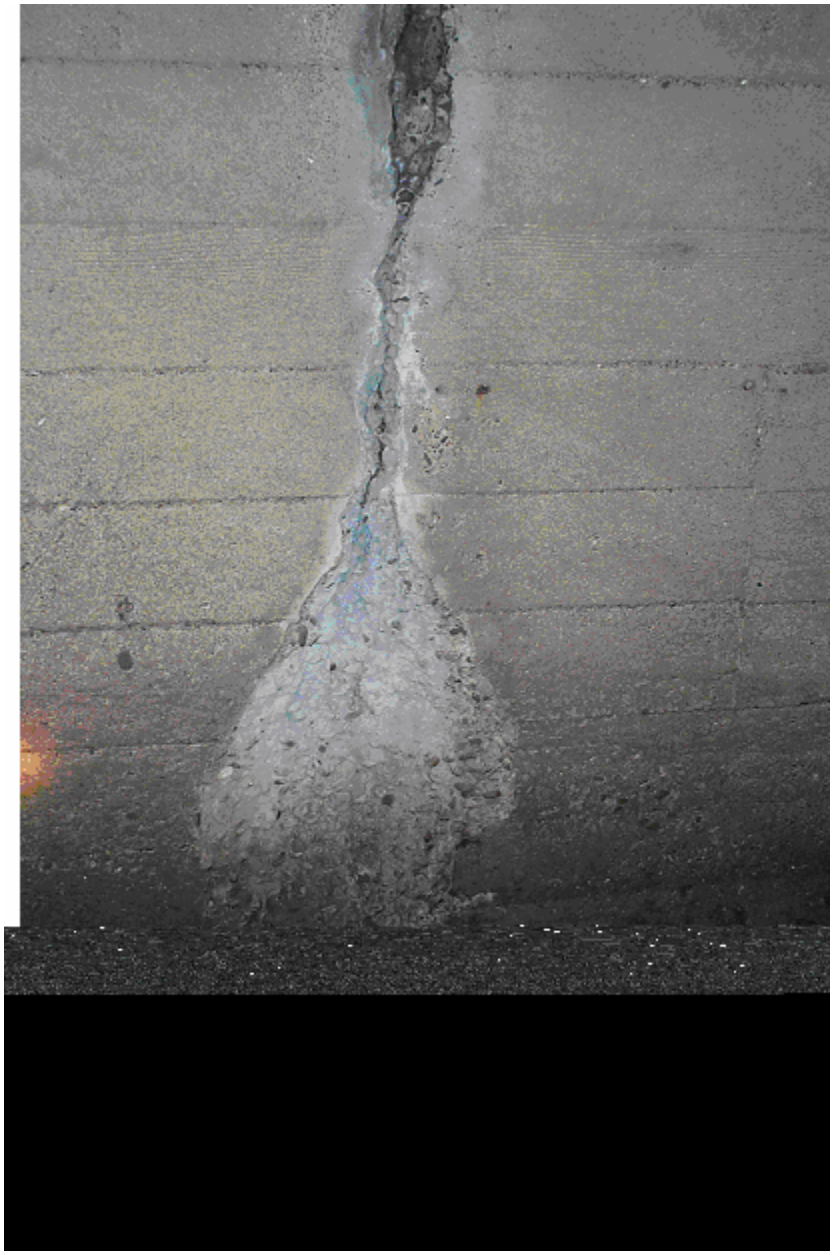

PHOTO 37 12/13/02 dcp_1969.jpg - Station 0+64 - Upper Afton Road cast-in-place box section, cracking around circumference, spalling along lower part.

PHOTO 40 12/13/02 dcp_1973.jpg - Station 0+70 - Upper Afton Road cast-in-place box section, reinforcement bars exposed along invert.

PHOTO 41 12/13/02 dcp_1974.jpg - Station 0+70 - Upper Afton Road cast-in-place box section, reinforcement bars exposed along invert.

PHOTO 42 12/13/02 dcp_1972.jpg - Station 1+20 - Upper Afton Road cast-in-place box section, minor cracking along sidewalls.

PHOTO 43 12/13/02 dcp_1977.jpg - Station 0+88 - RCPA Section upstream of Upper Afton Road, spalling and leaking along right side.

PHOTO 44 12/13/02 dcp_1976.jpg - Station 2+24 - RCPA Section upstream of Upper Afton Road, joint offset and leaking from left side.

PHOTO 45 12/13/02 dcp_1975.jpg - Station 2+88 - RCPA Section upstream of Upper Afton Road, spalling at joint along side and invert.

Project: Battle Creek Inspection
Date: 12/12/2002
Entry Location: Outlet Structure
Time In: 8:30 a.m.
Time Out: 1:30 p.m.
Inspection Team: CPB, JXB, ECB

Station	Pipe [(1)] Joint/ Section Number	Pipe Section Length (ft)	Photo ID	Joint Width (in)	Description/Comments
0	-207	-	1961		Start
8	-206	8		0.5	
16	-205	8		1.0	
24	-204	8		1.0	
32	-203	8		1.5	
40	-202	8		1.5	
48	-201	8		1.0	
56	-200	8		1.5	
64	-199	8		1.0	
72	-198	8		1.0	Repaired
80	-197	8		1.0	
88	-196	8		0.5	
96	-195	8		1.0	
104	-194	8		1.0	
112	-193	8		1.0	
120	-192	8		1.0	
128	-191	8		1.0	
136	-190	8		1.0	
144	-189	8		1.5	
152	-188	8		2.0	
160	-187	8		0.5	
168	-186	8		1.5	
176	-185	8		1.0	
184	-184	8		1.0	
192	-183	8		1.0	
200	-182	8		1.0	
208	-181	8		1.0	
216	-180	8		2.0	2" at crown
224	-179	8		1.0	
233	-178	9		2.5	Bend section, partially repaired
242	-177	9		2.5	Bend section, partially repaired
251	-176	9		1.0	Bend section
260	-175	9		2.0	Bend section
269	-174	9		3.0	Bend section, partially repaired
277	-173	8		1.5	
281.5	-172	4.5		2.0	
286	-171	4.5		1.0	
294	-170	8		1.5	
302	-169	8		1.5	
310	-168	8		2.0	
318	-167	8		1.0	
326	-166	8		1.0	
334	-165	8		0.5	
340	-164	6		1.5	
348	-163	8		1.0	
356	-162	8		1.0	
362	-161	6		1.0	
368	-160	6		1.0	
374	-159	6		1.0	
380	-158	6		2.0	
386	-157	6		1.0	
392	-156	6		1.0	
398	-155	6		1.0	
404	-154	6		2.0	
410	-153	6		3.0	
416	-152	6		2.0	
422	-151	6		1.0	
428	-150	6		3.0	
434	-149	6		2.0	
440	-148	6		2.5	
445	-147	5		2.0	
449	-146	4	1960	2.0	Transition 8' dia. to 9' dia.
457	-145	8		2.0	
465	-144	8		1.0	
473	-143	8		0.5	
481	-142	8		1.0	
489	-141	8		0.5	
497	-140	8		1.0	
505	-139	8		1.0	
513	-138	8		1.0	

521	-137	8	1.0	
529	-136	8	1.0	
537	-135	8	1.0	
545	-134	8	1.0	
553	-133	8	1.0	
561	-132	8	0.5	
569	-131	8	0.5	
577	-130	8	1.5	
585	-129	8	1.0	
593	-128	8	1.0	
601	-127	8	1.0	
609	-126	8	1.5	
617	-125	8	0.5	
625	-124	8	0.5	
633	-123	8	1.0	
641	-122	8	1.0	
649	-121	8	1.0	
657	-120	8	1.0	
665	-119	8	1.0	
673	-118	8	1.0	core hole leaking
681	-117	8	1.0	core hole leaking
689	-116	8	0.5	core hole leaking
697	-115	8	1.0	
705	-114	8	1.0	
713	-113	8	0.5	
721	-112	8	0.5	
729	-111	8	1.0	
737	-110	8	1.0	
745	-109	8	1.0	
753	-108	8	1.0	
761	-107	8	1.0	
769	-106	8	1.0	
777	-105	8	0.5	
785	-104	8	1.0	
793	-103	8	1.0	
801	-102	8	1.0	
809	-101	8	1.0	
817	-100	8	0.5	
825	-99	8	1.0	
833	-98	8	1.0	
841	-97	8	1.0	
849	-96	8	1.0	
853.5	-95	4.5	1.0	
858	-94	4.5	1.0	
862.5	-93	4.5	1.0	
867	-92	4.5	1.0	
871.5	-91	4.5	0.5	
876	-90	4.5	0.5	
880.5	-89	4.5	0.5	
885	-88	4.5	0.5	
889.5	-87	4.5	1.0	
897.5	-86	8	0.5	
905.5	-85	8	0.5	
913.5	-84	8	1.0	
921.5	-83	8	0.5	
929.5	-82	8	1.0	
937.5	-81	8	1.0	
945.5	-80	8	1.5	Partially repaired
953.5	-79	8	0.5	
961.5	-78	8	1.0	Dripping from crown
969.5	-77	8	1.0	Partially repaired; manhole -77/-78
977.5	-76	8	1.0	Partially repaired
985.5	-75	8	1.0	Partially repaired
993.5	-74	8	0.5	
1001.5	-73	8	1.0	
1009.5	-72	8	1.0	
1017.5	-71	8	1.0	
1025.5	-70	8	2.0	Partially repaired
1033.5	-69	8	1.0	
1041.5	-68	8	1.0	
1049.5	-67	8	1.0	
1057.5	-66	8	1.0	
1065.5	-65	8	1.0	
1070	-64	4.5	1.0	
1074.5	-63	4.5	1.0	
1079	-62	4.5	1.0	
1083.5	-61	4.5	0.5	
1088	-60	4.5	0.5	
1092.5	-59	4.5	0.5	

1097	-58	4.5	1.0	
1105	-57	8	1.0	
1113	-56	8	1.5	
1121	-55	8	1.0	
1129	-54	8	1.0	
1137	-53	8	1.0	
1145	-52	8	1.0	
1153	-51	8	1.0	
1161	-50	8	1.0	
1169	-49	8	1.5	
1177	-48	8	1.0	
1185	-47	8	1.0	
1193	-46	8	1.5	
1201	-45	8	1.0	
1209	-44	8	1.0	
1217	-43	8	1.0	
1225	-42	8	1.0	
1233	-41	8	1.0	
1241	-40	8	1.0	
1249	-39	8	1.0	
1257	-38	8	1.5	
1265	-37	8	1.0	
1273	-36	8	1.0	
1281	-35	8	1.0	
1289	-34	8	1.0	
1297	-33	8	1.0	
1305	-32	8	1.0	
1313	-31	8	1.0	
1321	-30	8	1.0	Leak along left side
1329	-29	8	1.0	
1337	-28	8	1.0	
1345	-27	8	1.0	
1353	-26	8	1.5	
1361	-25	8	1.0	
1369	-24	8	1.0	
1377	-23	8	1.5	Leaking from crown and right side
1385	-22	8	1.0	
1393	-21	8	0.5	
1401	-20	8	0.5	
1409	-19	8	0.5	
1417	-18	8	1.0	
1425	-17	8	1.0	
1429.5	-16	4.5	0.5	
1434	-15	4.5	1.0	
1438.5	-14	4.5	0.5	
1446.5	-13	8	0.5	
1454.5	-12	8	1.0	
1462.5	-11	8	1.5	
1470.5	-10	8	1.0	
1478.5	-9	8	1.0	
1486.5	-8	8	1.0	
1494.5	-7	8	0.5	
1502.5	-6	8	1.0	
1510.5	-5	8	1.5	
1518.5	-4	8	1.0	
1526.5	-3	8	1.5	Partially patched
1534.5	-2	8	1.5	Patched
1542.5	-1	8	1.0	Patched
1550.5	0	8	1.5	Patched
1558.5	1	8	1.0	Partially patched; mahole and 18" pipe entering
1566.5	2	8	1.0	
1574.5	3	8	1.0	Leaking from crown
1582.5	4	8	1.0	
1590.5	5	8	1.0	
1598.5	6	8	1.0	
1606.5	7	8	1.0	
1614.5	8	8	1.0	
1622.5	9	8	0.5	
1630.5	10	8	1.0	
1638.5	11	8	1.0	
1646.5	12	8	1.0	
1654.5	13	8	1.0	Leaking along left side
1662.5	14	8	1.0	
1670.5	15	8	1.0	
1675	16	4.5	1.0	
1683	17	8	1.0	
1691	18	8	1.5	
1699	19	8	1.0	
1707	20	8	1.0	Leaking from crown

1715	21	8		0.5	Leaking along left side
1723	22	8		0.5	Leaking along left side
1731	23	8		1.0	
1739	24	8		1.0	Leaking from crown
1747	25	8		1.0	
1755	26	8		0.5	
1763	27	8		0.5	
1771	28	8		1.0	
1779	29	8		1.5	Leaking from crown
1787	30	8		0.5	Dripping core hole along crown
1795	31	8		1.0	
1803	32	8		1.0	
1811	33	8		1.0	
1819	34	8		0.5	
1827	35	8		1.0	
1835	36	8	1959 (left)	2.0	Partially patched; leak along left side and crown
1843	37	8		0.5	
1851	38	8		0.5	
1859	39	8		1.0	
1867	40	8		1.5	
1875	41	8		0.5	
1883	42	8		1.0	
1891	43	8		0.5	
1899	44	8		1.0	
1907	45	8		1.5	
1915	46	8		1.5	
1923	47	8		1.5	
1931	48	8		1.0	
1939	49	8		0.5	
1947	50	8		0.5	
1955	51	8		1.5	
1963	52	8		2.5	
1971	53	8		1.5	
1979	54	8		1.0	
1987	55	8		1.0	
1995	56	8		1.0	
2003	57	8		1.0	
2011	58	8	1958	1.0	Leaking on both sides (midpoint)
2019	59	8		1.5	
2027	60	8		1.5	
2035	61	8		1.5	
2043	62	8		1.5	
2051	63	8		1.0	
2059	64	8		1.0	
2067	65	8		0.5	
2071.5	66	4.5		0.5	
2076	67	4.5		1.0	
2080.5	68	4.5		1.0	
2088.5	69	8		1.0	
2093	70	4.5		2.5	
2101	71	8		0.5	
2109	72	8		1.5	
2117	73	8		0.5	
2125	74	8		2.0	
2133	75	8		2.0	
2141	76	8		2.0	
2149	77	8		1.0	
2157	78	8		0.5	
2165	79	8		1.0	
2169.5	80	4.5		1.5	
2174	81	4.5		2.5	Leaking along left near invert
2178.5	82	4.5		2.0	
2183	83	4.5		1.5	Leaking along invert
2191	84	8		2.0	
2199	85	8		2.0	
2207	86	8		1.5	
2215	87	8	1956	2.0	
2219.5	88	4.5		2.0	Partially patched, but leaking at crown
2227.5	89	8		1.5	
2235.5	90	8		1.0	
2243.5	91	8		1.5	Partially patched, but leaking at crown
2251.5	92	8		2.0	Partially patched, but leaking at crown
2259.5	93	8	1955	2.0	Partially patched, leaking core hole
2267.5	94	8		2.0	Leaking along right and core hole
2275.5	95	8		2.0	Partially patched
2283.5	96	8		1.0	
2291.5	97	8		1.0	
2299.5	98	8		1.0	Leaking at crown
2307.5	99	8		1.5	

2315.5	100	8		1.0	Manhole
2323.5	101	8		1.5	
2331.5	102	8	1954	1.5	Small leak along crown; manhole
2339.5	103	8		1.0	
2344	104	4.5		1.0	
2352	105	8		1.0	
2360	106	8		1.0	Larger leak along crown (1gpm)
2368	107	8		1.0	Leak along crown
2376	108	8		2.0	Leak along crown
2384	109	8		1.5	Leak along crown
2392	110	8		1.5	
2400	111	8		1.0	
2404.5	112	4.5		1.0	
2412.5	113	8		1.5	
2420.5	114	8		2.0	
2428.5	115	8		2.0	
2433	116	4.5		1.0	
2441	117	8		2.0	
2449	118	8		1.0	Partially patched; leaking along left and crown
2457	119	8		1.0	
2465	120	8		1.0	
2473	121	8		1.0	
2481	122	8		2.0	
2489	123	8		1.0	
2493.5	124	4.5		1.0	
2501.5	125	8		1.5	Partially repaired
2509.5	126	8		1.0	
2517.5	127	8		2.0	
2525.5	128	8		1.0	
2533.5	129	8		1.0	
2541.5	130	8		1.5	
2549.5	131	8		1.0	
2557.5	132	8		2.0	
2565.5	133	8		1.0	
2573.5	134	8		1.0	
2581.5	135	8		1.0	
2589.5	136	8	1953	2.0	
2597.5	137	8		1.5	
2605.5	138	8		1.0	
2613.5	139	8		1.0	
2621.5	140	8		1.0	Patched, but leaking
2629.5	141	8		0.5	
2637.5	142	8		1.0	
2645.5	143	8		2.0	Patched, but leaking from crown and right
2653.5	144	8	1952	2.0	Patched, but leaking from crown
2661.5	145	8		1.0	
2666	146	4.5		1.5	
2671	147	5		1.5	
2679	148	8		2.5	Partially repaired , small leak
2683.5	149	4.5		2.5	Repaired
2691.5	150	8		0.5	
2699.5	151	8		1.0	
2707.5	152	8		1.0	Partially repaired, leaking from crown
2715.5	153	8		2.5	Partially repaired
2719.5	154	4		0.5	Leak; bottom of steep section
2727.5	155	8		0.5	Leaking from crown
2735.5	156	8		0.5	
2743.5	157	8		1.0	
2751.5	158	8		1.5	Partially patched
2755.5	159	4		0.5	Top of steep section
2763.5	160	8		3.0	Gap at invert, partially patched
2771.5	161	8	1951	2.0	Leaking along left
2779.5	162	8		1.0	
2787.5	163	8		1.0	
2795.5	164	8		1.0	
2803.5	165	8		1.0	
2811.5	166	8		0.5	
2819.5	167	8		1.5	Manhole
2827.5	168	8		1.0	
2835.5	169	8	1950	2.0	Manhole; leak from invert (1gpm)
2841.5	170	6	1949	1.5	Transition to 8'
2845	171	3.5		1.5	
2848.5	172	3.5		1.0	
2854.5	173	6		1.0	
2860.5	174	6		1.5	
2866.5	175	6	1948,1947	3.0	Partially repaired
2872.5	176	6		1.5	
2878.5	177	6		1.0	
2884.5	178	6		1.0	

2890.5	179	6		1.0	
2896.5	180	6		0.5	
2902.5	181	6		0.5	
2908.5	182	6		1.5	
2914.5	183	6		1.0	
2920.5	184	6		1.0	
2926.5	185	6		1.0	
2932.5	186	6		1.0	
2938.5	187	6		1.0	
2944.5	188	6		2.0	
2950.5	189	6		2.0	
2956.5	190	6		1.0	
2962.5	191	6		1.0	
2968.5	192	6		1.5	
2974.5	193	6		0.5	
2978.5	194	4		1.0	
2984.5	195	6		1.0	Bottom of steep section
2990.5	196	6		1.0	
2996.5	197	6		1.5	
3002.5	198	6		0.5	
3008.5	199	6	1946	2.5	Gap at invert; leaking along upper left side
3014.5	200	6		2.0	
3020.5	201	6		1.5	
3026.5	202	6		0.5	
3031	203	4.5		1.0	
3035.5	204	4.5		1.0	
3041.5	204A	6		0.5	
3046	204B	4.5	1945	1.0	
3054	204C	8		-	CIP joint
3062	204D	8		1.0	
3070	205	8		1.5	
3078	206	8		1.5	
3086	207	8		1.0	
3094	208	8		1.5	
3102	209	8		3.0	
3106.5	210	4.5		1.0	
3111	211	4.5		0.5	
3119	212	8		1.0	
3127	213	8		1.5	
3135	214	8		1.5	
3143	215	8		2.5	
3147.5	216	4.5		0.5	
3155.5	217	8		1.0	
3163.5	218	8		1.5	
3171.5	219	8	1944	1.0	Small leak
3179.5	220	8		2.0	
3187.5	221	8		1.0	
3192	222	4.5		1.0	
3200	223	8		1.0	
3208	224	8		2.0	
3216	225	8		1.0	
3220.5	226	4.5		1.5	Manhole
3228.5	227	8		1.0	
3236.5	228	8		1.0	
3244.5	229	8		1.0	Manhole
3252.5	230	8		1.0	
3260.5	231	8		1.0	
3268.5	232	8		1.0	
3276.5	233	8		1.0	
3284.5	234	8		1.0	
3292.5	235	8		1.0	
3300.5	236	8		1.0	
3308.5	237	8		1.0	
3316.5	238	8		1.0	
3324.5	239	8		1.0	
3332.5	240	8		1.0	Small leak at hole in crown
3340.5	241	8		1.0	
3348.5	242	8		1.0	
3356.5	243	8		1.0	
3364.5	244	8		0.5	
3372.5	245	8		1.0	
3380.5	246	8		0.5	
3388.5	247	8		0.5	
3396.5	248	8	1943	1.5	Small cracks around core hole in crown; small leak
3401	249	4.5		1.0	
3405.5	250	4.5		1.0	
3410	251	4.5		1.0	
3418	252	8		1.5	
3426	253	8		1.0	

3434	254	8		1.0	
3442	255	8		0.5	
3450	256	8		0.5	
3458	257	8		0.5	
3466	258	8		1.0	Manhole
3470.5	259	4.5		0.5	Manhole
3478.5	260	8		2.5	Partially patched along right
3486.5	261	8		1.0	
3494.5	262	8		1.0	
3502.5	263	8		1.0	
3510.5	264	8	1942	1.5	Crack on left side
3518.5	265	8		1.0	
3523	266	4.5		0.5	
3531	267	8		1.5	
3539	268	8		1.0	
3547	269	8		1.0	
3555	270	8		2.0	
3563	271	8		1.5	
3571	272	8		1.0	
3579	273	8		0.5	
3587	274	8		1.5	
3595	275	8		1.0	
3603	276	8		1.0	
3607.5	277	4.5		1.0	
3615.5	278	8		0.5	
3623.5	279	8		1.5	
3631.5	280	8		0.5	
3639.5	281	8		1.0	
3647.5	282	8		1.5	
3652	283	4.5		1.0	Transition 8' dia. to 7' dia.
3660	284	8		1.0	
3664.5	285	4.5		0.5	
3672.5	286	8		0.5	
3680.5	287	8		1.0	
3688.5	288	8		1.0	Manhole
3696.5	289	8		1.0	
3704.5	290	8	1941	1.0	Manhole
3712.5	291	8		1.5	
3720.5	292	8		1.0	
3728.5	293	8		1.0	
3736.5	294	8		1.0	
3744.5	295	8		2.0	
3752.5	296	8		1.0	
3760.5	297	8		1.0	
3768.5	298	8		1.0	
3776.5	299	8		1.0	
3784.5	300	8		1.0	
3792.5	301	8		1.0	
3800.5	302	8		1.5	
3808.5	303	8		2.0	
3813	304	4.5		0.5	
3821	305	8		1.0	
3829	306	8		1.0	
3837	307	8		0.5	
3845	308	8		1.5	
3853	309	8		1.0	
3861	310	8		1.0	
3869	311	8		1.5	
3877	312	8		2.0	
3885	313	8		0.5	
3893	314	8		1.5	
3901	315	8	1940	0.5	Leaking core hole
3909	316	8		1.0	
3917	317	8		1.0	
3925	318	8		1.0	
3933	319	8		0.5	
3941	320	8		0.5	
3949	321	8		0.5	
3957	322	8		0.5	
3965	323	8		0.5	
3973	324	8		0.5	
3977.5	325	4.5		1.0	Manhole
3982	326	4.5		0.5	
3986.5	327	4.5		0.5	
3994.5	328	8		0.5	
4002.5	329	8	1939	1.0	Manhole
4010.5	330	8		1.0	
4018.5	331	8		1.0	
4026.5	332	8		1.0	

4034.5	333	8		0.5	
4042.5	334	8		1.0	
4050.5	335	8		1.0	
4058.5	336	8		0.5	
4066.5	337	8		0.5	
4074.5	338	8		1.5	
4082.5	339	8		0.5	Small leak along right
4090.5	340	8		1.0	
4098.5	341	8	1938	2.0	Gap at invert, small leak along right
4106.5	342	8		2.0	
4114.5	343	8		1.0	
4122.5	344	8		1.0	
4130.5	345	8		1.0	
4138.5	346	8		1.0	
4146.5	347	8		0.5	
4154.5	348	8		1.0	
4162.5	349	8		0.5	
4170.5	350	8		1.0	
4178.5	351	8		0.5	
4183	352	4.5		1.5	gap along right; 1/2" gap along left
4187.5	353	4.5		0.5	
4192	354	4.5		0.5	
4196.5	355	4.5		1.0	
4201	356	4.5		3.0	gap along right; 1/2" gap along left
4205.5	357	4.5		0.5	
4210	358	4.5		0.5	
4214.5	359	4.5		0.5	
4222.5	360	8	1937	1.0	4' pipe enters
4230.5	361	8		1.0	Manhole
4238.5	362	8		1.0	Gap at crown
4246.5	363	8		0.5	
4254.5	364	8		1.0	
4262.5	365	8		0.5	
4270.5	366	8		<1	
4278.5	367	8		<1	Leaking core hole
4283	368	4.5		1.0	Leak along left side
4287.5	369	4.5		0.5	
4292	370	4.5		1.0	Leaking along crown
4296.5	371	4.5	1936	1.5	Leaking along right side
4301	372	4.5		0.5	
4305.5	373	4.5		<0.5	
4313.5	374	8		1.5	Gap at crown, <1" along invert
4321.5	375	8		<1	
4329.5	376	8		1.0	
4337.5	377	8		2.0	Gap on left, <1" along right
4345.5	378	8	1935	3.0	Gap at crown, <1" along invert
4353.5	379	8		2.0	Gap along right
4358.5	380	5		<0.5	
4363.5	381	5		<1	Patched along crown
4371.5	382	8		<1	
4376.5	383	5		3.0	Partially repaired, but still leaking
4384.5	384	8		1.0	Leaking along right side (2 gpm)
4392.5	385	8	1934	2.0	2" dia. core hole along invert leaking; Partial joint repair with polyurethane
4400.5	386	8		2.0	2" gap at bottom, <1" gap at crown
4406.5	387	6	1933,1932	<1	Small leak along invert; drop structure at Upper Afton Road
		4406.5			

(1) Pipe joint number refers to the upstream joint of the pipe section.

Project: Battle Creek Inspection
Date: 12/13/2002
Entry Location: Upper Afton Road - CIP Box Section and RCPA Section
Time In: 8:30 a.m.
Time Out: 10:30 a.m.
Inspection Team: CPB, JXB, ECB

CIP Box Section

Station	Photo ID	Description/Comments
0+00	1962	Drop Structure
0+24	1963	Joint left side. Separation at construction joint (1/2" gap)
	1964	Joint right side
0+42	1965	Spalling lower left side
0+53	1966, 1967	Vertical cracks along side walls (right and left sides)
0+64	1968, 1969	Cracking around circumference, spalling along lower parts
0+70	1970	Spalling both sides near bottom
	1971	Spalling around manhole pipe at crown
0+90 to 1+00		Minor cracking on side walls
1+00 to 1+30	1972 (1+20)	Some minor cracking on side walls
		Spalling in invert, rebar visible
0+50 to 0+85		Spalling
0+70	1973, 1974	Spalling along invert
0+30		Hole along invert with rebar visible

RCPA Section

Station	Photo ID	Description/Comments
4+80		Leaking joint, does not appear broken
3+92		Joint appears patched, but not leaking
3+76		Joint appears broken and patched, no leak
3+12		Appears to have broken and has been sealed, no leak
3+04		Transition from 4'-6" RCPA to 6' RCPA
2+96		Minor leaking
2+88	1975	Spalling at joint on right side and invert
2+48		Some spalling both sides at ends of joint
2+24	1976	Joint offset and leaking from left side
0+88	1977	Some spalling and leaking at right side
0+00		Start of RCPA Section upstream from Upper Afton Road