5.0 MONITORING

5.1 INTRODUCTION

The *Transforming the Rouge AOC from Mowed Down to Grown Up* (*Transforming the Rouge*)project restored riparian corridor, wetlands, and upland habitat in the Rouge River Watershed to advance the delisting of the benthos BUI ultimately leading to the delisting of the Fish and Wildlife Habitat and Population BUIs. The Project continued the measurable progress shown on the Rouge River as documented in improvement in flooding statistics (decreased peak floods), increases in dissolved oxygen and increase in diversity of benthos. The Rouge River Watershed has been the focus of restoration efforts by local government and a variety of stakeholder and stewardship groups. This project united these past efforts to reduce areas of mowed turf grass by installing grow zones and prairie in local parks. The project created or restored approximately 36.5 acres of grow zones and restored seven acres of wetlands within the Rouge River Watershed. This was accomplished through the restoration of six different sites located throughout the watershed.

Monitoring of in-stream benthic macro-invertebrate communities was conducted by Friends of the Rouge (FOTR), Wayne County staff and volunteers consistent with the FOTR's approved Quality Assurance Project Plan (QAPP). Benthic monitoring was conducted at representative sites across the watershed and within proximity to each of the project areas both before and after construction as part of the overall project evaluation effort. This document presents a summary of the overall Rouge River watershed benthic monitoring effort including spring (through 2013) and fall (through 2012) data trends; a brief overview of each of the restoration projects; and, a summary of the "pre" and "post" benthic monitoring results for each associated Rouge subwatershed and restoration project monitoring locations.

5.2 ROUGE RIVER MACROINVERTEBRATE MONITORING

Friends of the Rouge (FOTR) and the Wayne County Water Quality Management Division (WQMD) continued their partnership to complete benthic macroinvertebrate monitoring at numerous locations in the Rouge River on behalf of the Alliance of Rouge Communities (ARC). In January 2011 FOTR and WQMD conducted their winter stonefly searches. Stoneflies were found at 5 of the 29 sites sampled. Severe weather conditions hampered sampling efforts with many of the sites completely frozen over, limiting access. Slender Winter Stoneflies were the only stonefly found. WQMD sampled four of the 29 sites (two on the Main, one on the Middle, and one on Johnson Creek). The sites sampled by WQMD were: MN-1, MN-5 (Bridge Rd/Telegraph), MR-2 (Reservoir Rd), and MR-23 (Unknown Johnson Creek tributary). No stoneflies were found at any of these sites.

Forty-seven sites were monitored (30 by FOTR and 17 sites by the Wayne County WQMD) in the spring 2011. Figure 5-1 identifies the site locations and ratings for the spring 2011 monitoring. In the fall of 2011, 52 sites were monitored (31 by FOTR and 21 by WQMD). Figure 5-2 identifies the locations and site ratings for the fall 2011 monitoring. Fifty-four sites were monitored (32 by FOTR and 22 sites by the Wayne County WQMD) in the spring of 2012. Figure 5-3 identifies the site locations and ratings for the spring 2012 monitoring. In the fall of 2012, 57 sites were monitored (39 by FOTR volunteers and 18 by WQMD). Figure 5-4 identifies the locations and site ratings for the fall 2012 monitoring.

Figure 5-1: Rouge River Benthic Monitoring Sites and Scores, Spring 2011

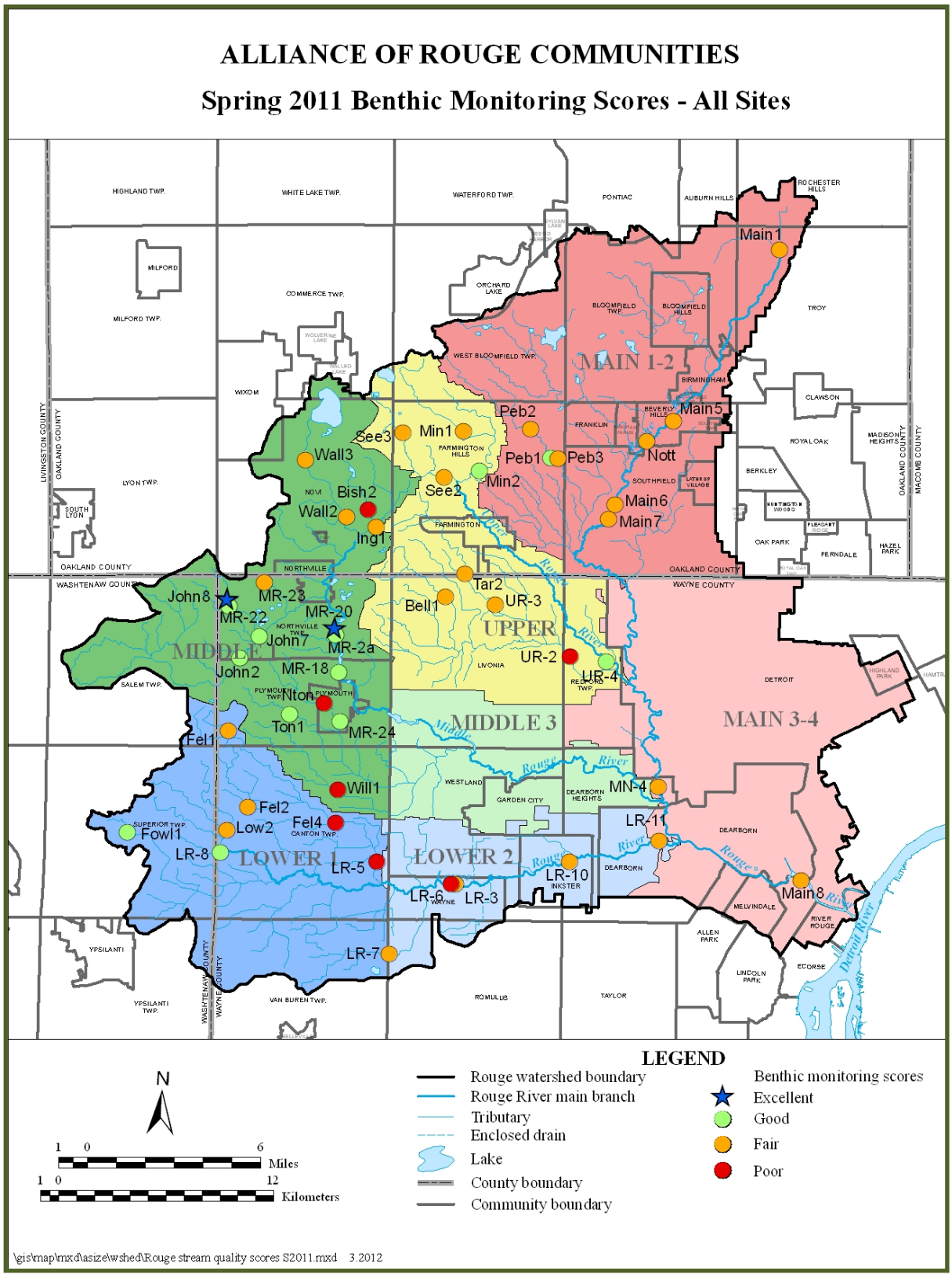


Figure 5-2: Rouge River Benthic Monitoring Sites and Scores, Fall 2011

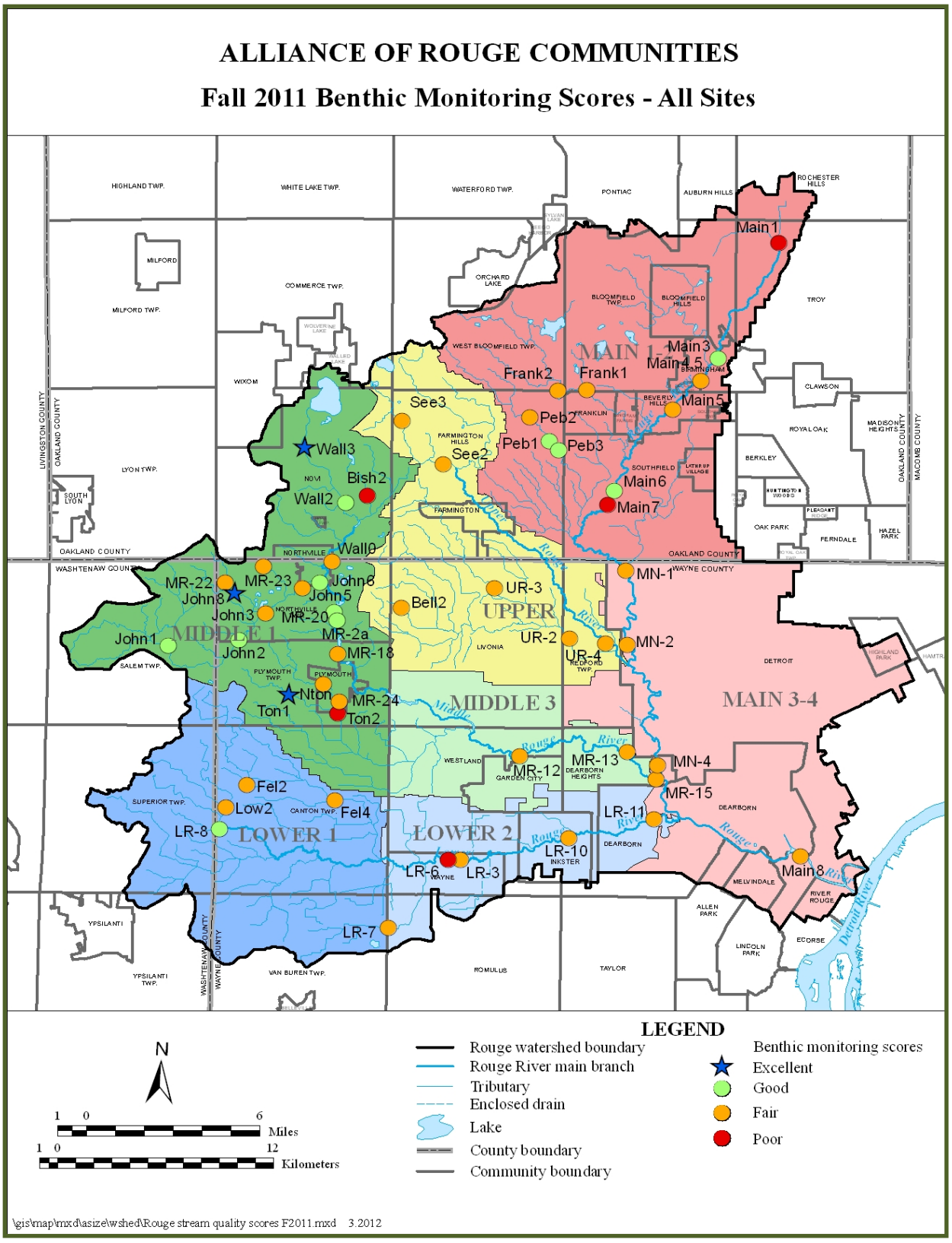


Figure 5-3: Rouge River Benthic Monitoring Sites and Scores, Spring 2012

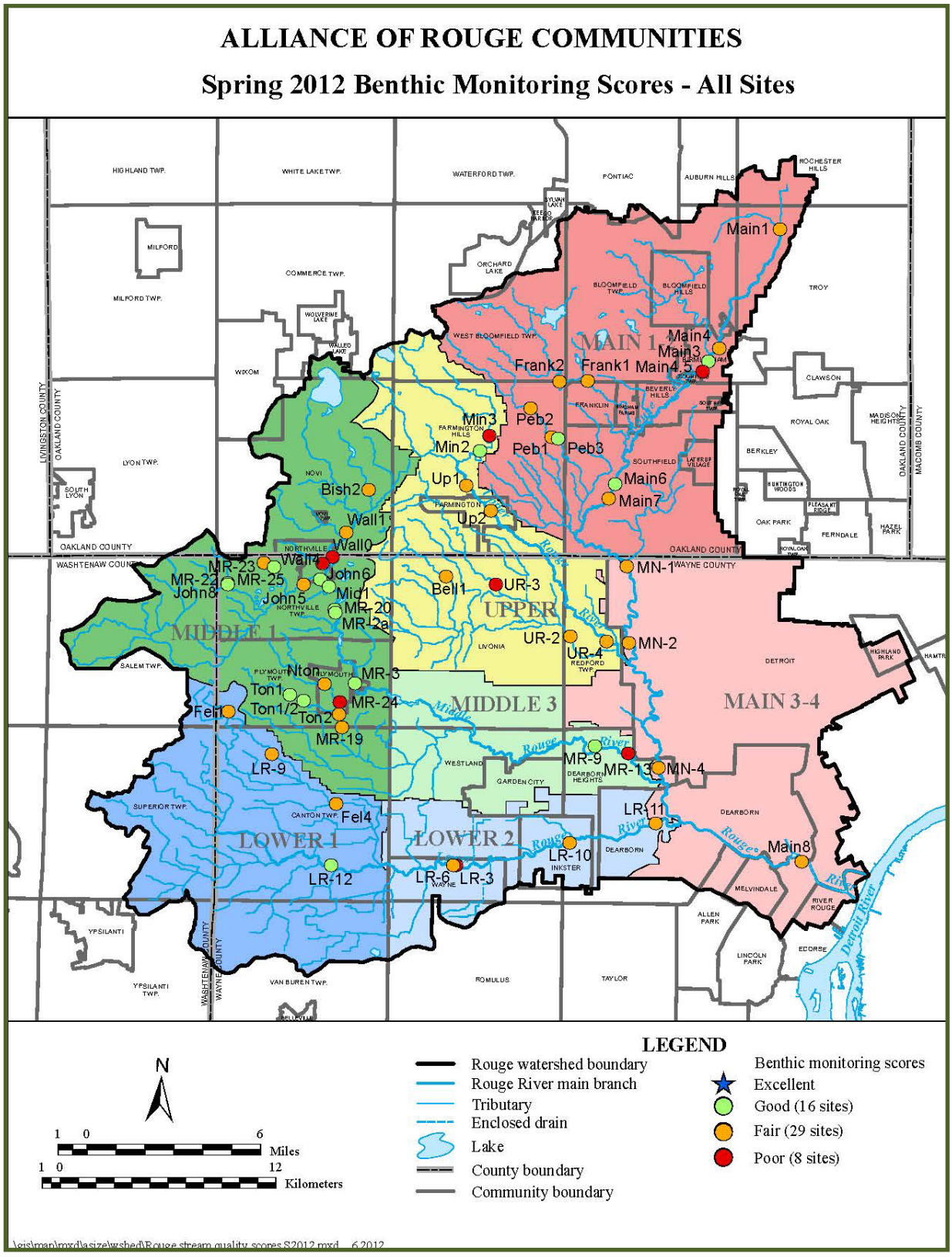
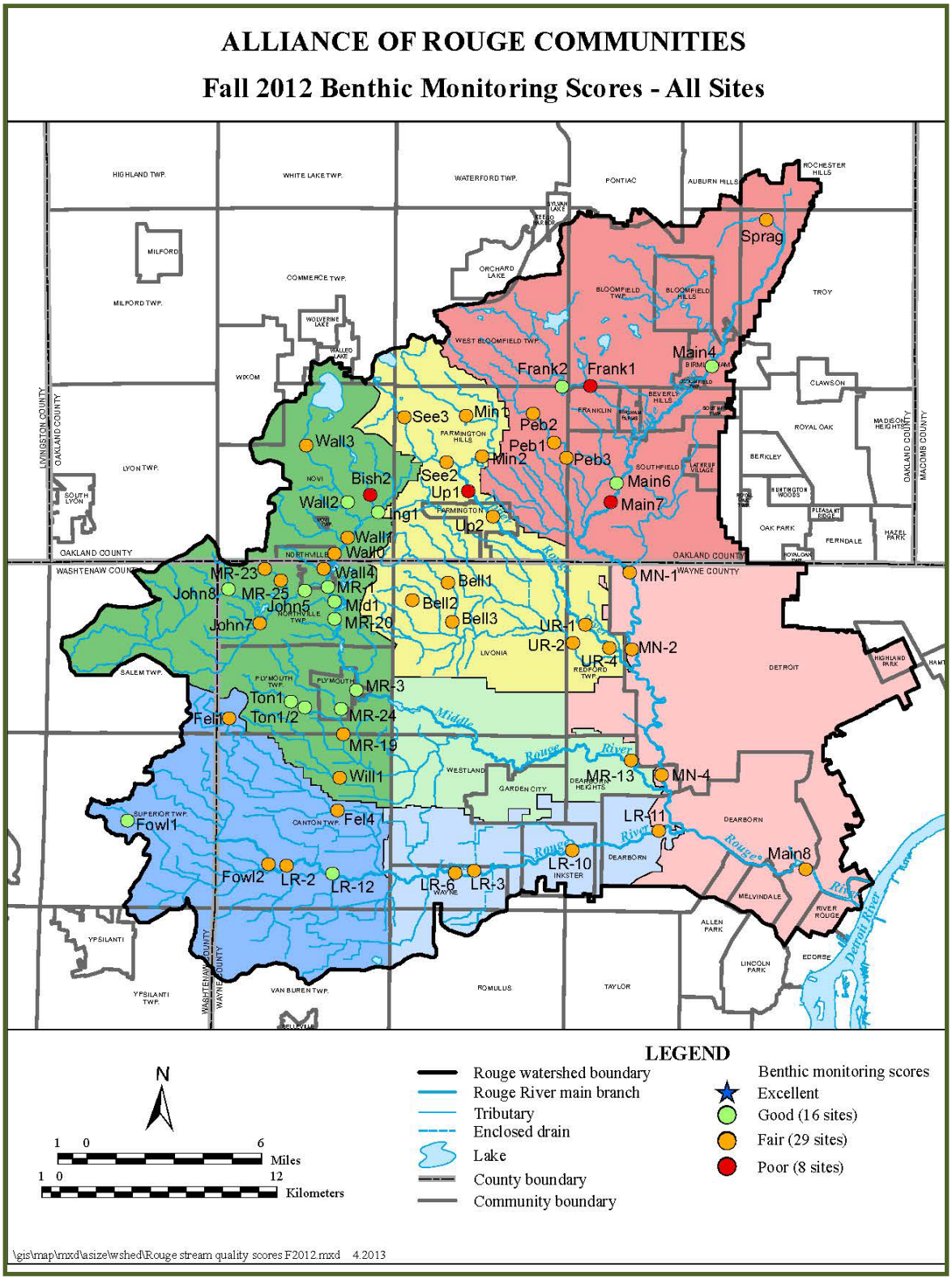


Figure 5-4: Rouge River Benthic Monitoring Sites and Scores, Fall 2012



FOTR and WQMD also performed a Winter Stonefly Search in January & February 2012. WQMD sampled five sites, three in the Lower Rouge River subwatershed (LR-3, LR-6 and LR-12), one in the Upper Rouge subwatershed (UR-1) and one on the Main Rouge River (MN-1). No stoneflies were found. An additional three sites were sampled in Maybury State Park, located the Johnson Creek subwatershed. Stoneflies were found at all three of these sites, the Slender Winter Stonefly (Family Capniidae) the predominant family. The Sump Drain site in Maybury State Park also had Perlodid Stoneflies (Family Perlodidae) in addition to the Capniids.

FOTR held its winter Stonefly Search on January 28, 2012. Seventy-three volunteers joined in to search for stoneflies at 31 sites (including the ones sampled by WQMD). Stoneflies were found at 14 of the 31 sites. A Broadback Stonefly, Family Taeniopterigidae, was discovered for the first time in the Johnson Creek watershed. This is the second time this type of stonefly was identified in the Rouge River watershed. The first time it was found was in the Main Rouge River at Eight Mile Road during Winter 2010.

FOTR and WQMD performed Winter Stonefly Searches in January and February 2013. WQMD sampled six sites; two on the Main Rouge (Main 7 & MN–1), one on the Upper Rouge (UR-1), and three on the Lower Rouge (LR-3, LR-6, & LR-10. No stoneflies were found at any of the locations sampled by WQMD.

FOTR reported that stoneflies were found at 10 of the 33 sites sampled throughout the watershed in 2013. Two sites were sampled on the Main-no stoneflies found, four sites on the Upper Rouge (one site on Bell Creek)-no stoneflies found, ten sites were sampled on Johnson Creek-stoneflies were found at eight of the sites. Perlodid stoneflies were found at John 8 (Sump Drain at Seven Mile), two different stonefly families (Capniidae and Taeniptergiidae) were found at John2 (Johnson Creek at Five Mile Road. One stonefly family (Capniidae) was found at the other six sites on Johnson Creek where stoneflies were found. Stoneflies were not found at the other seven sites sampled on the Middle Rouge. Capnid stoneflies were found at two Lower Rouge tributary sites, one on Fowler Creek, and the other on Fellows Creek. Stoneflies were not found at the other 11 sites sampled on the Lower Rouge and its tributaries. Several sites were frozen over due to the subfreezing weather in the days leading up to the winter stonefly search.

During the term of the *Transforming the Rouge Project* over 719 volunteers participated in the Rouge River watershed macro-invertebrate monitoring. This includes 243 in the Winter Stonefly Searches (2011, 2012, 2013), 265 in the Spring Bug Hunts (2011, 2012, 2013) and 211 in the Fall Bug Hunts (2011, 2012).

Notable 2011 Rouge River watershed macroinvertebrate findings:

- Stoneflies were found at 5 of the 29 sites sampled during the January 22, 2011 FOTR winter Stonefly Search. Severe weather conditions hampered sampling efforts this year, with many of the sites completely frozen over, limiting access. Slender Winter Stoneflies were the only stonefly found.
- The spring 2011 Bug Hunt was challenging due to high water generated by the rainy spring, making deeper sites difficult or impossible to sample. High water did not prevent the discovery of another new find for the Rouge: a new family of caddis fly (Family Lepidostomatidae), a sensitive family. They are found in small cool streams and indicators of clean water. The specimens were found in Johnson Creek. Family Lestidae, spread winged dragonflies, are a tolerant type of dragonfly, but new to the Rouge River, were found this spring in the Lower Rouge Fellows Creek tributary. Six sensitivie families were found at seven sites: Stonefiles (Families Nemouridae, Perlodidae, Capniidae) Pronggill

mayflies (Family Leptophlebiidae), free living caddis flies (Family Rhycophilidae) and Lepidostomatid caddis flies (Family Lepidostomatidae).

- Clubtail dragonflies, a member of the dragonfly family Gomphidae which is very sensitive to water quality, were found at on the Main Rouge (Firefighters Park) in Troy during the Fall 2011 bug hunt. Also collected during the fall 2011 bug hunt were a Dobsonfly, or Hellgrammite, was also found on Danvers Pond on Pebble Creek, a Main Rouge Tributary. The Dobsonfly is a member of the family Corydalidae, also very sensitive to water quality.
- Pronggill mayflies, another insect family sensitive to water quality, were found at four Johnson Creek sites in fall 2011. Perlodid stoneflies (Family Perlodidae), a water quality-sensitive family were also collected at a Johnson Creek site this fall.

Notable 2012 Rouge River watershed macroinvertebrate findings:

- *2012 Winter Stonefly Search:* Stoneflies were found at 14 of the 32 sites sampled during the winter Stonefly Search. FOTR volunteers sampled 24 sites and WQMD sampled seven sites. Unseasonably warm temperatures prior to sampling created snowmelt leading to high water conditions at some of the sites. Slender winter stoneflies (Family Capniidae) were the most common type found, collected at 13 sites. Perlodid stoneflies (Family Perlodidae) were collected at three sites, all in the Johnson Creek watershed. Broadback stoneflies (Family Taenoptergiidae) were collected at one Johnson Creek site.
- *Spring 2012 Bug Hunt:* Seven sensitive families were found at seven sites. Stonefiles (Families Nemouridae, Perlodidae, Perlida), Pronggill mayflies (Family Leptophlebiidae), saddlecase maker caddis flies (Family Glossomatidae) were found at four Johnson Creek sites. Gomphid dragonflies (Family Gomphidae) were found for the second time in the Upper Rouge watershed. Hellgrammites (Family Corydalidae) were collected at a site in the Main Rouge for the first time since 2010.
- *Fall 2012 Bug Hunt:* Prolonged warm temperatures and low precipitation levels in 2012 produced lower than average stream flow levels. Two tributary sites could not be sampled because the stream was dry. Three sensitive families were found at four sites. Gomphid dragonflies (Family Gomphidae) were collected at two Upper Rouge tributary sites- Sprague Creek and Seeley Creek. Pronggill mayflies (Family Leptophlebiidae) were found at one Johnson Creek site. A new sensitive family of caddisfly, the net-tube caddisfly (Family Psyschomyiidae), was collected for the first time in the Rouge River watershed at Northville Recreation Area on the Middle Rouge River. This type of caddisfly prefers cool, clear streams and makes it home in large woody debris and feeds on periphyton.

Rouge River Macroinvertebrate Data Trend Analysis: A trend analysis was performed on the Rouge River benthic macroinvertebrate data collected to date. The data were subdivided into the seven primary Rouge River subwatersheds and the Johnson Creek subwatershed for statistical analysis. Johnson Creek is recognized as a coldwater stream and therefore unique from the rest of the Rouge River system. A standard significance test (p=<0.05) was applied to the linear regression analysis to determine trend significance. The slope of the linear regression trend line is expressed as a number, either positive or negative. A positive slope suggests an upward (improving) trend in the data. A negative slope suggests a downward (declining) trend in the data. The direction of the trend line is recognized as significant if the p-value is equal to or less than 0.05. Table 5-1 summarizes the results of the data trend analysis since FOTR/WQMD macroinvertebrate monitoring began. Figure 5-5 presents a graphic representation of the linear regression analysis completed for macroinvertebrate data collected in Johnson Creek during the fall for the period 2001-2012.

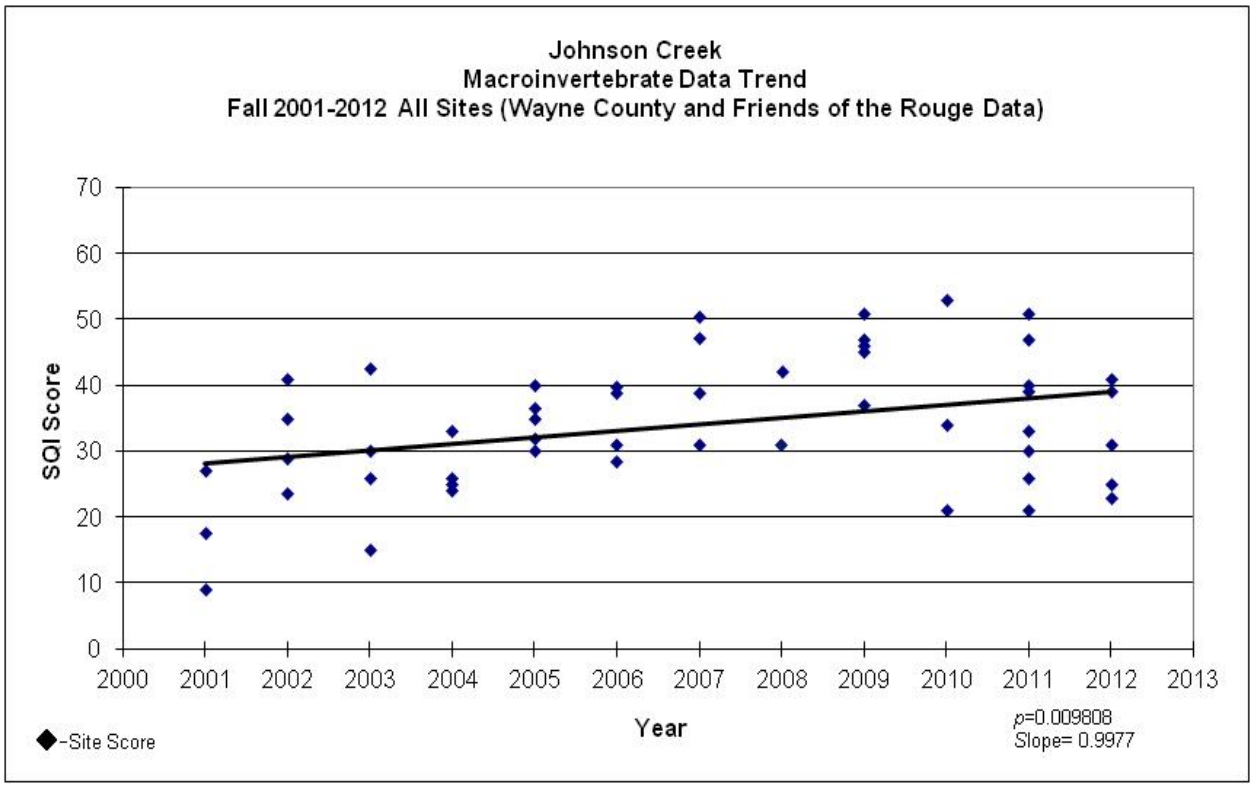
Table 5-1: Rouge River Macroinvertebrate Trend Analysis

Spring Data Trend 2001-2013			
Subwatershed	slope	*p*-value	Significant trend
Main 1-2	0.5911	0.0026	**Yes, improving**
Upper	0.0761	0.7557	No trend
Johnson Creek	1.0221	0.0017	**Yes, improving**
Middle 1	1.1575	0.0006	**Yes, improving**
Middle 3	1.2307	0.0470	**Yes, improving**
Lower 1	0.3508	0.2734	No trend
Lower 2	-0.0186	0.9655	No trend
Main3-4	0.0455	0.9632	No trend
Fall Data Trend 2001 - 2012			
Subwatershed	slope	*p*-value	Significant trend
Main 1-2	-0.3444	0.3077	No Trend
Upper	-0.5050	0.0328	**Yes, declining**
Johnson Creek	0.9977	0.0098	**Yes, improving**
Middle 1	0.5993	0.0307	**Yes, improving**
Middle 3	0.7317	0.0336	**Yes, improving**
Lower 1	0.2381	0.4506	No Trend
Lower 2	-0.5526	0.2605	No Trend
Main3-4	-1.4883	0.1591	No Trend

Based on this analysis, four of eight subwatersheds are showing significant improving trends for spring macroinvertebrate monitoring data. Three of eight subwatersheds have significant improving data trends for fall monitoring. One of the subwatersheds (Upper Rouge) had a significant declining data trend for the fall of 2012.

Detailed information about the 2011 - 2013 macroinvertebrate sampling in the Rouge River is available online at http://therouge.org/index.php?id=687847.

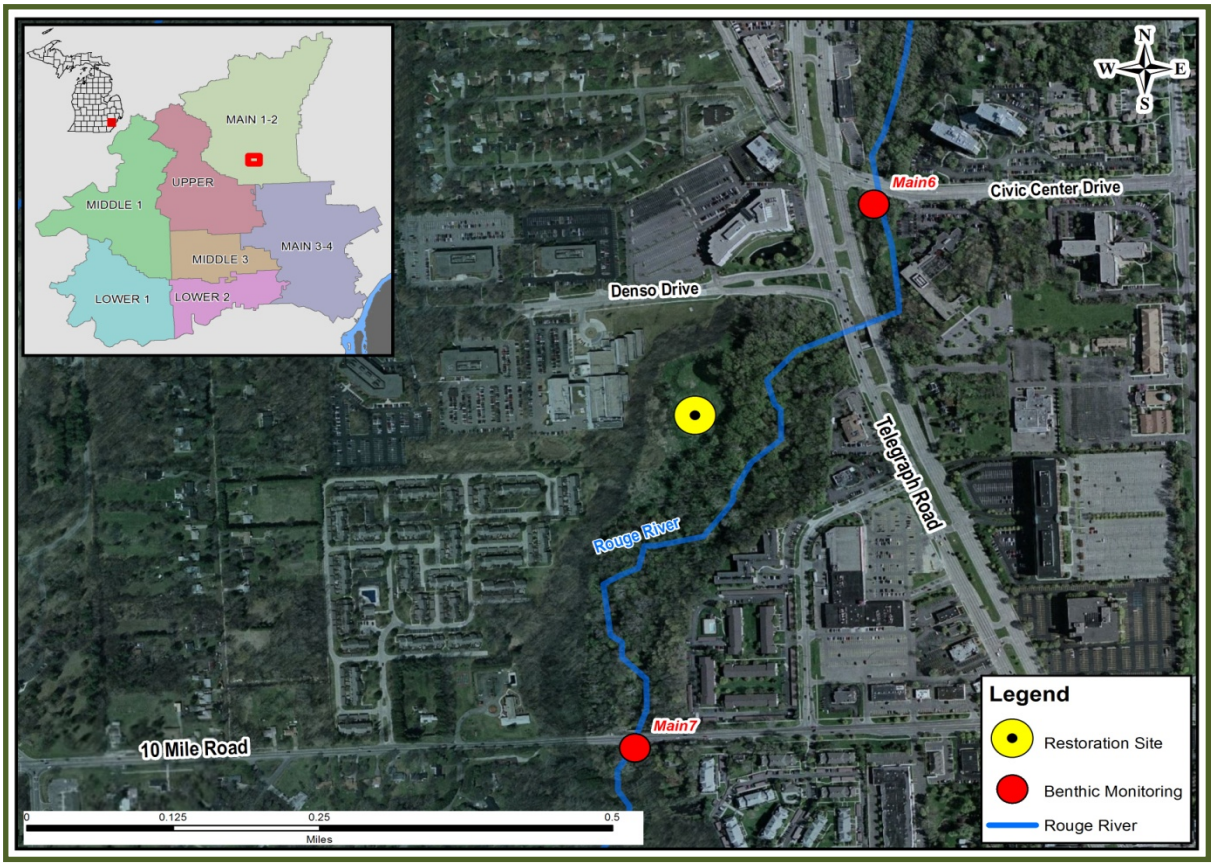
Figure 5-5: Fall Macroinvertebrate Data Trend for Johnson Creek Subwatershed, 2001-2012



5.2.1 MAIN 1-2 SUBWATERSHED – VALLEY WOODS WETLAND

The Valley Woods project is unique in that it is the only wetland that is being restored under this grant. Invasive stands of phragmites were treated and removed by prescribed burning, mechanical and chemical means. Existing overland drains were filled in, returning the site hydrology to its original wetland footprint (8.5 acres). The wetland area was replanted with a native plant seed mix suitable for the site conditions and additional open water areas were created within the restored wetland for habitat. The project was completed in November 2012. Post project monitoring occurred in Fall 2012 and Spring 2013. Figure 5-6 illustrates the location of the monitoring sites (Main 6 & Main 7) associated with the Valley Woods Wetland project.

Figure 5-6: Valley Woods Location



5.2.2 SPRING RESULTS - MAIN 1-2 SUBWATERSHED

Spring benthic communities have been monitored within the Main 1-2 Rouge River subwatershed since the Spring of 2001. Fifteen (15) sites have been monitored in the Main 1-2 for a minimum of three years to establish a baseline score. Figure 5-7 summarizes the spring benthic (i.e. macro invertebrate) data trend for the Main 1-2 Rouge subwatershed. Spring Main 1-2 benthic community scores are improving with a statistically significant positive trend line; slope of 0.5911. Table 5-2 presents the scores for each of the Main 1-2 sites monitored. Scores have improved from an all-sites average of 29 in spring 2001 to an average of 30 in spring 2013. Individual monitoring site scores appear to be improving at 12 of the 15 (80%) Main 1-2 spring monitoring sites.

Figure 5-7: Spring Main 1-2 Data Trend

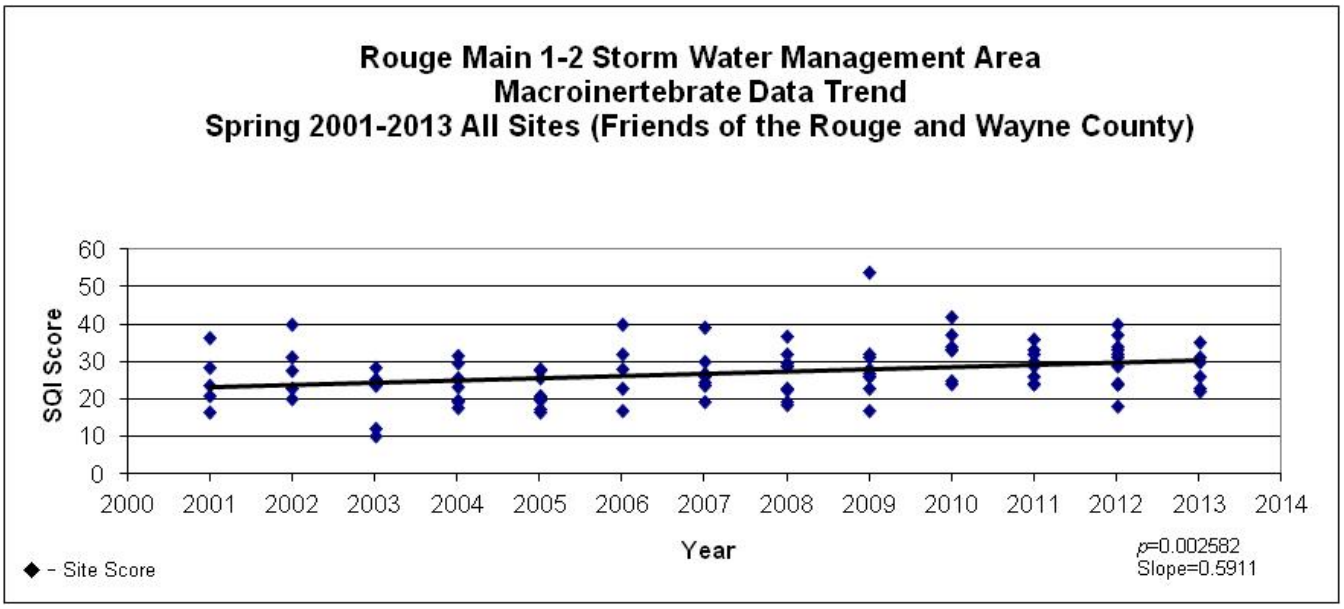


Table 5-2: Spring Main 1-2 Sites & Scores

Sample Site ID	Spring 2001	Spring 2002	Spring 2003	Spring 2004	Spring 2005	Spring 2006	Spring 2007	Spring 2008	Spring 2009	Spring 2010	Spring 2011	Spring 2012	Spring 2013	Trendline (+/-)	Significant Yes/No	Site Baseline (1st 3-Yrs) Average
Frank1	28		25	18	17		39		17	24		33	*	+	No	24
Frank2									28	25		24	*	+	No	26
Main1		20	28	30	17	40		19			26	29	26	+	No	26
Main3		28	24					30	27	37		31	31	+	No	27
Main4	24	23	25	23		28	30			34		34	*	+	Yes	24
Main4.5					20	32	27			33		18	*	–	No	26
Main5				20	21	23			26		33		30	+	Yes	21
Main6	21		10	25		17	19	18			29	40	28	+	Yes	19
Main7											24	32	44	+	No	33
Mur2							25	23	32	33			27	+	No	26
Sprag					28			32	54	42			34	+	No	38
Nott				31	21			29	26		24		22	–	No	27
Peb1	36	31	12	26	28		24	22	31		36	24	30	+	No	27
Peb2					26			37	23		30	24	23	–	No	28
Peb3											32	37	35	+	No	35
Year Average	29	31	11	26	25	20	22	27	32	38	30	31	30			

* trend derived from data through spring 2012

Pre-project scores (Spring 2011) for monitoring sites Main 6 and Main 7 were 29 and 24, respectively. Spring 2012 pre-project scores for monitoring sites Main 6 and Main 7 were 40 and 32, respectively. Post-project scores (Spring 2013) were 28 and 44, respectively. Individual site trend analysis suggests a significant positive trend at Main 6 and an improving but not significant trend at Main 7 for the spring data. Given the distance between the location of the project and the monitoring sites; the variability of instream habitat; as well as the limited post project data, it is not possible to correlate the differences in site scores and trends at the monitoring sites with implementation of the Valley Woods Wetland project.

5.2.3 FALL RESULTS - MAIN 1-2 SUBWATERSHED

Fall benthic communities have been monitored within the Main 1-2 Rouge River subwatershed since the Fall of 2001. Fourteen (14) sites have been monitored in the Main 1-2 for a minimum of three years to establish a baseline score. Figure 5-8 summarizes the fall benthic data trend for the Main 1-2 subwatershed. Fall Main 1-2 benthic community trend analysis suggests a negative but not significant trend. Table 5-3 presents the scores for each of the Main 1-2 sites monitored. Scores have declined from an all-sites average of 38 in fall 2002 to an average of 29 in fall 2012. Individual monitoring sites scores appear to be improving at 6 of the 14 (43%) Main 1-2 fall monitoring sites.

Figure 5-8: Fall Main 1-2 Data Trend

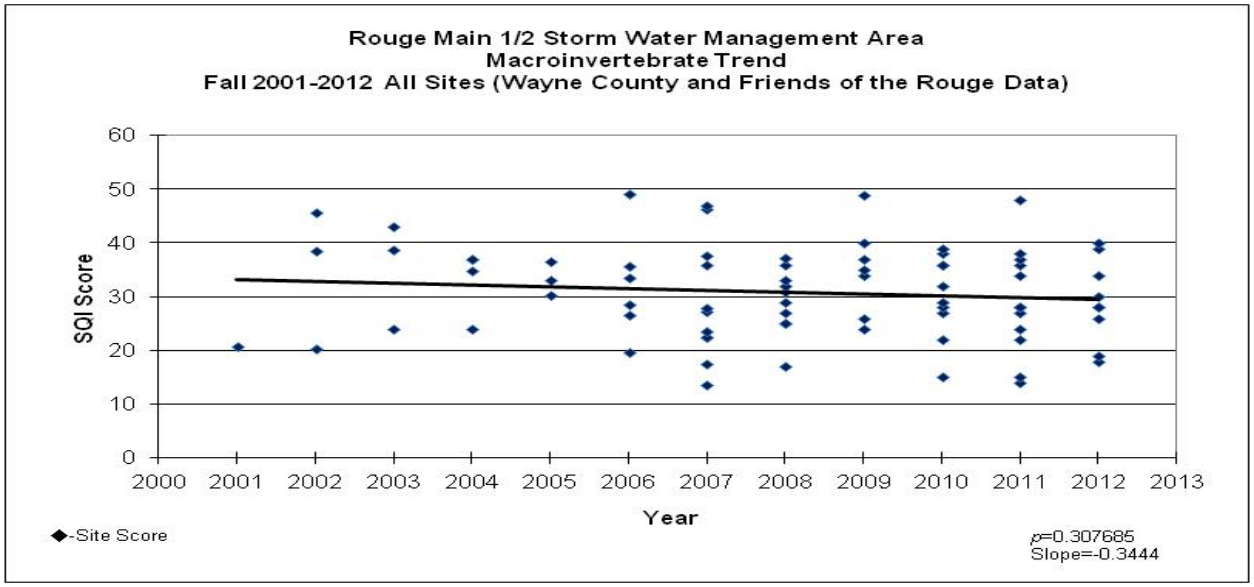


Table 5-3: Fall Main 1-2 Sites & Scores

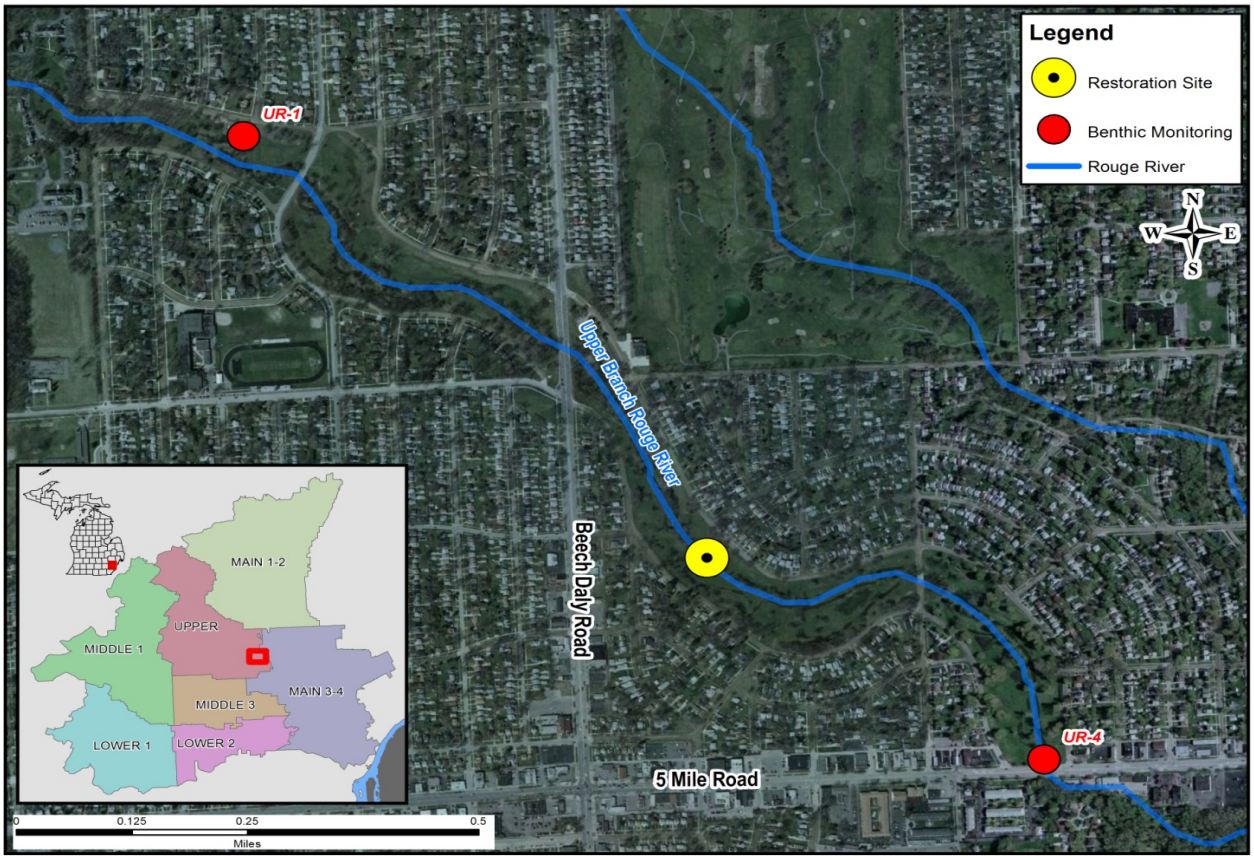
Sample Site ID	Fall 2001	Fall 2002	Fall 2003	Fall 2004	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Trendline (+/-)	Significant Yes/No	Site Baseline (1st 3-Yrs) Average
Frank1		20	24	24			14	17			28	18	-	No	23
Frank2										15	28	34	+	No	26
Main1						20	23	25			15		-	No	22
Main3							36	27	37		38		+	No	33
Main4	21	46	43	37	30	36		36		38		39	+	No	36
Main4.5					37	49	24	31			27		-	No	36
Main 5				37	33		22			39	22		-	No	31
Main 6		38	39	35		27			35	36	36	40	+	No	37
Main 7										27	14	19	-	No	20
Mur2								28	25	26	29		+	No	26
Sprag						34	46	33	49	36		28	-	No	38
Nott				34	28		27	32		22			-	No	30
Peb1		47	37	40		48	38			32	37	28	-	No	41
Peb2							18	29	24		24	26	+	No	24
Peb3											34	30	NA	NA	NA
Year Average	21	38	36	34	32	35	27	29	34	30	28	29			

Pre-project scores (Fall 2011) for monitoring sites Main 6 and Main 7 were 36 and 14, respectively. Post-project scores (Fall 2012) were 40 and 19, respectively. Individual site trend analysis suggests a positive but not significant trend at Main 6 and a negative but not significant trend at Main 7 for the fall data. Given the distance between the location of the project and the monitoring sites; the variability of instream habitat; as well as the limited post project data, it is not possible to correlate the differences in site scores and trends at the monitoring sites with implementation of the Valley Woods Wetland project.

5.2.4 UPPER ROUGE RIVER – LOLA VALLEY GROW ZONE

Lola Valley Park is within the Upper Rouge subwatershed and has approximately 1.5 miles of the Upper Rouge River flowing through 58 acres of riparian parkland owned by Wayne County. Lola Valley Park is completely within Redford Township and winds through a residential neighborhood. The park ends approximately one-half mile upstream of the City of Detroit's Eliza Howell Park. Through this grant project 8.8 acres of turf grass will be converted to native plant grow zone. The site was originally planted and seeded in June of 2012. Unfortunately the summer of 2012 was extremely dry and the grow zone failed to establish. The site has been re-seeded (November 2012) but the delay in grow zone establishment has made it impossible to gather post project monitoring data. Figure 5-9 illustrates the location of the monitoring sites (UR-1 & UR-4) associated with the Lola Valley project.

Figure 5-9: Lola Valley Location



5.2.5 SPRING RESULTS - UPPER ROUGE SUBWATERSHED

Spring benthic communities have been monitored within the Upper Rouge Subwatershed since the spring of 2002. Fifteen (15) sites have been monitored in the Upper Rouge for a minimum of three years to establish a baseline score. Figure 5-10 summarizes the spring benthic data trend for the Upper Rouge subwatershed. Trend analysis suggests a positive but not significant trend for the spring data through 2013. Table 5-4 presents the scores for eachof the Upper sites monitored. Scores have improved from an all-sites average of 19 in spring 2002 to an average of 25 in spring 2013. Individual monitoring site scores appear to be improving at 8 of the 15 (53%) Upper Rouge spring monitoring sites.

Figure 5-10: Spring Upper Subwatershed Data Trend

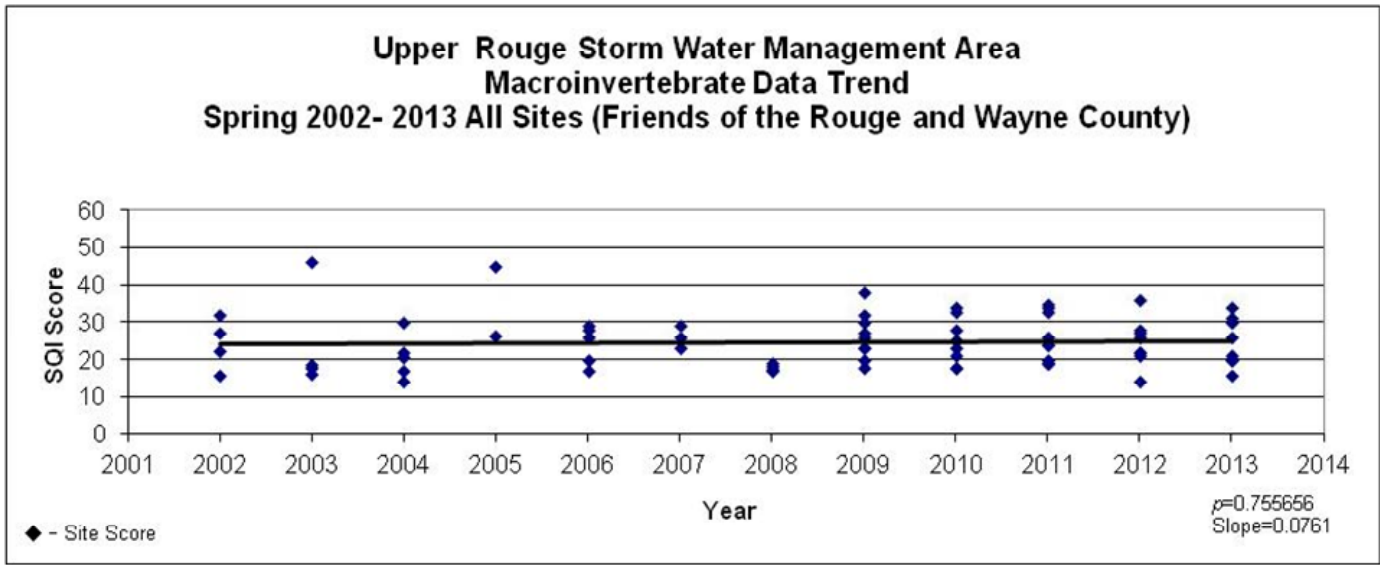


Table 5-4: Spring Upper Subwatershed Sites & Scores

Sample Site ID	Spring 2001	Spring 2002	Spring 2003	Spring 2004	Spring 2005	Spring 2006	Spring 2007	Spring 2008	Spring 2009	Spring 2010	Spring 2011	Spring 2012	Spring 2013	Trendline (+/-)	Significant Yes/No	Site Baseline (1st 3-Yrs) Average
Bell1			18	21		26		19	27	28	24	27		+	No	22
Bell2				27					30	34			34	+	No	30
Bell3				24		16		14		32			30	+	No	18
UR-2									23	18	19	22		–	No	20
Min1			32	46	22	45	28				26		20	–	No	33
Min2									38	23	34	36		+	No	32
Min3									32	25		14		–	Yes	24
See2			16	17						25	33		26	+	No	19
Tar2		16		30		29	26				24		31	+	No	25
UR-3									21	17	25	18		–	No	21
See3									18	33	20		20	–	No	24
Up1						20	23	17			19	28		+	No	20
Up2		22	19	14	26	17	29	18	20			26		+	No	18
UR-1								17	26	21			16	–	No	21
UR-4											35	21	21	–	No	26
Year Average		19	21	26	24	26	27	17	26	26	26	24	25			

Pre-project scores (Spring 2011) for monitoring sites UR-1 and UR-4 were 21 (baseline average) and 35, respectively. Pre-project scores (Spring 2012) for monitoring sites UR-1 and UR-4 were 21(baseline average) and 21, respectively. Pre-project scores (Spring 2013) for monitoring sites UR-1 and UR-4 were 16 and 21, respectively. As mentioned above, grow zone establishment problems have prevented the collection of post-project data at these sites. Individual site trend analysis suggests a negative but not significant trend at UR-1 and a negative but not significant trend at UR-4 for the spring data.

5.2.6 FALL RESULTS – UPPER SUBWATERSHED

Fall benthic communities have been monitored within the Upper Rouge River subwatershed since the Fall of 2002. Fourteen (14) sites have been monitored in the Upper for a minimum of 3 years to establish a baseline score. Figure 5-11 summarizes the fall benthic data trend for the Upper subwatershed. Fall Upper benthic community trend analysis suggests a significant negative trend. Table 5-5 presents the scores for each of the Upper sites monitored. Scores have declined from an all-sites average of 30 in fall 2002 to an average of 24 in fall 2012. Individual monitoring site scores are trending positive at 8 of the 14 (57%) Upper Rouge fall monitoring sites.

Figure 5-11: Fall Upper Subwatershed Data Trend

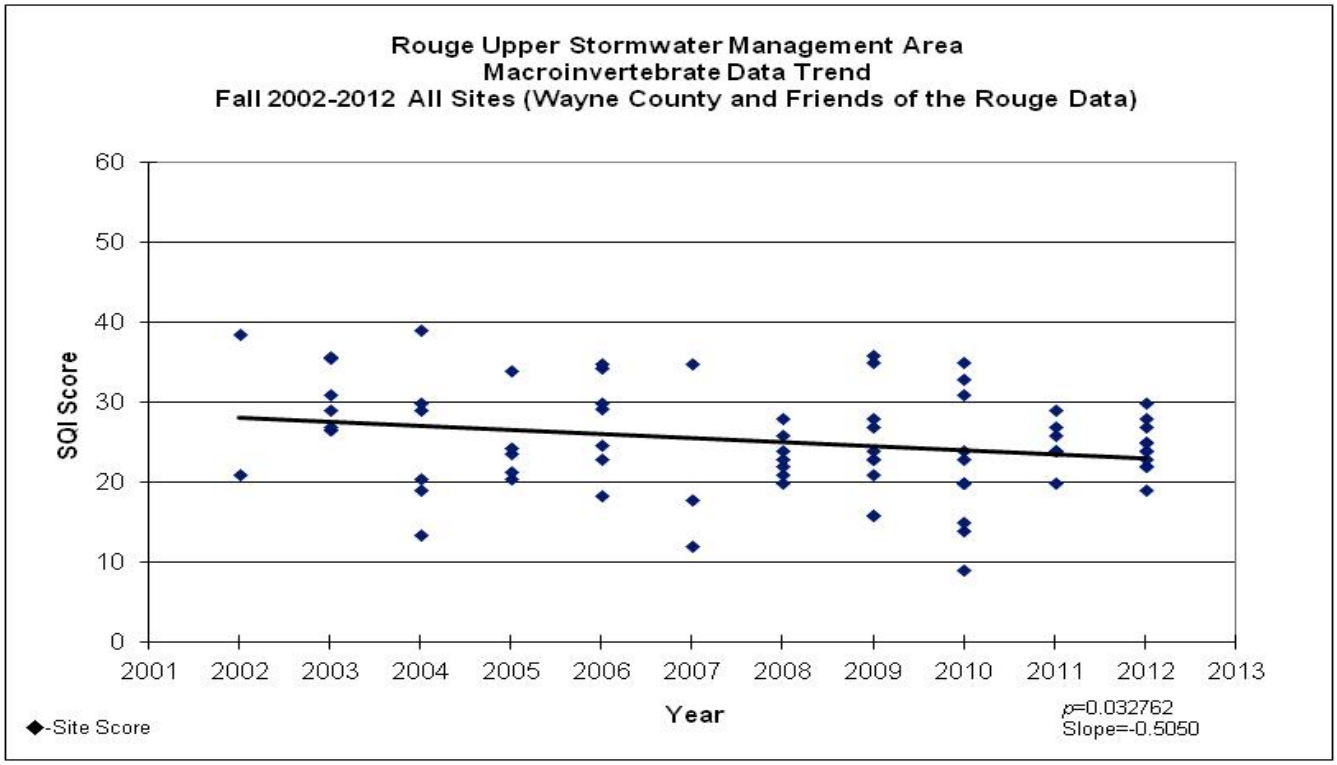


Table 5-5: Fall Upper Subwatershed Sites & Scores

Sample Site ID	Fall 2001	Fall 2002	Fall 2003	Fall 2004	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Trendline (+/-)	Significant Yes/No	Site Baseline (1st 3-Yrs) Average
Bell1			27	21	21	18		21		14		22	-	No	23
Bell2			31		24	29	18	28	36	35	24	30	+	No	28
Bell3				27	19		34	12		16		20	-	No	27
UR-2								23	28	9	26	25	+	No	20
Min1			27	29		25		42				27	+	No	27
Min2									23	20		23	+	No	22
Min3									23	15			NA	NA	NA
See2			36	13					35	20	29	25	+	No	28
Tar2		21	29	39	34	23	39		27				+	No	30
UR-3								22	24	24	24		+	No	23
See3									16	23	27	24	+	No	22
Up1					24	30		24		33		19	-	No	26
Up2		39	36	30	21	35		20		20		28	-	No	35
UR-1					35	26	21					24	-	No	27
UR-4										31	24	22	-	No	26
Year Average		30	31	26	25	27	28	24	27	22	26	24			

Pre-project scores (Fall 2011) for monitoring sites UR-1 and UR-4 were 27 (baseline average) and 24, respectively. Pre-project scores (Fall 2012) for monitoring sites UR-1 and UR-4 were 24 and 22, respectively. As mentioned above, grow zone establishment problems have prevented the collection of post-project data at these sites. Individual site trend analysis suggests a negative but not significant trend at UR-1 and a negative but not significant trend at UR-4 for the fall data.

5.2.7 MAIN 3-4 ROUGE RIVER – ELIZA HOWELL PARK & ROUGE PARK GROW ZONES

The City of Detroit's Eliza Howell and Rouge parks contain 17 acres of native plant grow zones originally established by the City in partnership with the federally-funded Rouge River National Wet Weather Demonstration Project in 2000. The current GLRI grant called for adding and restoring five acres in Eliza Howell park and restoring five acres of prairie in Rouge Park by conducting prescribed burning and reseeding of native plant seed mix. The prescribed burning occurred in April, 2012 and the reseeding with local student involvement occurred in April, 2012 (Rouge Park) and May, 2012 (Eliza Howell Park). Post project monitoring occurred in the Fall 2012 and Spring 2013. Figures 5-12 and 5-13 illustrates the location of the monitoring sites (UR-4, MN-2 and MN-4) associated with the Eliza Howell Park and Rouge Park project sites.

Figure 5-12: Eliza Howell Park Location

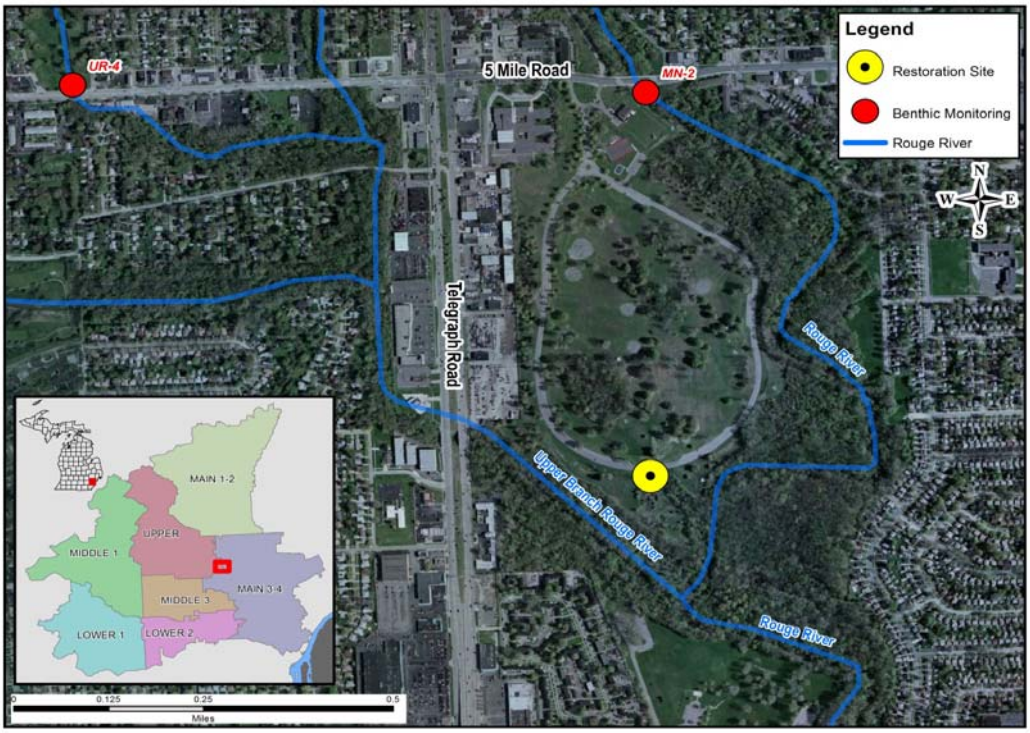
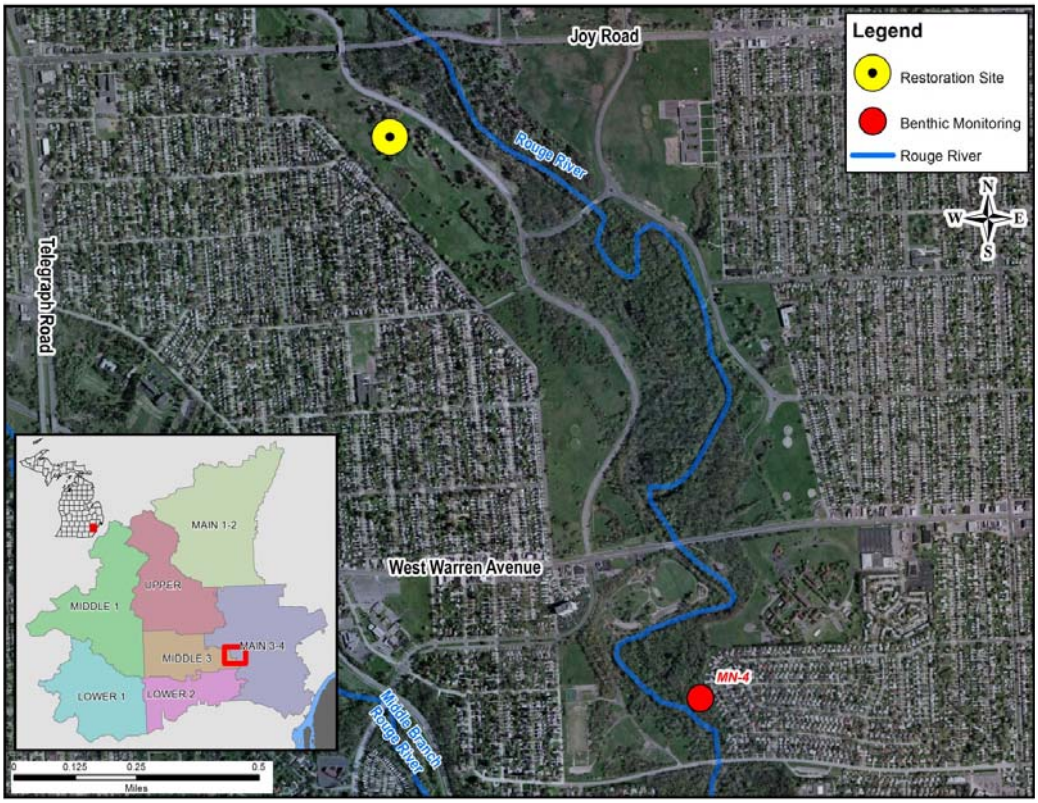


Figure 5-13: Rouge Park Location



5.2.8 SPRING RESULTS - MAIN 3-4 SUBWATERSHED

Spring benthic communities have been monitored within the Main 3-4 Rouge River subwatershed since the Spring of 2009. Four (4) sites have been monitored in the Main 3-4 for a minimum of three years to establish a baseline score. Figure 5-14 summarizes the spring benthic (i.e. macro invertebrate) data trend for the Main 3-4 Rouge subwatershed. Spring Main 3-4 trend analysis suggests a positive but not significant trend in the benthic community scores. Table 5-6 presents the scores for each of the Main 3-4 sites monitored. Individual monitoring site scores appear to be improving at 2 of the 4 (50%) Main 3-4 spring monitoring sites.

Figure 5-14: Spring Main 3-4 Data Trend

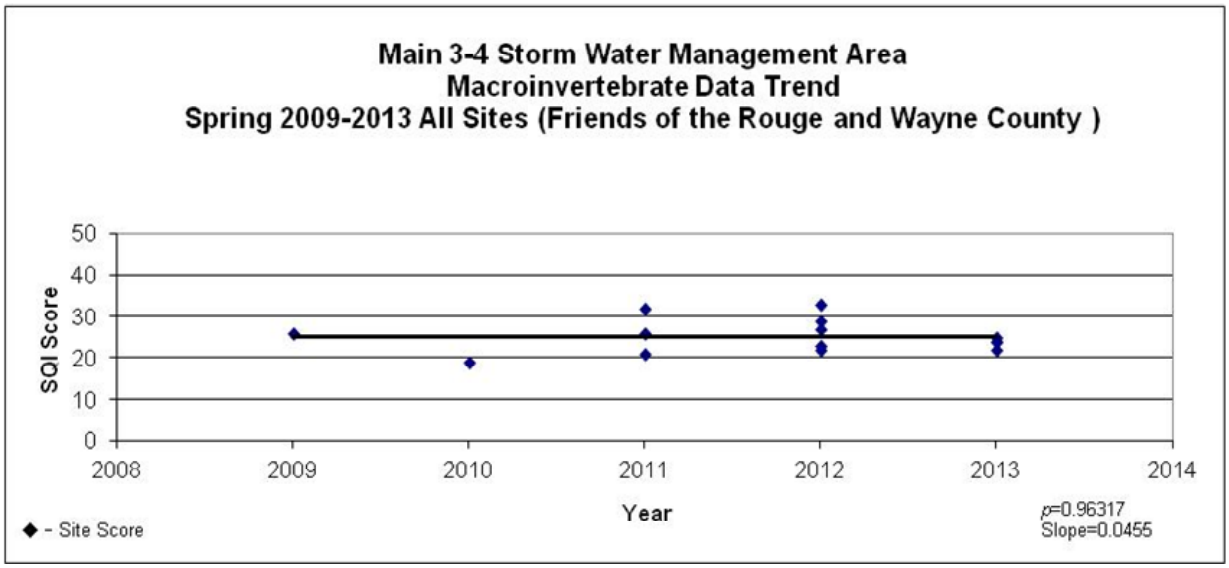


Table 5-6: Spring Main 3-4 Sites & Scores

Sample Site ID	Spring 2009	Spring 2010	Spring 2011	Spring 2012	Spring 2013	Trendline (+/-)	Significant Yes/No	Site Baseline (1st 3-Yrs) Average
Main8			21	23	22	+	No	22
MN-1	26	29		33	25	–	No	29
MN-2	26	19		27	24	+	No	24
MN-4			32	22	24	–	No	26
Year Average	26	24	27	26	24			

Pre-project scores (Spring 2011) for monitoring sites UR-4, MN-2 and MN-4 were 35, 24 (baseline average) and 32, respectively. Pre-project scores (Spring 2012) for monitoring sites UR-4, MN-2 and MN-4 were 21, 27 and 22, respectively. Post-project scores (Spring 2013) were 21, 24 and 24, respectively. Individual site trend analysis suggests a negative but not significant trend at UR-4, a

positive but not significant trend at MN-2 and a negative but not significant trend at MN-4 for the spring data.

5.2.9 FALL RESULTS - MAIN 3-4 SUBWATERSHED

Fall benthic communities have been monitored within the Main 3-4 Rouge River subwatershed since the Fall of 2008. Three sites have been monitored in the Main 3-4 for a minimum of three years to establish a baseline score. Figure 5-15 summarizes the fall benthic data trend for the Main 3-4 subwatershed. Fall Main 3-4 benthic community trend analysis suggests a negative but not significant trend for the subwatershed. Table 5-7 presents the scores for each of the Main 3-4 sites monitored. Scores have declined from an all-sites average of 38 in fall 2008 to an average of 28 in fall 2012. Individual monitoring sites scores are trending positive at none of the 3 (0%) Main 3-4 fall monitoring sites.

Figure 5-15: Fall Main 3-4 Data Trend

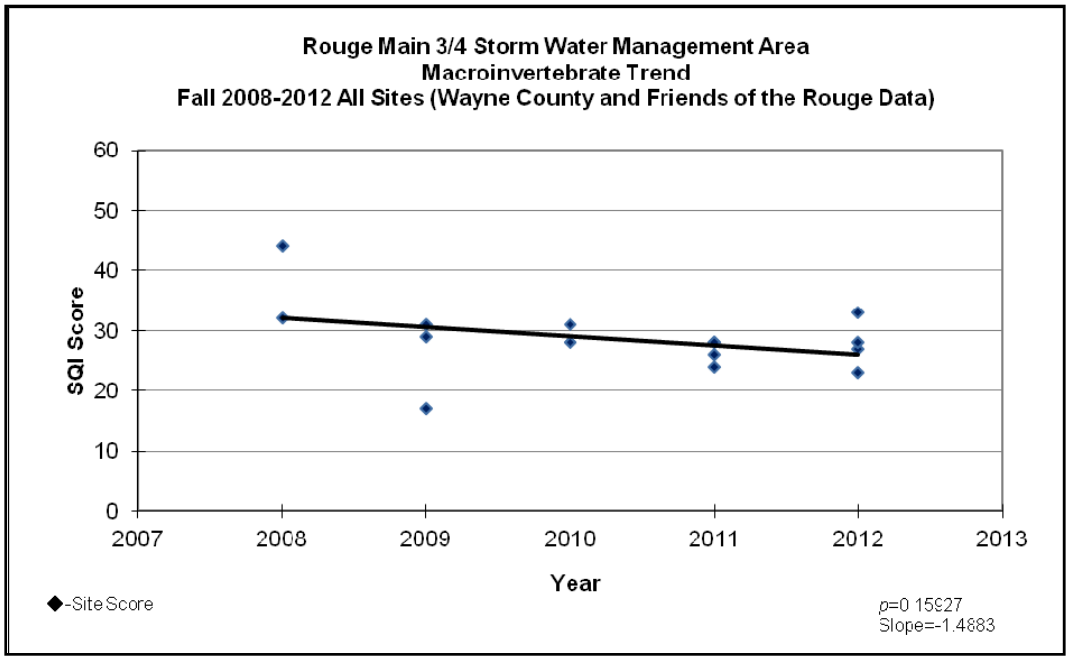


Table 5-7: Fall Main 3-4 Sites & Scores

Sample Site ID	Fall 2008	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Trendline (+/-)	Significant Yes/No	Site Baseline (1st 3-Yrs) Average
Main8				26	23	NA		NA
MN-1	44	31	31	28	33	_	No	35
MN-2	32	29	28	24	27	_	No	30
MN-3		17				NA		NA
MN4			28	28	28	**	**	28
Year Average	38	26	29	27	28			

** Trend line is flat (no slope).

Pre-project scores (Fall 2011) for monitoring sites UR-4, MN-2 and MN-4 were 24, 24 and 28, respectively. Post-project scores (Fall 2012) were 22, 27 and 28, respectively. Individual site trend analysis suggests a negative but not significant trend at both UR-4 and MN-2 monitoring sites for the fall data. The MN-4 site has had a constant score of 28 and therefore no trend, either positive or negative, has been observed.

5.2.10 LOWER ROUGE RIVER – VENOY PARK & INKSTER CSO BASIN GROW ZONE SITES

The Lower Rouge Parkway is nearly 1,200 acres of riparian public lands managed by Wayne County Parks which begins in the City of Dearborn at the downstream end of the Lower Rouge River and extends to Canton Township at the upstream end. Approximately, 15 miles of the Lower Rouge River flows through the Lower Rouge Parkway. Through this grant project, 6.6 acres of turf grass was converted to native plant grow zone at Venoy Park (4.0 acres) and adjacent to the Inkster CSO basin (2.6 acres). These grow zones were established in the summer of 2012. Post project monitoring occurred in the Fall 2012 and Spring 2013. Figure 5-16 and Figure 5-17 illustrates the location of the monitoring sites (LR-3 & LR-10) associated with the Venoy Park and Inkster CSO basin grow zone projects.

Figure 5-16: Venoy Park Location

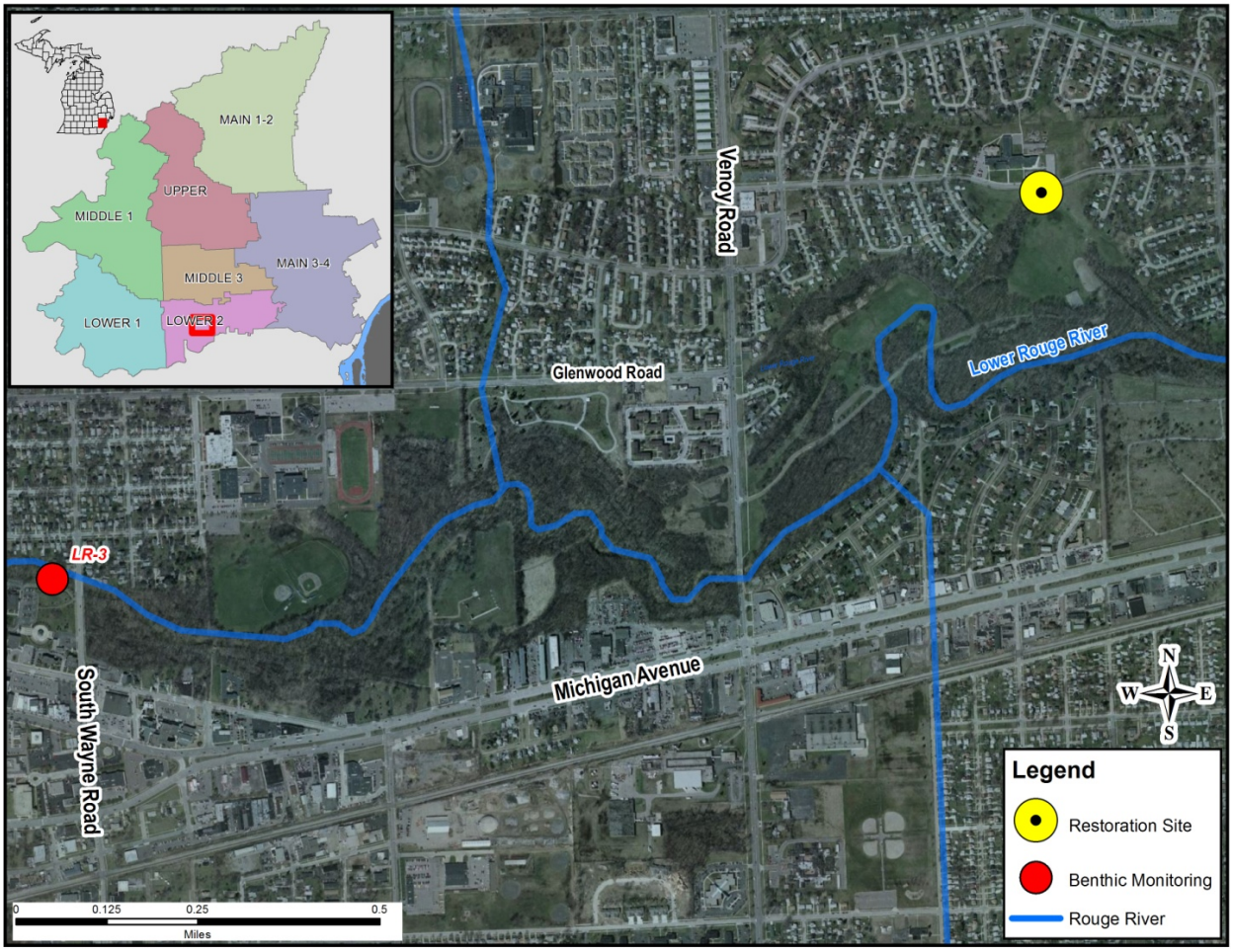
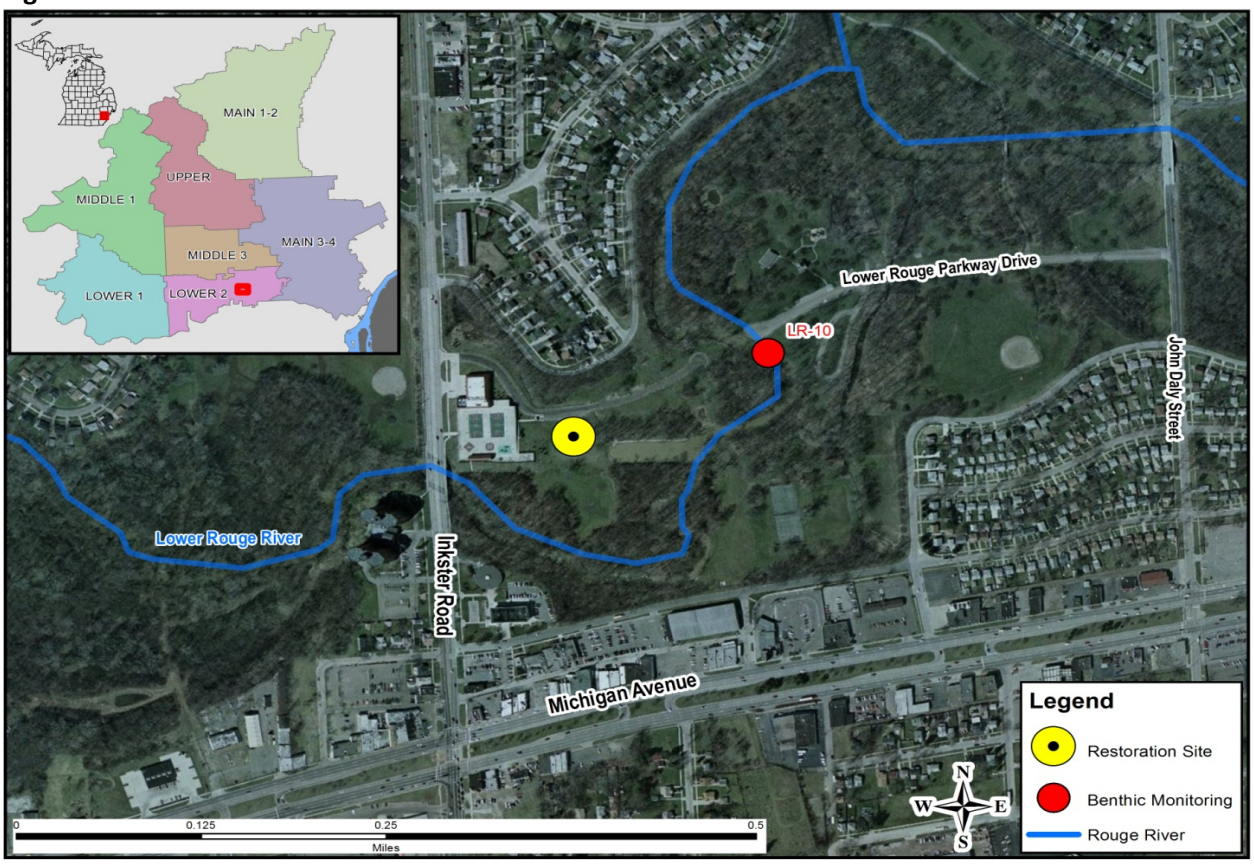


Figure 5-17: Inkster CSO Basin Location



5.2.11 SPRING RESULTS – LOWER 2 SUBWATERSHED

Spring benthic communities have been monitored within the Lower 2 Rouge River subwatershed since the Spring of 2005. Seven (7) sites have been monitored in the Lower 2 for a minimum of three years to establish a baseline score. Figure 5-18 summarizes the spring benthic (i.e. macro invertebrate) data trend for the Lower 2 Rouge Subwatershed. Lower 2 Spring benthic community scores appear to be declining but the trend is not significant. Table 5-8 presents the scores for each of the Lower 2 sites monitored. Scores have improved from an all-sites average of 24 in spring 2005 to an average of 25 in spring 2013. Individual monitoring site scores appear to be improving at 3 of the 7 (43%) Lower 2 spring monitoring sites.

Figure 5-18: Spring Lower 2 Data Trend

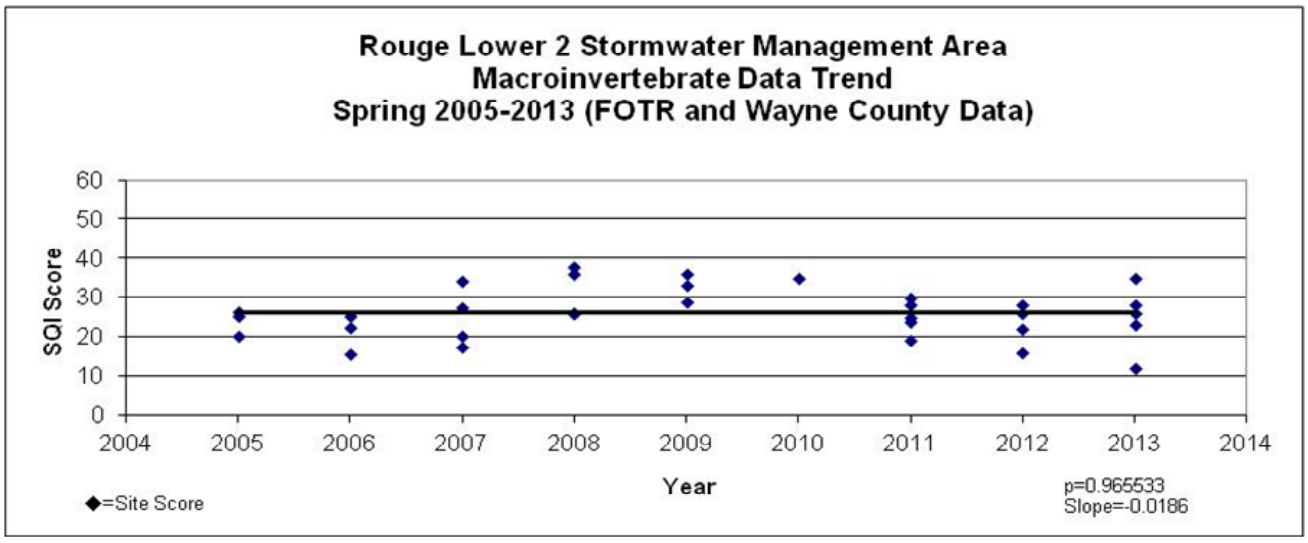


Table 5-8: Spring Lower 2 Sites & Scores

Sample Site ID	Spring 2005	Spring 2006	Spring 2007	Spring 2008	Spring 2009	Spring 2010	Spring 2011	Spring 2012	Spring 2013	Trendline (+/-)	Significant Yes/No	Site Baseline (1st 3-Yrs) Average
LR-1	20	25	34	26	29				35	+	No	27
LR-3	26	22	20	36			28	16	28	–	No	23
LR-4	25	15	18	26						–	No	19
LR-6			28	26	36		19	26	23	+	No	30
LR-7				38	33	35	30			-	No	35
LR-10							24	28	26	+	No	26
LR-11							25	22	12	–	No	20
Year Average	24	21	25	30	33	35	25	23	25			

Pre-project scores (Spring 2011) for monitoring sites LR-3 and LR-10 were 28 and 24, respectively. Pre-project scores (Spring 2012) for monitoring sites LR-3 and LR-10 were 16 and 28, respectively. Post-project scores (Spring 2013) for LR-3 and LR-10 were 28 and 26, respectively. Individual site trend analysis suggests a negative but not significant trend at LR-3 and a positive but not significant trend at LR-10 for the spring data.

5.2.12 FALL RESULTS - LOWER 2 SUBWATERSHED

Fall benthic communities have been monitored within the Lower 2 Rouge River subwatershed since the Fall of 2005. Seven (7) sites have been monitored in the Lower 2 for a minimum of three years to establish a baseline score. Figure 5-19 summarizes the fall benthic data trend for the Lower 2 subwatershed. Fall Lower 2 benthic community scores appear to be declining but the trend is not significant. Table 5-9 presents the scores for each of the Lower 2 sites monitored. Scores have declined from an all-sites average of 26 in fall 2005 to an average of 24 in fall 2012. Individual monitoring sites scores are trending positive at 4 of the 7 (57%) Lower 2 fall monitoring sites.

Figure 5-19: Fall Lower 2 Data Trend

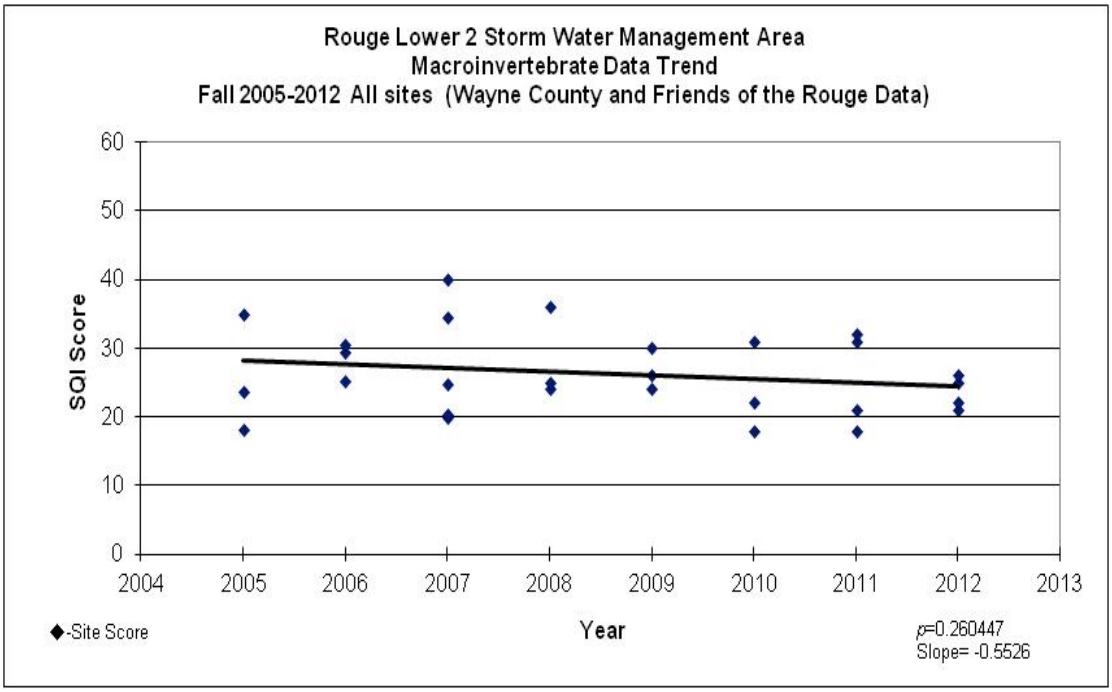


Table 5-9: Fall Lower 2 Sites & Scores

Sample Site ID	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Trendline (+/-)	Significant Yes/No	Site Baseline (1st 3-Yrs) Average
LR-1	18	30	20	36	26				+	No	23
LR-3	35	30	35			22		26	–	No	33
LR-4	24	25	25						+	No	25
LR-6			20	24	24		18	21	–	No	23
LR-7			40	25	30		31		+	No	32
LR10						31	32	22	–	No	28
LR11						18	21	25	+	No	21
Year Average	26	28	28	28	27	24	26	24			

Pre-project scores (Fall 2011) for monitoring sites LR-3 and LR-10 were 33(baseline average) and 32, respectively. Post-project scores (Fall 2012) were 26 and 22, respectively. Individual site trend analysis suggests a negative but not significant trend at both LR-3 and LR-10 monitoring sites for the fall data.

5.3 CONCLUSIONS

Although the distance between the location of the *Transforming the Rouge* restoration project sites and their associated monitoring sites; the variability of in-stream habitat; as well as the limited post project data, makes it difficult to correlate the differences in site scores and trends, between and at the monitoring sites, with implementation of any of the *Transforming the Rouge* restoration project sites. Post-project spring benthic monitoring scores appear to be improving in 3 of the 4 subwatersheds associated with the *Transforming the Rouge* restoration project sites. This includes the Main 1-2 (see Table 5-2 on page 5-11), the Upper (see Table 5-4 on page 5-14) and the Main 3-4 (see Table 5-6 on page 5-18). The Main 1-2's positive trend is statistically significant. The others are not statistically significant. The Lower 2 appears to have a declining trend but again the trend is not statistically significant.

Post-project fall benthic monitoring scores appear to be declining in all subwatersheds associated with the *Transforming the Rouge* restoration projects sites. This includes the Main 1-2, the Upper, Main 3-4 and the Lower 2. The declining trend within the Upper subwatershed is statistically significant. The declining trends in the Main 1-2, Main 3-4 and Lower 2 are not statistically significant therefore there is no true trend yet established. It is anticipated that these negative/declining subwatershed trends will turn positive as the project sites mature and additional green infrastructure/grow zone investments are made in the subwatersheds associated with the *Transforming the Rouge* project.

Within the Middle 1 and Middle 3 subwatersheds, the benthic monitoring data trends are improving significantly in both spring and fall. These subwatersheds have the oldest and most extensive upland grow zones, planted in 2006 and 2007, as well as the most contiguous riparian corridor. Therefore it is our belief that the significant improving trends in these subwatersheds is attributable, in part, to the age and extent of the Middle Rouge grow zones; and given more time and grow zone riparian investment, the other Rouge subwatersheds will also realize significant improving trends in their benthic communities.