Item 5F
BCWMC 3-21-13
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A Biotic Index Evaluation of Bassett Creek and Plymouth Creek: 2012

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Bassett Creek Watershed Management Commission

March 2013

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1.0 Executive Summary

During 2012, the Bassett Creek Watershed Management Commission (BCWMC) conducted biological monitoring of Plymouth Creek and Bassett Creek to evaluate the water quality of the streams (Figure 1). The BCWMC has conducted biological monitoring of Plymouth Creek and Bassett Creek at regular intervals since 1980 (1980, 1983, 1991, 1995, 2000, 2003, 2006, 2009, and 2012). In addition, biological samples were collected from the Sweeney Lake Branch and the Main Stem east of Zane Avenue in 1996. These historical data were compared with 2012 data to determine changes in the stream's biological community over time.

Biological indices, such as the Hilsenhoff Biotic Index (HBI) and Invertebrate Community Index (ICI), have been used to evaluate the water quality of Plymouth Creek and Bassett Creek. The HBI, used since 1980, is a measure of organic and nutrient pollution, which causes lower dissolved oxygen levels. The ICI is a measure of a wider range of pollutants and has been used since 1995. Low HBI scores are indicative of good water quality. Conversely, low ICI scores are indicative of poor water quality. Figure 8 shows the HBI and ICI results from 1995 – 2012, and Figure 9 shows the HBI results from 1980 – 2012.

A severe drought reduced stream flow and stream depth in Bassett Creek and Plymouth Creek later in 2012. The North Branch of Bassett Creek dried up and was not sampled. The 2012 drought provided ideal conditions for single species to dominate the macroinvertebrate community at locations most severely impacted by reduced flow and water depth (i.e., Plymouth Creek, Sweeney Lake Branch, and the upstream Main Stem locations). The species that capitalized on the habitat changes, *Gammarus* and Planaria, are species that live on the stream bottom and are tolerant of low flow and low water levels.

Because *Gammarus* and Planaria can survive and thrive under adverse habitat conditions (low flow and low water levels), they have low ICI tolerance values (a numerical value assigned to level of pollution tolerance, with low values indicating higher tolerance). Their low ICI tolerance values coupled with the high numbers of these organisms resulted in lower average ICI values than had been previously observed at all locations except the Main Stem at Irving Avenue—the most downstream location of the Main Stem. While the reduced ICI values indicate a poorer macroinvertebrate community, they are due to climatic changes, a variable that cannot be managed. In addition, literature suggests that both *Gammarus* and Planaria require relatively clean water to survive—

indicating that despite the lowered ICI numbers, water quality in areas where they proliferate is good (Hyman 1951; Gerhardt 2011; Maltby 1994).

The 2012 HBI results indicate the water quality of Bassett Creek and Plymouth Creek was:

- Very good at Plymouth Creek and the Main Stem at Rhode Island Avenue, which is the most upstream location on the Main Stem.
- Good at the Main Stem at Zane Avenue, Dresden Lane, and Irving Avenue.
- Fair at the Sweeney Lake Branch.

The only location with a significant change in HBI since the last monitoring period was the most upstream location on the Main Stem at Rhode Island Avenue. Here, there was significant improvement in water quality. Although not significant, improved water quality was also seen at Plymouth Creek, the Sweeney Lake Branch, and the Main Stem east of Zane Avenue. Degradation was seen at the Main Stem of Bassett Creek at Dresden Lane and Irving Avenue. Water quality improvements are attributed to reductions in stormwater runoff during the 2012 drought. This reduced the quantity of oxygen-demanding materials added to the stream. The drought also, however, reduced flow and oxygen in the stream, leading to the areas of water quality degradation.

The Minnesota Pollution Control Agency (MPCA) is developing a Macroinvertebrate Index of Biological Integrity (MIBI) to identify biologically impaired rivers and streams. When available, the BCWMC can apply the MIBI to all or some of the macroinvertebrate data collected to date. Once MIBI scores are computed for Plymouth Creek and Bassett Creek, the BCWMC will know whether the streams meet the MPCA impairment standard.

Based on the results of the 2012 monitoring program, the Commissioners will consider:

- Continuing management efforts of Bassett Creek and Plymouth Creek, including installation of BMPs to protect and, if possible, to improve the water quality of the stream as opportunities become available.
- Sampling all stations again in 3 to 5 years to maintain the long-term monitoring record and assess stream water quality changes.
- Continuing flow and water quality monitoring from the Watershed Outlet Monitoring Program (WOMP) sample station located on the Main Stem at Irving Avenue to evaluate physical and chemical parameters impacting the stream's plants and animals..
- Using the Macroinvertebrate Index of Biological Integrity (MIBI), when finalized by the MPCA, to assess the biological community of Bassett Creek and Plymouth Creek; the MIBI will replace the HBI and ICI that were used from 1980 to 2012.

- Applying the MIBI (when finalized) to all or some of the macroinvertebrate data collected from Bassett Creek and Plymouth Creek from 1980 to 2012 to determine whether the streams have met the MPCA impairment standard.

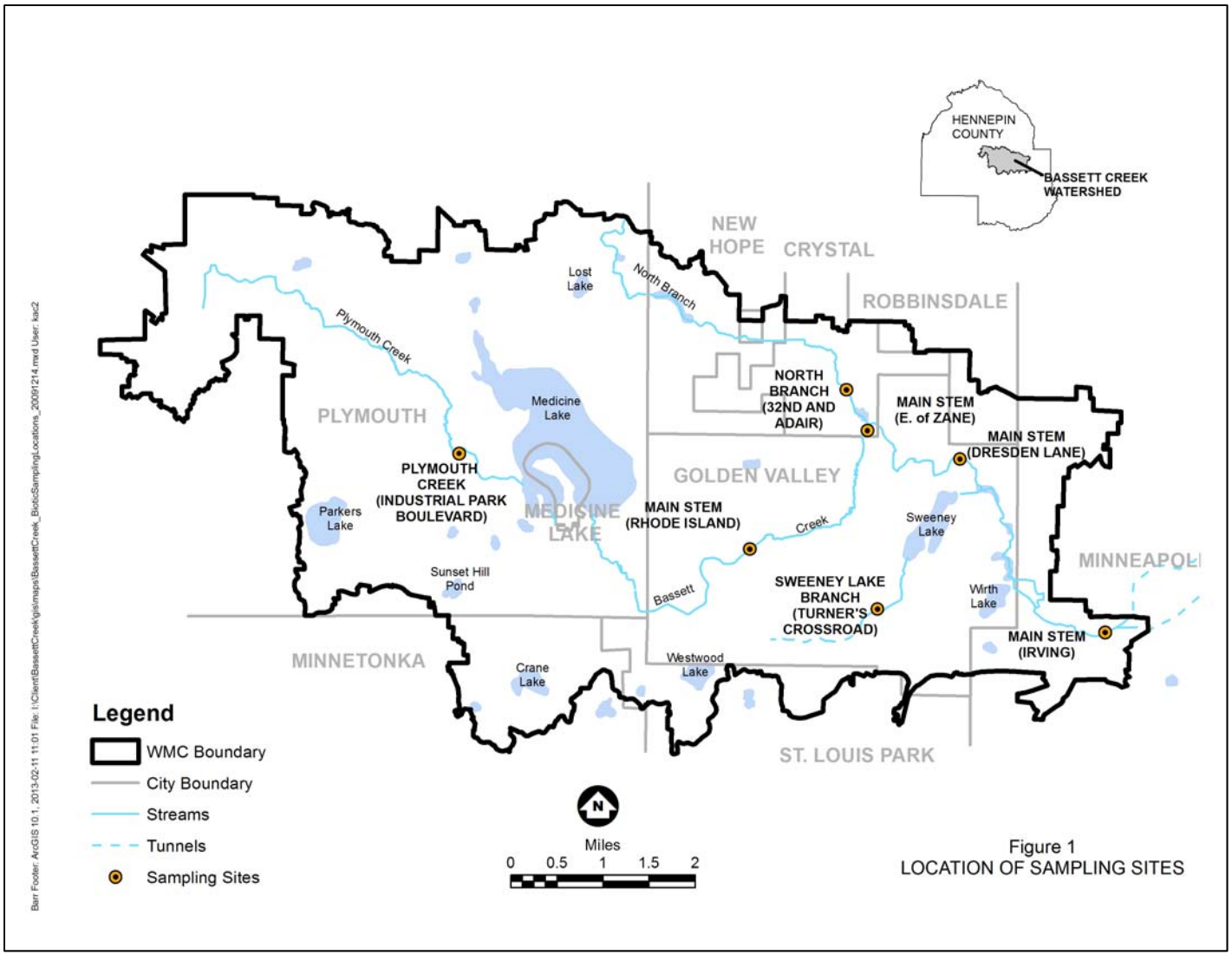

Figure 1 Location of Sampling Sites

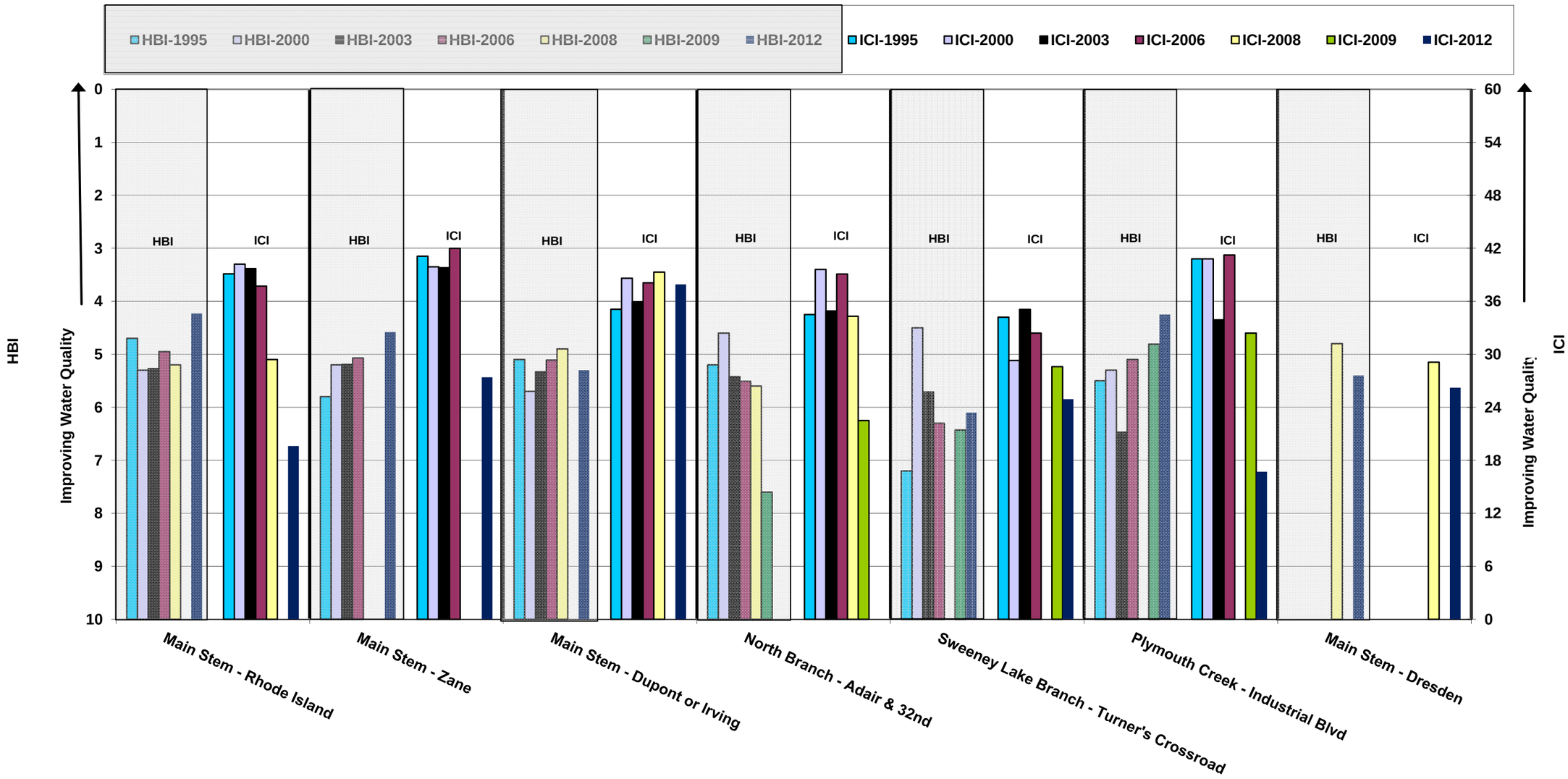

Figure 8. Summary of HBI and ICI Based Indices

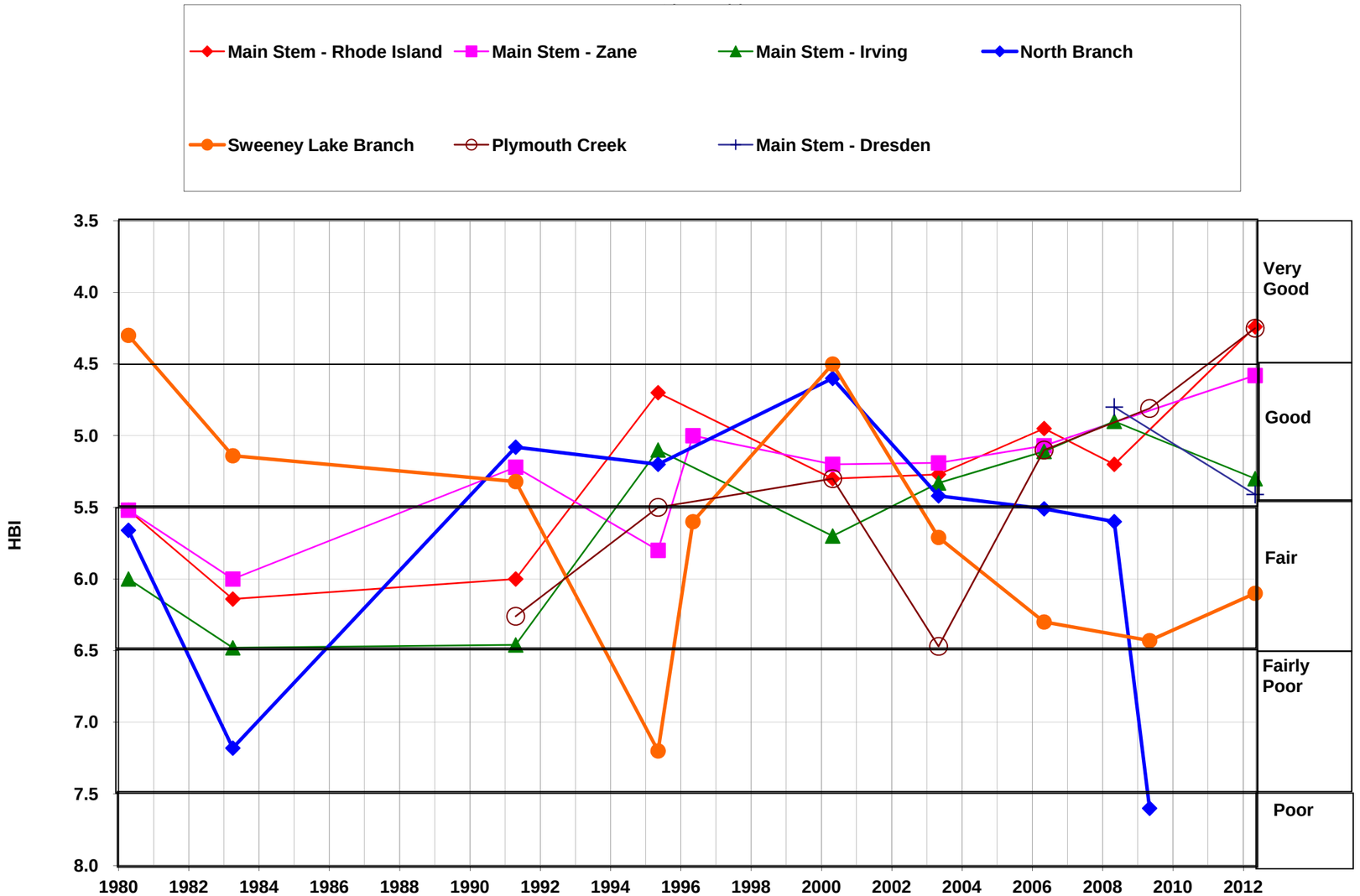

Figure 9. HBI Summary of Stream Water Quality from 1980-2012