

City of Flint Urban Watershed Assessment

September 2015

The City of Flint covers 31 square miles in the lower Flint River Watershed. And it is surrounded by the densely developed greater Flint Urbanized Area.

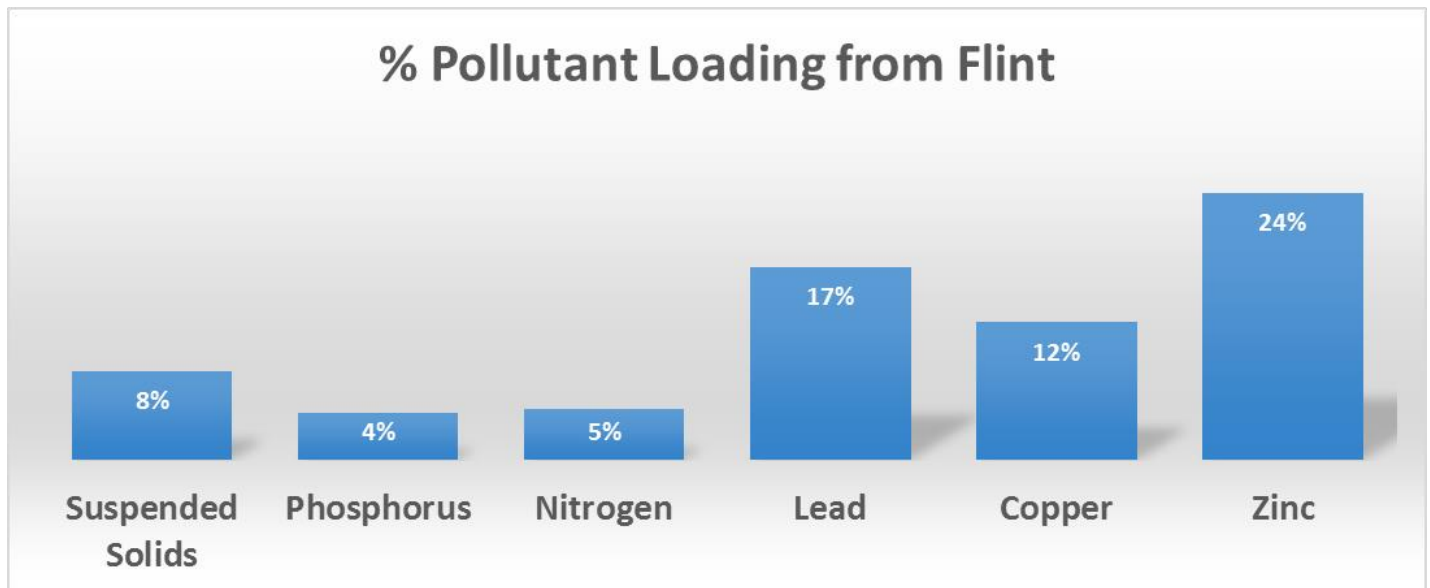
The following streams flow through Flint: the Brent Run, Carman Creek, Flint River, Gilkey Creek, Kearsley Creek, Robinson Drain, Swartz Creek, and Thread Creek.

The Flint River Watershed covers over 1,359 square miles in parts of Genesee, Lapeer, Oakland, Saginaw, Shiawasee and Tuscola Counties in Michigan. The proportion of land uses in the watershed are 67% human (20% urban and 47% agricultural) and 33% natural. And the watershed is 6.8% impervious to precipitation. Watershed maps are presented in Appendix A.

The land cover in the City of Flint is 34% impervious. And there are nearly 300 storm sewer outfalls draining the City. Therefore, pollutants in storm water runoff flows into receiving waters throughout Flint.

However, because the City is in the lower watershed, the amount of storm water runoff pollution in streams in Flint coming from inside it, especially suspended solids and plant nutrients, is only a small proportion of the total amount coming from both inside and outside of it (< 25%), as shown below:

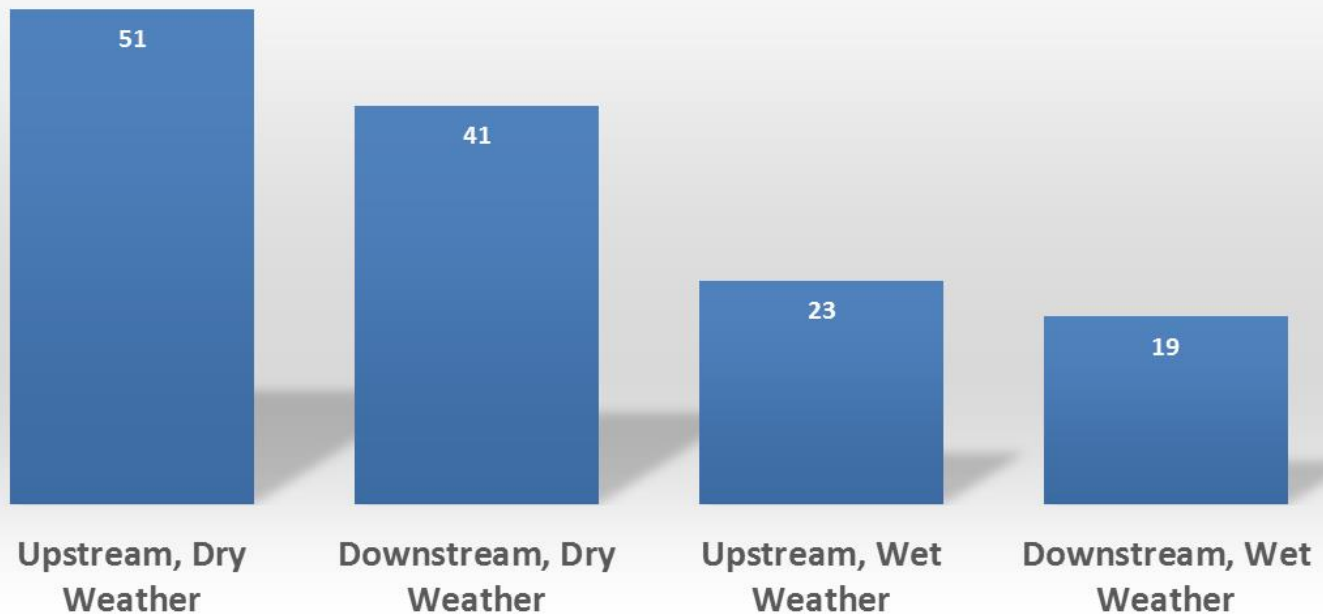
Estimated Runoff Pollutant Loadings (lb/yr) in Flint Streams						
Origin	Suspended Solids	Phosphorus	Nitrogen	Lead	Copper	Zinc
Outside	7,669,521	129,182	431,831	721	1,321	5,324
Inside	663,178	5,729	20,651	150	185	1,663
Total	8,332,699	134,911	452,482	871	1,506	6,987



A pollutant loading mass balance analysis, based on computer modeling (L-THIA), is presented in Appendix B.

The larger suspended solids loadings from runoff cause diminished water clarity in streams during wet weather, but it does not vary much between upstream locations at the Flint City limits and downstream locations within the City (based on 130 measurements made in 2013 and 2014), except during dry weather, as shown below:

Median Water Clarity in Flint Streams (cm)



Detailed water clarity data is presented in Appendix C.

Impairments to stream uses caused by pollutants in streams in Flint are as follows:

Receiving Stream	Pollutant
Flint River	PCB
Gilkey Creek	PCB
Kearsley Creek	PCB and Mercury
Swartz Creek	PCB
Thread Creek	PCB

As shown in Section 4.2 below, despite these problems caused by toxic pollutants, the water quality in streams in Flint for supporting ecological and human health ranges from “medium” to “good” and ecological health in certain receiving streams, where assessed, ranges from “fair” to “good”.

City of Flint Water Pollution Control periodically monitors stream water quality for supporting ecological and human health, using a water quality index (WQI) developed by the National Sanitation Foundation for the EPA. A numerical water quality score is calculated with the monitoring data and a water quality rating is determined by the score, using the following scale:

Score	Rating
91 - 100	Excellent water quality
71 - 90	Good water quality
51 - 70	Medium water quality
26 - 50	Fair water quality
0 - 25	Poor water quality

The median upstream and downstream WQI scores, calculated with data from 230 total monitoring events conducted from 2009 through 2015, are compared below:

Stream	Location	WQI	Location	WQI
Brent Run	source	64 (medium)	downstream	75 (good)
Flint River	upstream	81 (good)	downstream	76 (good)
Gilkey Creek	upstream	71 (good)	mouth	74 (good)
Robinson Drain	upstream	73 (good)	mouth	74 (good)
Kearsley Creek	upstream	77 (good)	mouth	78 (good)
Carman Creek	upstream	73 (good)	mouth	71 (good)
Swartz Creek	upstream	73 (good)	mouth	71 (good)
Thread Creek	upstream	74 (good)	mouth	76 (good)

And monitoring done from April through September 2015 by Saginaw Bay Resources Conservation and Development for evaluating water quality for supporting stream ecological health indicated that the median WQI scores and ratings for the Flint River at Carpenter Road (upstream of Flint) and University Avenue (downstream of Flint) were 79 (good) and 80 (good), respectively, based on 11 monitoring events at each location.

Monitoring data is summarized in Appendix C.

In addition, stream quality scores and ratings, for indicating ecological health, from semi-annual macro-invertebrate (biodiversity) studies done by the Flint River Watershed Coalition in streams at locations within the City are also considered. A numerical score is calculated with the sampling data and a stream quality rating is determined by the score, using the following scale:

Score	Rating
> 48	Excellent
34 - 48	Good
19 - 33	Fair
< 19	Poor

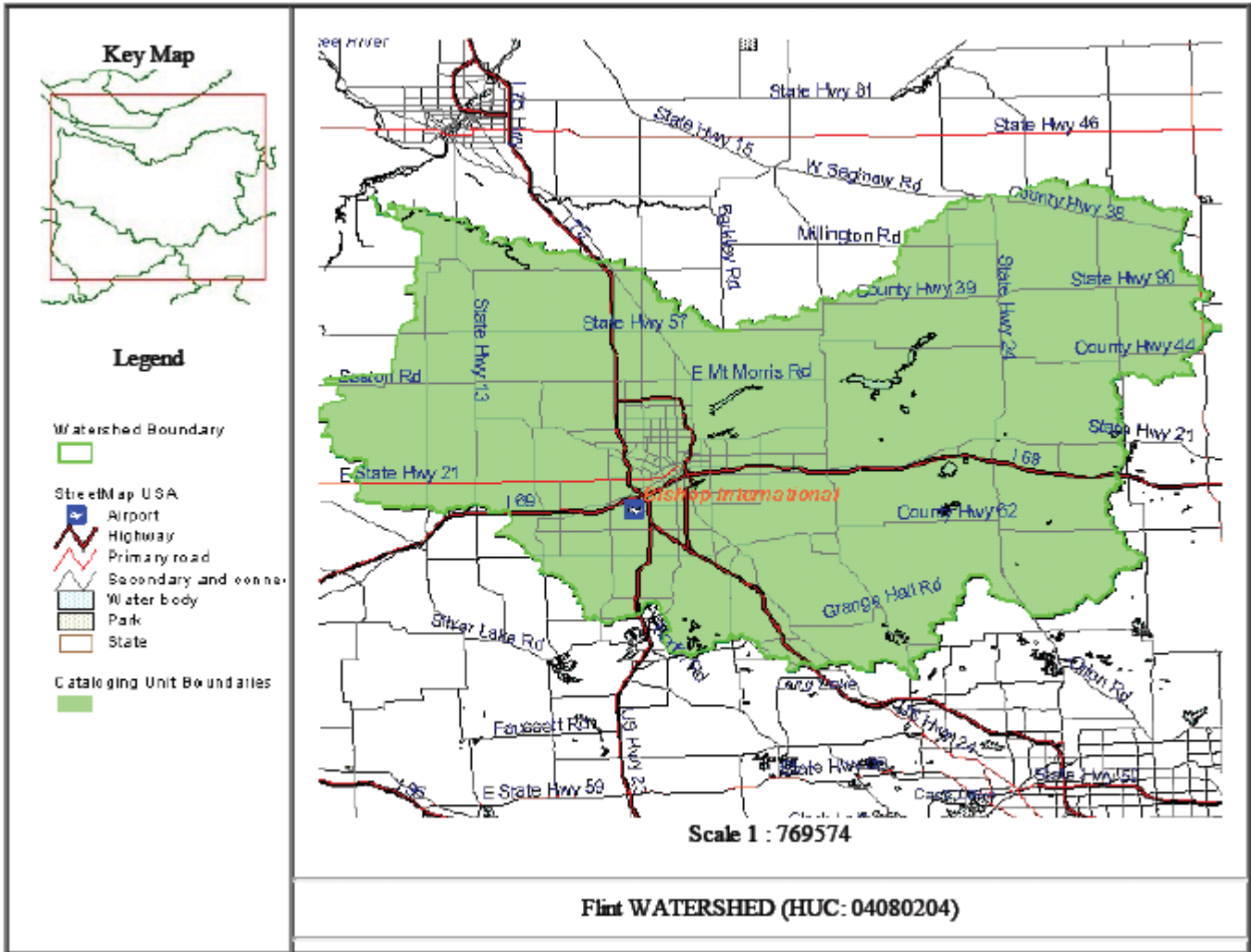
The average scores for 32 total monitoring events conducted in FY11 through FY14, are presented below:

Stream	Location	Score
Gilkey Creek	Court Street	21.9 (fair)
	Longway Boulevard	32.2 (fair)
	Kearsley Park Boulevard	37.8 (good)
Swartz Creek	Hammerberg Road	36.4 (good)
Thread Creek	Dort Highway	22.9 (fair)

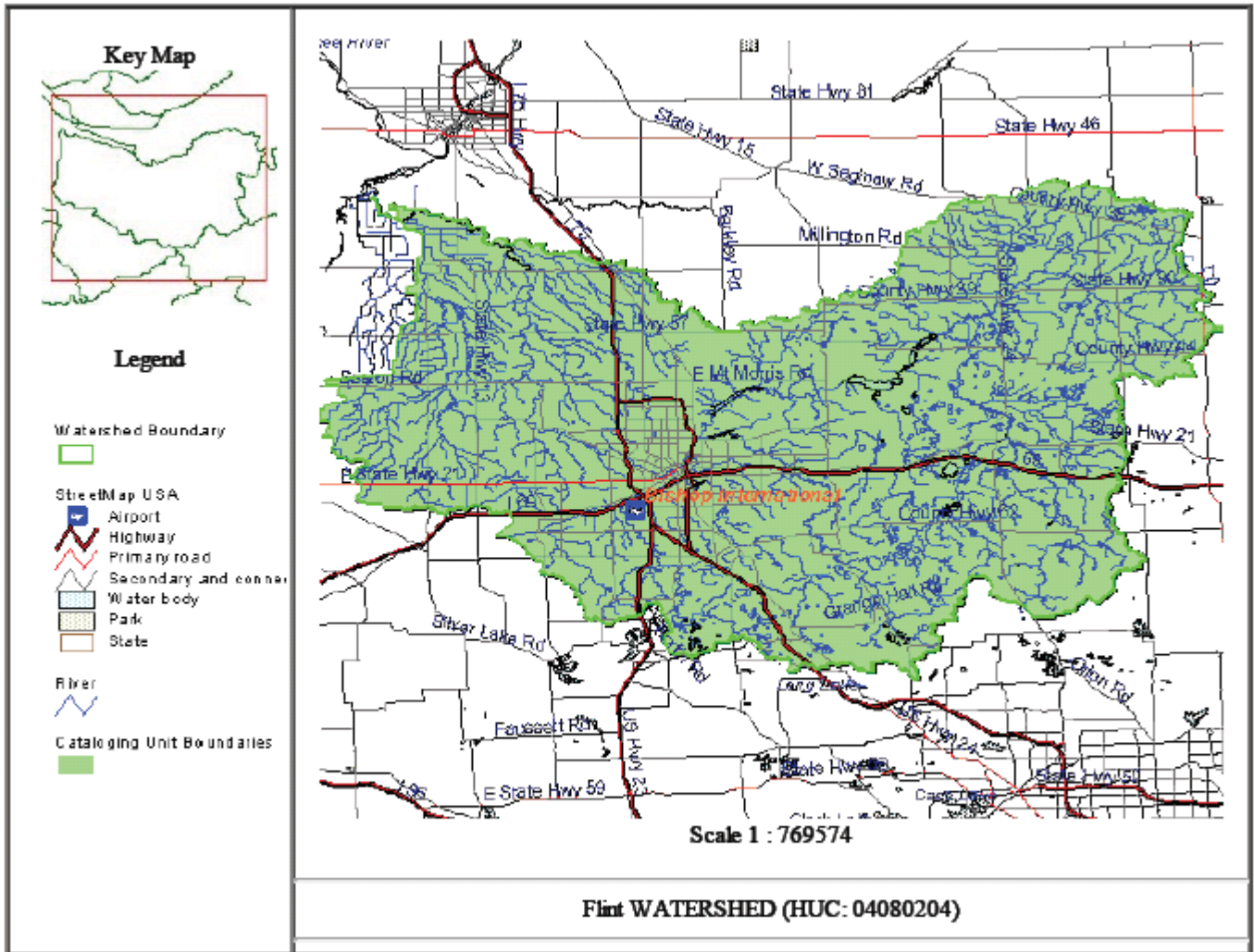
In addition, the average stream score for this same period (7 monitoring events) for the Flint River a few miles downstream of Flint near Mt. Morris Road in Flushing Township is 39.4 (good).

Appendix A
Maps

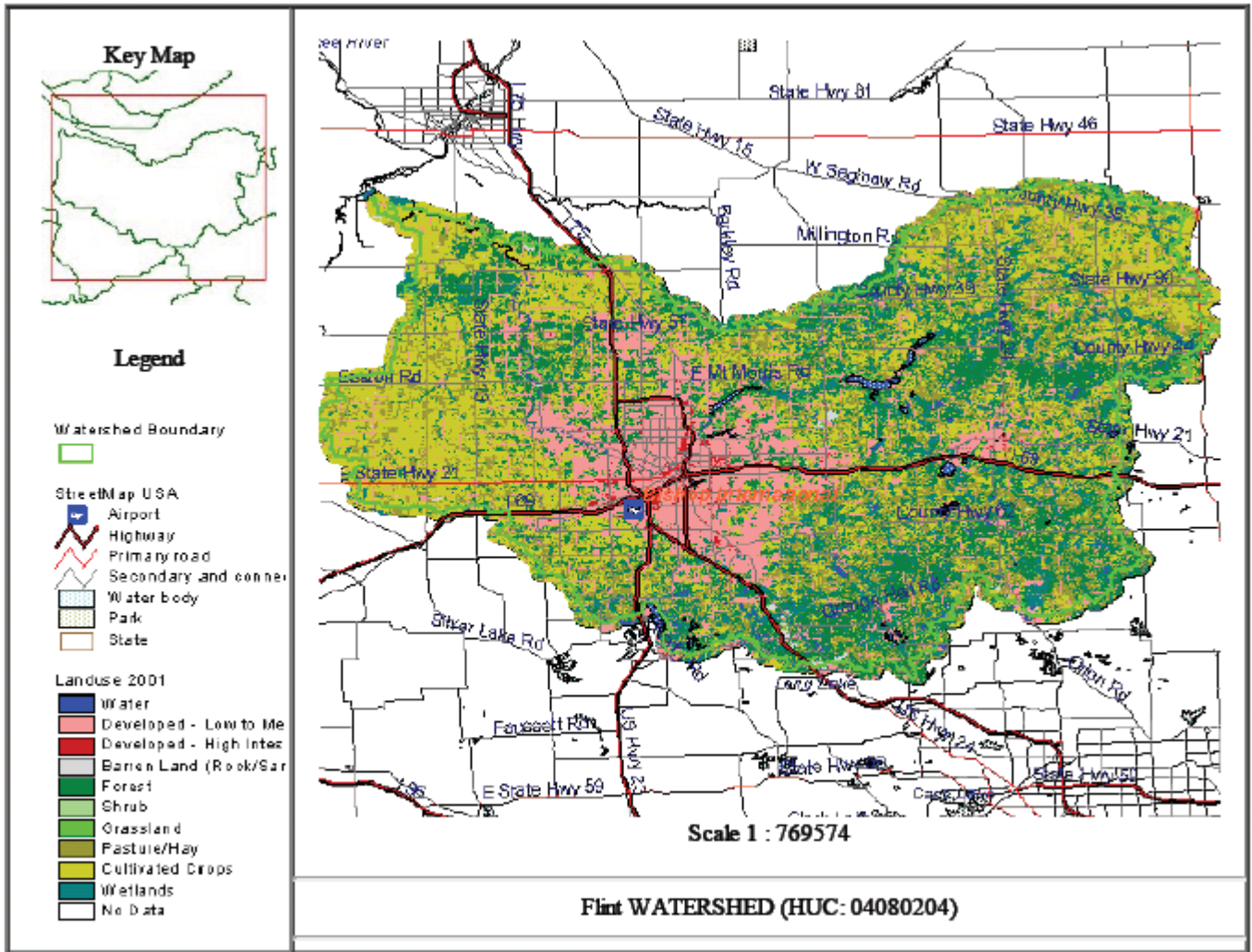
Flint River Watershed Map



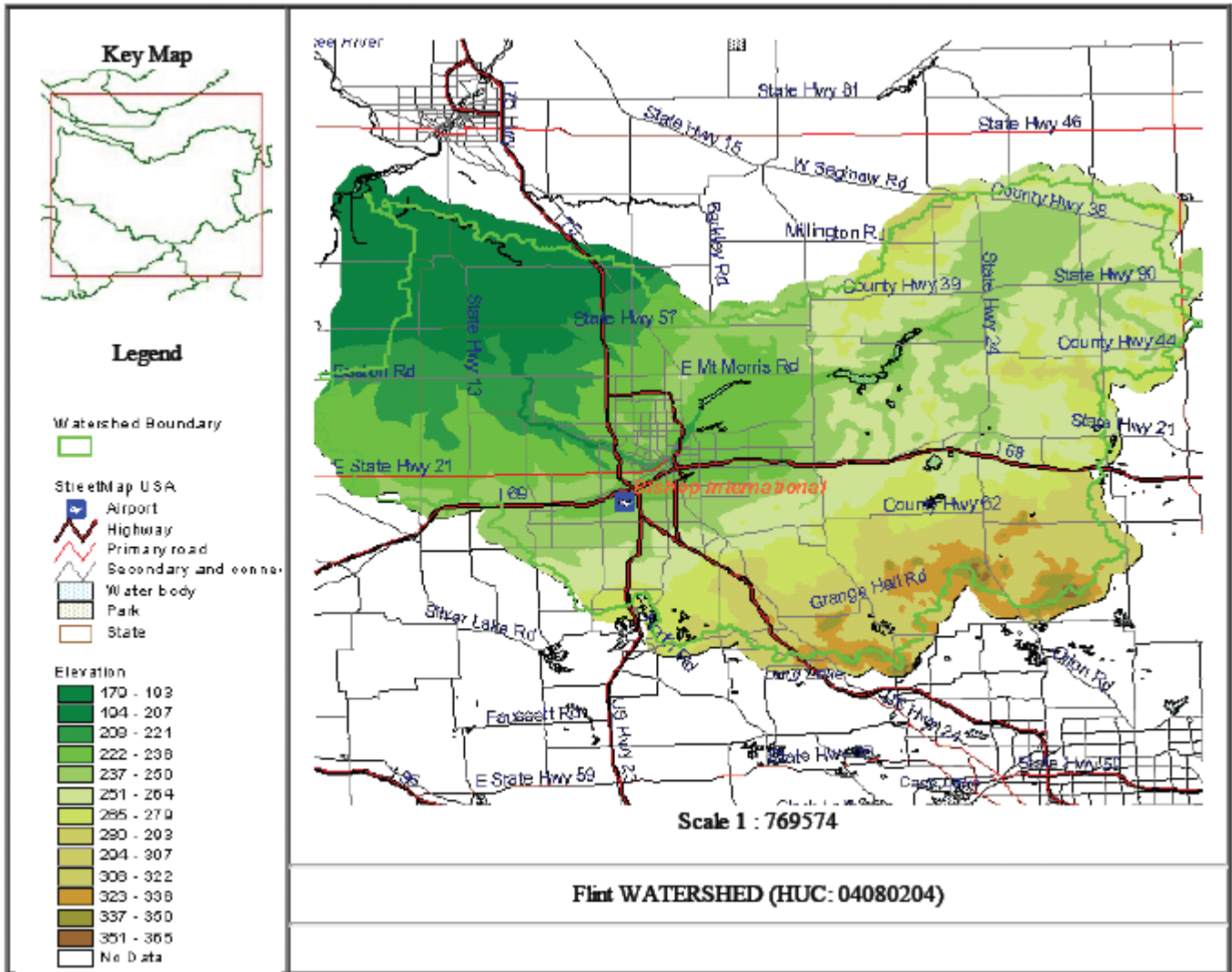
Flint River Watershed Map – Streams



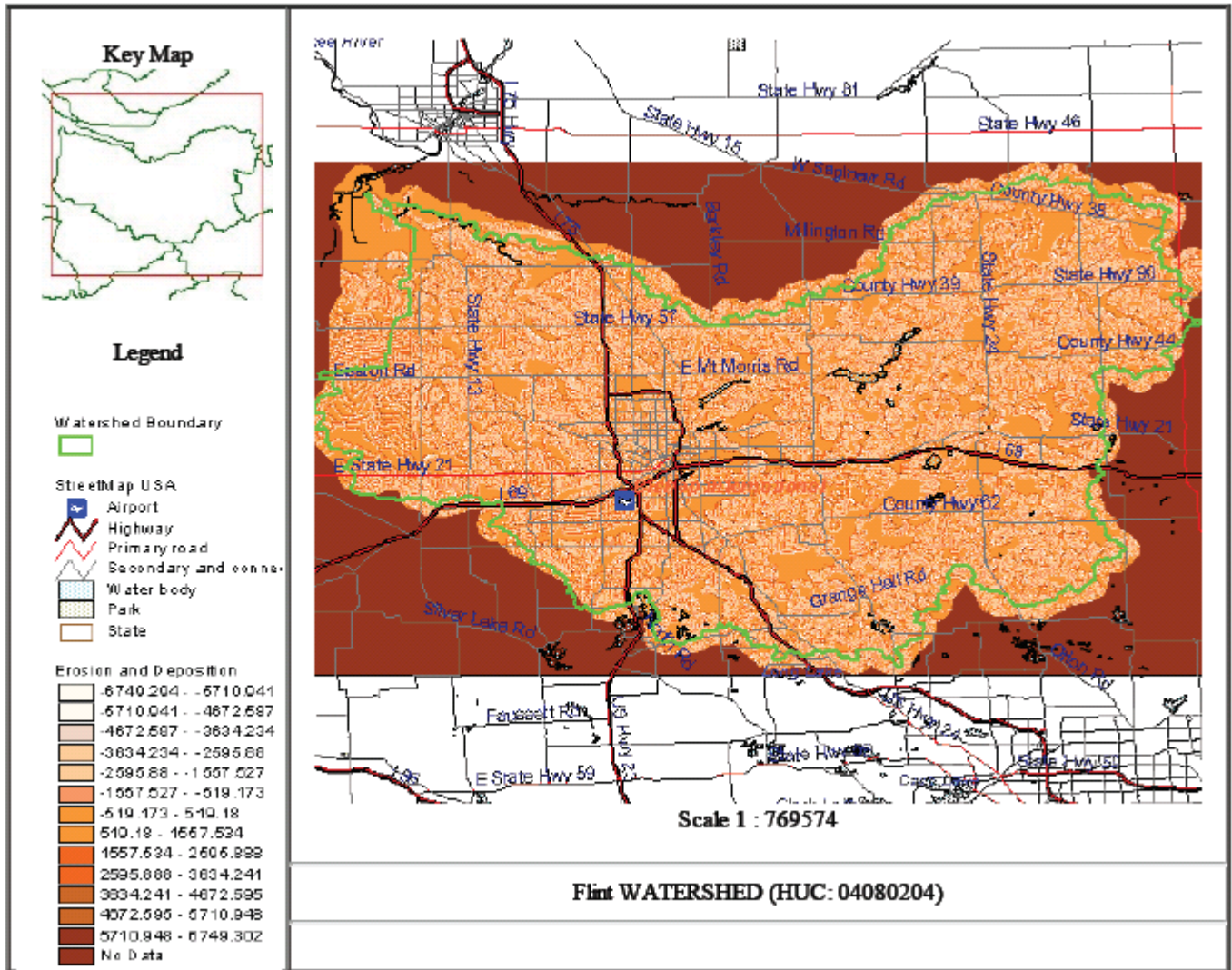
Flint River Watershed Map – Land Uses



Flint River Watershed Map – Elevation



Flint River Watershed Map – Erosion and Deposition



Appendix B
Estimated Storm Water Runoff Pollutant Loadings
Based on Computer (L-THIA) Model Output

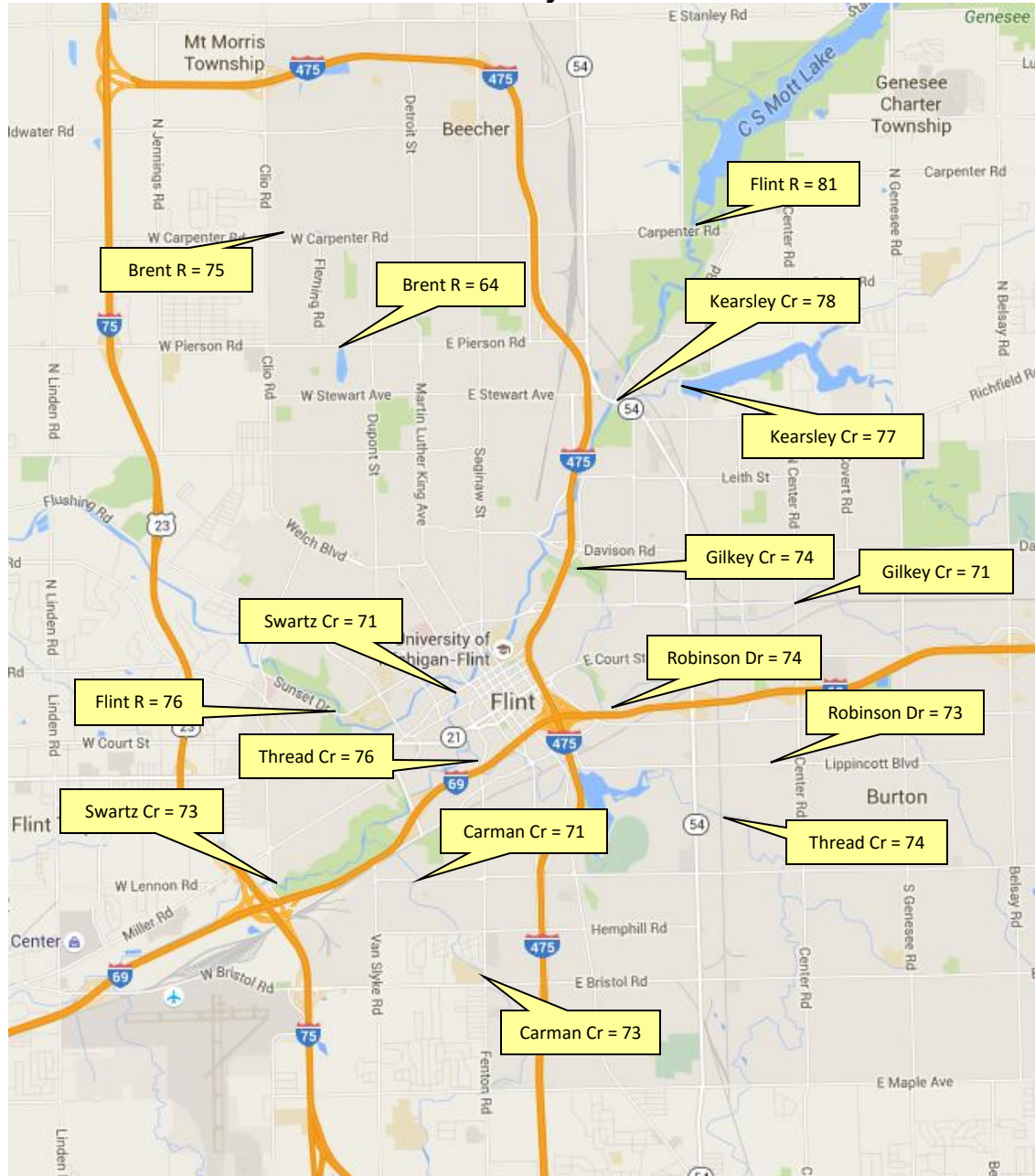
Estimated Pollutant Loadings in Flint Streams								
	Place		Suspended Solids	Phosphorus	Nitrogen	Lead	Copper	Zinc
	Stream	Location	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr
From Outside Flint	Flint River	Carpenter Road	4,866,319	84,888	287,793	320	643	2,116
	Kearsley Creek	Western Road	736,703	12,220	40,550	104	190	740
	Gilkey Creek	Center Road	107,268	1,478	4,721	25	39	209
	Robinson Drain	Lippincott Boulevard	34,104	508	1,573	6	10	53
	Swartz Creek	Ballenger Highway	1,380,151	21,778	70,832	162	267	1,387
	Carman Creek	Hemphill Road	154,551	2,169	6,367	33	51	289
	Thread Creek	Term Street	390,424	6,141	19,995	70	119	529
	Overall			7,669,521	129,182	431,831	721	1,321
From Inside Flint	Brent Run	Carpenter Road	47,354	3	1,639	10	14	96
	Flint River	Ballenger Highway	615,824	5,726	19,012	141	172	1,567
	Overall			663,178	5,729	20,651	150	185
From Outside and Inside Flint			8,332,699	134,911	452,482	871	1,506	6,987

**Appendix C
Stream Survey Data**

Median Water Quality in Flint Streams - 2009 through 2015

Stream	Crossing	Relative Location	BOD	DO	Fecal Coliform Bacteria	Nitrates	Oil & Grease	pH	Total Phosphates	Solids			Toxicity	Turbidity	Water Quality			
			mg/L	mg/L	#/100 ml	mg/L	mg/L	SU	mg/L	Suspended	Dissolved	Total			TU	NTU	Score	Rating
										mg/L	mg/L	mg/L						
Brent Run	Carpenter Rd.	downstream	2.8	7.5	600	4.0	0.0	7.8	0.88	5	334	339	0.0	6.0	75	Good		
Brent Run	Pierson Rd	source	3.8	4.0	285	2.2	0.0	7.3	0.83	12	385	400	0.0	7.5	64	Medium		
Flint River	Ballenger Hwy.	downstream	2.5	8.0	380	4.0	0.0	7.9	0.64	13	420	435	0.0	8.8	76	Good		
Flint River	Carpenter Rd.	upstream	2.8	7.8	80	4.0	0.0	8.2	0.43	9	393	400	0.0	10.8	81	Good		
Gilkey Creek	Chavez Blvd.	mouth	2.4	7.1	480	3.3	0.0	7.9	0.41	9	641	650	0.0	10.1	74	Good		
Gilkey Creek	Center Rd.	upstream	2.1	6.3	495	2.6	0.0	7.7	0.44	6	987	998	0.0	9.5	71	Good		
Robinson Drain	Brookside Dr.	mouth	1.9	7.6	600	3.5	0.0	7.7	1.07	4	873	874	0.0	5.4	74	Good		
Robinson Drain	Lippincott Blvd.	upstream	1.9	7.2	600	3.5	0.0	7.6	0.75	14	997	1083	0.0	10.4	73	Good		
Kearsley Creek	E. Boulevard Dr.	mouth	2.4	7.8	68	2.2	0.0	7.9	0.64	10	432	442	0.0	11.0	78	Good		
Kearsley Creek	Western Rd.	upstream	2.3	7.3	76	3.5	0.0	8.0	0.72	10	438	449	0.0	12.1	77	Good		
Carman Creek	Twelfth St	mouth	3.0	6.3	600	4.2	0.0	7.7	0.87	11	798	851	0.0	11.2	71	Good		
Carmen Creek	Hemphill Rd.	upstream	2.1	6.7	600	4.6	0.0	7.9	0.46	6	929	934	0.0	6.8	73	Good		
Swartz Creek	Kearsley St.	mouth	2.4	7.5	600	4.2	0.0	8.0	0.76	15	568	583	0.0	15.3	71	Good		
Swartz Creek	Ballenger Hwy.	upstream	1.9	7.4	555	2.6	0.0	8.0	0.67	10	531	550	0.0	11.5	73	Good		
Thread Creek	Fenton Rd.	mouth	2.1	8.3	375	2.0	0.0	8.0	0.69	16	535	555	0.0	17.3	76	Good		
Thread Creek	Term St.	upstream	1.5	7.6	360	3.7	0.0	8.0	0.74	11	514	529	0.0	11.5	74	Good		

Median Water Quality in Flint Streams



Median Water Clarity in Flint Streams – 2013 and 2014					
Dry-weather					
Upstream			Downstream		
Stream	Crossing	Clarity (cm)	Stream	Crossing	Clarity (cm)
Carman Creek	Blackberry Lane	>60	Carman Creek	Atherton Road	>60
Flint River	Carpenter Road	34	Flint River	University Avenue	38
Gilkey Creek	Kelso Street	>60	Gilkey Creek	Chavez Boulevard	>60
Swartz Creek	Swartz Creek Golf Course	51	Swartz Creek	Kearsley Street	40
Thread Creek	Term Street	44	Thread Creek	Fenton Road	31
Overall		51	Overall		41
Wet-weather					
Upstream			Downstream		
Stream	Crossing	Clarity (cm)	Stream	Crossing	Clarity (cm)
Carman Creek	Blackberry Lane	23	Carman Creek	Atherton Road	20
Flint River	Carpenter Road	28	Flint River	University Avenue	19
Gilkey Creek	Kelso Street	22	Gilkey Creek	Chavez Boulevard	20
Swartz Creek	Swartz Creek Golf Course	6	Swartz Creek	Kearsley Street	7
Thread Creek	Term Street	28	Thread Creek	Fenton Road	14
Overall		23	Overall		19

Median Water Quality in Lower Flint River - April through September 2015											
Crossing	Clarity	DO	Nitrate	pH	Total Phosphate	Solids			Turbidity	Water Quality	
						Suspended	Dissolved	Total		Score	Rating
	cm	mg/L	mg/L	SU	mg/L	mg/L	mg/L	mg/L	NTU		
Carpenter Rd.	42.9	8	<6.6	8.7	0.4	44	391	433	14	79	Good
University Ave.	>60.0	9	<6.6	8.4	0.5	30	449	507	8	80	Good
Main St. (Flushing)	57.0	9	<6.6	8.5	1.0	33	474	518	9	72	Good
Mt. Morris Rd.	>60.0	9	<6.6	8.7	0.6	30	445	523	8	69	Medium
Curtice Rd.	34.3	9	<6.6	8.2	0.6	56	529	598	19	69	Medium