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Minneapolis, MN • Hibbing, MN • Duluth, MN • Ann Arbor, MI • Jefferson City, MO • Bismarck, ND

Memorandum

To: Bassett Creek Watershed Management Commission
From: Barr Engineering Company
Subject: Agenda Item 6G of BCWMC February 18, 2010 Meeting Agenda
Date: February 11, 2010
Project: 23/27 051 2010 003

6G. 2009 Flood Control Project Inspection

In accordance to the Operation and Maintenance Manual for the Bassett Creek Flood Control Project, an annual inspection is required to review the condition of the flood control features. The inspection program covers the flood control project features completed by the BCWMC between 1974 and 1996. The objective of the inspection program is to address erosion, settlement, sedimentation, and structural issues. The annual flood control project inspection and report preparation was performed between November, 2009 and February 2010. See the attached memorandum.

The 5-year double box culvert inspection performed during 2009 was discussed during the December 17, 2009 BCWMC meeting.

Recommended Commission Action:

- a. Provide copies of inspection report to communities, DNR and Corps of Engineers regarding results of inspection and recommended action.
- b. Provide copy of inspection report regarding inspection of Highway 100 culvert to Mn/DOT.



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Memorandum

To: Bassett Creek Watershed Management Commission
From: Barr Engineering Company
Subject: Bassett Creek 2009 Flood Control Project Inspection
Date: February 5, 2010
Project: 23/27 0051 2010 065

In accordance to the Operation and Maintenance Manual for the Bassett Creek Flood Control Project, an annual inspection is required to review the condition of the flood control features. The flood control project was turned over to the local sponsor during 2002. Therefore, inspection of the flood control features was initialized during the fall of 2002, which was the first formal inspection by the BCWMC. Annual inspections were performed during 2004-2009. Some of the municipalities have performed independent inspections of several of the structures. The BCWMC is responsible for maintaining the structures and the municipalities are responsible for general debris removal. Following are comments and recommendation regarding the 2009 inspection:

Plymouth Features

Inspection Date: November 17, 2009
Personnel: Jake Burggraff (Barr), Whitney Eriksson (Barr)

1. Plymouth Creek Fish Barrier (Constructed 1987)

- a. The water flow was a couple inches over the structure.
- b. The overall condition of the structure was satisfactory and appeared similar to the previous inspection (the concrete appeared to be in good condition).
- c. There are a few small cracks in the downstream portion of the left wing wall. No change from previous inspection notes.
- d. The expansion joint in the middle of the right abutment wall appears to be consistent to last few years and the gap was measured at approximately 7/8".
- e. Both sides of downstream banks were stabilized with new granite rip rap. Accumulated sediment downstream has been removed.
- f. Sediment has accumulated upstream of the structure. The upstream pool is filling in with sediment and has formed a delta/island with grass growing on it. The island is forcing the creek current to the west bank.
- g. Tree was growing on left side of the embankment.
- h. Rust was noted on the handrail.

Recommended Action:

- Monitor width of joint opening during future inspection
- Remove accumulation of upstream sediment.

Note: references to "right" and "left" are with respect to facing downstream.

2. Medicine Lake Outlet Structure (Constructed 1996)

- a. The overall condition of the structure appeared satisfactory. The concrete appeared to be in good condition with no major cracks.
- b. A couple inches of water was flowing over the weir. A couple feet of water existed in the channel between the weir and the lake during the inspection.
- c. The top rail of the chain link fence along the north side of bridge was loose and one of the fence posts has settled and no longer reaches the top rail, as noted in the 2008 inspection.
- d. Geotextile fabric flap referenced and submerged during previous inspections was observed as a lapped joint in 2008. In 2009 more of the filter fabric was exposed than in the previous year.

Recommended Action:

- None

Golden Valley Features

Inspection Date: November 17 and 18, 2009

Personnel: Jake Burggraaf (Barr), Whitney Eriksson (Barr)

1. Wisconsin Avenue Control Structure (Constructed 1987)

- a. The overall condition of the structure appeared to be satisfactory.
- b. The culverts have settled approximately 3-4 inches directly under Wisconsin Avenue (water is deeper in the middle). This comment was noted in previous inspections and no noticeable change has occurred since 2005 inspection.
- c. The portion of the gabion baskets that were below water have deteriorated and baskets are not intact; riprap has fallen out of the baskets at some locations (the deterioration has increased over the years and since the 2002 inspection).
- d. A small sediment delta has been forming on the upstream end of the structure as noted in previous inspections.
- e. The flood gate was in the down-position at the time of the inspection; some of the paint was peeling from the gate and rust forming on either side of the gate.
- f. Noted erosion around CMP pipe on North side, just upstream of Wisconsin flood gate.

Recommended Action:

- Monitor gabion baskets and potential erosion during future inspections.
- The flood gate should be repainted to prevent further rusting.

2. Golden Valley Country Club – Includes Box Culvert, Overflow Weir, D/S Channel Constructed 1994

- a. The channel appeared to be in satisfactory condition with no change as stated in previous inspections. The riprap is in place along the channel and there was no erosion noted on either bank. Some riprap had collected in the channel bottom. Weeds and grass have grown in the riprap in the lower part of the channel. No debris, trees or brush have accumulated in the channel.

Note: references to “right” and “left” are with respect to facing downstream.

- b. The box culvert structure appears to be satisfactory. No debris was found around the structure to obstruct the flow through it.
- c. The handrails along the box culvert are covered in rust.
- d. There still is a delta forming downstream of the box culvert, as noted in previous inspections. Vegetation has started to grow on the delta. Consideration should be give to remove the delta so the channel does not change course, re-route itself, or erode slopes.
- e. The overflow weir appeared in very good condition. The turf grass on the weir is very well established and groomed. New 8" pipe drain installed during 2008 inspection now in place upstream of box culvert.

Recommended Action:

- Paint box culvert hand rails
- Remove downstream delta

3. Westbrook Road Crossing (Constructed 1993)

- a. The overall condition of the structure appeared satisfactory.
- b. As noted in previous inspections a small hairline crack was observed along the top of most sections of the Bebo arch culvert. The crack had extended across the entire section (pre-cast section) width. The cracks appeared to be about 2' off center of the structure (no change since 2002).
- c. Small piece of concrete spalled off of top of wing wall section at downstream eastside there has been no change to the top of the wing wall since the 2007 inspection.
- d. Storm sewer pipe entering bebo from west side has exposed rebar and could use some mortar around the top of the pipe to form a better seal to the bebo.

Recommended Action:

- Monitor cracks during future inspections.

4. Regent Avenue Crossing (Constructed 1981-1984)

- a. The overall condition of the structure is satisfactory.
- b. The channel bottom was very soft and approximately one foot of very soft silt coated the base of the structure. Due to high water levels and silt inspectors were unable to walk through the culvert.
- c. The depth from the Bebo arch culvert crown to the creek bottom was measured again this year at each end of the culvert and there appears to be a slight decrease in depths. The measurements of 9.65 feet upstream side and 9.2 feet downstream side were slightly less than the same measurements in previous years. (2008 – 10.0' upstream and 9.4' downstream, 2007 - 10.4' upstream and 9.6' downstream)
- d. Some scour/erosion was again observed around the end of the left downstream wing wall as was noted in the last four years and some erosion has now been discovered at the upstream right side wing wall, as noted last year. Additionally, erosion was noted on the left upstream bank and the right downstream bank due to the high flows.
- e. Top of upstream right wing wall minor spalling with 3 small cracks, as noted previously.
- f. Diagonal hairline crack near top of upstream left wing wall.

Note: references to "right" and "left" are with respect to facing downstream.

- g. Large maple tree undercut at upstream left bank, as noted in 2008 inspection.

Recommended Action:

- Monitor channel depth during future inspections
- Monitor erosion of bank at downstream of left wing wall and upstream right wing wall and consider repair of bank with rip rap.

5. Noble Avenue Crossing (Constructed 1981-1984)

- a. The overall condition of the structure appeared satisfactory.
- b. Hairline cracks were noted along the top of the Bebo arch culvert. Most Bebo pre-cast sections had 2-4 hairline cracks across each section. Most cracks were either down the center or spaced 2 ft. off from center. (Same comment noted in past inspections since 2002).
- c. Downstream right wing wall tilted in (toward creek) 1-1/8-inch. Measurement increased by 1/8 inch since 2008 inspection.
- d. The depth from the Bebo arch culvert crown to the creek bottom was measured this year at each end of the culvert. The measurements were 9.96 feet upstream side and 8.67 feet downstream side. Previous measurements have not been taken.
- e. Small piece of concrete chipped off the top of the left downstream wing wall and cracks nearby as noted in previous inspections. Some of the cracking appears to be expanding.
- f. Erosion at the upstream right wing wall at the outside edge of the wing wall. Filter fabric is exposed. Creek is entering the Bebo arch culvert at an angle. Additional riprap may minimize erosion.
- g. Storm sewer pipe on the north side entering the Bebo under the road needs re-grouting as there is exposed rebar. This has been noted in previous inspections since 2002.
- h. The hand rails were painted in 2007 and look in good condition except for a small amount of peeling on the bottom of the rails.
- i. 4 to 5 hairline cracks on downstream right wing wall section nearest roadway no change since previous inspection.

Recommended Action:

- Monitor cracks, spalling and scour during future inspections especially the downstream left wing wall.
- Patch exposed end of RCP storm sewer connecting bebo section from north side of culvert.

Golden Valley/Minneapolis Features

Inspection Date: November 18, 2009

Personnel: Jake Burggraff (Barr), Whitney Eriksson (Barr)

1. Highway 55 Control Structure (Constructed 1987)

- a. The overall condition of the structure appeared satisfactory.

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- b. There is some erosion around both the east and west sides of the structure from water flowing along the bituminous path from above the structure as noted in 2007 inspection. The east side is more noticeable than the west side. Riprap and filter fabric could be placed on both sides.
- c. There is a small hairline crack in the left wall of the inlet structure. The crack is positioned in the middle of the wall extending full height, this crack has been noted in previous inspections and there is no apparent change.
- d. One smaller bush is growing into the fence between the control structure and the bituminous path.

Recommended Action:

- Monitor cracks and erosion during future inspections
- Consider adding riprap and filter to each side of the structure, same comment since 2007. (not urgent)

Crystal Features

Inspection Date: November 17-18 and 25, 2009

Personnel: Jake Burggraff (Barr), Whitney Eriksson (Barr); Dave Fritzke, November 25 (Crystal)

1. 36th Ave. & Hampshire Ave. Crossing/Markwood 8'x 6' Box Culverts (Constructed 1981-1984)

- a. The overall condition of the structure appeared satisfactory.
- b. The riprap in the box culverts still remains as noted in previous inspections; most of the riprap was located in the upstream end of the left (north) box culvert.
- c. The crack located in the right/top of the south culvert noted in previous inspections has not changed.
- d. On both culverts, the fifth joint from the downstream end had a 2 ½" gap.
- e. The RCP drainage pipe that was noted first in the 2004 inspection ties directly into the left (north) box. No grout exists on the inside of the connection and exposed wire is visible (no change since 2004).
- f. On the downstream end of the box culverts trees are growing between the culverts.
- g. Catch basins on north side of 36th Ave. at Jersey have loose bolts on curb boxes.

Recommended Action:

- Monitor cracks and joint gaps during future inspections.
- Remove riprap and debris from inside culvert and replace at upstream inlet.
- Patch exposed end of RCP drain.
- Cut trees growing between the box culverts.
- Tighten bolts on curb boxes

2. Markwood Open Channel (Constructed 1981-1984)

- a. The channel banks have become inundated with trees and brush as noted in previous inspections. The trees are becoming large now and the brush very thick. The bottom of the channel is mostly free of vegetation except for one larger twin trunk maple tree that has slid into the middle of the channel (behind 7001 Markwood Dr.)

Note: references to "right" and "left" are with respect to facing downstream.

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- b. Behind 7002 36th Ave N. and 6926 36th Ave. N there is erosion on the south bank of the channel.
- c. Erosion on the south bank behind 6917 36th Ave is causing a lattice fence to become unstable and lean towards the channel.

Recommended Action:

- Any trees, limbs, and brush that may impede high flows should be removed from the channel.
- The twin trunk maple tree should be removed.

3. Markwood Channel Gabion Section (Constructed 1981-1984)

- a. Some small trees and brush continue to grow through the gabions as noted in previous inspections. They have been cut down before and have re-sprouted even thicker than before; however the gabions appear to be intact.
- b. The east edge of the gabions are located next to a retaining wall, behind 7010 36th Ave. The retaining wall has blocks on the top that are separated from the others and leaning towards the channel.

Recommended Action:

- Any trees and brush should be cut off of the gabions and the stumps treated with herbicide to prevent re-sprouting. Gabions will be damaged if the trees continue to grow.

4. Markwood D/S Overflow (Constructed 1981-1984)

- a. Sediment has accumulated in front of the overflow inlet as noted since the 2006 inspection and some small trees and brush.

Recommended Action:

- The sediment should be removed to bring the channel to the overflow back to the designed elevation.
- Any trees or brush that may impede flows should be removed.

5. Markwood 8'x4' Box Culvert (Constructed 1981-1984)

- a. The downstream side of the box culvert is undermined approximately 4 feet in the middle of the box. This section should continue to be monitored, and repaired when other features along this reach are maintained or if undermining extends further.

Recommended Action:

- Continue to monitor the erosion under the box culvert outlet during future inspections. Repair when other features along reach are maintained or if undermining increases.

Note: references to “right” and “left” are with respect to facing downstream.

6. Georgia Ave. Crossing (Constructed 1981-1984)

- a. The overall condition of the structures is satisfactory; however some maintenance may be required to preserve structural integrity.
- b. Sediment has accumulated on the south side of the creek bank directly in front of the south culvert thus directing the majority of the base flows into the northern culvert. This was first noted in the 2008 inspection.
- c. The casting assembly on the manhole over the north culvert on the east side of Georgia is off-set on the concrete opening of the manhole top exposing soil when observed from below. The manhole is in the boulevard area and the soil around it seems to be very firm and should be checked in the future. This was first noted in the 2007 inspection.
- d. Large trees are growing on the upstream side between the culvert inlets. First noted in 2009 inspection.
- e. As noted in previous inspections, the upstream culvert flares have settled slightly and there is some under cutting of the flared sections. No soil remains between the culverts from the upstream side to approximately 4 feet downstream of the upstream edge.
- f. The downstream culvert flares are undercut nearly 4 feet and the first sections are supported only by the tie rods. The under cutting of the outlets were measured again this year at 4 feet. The banks on the down stream end on each side of the culvert flares have also eroded as noted since the 2005 inspection. The south bank continues to show the most erosion. The north bank has an old concrete sewer exposed and failing.

Recommended Action

- Repair undermined flared end sections and eroded banks by backfilling and protecting with riprap and filter fabric.
- Remove old concrete pipe in downstream north bank of creek.

7. Edgewood Embankment (Constructed 1981-1984)

- a. The overall condition of the feature appeared satisfactory.
- b. There is no visible settlement along the embankment
- c. The trees on the west side of the berm that have been referenced in previous inspections are now 3 to 4 inches in diameter.
- d. The creek banks approximately 200 feet downstream of the outlet structure are eroded on each side of the creek and are about 6 feet vertical as were noted during previous inspections.

Recommended Action

- Monitor erosion of down stream banks during future inspections.
- Remove trees along embankment, as necessary

8. Douglas Drive (Constructed 1981-1984)

- a. The overall condition of the structure appeared satisfactory.
- b. Erosion noted on upstream right bank.

Note: references to “right” and “left” are with respect to facing downstream.

- c. Erosion on left side of private drive CMP culvert just downstream of the downstream end of the box culvert.
- d. Private CMP culvert is sagging on private driveway

Recommended Action

- Monitor street pavement for settlement.

9. 34th Ave. Crossing (Constructed 1981-1984)

- a. The overall condition of the structure appeared satisfactory.
- b. Some erosion on the upstream east side bank as noted in previous inspections.
- c. Tree roots are exposed along the bank on either side for approximately 200 feet upstream from the crossing culvert. A sanitary sewer manhole is exposed in the middle of the creek as noted in previous inspections.
- d. Some sediment was noted on the bottom of the pipe, at similar levels to the 2008 inspection.
- e. The tie rods are very rusty and flaking near the center section of the culvert, as noted in previous inspections.
- f. Handrails need paint.
- g. Road guardrail cables are broken and hanging loose on the south side of the road.

Recommended Action

- Monitor erosion during future inspections.
- Remove rip rap and debris from in front of the outlet end of the culvert.
- Paint handrails.
- Fix broken guardrail cables.

10. Brunswick Crossing (Constructed 1981-1984)

- a. The overall condition of the structure appeared satisfactory.
- b. There are still rocks missing from the bottom gabion on the north side adjacent the home as noted in previous inspections. The gabion appears to be settling as indicated by the repairs added to the top of the gabions. Noted sloughing of gabion baskets and potential issues with neighbor's fence. Comparing photos from year to year shows some additional settlement from 2008 to 2009. There appears to be no foundation for the gabion wall with a majority of rocks missing from the bottom row of the gabions.
- c. Drive and fence settling towards creek at 3224 Brunswick.
- d. Sediment has accumulated over the years along the south bank of the creek on the up-stream end of the culverts thus directing most of the base flows to the northern culvert.
- e. On the south culvert, the fourth pipe joint from the downstream side has two broken ties and had been re-grouted by the City. The joint appears to be moving and is now about a 3 inch opening, with a gap between the pipe joint and the new grout. There is little change with the several other broken culvert tie-rods along each culvert as noted in previous inspections, with joint offsets up to 3/4 inch.

Note: references to "right" and "left" are with respect to facing downstream.

- f. The wide gap in the pavement noted during the previous inspection was repaired and seal coated prior to the 2008 inspection. The 2008 inspection noted some settlement, at about a half an inch at the crack. A similar measurement was taken during the 2009 inspection.
- g. A sediment delta is forming on the downstream end of the culverts.
- h. The downstream banks on each side of the creek between Brunswick and 32nd Avenue are eroded vertically 4 to 6 feet high exposing soil and tree roots.
- i. Large debris pile between two culverts on the upstream end.

Recommended Action

- Monitor concrete pipe condition and pipe ties during future inspections.
- Continue to monitor crack in pavement.
- Consider replacement of gabions before they fail or cause damage to neighbor's drive and fence.
- Remove accumulated sediment at upstream and down stream ends of culverts to keep creek aligned with culverts.

11. 32nd Ave. Crossing (Constructed 1981-1984)

- a. The overall condition of the structure appeared satisfactory.
- b. A few large trees and other debris have accumulated on the upstream end of the culverts impeding flow through the culverts.
- c. Extensive erosion observed along the creek banks between Brunswick and 32nd Avenue with exposed soil vertical banks 4 – 6 feet high. Thus exposing root masses and allowing trees to fall into the creek that can and do get lodged in-front of the culverts.
- d. Approximately 6-inches of sediment have accumulated in the lower downstream ends of the two culverts.
- e. Handrails are rusty and need painting as noted in previous inspections.
- f. Some erosion observed at upstream right bank as notes in previous inspections.
- g. 36" R.C.P. entering manhole over easterly culvert is missing grout where it is connected to the manhole. Soil around the pipe is exposed. In the 2007 inspection, ground water was observed flowing into the manhole from under the pipe.

Recommended Action

- Remove trees, sediment and debris at upstream end of culverts.
- Repair connection of 36-inch pipe into manhole.
- Monitor and consider stabilizing the stream banks between Brunswick and 32nd Ave. to prevent possible problems in the future.
- Sand, prime and paint box culvert hand rails, as necessary (not urgent)

12. Bassett Creek Park Pond and Outlet (Constructed 1995)

- a. The overall condition of the outlet pipes appears in satisfactory condition, there are some small boulders in the pipes as indicated in previous inspections.

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- b. There is a large amount of sediment that has accumulated in the North West corner of the pond where the creek enters. This has been noted in previous inspections; brush and vegetation is now growing in these areas on the sediment deltas.
- c. The western half of the pond appears very shallow, as last year.
- d. Flared end section outlet is covered in riprap and debris.
- e. A depression was noted on top of the eastern culvert, behind the curb.

Recommended Action

- Survey existing pond bottom so it can be compared to the original design to determine the amount of accumulated sediment and consider future maintenance dredging project.
- In future inspections monitor size of depression on top of the eastern culvert.

13. Detention Pond and Outlet

- a. The overall condition of the outlet structure is in satisfactory.
- b. The pond is in good condition.
- c. Brush is located around the outlet.

Recommended Action

- None

Crystal/Golden Valley Features

Inspection Date: November 25, 2009

Personnel: Jake Burggraaf (Barr), Whitney Eriksson (Barr)

1. HWY 100 Double Box Culverts.

- a. The control inlet structure condition appeared satisfactory.
- b. The large cracks and transition joint damage as noted in previous inspections were repaired by Mn/DOT in 2007. The repairs still remain in good shape with just a few hairline cracks in them and should continue to be monitored.
- c. As in previous inspections, accumulated sediment (approximately 12 to 18 inches deep) was noted at the downstream end of the north easterly culvert and has remained about the same since last year's inspection.
- d. The outlet portion of the structure appeared in satisfactory condition some of the pea rock in between the box culvert sections has washed away.
- e. Sediment delta forming in creek about 60 feet downstream of culverts changing creek alignment and backing up low base flows.
- f. On the downstream end of the culverts, rocks are eroding away in the space between the two culverts.

Recommended Action:

- Remove silt from down stream end of north easterly culvert.
- Continue to monitor sediment downstream of culverts.

Note: references to "right" and "left" are with respect to facing downstream.

Minneapolis Features

Inspection Date: November 18, 2009

Personnel: Jake Burggraff (Barr), Whitney Eriksson (Barr)

1. Inlet Structure

- a. The overall condition of the inlet structure appeared satisfactory but the high water backed up at the inlet prevented inspection of the lower area.
- b. The overall condition of the fence and railing appeared satisfactory.
- c. Minor cracks were found in the concrete, especially where handrail posts were embedded.
- d. Approximately 30 inches of silt in front of structure with lots of debris. The debris was backing up the water in the creek all the way to the Irving Avenue Bridge making inspection of the riprap channel not feasible, similar to the conditions found 2008 inspection.
- e. The School Board is storing roofing material directly over the top of the inlet structure that will be in the way for City crews to access the structure for cleaning.
- f. A sediment pile is forming on the upstream south side that has vegetation growing on it.

Recommended Action:

- Remove accumulates debris from in-front of the inlet structure to limit possible back-up in the spring.

2. Debris Barrier

- a. The debris barrier has some debris upstream.

Recommended Action:

- Clear debris from upstream of the debris barrier. Remove debris from site and do not place along the shore.

3. New Tunnel: Phase 3 Tunnel-Double Box Culvert, (Constructed 1992) [5-year inspection schedule]

Inspection Date: November 19, 2009

Inspection Personnel: Jim Herbert (Barr), Jake Burggraff (Barr), Rich Ver Strate, Mike Weeber (Mpls), Will Schutte (Mpls).

Surface Attendants: Irv Woodson (Mpls), John Engstrom(Mpls), Matt Stonich (Mpls)

- a. The double box culvert was inspected by Barr Engineering and City of Minneapolis staff. Kevin Danen, P.E. City of Minneapolis coordinated overall planning. Access assistance and surface attendants were provided by City of Minneapolis staff. Fall protection was provided in accordance to OSHA requirements and included tripod and winch at entry and at each intermediate access manhole. Surface attendants monitored inspection at surface of access manhole and at manholes along box culvert. Barr and Minneapolis staff completed the confined space entry permit prior to inspection. Oxygen and combustible gas was monitored during the entire inspection by

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- b. Inspection began at 9:55 a.m. at box culvert inlet (Sta 172+24). Crew walked downstream along the right box of double box culvert to the edge of drop structure (Sta 116+72.5). Crew turned around and walked upstream along left box culvert from drop structure to box culvert inlet (Sta 172+24). Inspection was completed at 3:20 p.m. The double box culvert transition to single box culvert occurred at Sta 119+88. (Note right and left with respect to facing downstream.)
- c. Several hairline shrinkage cracks were observed throughout the culvert sections. Seepage and accumulation of leachate deposits was noted at some of the cracks. The shrinkage cracks are most likely construction related and occurred shortly after construction of the double box culvert.
- d. Diagonal cracks and concrete deterioration was observed at several shear keys. These cracks and deterioration were also observed during the 2004 inspection and most likely occurred during initial settlement.
- e. Gaps have developed ≈ 1 to $1\frac{1}{2}$ inches wide at approximately 70% of the shear keys (joints. Ruler typically extended 1.6 feet through wall at joints. Loss of backfill material was not noted through gaps. Black membrane (5' wide butyl rubber membrane) appeared to protect joints at outside of structure to prevent loss of material. Gaps probably due to shrinkage. Joint filler (1/2" thick bitumastic bond breaker) has deteriorated at several joints.
- f. New access vaults were installed at Station 128+50 (single box) and Station 119+50 (double box) as part of Twins Stadium construction. The access vault at Station 125+10 was abandoned.
- g. A 3-inch hole was observed through the box culvert concrete crown at Station 123+19 (right box). The hole appeared to be due to soil borings during construction of Twins Stadium that passed through the concrete crown. The hole should be patched.
- h. Deteriorated/eroded concrete was observed along the base slab at various locations. Generally the eroded areas were located along existing joints, were less than 2-inches deep and ranged in size from (1 ft x 1 ft) to (2 ft x 2 ft). One small scour hole at Station 164+50 (right box) was 3-4" deep. A (1 ft. x 4 ft. long x 1-2 in. deep) eroded area was observed along the base slab joint at Sta 141+00. A (1 ft x 6 ft long x 2 in. deep) eroded area was observed along the base slab joint at Sta 132+50.
- i. Exposed rebar was observed at RCP inlet between Shear Key 4 (Sta 166+00) and Shear Key 3 (Sta 168+00)

Recommendations

- a. BCWMC should prepare letter to Minnesota Ballpark Authority requesting it investigate and patch the 3-inch hole through the double box culvert to prevent potential loss of material.
 - b. Cracks and deficiencies noted in double box culvert do not require immediate attention and should be evaluated during the next 5-year inspection scheduled for 2014.
 - c. Double Box Culvert inspection notes should be sent to the City of Minneapolis and Corps of Engineers.
4. New Tunnel: Phase 1-Second Street Tunnel (Constructed 1979) and Phase 2-Third Avenue Tunnel and Drop Structure (Constructed 1990) were inspected February 20, 2008 when the Corps of Engineers lowered the middle pool. Portions of these features are submerged and are on a 20-year inspection schedule.] Note: See December 1, 2008 inspection report

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