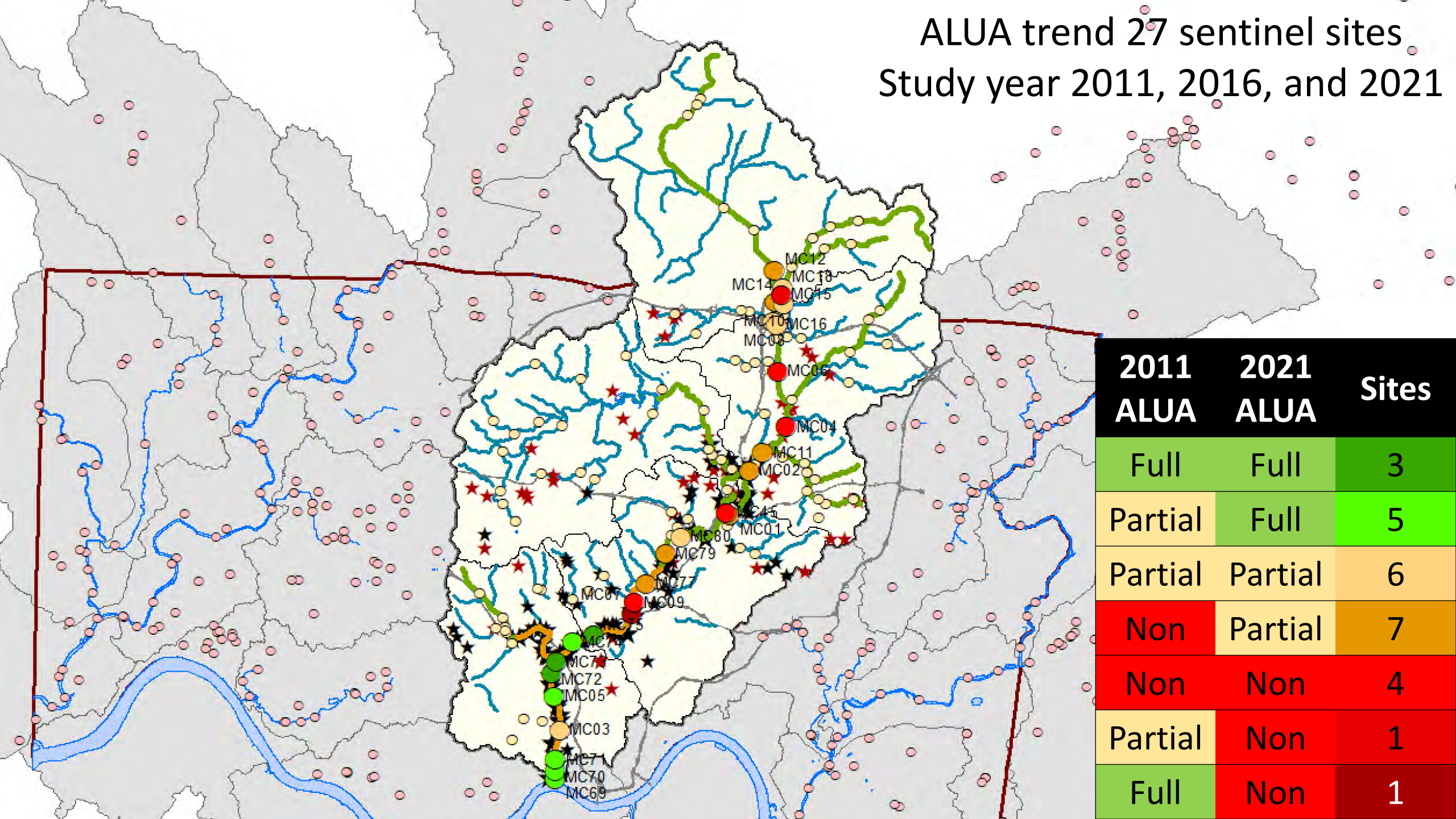


ALUA trend 27 sentinel sites Study year 2011, 2016, and 2021



2011 ALUA	2021 ALUA	Sites
Full	Full	3
Partial	Full	5
Partial	Partial	6
Non	Partial	7
Non	Non	4
Partial	Non	1
Full	Non	1

Site, Stream Name, River Mile, Designated Aquatic Life Use.				Measured Aquatic Life Use Attainment - Difference between study years and improvement over ten-years				Site, Stream Name, River Mile, Designated Aquatic Life Use.				Measured Aquatic Life Use Attainment - Difference between study years and improvement over ten-years			
Site	Stream Name	River Mile	Aquatic Life Use	2011 Attainment Status	2016 Attainment Status	2021 Attainment Status	ALUA 2011-21 10-year Improvement	Site	Stream Name	River Mile	Aquatic Life Use	2011 Attainment Status	2016 Attainment Status	2021 Attainment Status	ALUA 2011-21 10-year Improvement
MC69	Mill Creek	0.21	MWH	PARTIAL	FULL	FULL	PARTIAL-FULL	MC45	West Branch	0.2	WWH	NON	PARTIAL	NON	NON-NON
MC70	Mill Creek	0.5	MWH	PARTIAL	FULL	FULL	PARTIAL-FULL	MC80	Mill Creek	10.48	WWH	PARTIAL	NON	PARTIAL	PARTIAL-PARTIAL
MC71	Mill Creek	0.83	MWH	PARTIAL	PARTIAL	FULL	PARTIAL-FULL	MC01	Mill Creek	11.7	WWH	NON	PARTIAL	PARTIAL	NON-PARTIAL
MC03	Mill Creek	1.69	MWH	PARTIAL	FULL	PARTIAL	PARTIAL-PARTIAL	MC02	Mill Creek	13.27	WWH	NON	PARTIAL	PARTIAL	NON-PARTIAL
MC05	Mill Creek	2.5	MWH	PARTIAL	FULL	FULL	PARTIAL-FULL	MC11	Mill Creek	13.96	WWH	NON	FULL	PARTIAL	NON-PARTIAL
MC72	Mill Creek	3.15	MWH	FULL	FULL	FULL	FULL-FULL	MC04	Mill Creek	15.41	WWH	NON	NON	NON	NON-NON
MC73	Mill Creek	3.45	MWH	FULL	FULL	FULL	FULL-FULL	MC06	Mill Creek	16.73	WWH	NON	NON	NON	NON-NON
MC74	Mill Creek	4.21	MWH	PARTIAL	FULL	FULL	PARTIAL-FULL	MC08	Mill Creek	18.37	WWH	PARTIAL	PARTIAL	PARTIAL	PARTIAL-PARTIAL
MC75	Mill Creek	4.84	MWH	FULL	FULL	FULL	FULL-FULL	MC10	Mill Creek	18.86	WWH	NON	PARTIAL	PARTIAL	NON-PARTIAL
MC07	Mill Creek	6.45	MWH	FULL	PARTIAL	NON	FULL-NON	MC12	Mill Creek	19.22	WWH	NON	PARTIAL	PARTIAL	NON-PARTIAL
MC09	Mill Creek	6.8	MWH	NON	PARTIAL	NON	NON-NON	MC16	East Branch	0.39	WWH	PARTIAL	NON	PARTIAL	PARTIAL-PARTIAL
MC77	Mill Creek	7.47	WWH	NON	PARTIAL	PARTIAL	NON-PARTIAL	MC14	East Branch	0.66	WWH	PARTIAL	PARTIAL	PARTIAL	PARTIAL-PARTIAL
MC79	Mill Creek	8.63	WWH	NON	FULL	PARTIAL	NON-PARTIAL	MC15	East Branch	0.96	WWH	FULL	PARTIAL	PARTIAL	FULL-PARTIAL
								MC18	East Branch	1.14	WWH	PARTIAL	PARTIAL	PARTIAL	PARTIAL-PARTIAL

2021 Biological and Water Quality Study of Mill Creek

- Highlights:

1. Continued improvements between 2016 and 2021, but the rate is slowing.
2. Exceptional macroinvertebrate scores were recorded in Mill Creek for the first time, and they met their WWH criteria at all sites.
3. Fish showed some incremental improvement; fish are the limiting factor at the sites in partial attainment.
4. The two lowermost sites in Cooper Creek were in full attainment of WWH – this is very rare for an urbanized watershed. ***Good job Adam Lehman and the Cooper Creek Collaborative!***
5. Lick Run was about what we expected – no fish, very poor-quality bugs, lots of algae. Lick Run is not listed in the Ohio WQS; no recommendations were made for aquatic life use.
6. Nutrient enrichment effects were serious in the concrete channel; this is a MWH reach and is therefore, habitat controlled.
7. The Butler Co. WRF continues to deliver high loads of TDS and chlorides into Mill Creek.
8. *E. coli* was exceeded everywhere including well outside the influence of CSOs – this is no surprise. Actual maximum values were reported as opposed to the >2,400 values previously reported; we need to take a closer look at patterns of 5-digit values. A study designed for *E. coli* would tell this story more effectively.

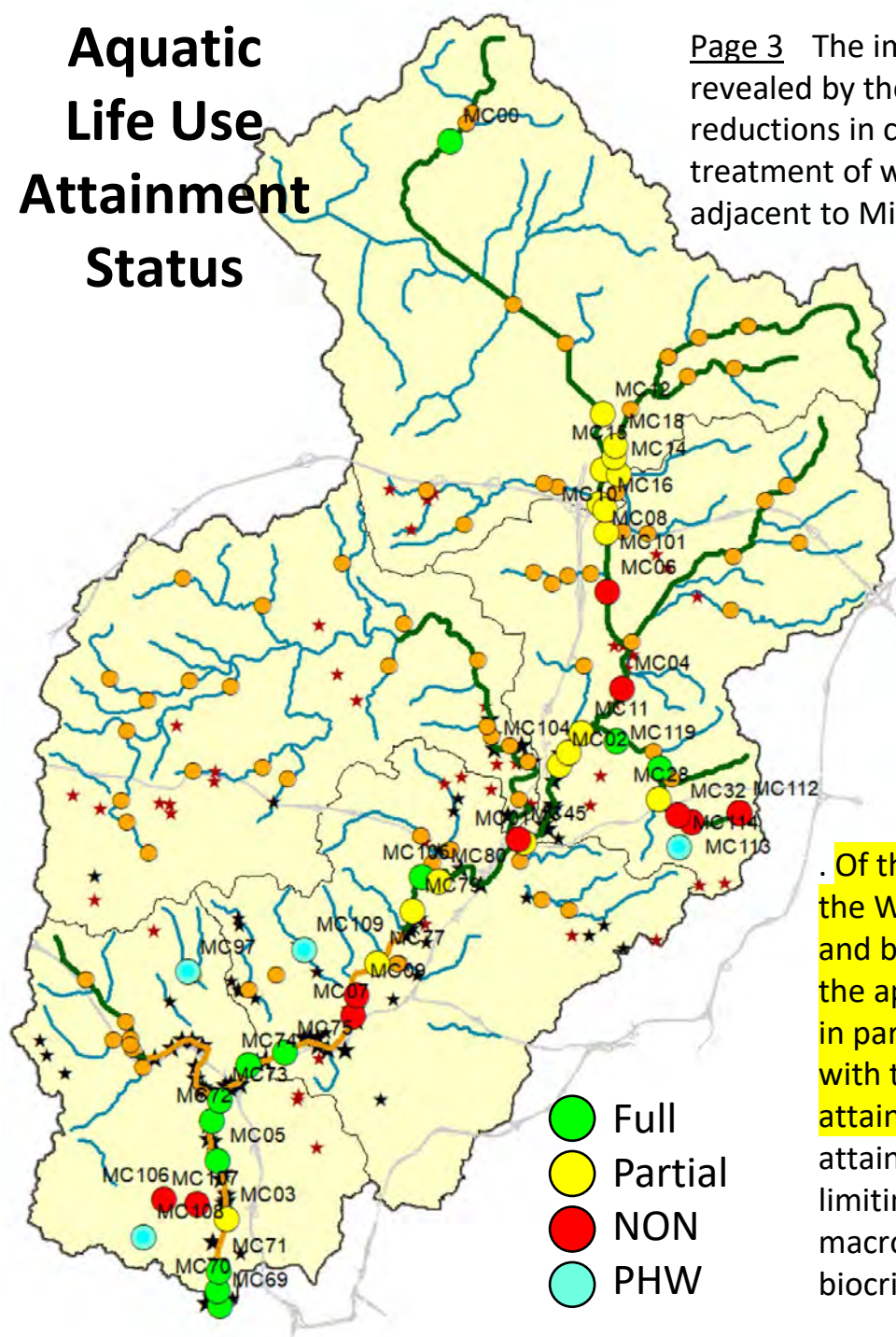
Page 3 The improvements in the biological assemblages that have been revealed by the biological assessment since 1992 are due in large part to reductions in chemical pollutant loadings resulting from the collection and treatment of wastewater and the clean-up of toxic materials handling adjacent to Mill Creek and tributaries.

In the 26 miles of the mainstem study area, full attainment increased from 0.1 mile in 1992 to 10.8 miles in 2016 and non-attainment declined from 24.4 miles in 1992 to 5.8 miles in 2016 and 5.1 miles in 2021. While reaches of partial and isolated sites in non-attainment remained in 2021, the results indicate continued incremental improvement since the 2011 and 2016

Recreational uses continued to exhibit widespread impairment based on E. coli results. Although E. coli values were reduced compared to 2011 and 2016, no site fully attained the Primary Contact Recreation (PCR) use criteria.

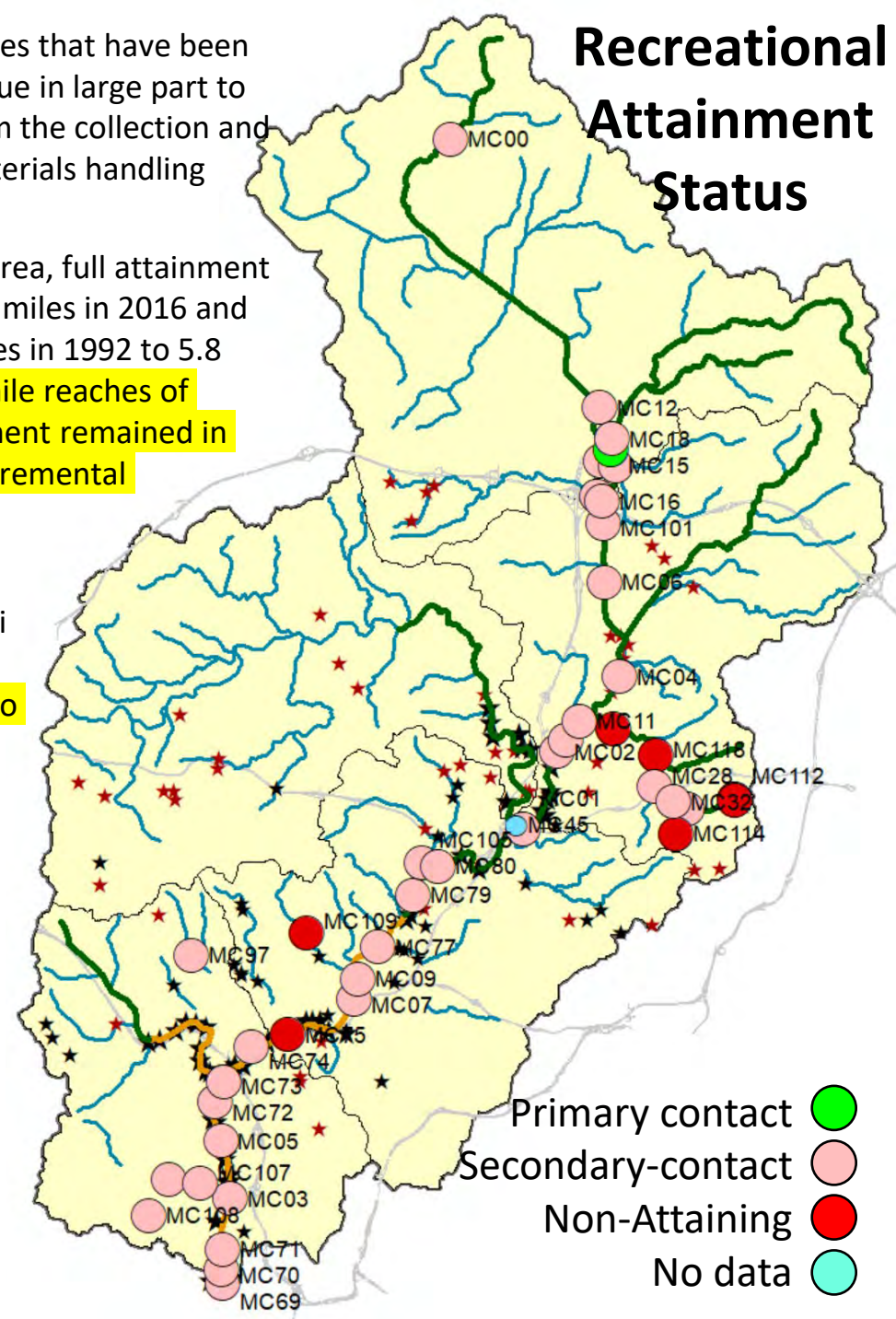
Of the 41 sites that were evaluated under the Warmwater Habitat (WWH) suite of uses and biocriteria, 12 were in full attainment of the applicable use tier (WWH-4; MWH-8), 18 in partial attainment (WWH-17; MWH-1), with the remaining 11 in non-attainment (WWH-7; MWH-4); Of the partially attaining sites, the fish assemblage was the limiting determinant as the macroinvertebrate assemblage met the ICI biocriterion at all these sites;

Aquatic Life Use Attainment Status



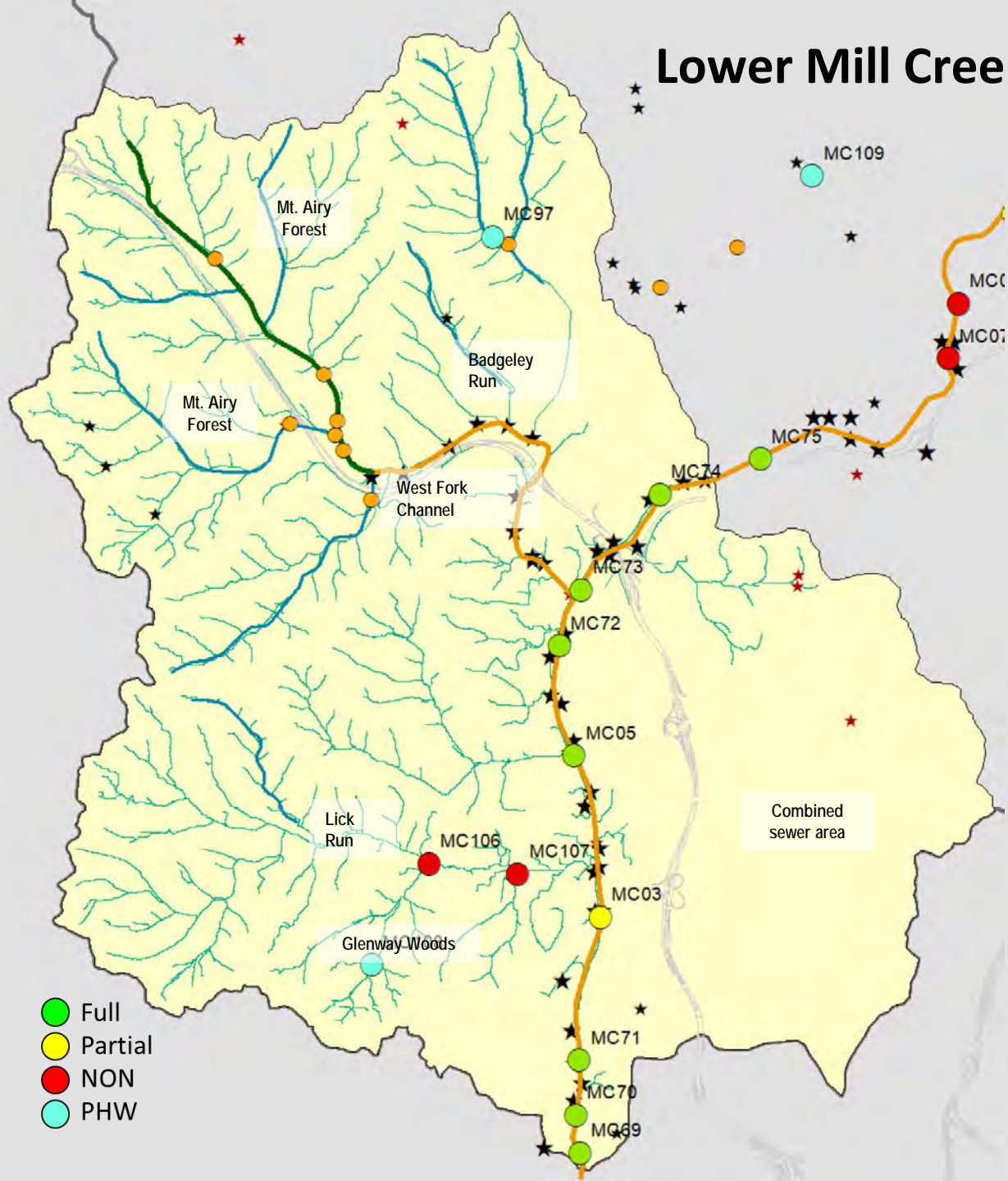
- Full
- Partial
- NON
- PHW

Recreational Attainment Status



- Primary contact
- Secondary-contact
- Non-Attaining
- No data

Lower Mill Creek



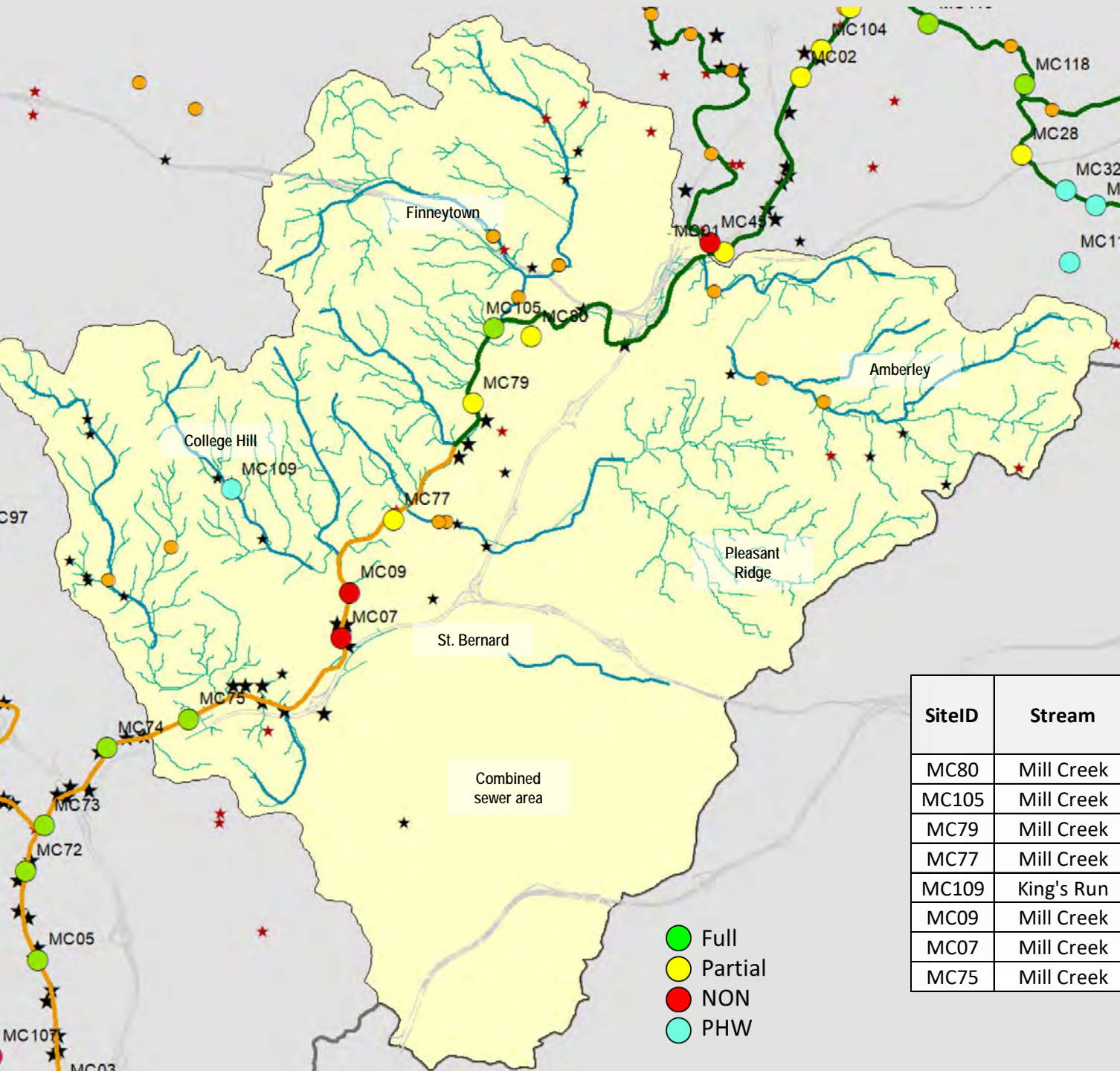
Page 3 Two (2) of the non-attaining sites were in Lick Run which failed to meet the WWH biocriteria being a **newly daylighted channel** that is not directly connected to Mill Creek and with a substrate covered in dense mats of filamentous algae. Lick Run is currently undesignated and no recommendation for an aquatic life or recreational use will be made at this time.

SiteID	Stream	River mile	Aquatic life Use	Attainment status	IBI	MIwb	ICI	QHEI
MC74	Mill Creek	4.21/4.30	MWH	FULL	38	6.98	28	62
MC73	Mill Creek	3.45/3.50	MWH	FULL	34	6.34	44	58.5
MC97	West Fork	1.49/1.40	PHW3A	-				69.5
MC72	Mill Creek	3.15/3.10	MWH	FULL	36	7.26	36	58.5
MC108	Lick Run	1.70/1.70	PHW2	-				
MC106	Lick Run	0.98/0.98	WWH	NON	16		P	45
MC107	Lick Run	0.45/0.45	WWH	NON	20		P	47.5
MC05	Mill Creek	2.50/2.50	MWH	FULL	34	6.69	36	53
MC03	Mill Creek	1.69/1.70	MWH	Partial	34	9.27	20	57.5
MC71	Mill Creek	0.83/0.65	MWH	FULL	34	8.16		49
MC70	Mill Creek	0.50/0.30	MWH	FULL	30	7.72		50
MC69	Mill Creek	0.21/0.10	MWH	FULL	28	6.47		50.5

Page 2 The 2021 assessment of Mill Creek provided an opportunity to gauge the effectiveness of past and ongoing attempts to improve water quality and overall conditions by comparing the results to prior assessments. The 2011, 2013, and 2016 (fish/habitat only) by MBI and the 1992, 1997, and 2014 surveys by Ohio EPA provide the most consistent basis for comparisons in terms of spatial coverage and between indicators and parameters for the Mill Creek mainstem.

Middle (South Branch) Mill Creek

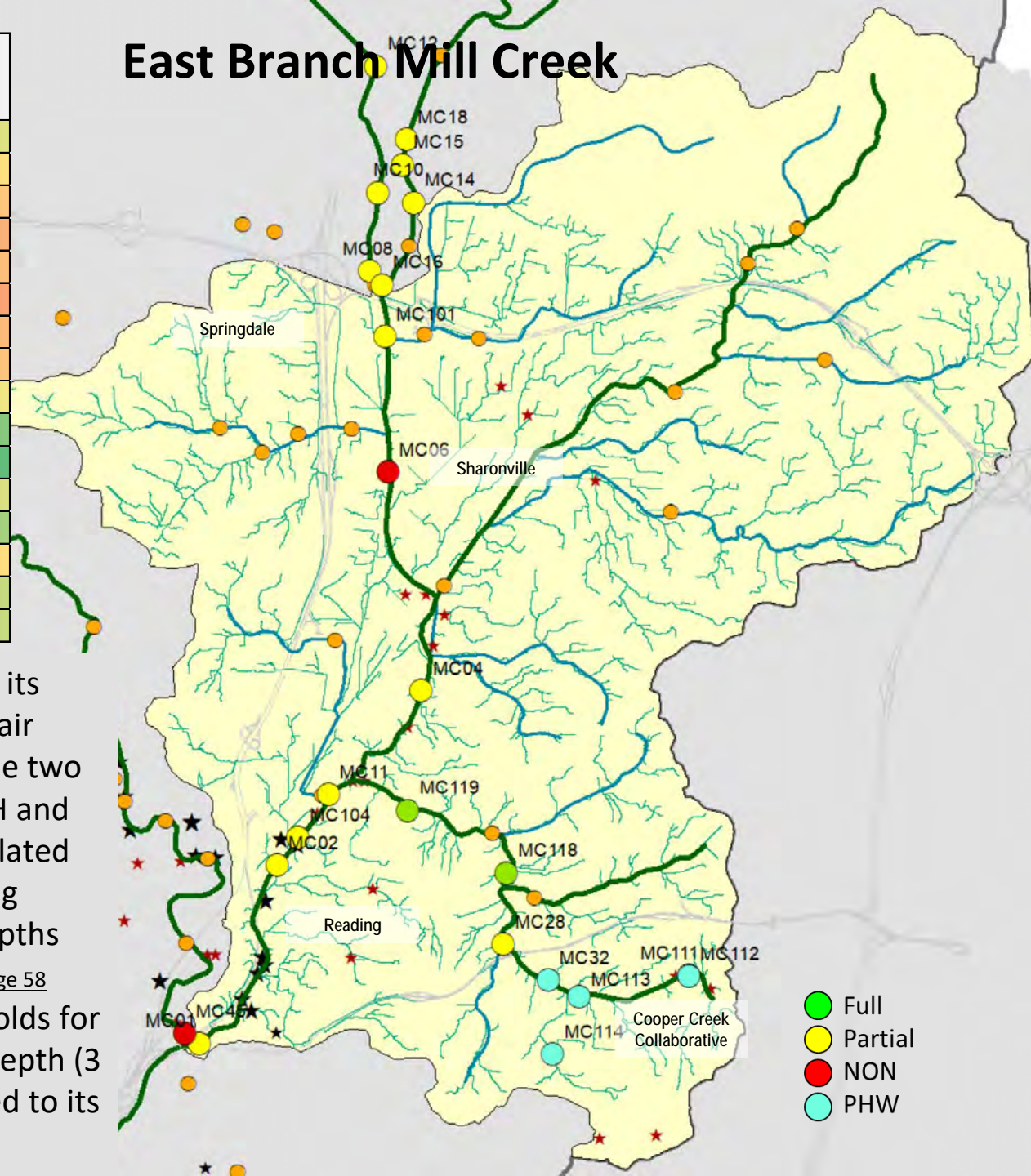
Page 3 Based on the results of the continuous monitoring of D.O. and temperature, the over-riding influence of the concrete channel beginning at RM 6.9 and the downstream channelized reach of Mill Creek was evident. From this point downstream, **diel D.O. swings** were extremely wide, and temperatures were elevated above the average and maximum Ohio water quality criteria. The feasibility of restoration aside, the controlling factor is the highly modified habitat that exacerbates water quality effects.



SiteID	Stream	River mile	Aquatic life Use	Attainment status	IBI	MIwb	ICI	QHEI
MC80	Mill Creek	10.48/10.45	WWH	Partial	37	7.09	36	78.3
MC105	Mill Creek	9.24/9.24	WWH	FULL	38	7.84	38	71.8
MC79	Mill Creek	8.63/8.65	WWH	Partial	35	8.09	40	75.5
MC77	Mill Creek	7.47/7.45	WWH	Partial	40	6.88	38	55
MC109	King's Run	1.11/1.00	PHW3A	-				52
MC09	Mill Creek	6.80/6.80	MWH	NON	30	3.84	24	28.5
MC07	Mill Creek	6.45/6.35	MWH	NON	28	3.69	16	38.5
MC75	Mill Creek	4.84/5.10	MWH	FULL	31	6.53	28	49

SiteID	Stream	River mile	Aquatic life Use	Attainment status	IBI	MIwb	ICI	QHEI
MC101	Mill Creek	17.96/1.30	WWH	Partial	31	6.41	40	65
MC06	Mill Creek	16.73/16.60	WWH	NON	22	5.09	40	56
MC04	Mill Creek	15.41/14.80	WWH	Partial	24	3.74	40	50.5
MC114	Cooper Creek	0.55/0.55	WWH	NON				45.5
MC111	Cooper Creek	3.57/3.57	WWH	NON	28	NA		48.5
MC112	Cooper Creek	3.42/3.42	WWH	NON	28	NA		42.5
MC113	Cooper Creek	2.84/2.84	WWH	NON	30	NA		47.5
MC32	Cooper Creek	2.59/2.55	PHW3B	-	30	NA		49.5
MC28	Cooper Creek	2.13/2.20	WWH	Partial	32	NA	MG	61.3
MC118	Cooper Creek	1.58/1.58	WWH	FULL	46	NA	G	81.5
MC119	Cooper Creek	0.44/0.46	WWH	FULL	46	NA	G	88.5
MC11	Mill Creek	13.96/13.90	WWH	Partial	35	7.06	40	65.5
MC104	Mill Creek	13.76/13.70	WWH	Partial	36	6.57	46	75.8
MC02	Mill Creek	13.27/13.10	WWH	Partial	31	5.92	46	55.5
MC01	Mill Creek	11.70/11.30	WWH	Partial	39	7.19	42	69.5
MC45	West Branch	0.20/0.20	WWH	NON	26	7.06	30	69.3

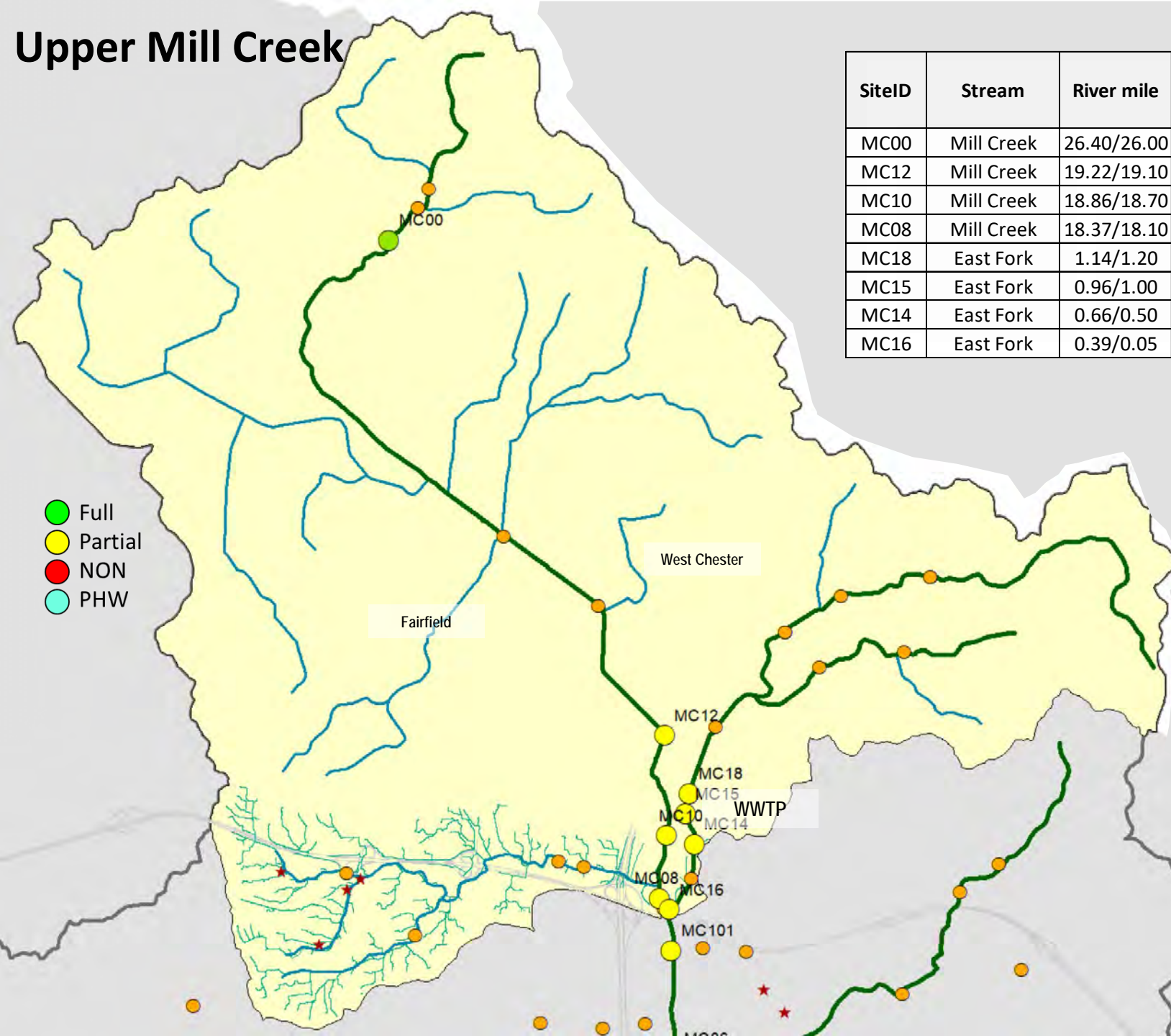
East Branch Mill Creek



Stream Habitat [Page 54](#) The habitat assessment is based on the **QHEI** and its metrics, submetrics, and individual attributes. [Page 55](#) Cooper Creek had fair QHEI scores at the upstream most sites, but **excellent QHEI** scores at the two downstream sites. The upper sites were classified by this study as WWH and had both high and moderate influence modified QHEI attributes that related to shallow depths and flow intermittency. **Rehabilitation steps** are being taken by the Hamilton County Conservation District to increase pool depths and riffle development using natural materials such as woody debris. [Page 58](#) Cooper Creek showed multiple deficiencies below the WWH IPS thresholds for the Hydro QHEI at 4 sites, along with deficiencies for current (4 sites), depth (3 sites), channel (3 sites), cover (4 sites), and riffle (4 sites) which is related to its highly urbanized watershed.

Upper Mill Creek

SiteID	Stream	River mile	Aquatic life Use	Attainment status	IBI	MIwb	ICI	QHEI
MC00	Mill Creek	26.40/26.00	WWH	FULL	43	NA	44	69
MC12	Mill Creek	19.22/19.10	WWH	Partial	30	6.2	42	69.3
MC10	Mill Creek	18.86/18.70	WWH	Partial	28	6.22	44	70.5
MC08	Mill Creek	18.37/18.10	WWH	Partial	34	6.57	44	83.5
MC18	East Fork	1.14/1.20	WWH	Partial	33	NA	42	71.5
MC15	East Fork	0.96/1.00	WWH	Partial	34	NA	30	78
MC14	East Fork	0.66/0.50	WWH	Partial	28	NA	38	71
MC16	East Fork	0.39/0.05	WWH	Partial	28	NA	36	60.5



Page 3 Of the partially attaining sites the **fish assemblage was the limiting** determinant as the macroinvertebrate assemblage met the ICI biocriterion at all of these sites;

Page 3 The longitudinal patterns in **conductivity, total dissolved solids (TDS), chlorides,** nitrate, and total phosphorus continue to clearly point to the Butler Co. Upper Mill Creek WRF as the principal source of elevated levels of these parameters in the East Fork and well downstream into Mill Creek extending to the MWH reach at RM 6.9.