

Appendix K

Biological and Ecological Features, and
Ecological Impairments

Biological and Ecological Features, and Ecological Impairments

Main 1-2 Subwatershed

Introduction

This document summarizes the information available on the status of the aquatic biology and ecological impairments in the Rouge River Main 1-2 subwatershed. It emphasizes data gathered since the Rouge River National Wet Weather Demonstration Project began, and is mostly drawn from reports issued by the Rouge Program Office (RPO), the Michigan Department of Environmental Quality (MDEQ) and the Department of Natural Resources (MDNR) during the 1990s.

This document summarizes information for the following topics for the Main 1-2 subwatershed:

- Aquatic habitat quality
- Fish community
- Other aquatic life
- Chemical contamination
- Rouge River Report Card

Aquatic Habitat Quality – Main 1-2 Subwatershed

- In 1996, RPO staff evaluated aquatic habitat quality at 17 locations in the Main 1-2, using the MDEQ's GLEAS 51 protocol (see attached figure). Two of the locations were determined to have "Good" aquatic habitat; four had "Fair" habitat; and the remaining 11 locations had "Poor" habitat. Identified habitat problems included excessive flow variation, lack of riffles and pools, and bank erosion.
- In general, habitat quality was slightly better along the main stem of the Main 1-2 than in the tributaries.
- Reducing post-storm peak flows is the most important factor in improving aquatic habitat quality. Restoring a more natural flow regime would reduce bank erosion, and reduce burial or scouring of riffles, pools, and other instream habitat features.

Fish Community – Main 1-2 Subwatershed

Summary of the 1995 MDNR Fish Monitoring Survey; Main 1-2

Location	# Species	GLEAS Score*	IBI Score*	Sensitive Species Found?	Comment
Beach Rd., N of Wattles Rd.	15	G	F	X	
Lahser Rd., S of 13 Mile Rd.	14	G	P	X	
Beech Rd., S of 10 Mile Rd.	11	G	P		Good instream habitat
Evans Ditch, at Lahser Rd.	5	F	P-VP		
Cranbrook Cr., at Lahser Rd.	5	G	F-P		Good instream habitat
Franklin Drain, N of 14 Mile Rd.	8	G	F-P	X	
Pebble Cr., at 13 Mile Rd.	7	G	P		Severe bank erosion

*E = excellent; G = good; F = fair; P = poor; VP = very poor

- The 1995 MDNR fish monitoring survey sampled fish populations at 7 locations in the Main 1-2 (see attached figure, and table above). Two “scoring” systems were used to evaluate the fish population data; the MDEQ’s GLEAS 51 scoring procedure, and the Index of Biotic Integrity scoring procedure (IBI; developed for the state of Ohio). The MDEQ GLEAS 51 procedure scored the fish communities as “Good” at 6 of the 7 locations and “Fair” at Evans Ditch. The IBI scores were consistently lower, and were felt to better reflect the status of the fish communities.
- The healthiest fish communities were found in Franklin Branch, Cranbrook Creek, and on the main stem at Beech Road in Troy.
- Franklin Drain may be capable of supporting brown trout, if water flow variations are controlled.
- Excessive flow variation and lack of instream habitat were the factors most often cited as limiting the fish community in the Main 1-2.
- Future fish monitoring: Increasing populations of almost any fish (except exotic rough fish like carp or goldfish) would be an indication of improving environmental conditions in the river. Certain species, however, are especially useful for demonstrating improving conditions. These species tend to be sensitive to turbidity, prefer cleaner, cooler water, and their distribution in the Rouge Watershed is currently quite limited. The table below lists these species for the entire watershed, and those in **bold** have been found in the Main 1-2 subwatershed. Note that rock bass was the only sensitive fish species observed in the Main 1-2 main stem in 1995; the other indicated species were found only in the tributaries.

Sensitive Fish Species of the Rouge River Watershed

Common Name	Scientific Name
American brook lamprey	<i>Lampetra appendix</i>
Redside dace*	<i>Clinostomus elongatus</i>
Spotfin shiner	<i>Cyprinella spiloptera</i>
Hornyhead chub	<i>Nocomis biguttatus</i>
Northern hog sucker	<i>Hypentelium nigricans</i>
Stonecat	<i>Noturus flavus</i>
Mottled sculpin	<i>Cottus bairdi</i>
Starhead topminnow	<i>Fundulus dispar</i>
Rock bass	<i>Ambloplites rupestris</i>

* Listed as “Threatened” on the MDNR’s list of endangered, rare, and threatened species

Chemical Contaminants – Main 1-2 Subwatershed

Fish consumption advisories: The Michigan Department of Natural Resources and the Department of Community Health (MDCH) have established fish consumption advisories for the fish listed in the table below. MDCH defines “general population” as men, boys older than 15, and women beyond childbearing years, and “women and children” as women who are pregnant or breastfeeding, women who intend to have children, girls older than 15, and all children under 15. The source of the PCBs upstream of Ford Road is unknown. Mercury in the lakes is due to atmospheric deposition, which is expected to continue for the foreseeable future.

Fish Consumption Advisories for the Main 1-2 Subwatershed.

Location	Fish Species	Contaminant	Specifics of Advisory
Beverly Impoundment and all other lakes (This is the generic advice for any Michigan lakes and impoundments.)	Rock bass, yellow perch, crappie	Mercury	For fish over 9”: one meal per month for women and children; one meal per week for general population.
	Bass, walleye, northern pike or muskie		For fish of any size: one meal per month for women and children; one meal per week for general population.
Upstream of M-153/Ford Road	White sucker	PCBs	For fish of any size: One meal per week by women and children; unlimited consumption by the general population.

Toxic Chemicals in Water and Sediment: In 1996, RPO measured the concentrations of potentially toxic metals and organic compounds in water and sediment at one location in the Main 1-2, and also performed water and sediment toxicity tests (table, below). The water sample tested was not toxic to fathead minnows or green algae. The sediment tested was toxic to aquatic insect larvae (midges), but not to amphipods. The cause(s) of this toxicity is unknown. The only chemical contaminant that exceeded established criteria in either water or sediment was total PCBs in water (44.1 parts per trillion, vs. the MDEQ wildlife exposure criteria of 12 parts per trillion). The source of the PCBs is unknown, but may be atmospheric deposition.

Results of the 1996 RPO Toxics Survey: Main 1-2

Location	Toxic in Water Bioassay?	Toxic in Sediment Bioassay?	Significant* Toxics in Water	Significant** Toxics in Sediment
Adams Road	No	Yes	PCBs	None

* Exceeded MDEQ criteria for wildlife exposure

** Exceeded NOAA guideline sediment quality values

- In 1993, RPO staff collected and analyzed 26 surficial sediment samples from the Main 1-2. All samples were analyzed for PCBs, PAHs, and 12 metals. None of the measured concentrations exceeded the NOAA ER-M sediment quality guideline value.

Chemical Contaminants – Main 1-2 Subwatershed (continued)

- In 1989, MDNR collected sediment samples from four locations in Evans Ditch and analyzed them for metals and organic contaminants (table, below). The only organic contaminants present above method detection limits in each sample were low concentrations of DDT or its breakdown products. Concentrations of chromium, copper, mercury, and nickel were somewhat elevated over expected “background” concentrations at most stations, and lead concentrations (32 – 76.5 mg/Kg) and zinc concentrations (110 – 360 mg/Kg) were about 10 times higher than background. The most contaminated sediment was found at Rolling Rock Creek Drive, north of 12 Mile Road. These sediments were fine organic silts, from behind a low head dam, and would be expected to contain higher contaminant concentrations. The elevated metal concentrations were attributed to basin-wide urban runoff rather than a particular point source.

Results of 1989 MDNR Sediment Analyses – Evans Ditch

Location	Contaminants Above “Background”
13 Mile Rd.	Chromium, copper, nickel, lead, zinc
Rolling Rock Cr. Dr., N of 12 Mile Rd.	Chromium, copper, nickel, lead, zinc
Lahser Rd.	Chromium, copper, lead, zinc
Berg Rd., S of 8 Mile Rd.	Chromium, copper, nickel, lead, zinc

Other Aquatic Life – Main 1-2 Subwatershed

Macroinvertebrate Community

- The most recent MDNR macroinvertebrate survey with extensive coverage of the watershed was performed in 1986. (Note that the MDEQ has changed its scoring protocol since this report, and that the '86 data have not been re-scored.) Results for the four Main 1-2 subwatershed stations are below.

Results of the 1986 MDNR Macroinvertebrate Survey

Location Sampled	Score	Comments
Near Square Lake Rd.	Fair	Conditions generally better than in 1978.
Lahser Rd.	Fair	
Evans Ditch, at Lahser Rd.	Very Poor	
Upstream of 8 Mile Road	Poor	

- In 1999 RPO staff collected macroinvertebrates (aquatic insects and other organisms) from 6 locations in the vicinity of the Oakland County CSO basins, as part of an assessment of the effects of the basin discharges on the river. Collected data were used to calculate a score for the communities at each location, using the MDEQ GLEAS 51 protocol (table, below). Two conclusions were reached: (1) the macroinvertebrate communities upstream, between, and immediately downstream of the basins are not healthy, with scores ranging from “tending towards poor” to “neutral”; (2) discharge from the basins has no effect on the macroinvertebrate communities immediately downstream.

Results of the 1999 Oakland County CSO Basin Macroinvertebrate Survey.

Location	Macroinvertebrate Community Score	Score Interpretation
Big Beaver Rd. & Adams Rd.	-3	Tending towards poor
Maple Rd. & Southfield Rd.	-2	Tending towards poor
<i>(Birmingham CSO basin)</i>		
Lincoln Dr. & Shirley Rd.	0	Neutral
<i>(Bloomfield Village CSO Basin)</i>		
Douglas Evans Nature Preserve	-4	Tending towards poor
<i>(Acacia Park CSO basin)</i>		
100' d/s of Acacia basin outfall	-1	Tending towards poor
500' d/s of Acacia basin outfall	-1	Tending towards poor

- Mussel beds: Main 1-2 contains the most extensive and diverse populations of mussels (clams) observed by RPO staff to date. Some individuals are at least 25 years old. Mussels are sensitive to siltation, turbidity, and low dissolved oxygen concentrations, and their distribution and abundance should be monitored.

Other Aquatic Life – Main 1-2 Subwatershed (continued)

- MDNR collected macroinvertebrates from 4 locations in Evans Ditch, in 1989 (table, below). The report stated that Good to Excellent streams would have > 25 taxa. The low numbers of taxa in Evans Ditch were attributed to flow variations, poor water quality, and possibly to metal-contaminated sediments.

Results of the 1989 MDNR Macroinvertebrate Survey – Evans Ditch

Location Sampled	# Taxa	Comments
13 Mile Rd.	3	
Rolling Rock Cr. Drive, near 12 Mile Rd.	3	
Lahser Rd.	2	
Berg Rd., N of 8 Mile Rd.	15	- Habitat = pond-like - d/s of CSOs - More taxa than in '73, '85, or '86

Rouge River Report Card Indicators – Main 1-2

The Rouge Remedial Action Plan Advisory Council (RRAC), with input from many parties, has written a Rouge River Watershed Report Card. This report card summarizes data and objectives for 18 indicators of watershed conditions, ranging from water quality to government stewardship. Eight of these indicators address factors that influence biological and ecological conditions in the watershed. The report card takes a watershed-wide perspective on these indicators. The table below summarizes these eight indicators specifically for the Main 1-2 subwatershed.

Status of Selected Rouge River Report Card Indicators in the Main 1-2 Subwatershed

Indicator	Status	Watershed Trend*
5. Toxic Chemicals & Fish Consumption Advisories	- Water & sediment relatively uncontaminated (based on limited data) - Fish consumption advisory still in effect (see above)	↑
6. Water Quality – Aquatic Life	DO was monitored at 3 locations in 1998, and was below 5 mg/L ~ 1 % of the time (see 1998 Baseline Data Summary Report for additional data).	↔
7. Riparian Zone	Habitat loss due to development pressures continues	↓
8. Wetlands, Woodlands, & Meadows	Habitat loss due to development pressures continues	↓
9. Wildlife	Concentrations of toxic chemicals relatively low, but habitat loss due to development continues	↓
10. Stream Flow & Habitat	Increasing development will eventually increase flow variability	↓
11. Fish	Habitat loss due to stream degradation	↔
12. Benthos	Habitat loss due to stream degradation	↓

* ↑ = condition improving; ↓ = condition deteriorating; ↔ = condition unchanged; ? = insufficient data to evaluate recent trend

Biological and Ecological Features, and Ecological Impairments

Main 3-4 Subwatershed

Introduction

This document summarizes the information available on the status of the aquatic biology and ecological impairments in the Rouge River Main 1-2 subwatershed. It emphasizes data gathered since the Rouge River National Wet Weather Demonstration Project began, and is mostly drawn from reports issued by the Rouge Program Office (RPO), the Michigan Department of Environmental Quality (MDEQ) and the Department of Natural Resources (MDNR) during the 1990s.

This document summarizes information for the following topics for the Main 3-4 subwatershed:

- Aquatic habitat quality
- Fish community
- Other aquatic life
- Chemical contamination
- Rouge River Report Card

Aquatic Habitat Quality – Main 3-4

- In 1996, RPO staff evaluated aquatic habitat quality at 12 locations in the Main 3-4, using the MDEQ's GLEAS 51 protocol (see attached map). Two of the locations were determined to have "Fair" aquatic habitat quality; and the remaining 10 locations had "Poor" habitat. Identified habitat problems included excessive flow variation, excessive siltation, lack of streamside vegetation and cover, and a lack of pool and riffle habitat. In addition, instream habitat downstream of Michigan Avenue to the river mouth is extremely poor, due to the concrete-lined channel, poor water quality, contaminated sediments, and loss of riparian wetlands and forests. These conditions greatly inhibit the movement of fish between the Rouge River and the Detroit River.
- Reducing post-storm peak flows and improving habitat conditions in the concrete channel area are the most important factors in improving aquatic habitat quality.

Fish Community – Main 3-4 Subwatershed

Summary of 1995 MDNR Fish Monitoring Survey; Main 3-4

Location	# Species	GLEAS Score*	IBI Score*	Sensitive Species Found?	Comment
Spinoza Rd., in Rouge Park	5	F	P-VP		Severe erosion; sewage & petroleum odor; much litter
Between Ford Dam & Lower Br.	34	--	--	X	

* E = excellent; G = good; F = fair; P = poor; VP = very poor; -- = score not calculated

- The 1995 MDNR fish monitoring survey sampled fish populations at 2 locations in the Main 3-4 (see attached map, and table, above). Using the MDEQ GLEAS 51 scoring procedure, the fish community was characterized as “Fair” at Spinoza Road bridge in Rouge Park. The Index of Biotic Integrity score, Poor to Very Poor, was lower than the GLEAS score, and was considered to better reflect the status of the fish community at this location.
- Scores were not calculated for the fish community collected between Evergreen Road and the dam at the Henry Ford Estate. This location exhibited the most diverse fish community sampled in 1995 (34 species), including limited numbers of several game fish species that managed to migrate upstream from the Detroit River and the Great Lakes (chinook salmon, steelhead, northern pike). Observed numbers of these species were too low to support a large recreational fishery.
- A few fish were also collected at Dix Avenue in the lower-most portion of the subwatershed, and these were mostly goldfish, carp, and gizzard shad, many of which exhibited external tumors.
- The size and diversity of the fish community is constrained by the limited connection of the subwatershed to the Detroit River and the Great Lakes, due to the channelized, concrete-lined streambed downstream of Michigan Avenue. Historically this lower portion of the river contained the best game fish habitat in the watershed. Presently, however, poor water quality and limited instream and riparian habitat severely limit fish populations and fish passage. This situation affects the entire watershed, but is especially important in this subwatershed.
- The fish community is also constrained by the dam at the Henry Ford Estate, which currently prevents fish passage between the upper and lower portions of the Main Branch.

- Future fish monitoring: Increasing populations of almost any fish (except exotic rough fish like carp or goldfish) would be an indication of improving environmental conditions in the river. Certain species, however, are especially useful for demonstrating improving conditions. These species tend to be sensitive to turbidity, prefer cleaner, cooler water, and their distribution in the Rouge Watershed is currently quite limited. The table below lists these species for the entire watershed, and those in **bold** have been found in the Main 3-4 subwatershed.

Sensitive Fish Species of the Rouge River Watershed

Common Name	Scientific Name
American brook lamprey	<i>Lampetra appendix</i>
Redside dace*	<i>Clinostomus elongatus</i>
Spotfin shiner	<i>Cyprinella spiloptera</i>
Hornyhead chub	<i>Nocomis biguttatus</i>
Northern hog sucker	<i>Hypentelium nigricans</i>
Stonecat	<i>Noturus flavus</i>
Mottled sculpin	<i>Cottus bairdi</i>
Starhead topminnow	<i>Fundulus dispar</i>
Rock bass	<i>Ambloplites rupestris</i>

* Listed as “Threatened” on the MDNR’s list of endangered, rare, and threatened species

Chemical Contaminants – Main 3-4 Subwatershed

- Fish consumption advisories: The Michigan Department of Natural Resources and the Department of Community Health have established fish consumption advisories for the fish listed in the table below. MDCH defines “general population” as men, boys older than 15, and women beyond childbearing years, and “women and children” as women who are pregnant or breastfeeding, women who intend to have children, girls older than 15, and all children under 15.

Fish Consumption Advisories for the Main 3-4.

Location	Fish Species	Contaminant(s)	Specifics of Advisory
Downstream of M-153/Ford Road	Carp, catfish, suckers	PCBs	For fish of any size: no consumption by women, children, or the general population.
	Largemouth and smallmouth bass		No consumption of fish between 14" and 30" by women, children, or the general population.
	Northern pike		No consumption of fish longer than 22" by women, children, or the general population.
	All other species		For fish of any size: no consumption by women and children; one meal per week for the general population.

- Toxic Chemicals in Water and Sediment:** In 1996, RPO measured the concentrations of potentially toxic metals and organic compounds in water and sediment at two locations in the Main 3-4, and also performed water and sediment toxicity tests (table, below). Several chemical contaminants exceeded established criteria in both water and sediment at both locations. Water at both locations was not toxic to fathead minnows or green algae. The sediment tested was toxic to both aquatic insect larvae (midges) and to amphipods. The cause(s) of this toxicity is suspected to be ammonia, which was released from the sediments during the bioassays.

Results of the 1996 RPO Toxics Survey: Main 3-4

Location	Toxic in Water Bioassay?	Toxic in Sediment Bioassay?	Significant* Toxics in Water	Significant** Toxics in Sediment
Upstream of UM-D dam	No	Yes	Zinc	Lead, zinc
Rotunda Dr.	No	Yes	PCBs	PAHs

* Exceeded MDEQ criteria for wildlife exposure

** Exceeded NOAA guideline sediment quality values

- In 1993, RPO staff collected and analyzed 34 surficial sediment samples from the Main 3-4. All samples were analyzed for PCBs, PAHs, and 12 metals. Contamination generally increased in the downstream direction, and concentrations of PCBs, cadmium, lead, nickel, and zinc exceeded the NOAA ER-M sediment quality guideline value in one or more samples. Sediments downstream of 7 Mile Road were noticeably more contaminated than sediments further upstream.

- In 1997-98, researchers from Michigan State University collected and analyzed sediments from 16 locations in the lower portion of the Main 3-4, from just upstream of the Turning Basin to the river mouth. Concentrations of PAHs ranged from 7.5 to 43.8 mg/kg; and of alkylphenols, from < 0.1 to 60 mg/kg. “Hot spots” for PAH contamination (> ER-M of 35 mg/kg) were the Ford Slip in the Turning Basin, and Fordson Island. The highest alkylphenol concentration (60 mg/kg) was near the I-75 bridge.
- Finally, the MDEQ collected and analyzed 84 sediment grab and core samples in the lower portion of the Main 3-4 in 1997-98. They found elevated concentrations of PCBs (maximum concentration = 24.6 mg/kg), total PAHs (max = 2,500 mg/kg), and many metals. A final report is in production.

Other Aquatic Life – Main 3-4

Macroinvertebrate Community

- The most recent MDNR macroinvertebrate survey with extensive coverage of the watershed was performed in 1986. (Note that the MDEQ has changed its scoring protocol since this report, and that the '86 data have not been re-scored.) Results for the two Main 3-4 subwatershed stations are below.

Results of the 1986 MDNR Macroinvertebrate Survey

Location Sampled	Score	Comments
Evans Ditch, at 8 Mile Rd.	Poor-Very Poor	(None)
Between Joy Rd. and Plymouth Rd.	Poor	

Rouge River Report Card Indicators – Main 3-4

The Rouge Remedial Action Plan Advisory Council (RRAC) has written a Rouge River Watershed Report Card, which summarizes data and objectives for 18 indicators of watershed conditions, ranging from water quality to government stewardship. Eight of these indicators address factors that biological and ecological conditions in the watershed. The report card takes a watershed-wide perspective on these indicators. The table below summarizes these eight indicators for the Main 3-4 subwatershed.

Status of Selected Rouge River Report Card Indicators in the Main 3-4 Subwatershed.

Indicator	Status	Watershed Trend*
5. Toxic Chemicals & Fish Consumption Advisories	- Sediments in lower portion of subwatershed contaminated - Fish consumption advisory still in effect	↑
6. Water Quality – Aquatic Life	- Concerns = low DO and high ammonia concentrations in water during summer, d/s of Michigan Avenue - DO was continuously monitored at 1 location in 1998, and was below 5 mg/L 39.2 % of the time (see 1998 Baseline Data Summary Report for additional data).	↔
7. Riparian Zone	Existing parks provide good habitat	↓
8. Wetlands, Woodlands, & Meadows	Existing parks provide good habitat	↓
9. Wildlife	Existing parks provide good habitat	↓
10. Stream Flow & Habitat	Excessive flow variability = instream habitat loss, bank erosion, etc.	↓
11. Fish	Habitat loss due to stream degradation, especially in concrete channel	↔
12. Benthos	Habitat loss due to stream degradation, especially in concrete channel	↓

* ↑ = condition improving; ↓ = condition deteriorating; ↔ = condition unchanged; ? = insufficient data to evaluate recent trend

Biological and Ecological Features, and Ecological Impairments

Upper Subwatershed

Introduction

This document summarizes the information available on the status of the aquatic biology and ecological impairments in the Rouge River Main 1-2 subwatershed. It emphasizes data gathered since the Rouge River National Wet Weather Demonstration Project began, and is mostly drawn from reports issued by the Rouge Program Office (RPO), the Michigan Department of Environmental Quality (MDEQ) and the Department of Natural Resources (MDNR) during the 1990s.

This document summarizes information for the following topics for the Upper subwatershed:

- Aquatic habitat quality
- Fish community
- Other aquatic life
- Chemical contamination
- Rouge River Report Card

Aquatic Habitat Quality - Upper

- In 1996, RPO staff evaluated aquatic habitat quality at 16 locations in the Upper subwatershed, using the MDEQ's GLEAS 51 protocol (see attached map). Three of the locations were determined to have "Good" aquatic habitat; six had "Fair" habitat; and the remaining seven locations had "Poor" habitat. All three of the stations with Good habitat quality were on the main stem of the Upper Branch. Stations on the Bell Branch had particularly poor habitat. Identified habitat problems included excessive flow variation, and a lack of riffles and pools.
- Reducing post-storm peak flows is the most important factor in improving aquatic habitat quality.

Fish Community – Upper Subwatershed

Summary of 1995 MDNR Fish Monitoring Survey; Upper Subwatershed

Location	# Species	GLEAS Score*	IBI Score*	Sensitive Species Found?	Comments
Powers Rd., S of Grand River Ave.	16	G	F	X	
5 Mile Rd.	6	P	P-VP		Oily sediments Dredged?
Bell Branch, near Beech-Daly Rd.	10	G	F-P		Strong sewer odor
Seeley Drain, at Halstead Rd.	7	G	P	X	
Minnow Pond Drain, at Farmington Rd.	14	G	F	X	
Tarabusi Creek, at Merriman Rd.	8	G	P		

*E = excellent; G = good; F = fair; P = poor; VP = very poor

- The 1995 MDNR fish monitoring survey sampled fish populations at 6 locations in the Upper subwatershed (see attached map, and the table above). Using the MDEQ GLEAS 51 scoring procedure, the fish community was characterized as “Good” at 5 of the 6 sampled locations, and “Poor” at 5 Mile Road. Index of Biotic Integrity scores were consistently lower, and were felt to better reflect the true condition of the fish community.
- Of the 4 tributaries sampled, Minnow Pond Drain (near Farmington Road) and Seeley Drain (at Halstead Road) contained sensitive fish species (reidside dace and mottled sculpin) and the most variable aquatic habitat, while Tarabusi Creek (at Orchard Lake Road) and the Bell Branch (between Beech-Daly and Telegraph Roads) exhibited unstable, eroded stream banks due to excessive flow variation and less variable habitat.
- Adult rainbow trout have been stocked near Powers Road, for fishing derbies, but there is no evidence that these fish remain in the area or reproduce. Brown trout may be a better choice for creating a permanent trout population, as they are more tolerant of warm water temperatures. Rainbow trout are also known to compete with the state listed reidside dace, which is found in this subwatershed.
- Future monitoring: Increasing populations of almost any fish (except exotic rough fish like carp or goldfish) would be an indication of improving environmental conditions in the river. Certain species, however, are especially useful for demonstrating improving conditions. These species tend to be sensitive to turbidity, prefer cleaner, cooler water, and their distribution in the Rouge Watershed is currently quite limited. Table 1 lists these species for the entire watershed, and those in bold have been found in the Upper subwatershed.

Sensitive Fish Species of the Rouge River Watershed.

Common Name	Scientific Name
American brook lamprey	<i>Lampetra appendix</i>
Redside dace*	<i>Clinostomus elongatus</i>
Spotfin shiner	<i>Cyprinella spiloptera</i>
Hornyhead chub	<i>Nocomis biguttatus</i>
Northern hog sucker	<i>Hypentelium nigricans</i>
Stonecat	<i>Noturus flavus</i>
Mottled sculpin	<i>Cottus bairdi</i>
Starhead topminnow	<i>Fundulus dispar</i>
Rock bass	<i>Ambloplites rupestris</i>

* Listed as "Threatened" on the MDNR's list of endangered, rare, and threatened species

Chemical Contaminants – Upper Subwatershed

- Fish consumption advisories: The Michigan Department of Natural Resources and the Department of Community Health have established fish consumption advisories for the fish listed in the table below. MDCH defines “general population” as men, boys older than 15, and women beyond childbearing years, and “women and children” as women who are pregnant or breastfeeding, women who intend to have children, girls older than 15, and all children under 15.

Fish Consumption Advisories for the Upper Subwatershed.

Location	Species	Contaminant(s)	Specifics of Advisory
Upstream of M-153/Ford Road	White sucker	PCBs	For fish of any size: One meal per week for women and children; unlimited consumption for the general population.

- Toxic Chemicals in Water and Sediment: In 1996, RPO measured the concentrations of potentially toxic metals and organic compounds in water and sediment at two locations in the Upper subwatershed, and also performed water and sediment toxicity tests (table, below). Several chemical contaminants exceeded established criteria in sediment at both locations. Water at 8 Mile Road was toxic to green algae but not to fathead minnows. The sediment tested was toxic to amphipods, but not to aquatic insect larvae (midges).

Results of the 1996 RPO Toxics Survey: Upper Subwatershed

Location	Toxic in Water Bioassay?	Toxic in Sediment Bioassay?	Significant* Toxics in Water	Significant** Toxics in Sediment
8 Mile Road	Yes	Yes	None	PAHs, zinc
Inkster Road	No	Yes	None	Lead, zinc

* Exceeded MDEQ criteria for wildlife exposure

** Exceeded NOAA guideline sediment quality values

- In 1993, RPO staff collected and analyzed 19 surficial sediment samples from the Upper subwatershed. All samples were analyzed for PCBs, PAHs, and 12 metals. Only the zinc concentration in the sample from Inkster Road exceeded the NOAA ER-M sediment quality guideline value. In general, surficial sediments in the Upper subwatershed are relatively uncontaminated.

Other Aquatic Life – Upper Subwatershed

Macroinvertebrate Community

- The most recent MDNR macroinvertebrate survey with extensive coverage of the watershed was performed in 1986. (Note that the MDEQ has changed its scoring protocol since this report, and that the '86 data have not been re-scored.) Results for the four Upper subwatershed stations are below.

Results of the 1986 MDNR Macroinvertebrate Survey

Location Sampled	Score	Comments
Grand River Ave.	Fair – Poor	Problems = runoff from Northville u/s of 7 Mile Rd., and drains and sewers on the Bell Branch and Tarabusi Creek.
7 Mile Rd.	Very Poor	
5 Mile Rd.	Fair – Poor	
Bell Br., between Beech-Daly & Telegraph	Very Poor	

- In 1999 RPO staff collected macroinvertebrates (aquatic insects and other organisms) from 5 locations in the vicinity of the Redford CSO basin, as part of an assessment of the effects of the basin discharges on the river. Collected data were used to calculate a score for the communities at each location, using the MDEQ GLEAS 51 protocol (table, below). Two conclusions were reached: (1) the macroinvertebrate communities upstream, and several hundred feet downstream of the basin outfall are in poor condition; (2) discharge from the may impact the macroinvertebrate communities immediately downstream of the outfall.

Results of the 1999 Upper Branch CSO Basin Macroinvertebrate Survey.

Location	Macroinvertebrate Community Score	Score Interpretation
6 Mile Road	-1	“Tending towards poor”
Kinloch Road	0	“Neutral”
<i>(Redford CSO basin outfall)</i>		
At basin outfall	-1	“Tending towards poor”
150’-200’ d/s of the outfall	-4	“Tending towards poor”
Garfield Road	0	“Neutral”

- MDNR surveys have found abundant populations of sensitive macroinvertebrates like mayflies, dragonflies, and case-building caddisflies.
- An informal RPO macroinvertebrate survey found a single large (~ 3”) hellgrammite (alder fly larvae) at Powers Road in Farmington. Hellgrammites are indicative of good water quality, and are also long-lived for insect larvae (2-3 years).

Rouge River Report Card Indicators – Upper Subwatershed

The Rouge Remedial Action Plan Advisory Council (RRAC) has written a Rouge River Watershed Report Card, which summarizes data and objectives for 18 indicators of watershed conditions, ranging from water quality to government stewardship. Eight of these indicators address factors that biological and ecological conditions in the watershed. The report card takes a watershed-wide perspective on these indicators. The table below summarizes these eight indicators for the Upper subwatershed.

Status of Selected Rouge River Report Card Indicators in the Upper Subwatershed.

Indicator	Status	Watershed Trend*
5. Toxic Chemicals & Fish Consumption Advisories	- Fish consumption advisory still in effect - Some toxicity at 8 Mile Rd. and Inkster Rd.	↑
6. Water Quality – Aquatic Life	- DO was continuously monitored at 3 locations in 1998, and was below 5 mg/L 0.5% to 9.6 % of the time (see the 1998 Baseline Data Summary Report for additional data). - Some toxicity at 8 Mile Rd. and Inkster Rd.	↔
7. Riparian Zone	Existing parks provide habitat protection	↓
8. Wetlands, Woodlands, & Meadows	Concern for habitat loss in upper portion of subwatershed	↓
9. Wildlife	- Mink observed in Farmington - Concern for habitat loss in upper portion of subwatershed	↓
10. Stream Flow & Habitat	Excessive flow variation a problem; may worsen in upper portion of subwatershed	↓
11. Fish	Sensitive species in Minnow Pond Drain and Seeley Drain	↔
12. Benthos	Sensitive species u/s of Grand River Avenue	↓

* ↑ = condition improving; ↓ = condition deteriorating; ↔ = condition unchanged; ? = insufficient data to evaluate recent trend

Biological and Ecological Features, and Ecological Impairments

Middle 1 Subwatershed

Introduction

This document summarizes the information available on the status of the aquatic biology and ecological impairments in the Rouge River Middle 1 subwatershed. It emphasizes data gathered since the Rouge River National Wet Weather Demonstration Project began, and is mostly drawn from reports issued by the Rouge Program Office (RPO), the Michigan Department of Environmental Quality (MDEQ) and the Department of Natural Resources (MDNR) during the 1990s.

This document summarizes information for the following topics for the Middle 1 subwatershed:

- Aquatic habitat quality
- Fish community
- Other aquatic life
- Chemical contamination
- Rouge River Report Card

Aquatic Habitat Quality – Middle 1 Subwatershed

- In 1996, RPO staff evaluated aquatic habitat quality at 11 locations in the Middle 1 subwatershed, using the MDEQ's GLEAS 51 protocol (see attached figure). One location was determined to have "Excellent" aquatic habitat (and had the highest score found in the survey; downstream of Wilcox Lane, east of Hines Drive); two of the locations had "Good" aquatic habitat; four had "Fair" habitat; and the remaining four locations had "Poor" habitat. Identified habitat problems included excessive flow variation, a lack of riffles and pools, and a lack of streamside cover.
- Reducing post-storm peak flows is the most important factor in improving aquatic habitat quality.

Fish Community – Middle 1 Subwatershed

Summary of the 1995 MDNR Fish Monitoring Survey; Middle 1 Subwatershed.

Location	# Species	GLEAS Score*	IBI Score*	Sensitive Species Found?	Comment
Novi Rd.	2**	G	F-P		
9 Mile Rd.	18	G	P	X	
Northville Rd.	14	G	F	X	
Ingersoll Cr. @ 10 Mile Rd.	9	G	F		
Bishop Cr. @ 10 Mile Rd.	12	E	G-F		
Johnson Cr. @ Napier Rd.	15	G	F	X	<i>Fishery stable</i>
Willow Cr. @ Lotz Rd.	7	G	P		

*E = excellent; G = good; F = fair; P = poor; VP = very poor

** Believed to be an intermittent stream.

- The 1995 MDNR fish monitoring survey sampled fish populations at 7 locations in the Middle 1 subwatershed (see attached figure, and the table above). The Novi Road location was judged to be an intermittent stream, which explains its low number of species. Using the MDEQ GLEAS 51 scoring procedure, the fish community was characterized as “Good” at 6 of the 7 sampled locations, and “Excellent” at Bishop Creek at 10 Mile Road. The Index of Biotic Integrity scores were consistently lower than the GLEAS scores, and were felt to better reflect the condition of the fish communities.
- Of the 4 tributaries sampled, Johnson Creek (at Napier Road) and Bishop Creek (at 10 Mile Road) exhibited variable aquatic habitats and stable stream banks, while Ingersoll Creek (at 10 Mile Road) and Willow Creek (at Lotz Road) exhibited eroded banks, less variable habitat, and fewer species of fish.
- Yearling brown trout have been stocked in Johnson Creek since 1992. Year-to-year survival and reproduction have been documented, but are considered poor, due to low base flows during the winter (and possibly elevated summer temperatures).
- The size and diversity of the fish community in the Middle 1 are constrained by the dams at Wilcox Lake, Phoenix Lake, Waterford Lake, and Meadowbrook Lake, which prevent fish passage within the subwatershed.
- Future monitoring: Increasing populations of almost any fish (except exotic rough fish like carp or goldfish) would be an indication of improving environmental conditions in the river. Certain species, however, are especially useful for demonstrating improving conditions. These species tend to be sensitive to turbidity, prefer cleaner, cooler water, and their distribution in the Rouge Watershed is currently quite limited. Table 1 lists these species for the entire watershed, and those in **bold** have been found in the Middle 1 subwatershed.

Sensitive Fish Species of the Rouge River Watershed

Common Name	Scientific Name
American brook lamprey	<i>Lampetra appendix</i>
Redside dace*	<i>Clinostomus elongatus</i>
Spotfin shiner	<i>Cyprinella spiloptera</i>
Hornyhead chub	<i>Nocomis biguttatus</i>
Northern hog sucker	<i>Hypentelium nigricans</i>
Stonecat	<i>Noturus flavus</i>
Mottled sculpin	<i>Cottus bairdi</i>
Starhead topminnow	<i>Fundulus dispar</i>
Rock bass	<i>Ambloplites rupestris</i>

* Listed as "Threatened" on the MDNR's list of endangered, rare, and threatened species

Fish Community – Middle 1 Subwatershed (continued)

- A 1995 MDNR fish monitoring survey reported that a fish kill was conducted in Phoenix Lake and Wilcox Lake in 1967, to remove an extensive rough fish population and stunted panfish community. Phoenix Lake was then restocked with rainbow trout, brown trout, largemouth bass, bluegill, and black crappie. Wilcox Lake was restocked with largemouth bass and bluegill. In 1995, 16 species were captured in Phoenix Lake, and 14 species in Wilcox Lake. Phoenix Lake was dominated by slow-growing populations of black crappie, bluegill, and white suckers, and Wilcox Lake was dominated by slow-growing populations of bluegill, black crappie, and pumpkinseed sunfish. Twenty percent of the white suckers in Phoenix Lake were in an emaciated state, which was attributed to an unknown internal parasite or pollutant.

Chemical Contaminants – Middle 1 Subwatershed

- Fish consumption advisories: The Michigan Department of Natural Resources and the Department of Community Health have established fish consumption advisories for the fish listed in the table below. MDCH defines “general population” as men, boys older than 15, and women beyond childbearing years, and “women and children” as women who are pregnant or breastfeeding, women who intend to have children, girls older than 15, and all children under 15.

Fish Consumption Advisories for the Middle 1 Subwatershed.

Location	Fish Species	Contaminant	Specifics of Advisory
Meadowbrook Lake, Waterford Pond, Wilcox Lake, and all other lakes (This is the generic advice for any Michigan lake or impoundment.)	Rock bass, yellow perch, crappie	Mercury	For fish over 9”: one meal per month for women and children; one meal per week for general population.
	Bass, walleye, northern pike or muskie		For fish of any size: one meal per month for women and children; one meal per week for general population.
Walled Lake	Carp	PCBs	One meal per week of fish between 6” and 22”, and one meal per month of fish more than 22”, by women and children; unlimited consumption of fish of any size the general population.
	Northern pike		Unlimited consumption of fish 22”-26”, and one meal per month for fish longer than 26”, by women and children; unlimited consumption of fish 22” to 26” long and one meal per week for fish longer than 26”, by the general population.
Phoenix Lake	Bluegill	PCBs	One meal per week of fish less than 18” long by women and children; unlimited consumption by the general population.
	Carp		For fish of any size: One meal per month by women and children; unlimited consumption by the general population
Downstream of Phoenix Lake	Carp, catfish, suckers	PCBs	For fish of any size: no consumption by women, children, or the general population.
	Largemouth and smallmouth bass		No consumption of fish between 14” and 30” by women, children, or the general population.
	Northern pike		No consumption of fish longer than 22” by women, children, or the general population.
	All other species		For fish of any size: no consumption by women and children; one meal per week for the general population.

Toxic Chemicals in Water and Sediment

- In 1996, RPO measured the concentrations of potentially toxic metals and organic compounds in water and sediment at two locations in the Middle 1 subwatershed, and also performed water and sediment toxicity tests (table, below). The water samples at both locations were toxic to fathead minnows but not to green algae. Sediments from both locations were not toxic to amphipods or aquatic insect larvae (midges), although sediment from the Phoenix Lake outlet did contain elevated concentrations of PAHs (cyclic compounds resulting from the combustion of fossil fuels).

Results of the 1996 RPO Toxics Survey: Middle 1 Subwatershed

Location	Toxic in Water Bioassay?	Toxic in Sediment Bioassay?	Significant* Toxics in Water	Significant** Toxics in Sediment
Phoenix Lake outlet	Yes	No	None	PAHs
Johnson Creek, in the Rural Hill Cemetery	Yes	No	PCBs	None

* Exceeded MDEQ criteria for wildlife exposure

** Exceeded NOAA guideline sediment quality values

- Two sediment cores from Phoenix Lake and three cores from Wilcox Lake were also analyzed for metals and organic contaminants as part of this study (tables, below). The surficial and subsurface subsample from each Phoenix Lake core contained elevated concentrations of arsenic and lead, and the surficial sample from core #1 contained an elevated amount of zinc. Concentrations of organic contaminants (PCBs, PAHs, etc.) were not elevated in the Phoenix Lake sediments. Several core subsamples from Wilcox Lake also contained elevated concentrations of arsenic, lead, and zinc, as well as two PAHs. Further core sampling of this lake would be appropriate, prior to any dredging activity.

Metal Concentrations in Cores from Phoenix Lake (1996)

Core Subsample	Arsenic (mg/kg)	Lead (mg/kg)	Zinc (mg/kg)
ER-L*	33	35	120
ER-M*	85	110	270
#1; 0"-24"	65	82	130
#1; 24"-47"	64	52	86
#2; 0"-20"	64	67	110
#2; 24"-48"	57	53	89

* NOAA guideline values; ER-L = potentially toxic to sensitive aquatic organisms; ER-M = potentially toxic to most aquatic organisms

Metal and PAH Concentrations in Cores from Wilcox Lake

Core Subsample	Arsenic (mg/kg)	Lead (mg/kg)	Zinc (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)
ER-L	33	35	120	225	350
ER-M	88	110	270	1,380	2,200
#1; 0-9.5"	25	47	22	---	340
#2; 0-19"	46	35	60	---	---
#2; 19-37"	25	11	22	---	---
#3; 0-15.5"	65	58	120	850	930
#3; 15.5-33"	46	41	65	---	---

* NOAA guideline values; ER-L = potentially toxic to sensitive aquatic organisms; ER-M = potentially toxic to most aquatic organisms

--- = Non-detect

- In 1993, RPO staff collected and analyzed 20 surficial sediment samples from the Middle 1 subwatershed. All samples were analyzed for PCBs, PAHs, and 12 metals. Only two samples exceeded the NOAA ER-M sediment quality value for any of the contaminants:
 - Newburgh Lake inlet, for total PCBs (this location has since been remediated)
 - A location between 7 Mile Road and 8 Mile Road, for chromium, lead and nickel

In general, surficial sediments in the Middle 1 are fairly uncontaminated.

Chemical Contaminants – Middle 1 Subwatershed (continued)

- In 1988, MDNR sampled water and sediment from 6 locations in Johnson Creek, and analyzed them for 7 metals. All of the reported concentrations were low, and many were less than the method detection limit.

Other Aquatic Life – Middle 1 Subwatershed

Macroinvertebrate Community

- The most recent MDNR macroinvertebrate survey with extensive coverage of the watershed was performed in 1986. (Note that the MDEQ has changed its scoring protocol since this report, and that the '86 data have not been re-scored.) Results for the five Middle 1 subwatershed stations are below.

Results of the 1986 MDNR Macroinvertebrate Survey

Location Sampled	Score	Comments
Novi Rd.	Fair	Somewhat better than in 1978.
9 Mile Rd.	Fair	
Between 6 Mile Rd. and 7 Mile Rd.	Fair	
Between Phoenix Lake and Wilcox Lake	Fair	
Between Haggerty Rd. and Newburgh Lake	Good	

- Populations of several mussel species used to occur between Wilcox Lake and Newburgh Lake. These were extirpated by the fish kill conducted during the Newburgh Lake remediation. Attempts to re-establish the most common species (*Lasmigona complanata*; the white heelsplitter) were made in 1998, but survival was poor.
- Normal populations of macrophytes (aquatic plants) are important to lake environments, providing habitat for aquatic insects, shelter for larval fishes, etc. They are common in shallow water in Walled Lake, and are extremely common in Wilcox Lake (suggesting excessive nutrient inputs, especially of phosphorous). Macrophytes have also been replanted in Newburgh Lake after its remediation. Macrophytes are missing from Meadowbrook Lake and Phoenix Lake, however. The reasons for this are unknown, although elevated metal concentrations in the sediment are a possible cause at Phoenix Lake.
- Phytoplankton populations in the Middle 1 lakes in 1994-95 were most diverse in Walled Lake, and less diverse in the more eutrophic Meadowbrook Lake and Phoenix Lake. Meadowbrook Lake and Phoenix Lake were dominated by algae species indicative of eutrophic conditions and known to cause taste and odor problems in drinking water.

Middle 1 Other Aquatic Life, continued

- MDNR also sampled the macroinvertebrates at a total of 7 locations in Johnson Creek in 1988 and 1989 (table, below). The reports stated that good to excellent streams would be expected to contain > 25 taxa (taxonomic Families, usually). Lower taxa numbers in Johnson Creek were attributed to fluctuating flows, and to water quality problems at 2 locations (see table). Although these reports did not convert the number of taxa collected into “scores”, the 1986 MDNR report would have classified the 1988 stations as “Fair - Poor”, and the 1989 stations as “Poor – Very Poor”. (More recent MDNR/MDEQ reports employ a more sophisticated scoring system.)

Results of the 1988 & 1989 MDNR Macroinvertebrate Surveys – Johnson Creek

Location Sampled	# Taxa	Comments
Curtis Rd. ('88)	17	
5 Mile Rd. in Salem Twp. ('88)	22	Pond-like habitat, with several surface-breathing taxa; Profuse growths of filamentous algae (<i>Cladophora</i>) = suspected nutrient problems
5 Mile Rd. in Northville Twp. ('88)	13	
6 Mile Rd. in Northville Twp. ('88)	15	
Fish Hatchery Park ('88)	14	
6 Mile Rd. in Salem Twp. ('89)	6	Low number of taxa = fluctuating flows; station near CSO outfall
Behind South Lyon School ('89)	6	Low number of taxa = fluctuating flows; bacterial slime present d/s of packing plant outfall

Rouge River Report Card Indicators – Middle 1

The Rouge Remedial Action Plan Advisory Council (RRAC) has written a Rouge River Watershed Report Card, which summarizes data and objectives for 18 indicators of watershed conditions, ranging from water quality to government stewardship. Eight of these indicators address factors that biological and ecological conditions in the watershed. The report card takes a watershed-wide perspective on these indicators. The table below summarizes these eight indicators for the Middle 1 subwatershed.

Status of Selected Rouge River Report Card Indicators in the Middle 1 Subwatershed.

Indicator	Status	Watershed Trend*
5. Toxic Chemicals & Fish Consumption Advisories	<ul style="list-style-type: none"> - Toxic effects observed at Johnson Cr. & Phoenix Lake outlet - Sediments relatively uncontaminated - Fish consumption advisories still in effect 	↑
6. Water Quality – Aquatic Life	<ul style="list-style-type: none"> - DO was continuously monitored at 2 locations in 1995, and was < 5 mg/L less than 1 % of the time (see 1998 Baseline Data Summary Report for additional data). - Excessive phosphorous concentrations = eutrophic conditions in impoundments (see 1998 Data Summary Report) 	↔
7. Riparian Zone	<ul style="list-style-type: none"> - Existing parks provide habitat protection - Excessive erosion degrading riparian zone 	↓
8. Wetlands, Woodlands, & Meadows	Existing parks provide habitat protection	↓
9. Wildlife	<ul style="list-style-type: none"> - Existing parks provide good woodland habitat - Cormorants sighted on impoundments 	↓
10. Stream Flow & Habitat	Excessive flow variation = bank erosion, instream habitat loss, etc.	↓
11. Fish	<ul style="list-style-type: none"> - Good fishery in Walled Lake - Good fish habitat in Johnson Cr. & Bishop Cr. - Dams interfere with fish passage 	↔
12. Benthos	Mussel beds lost during Newburgh Lake remediation	↓

* ↑ = condition improving; ↓ = condition deteriorating; ↔ = condition unchanged; ? = insufficient data to evaluate recent trend

Biological and Ecological Features, and Ecological Impairments

Middle 3 Subwatershed

Introduction

This document summarizes the information available on the status of the aquatic biology and ecological impairments in the Rouge River Main 1-2 subwatershed. It emphasizes data gathered since the Rouge River National Wet Weather Demonstration Project began, and is mostly drawn from reports issued by the Rouge Program Office (RPO), the Michigan Department of Environmental Quality (MDEQ) and the Department of Natural Resources (MDNR) during the 1990s.

This document summarizes information for the following topics for the Middle 3 subwatershed:

- Aquatic habitat quality
- Fish community
- Other aquatic life
- Chemical contamination
- Rouge River Report Card

Aquatic Habitat Quality – Middle 3 Subwatershed

- In 1996, RPO staff evaluated aquatic habitat quality at eight locations in the Middle 3 subwatershed, using the MDEQ's GLEAS 51 protocol (see attached map). One location was determined to have "Fair" aquatic habitat; and the remaining seven locations had "Poor" habitat. Identified habitat problems included excessive flow variation, a lack of instream habitat, unstable banks, and a lack of streamside vegetation and cover.
- Reducing post-storm peak flows is the most important factor in improving aquatic habitat quality.

Fish Community – Middle 3 Subwatershed

Summary of 1995 MDNR Fish Monitoring Survey; Middle 3 Subwatershed.

Location	# Species	GLEAS Score*	IBI Score*	Intolerant Species Found?	Comment
Hines Rd. at Wayne Rd.	9	G	F	X	Little instream cover; severe bank erosion
Inkster Rd. at Nollar Bend Park	6	G	P	X	Little instream cover; severe bank erosion
Tonquish Creek, at Hix Rd.	11	G	F-P		Little instream cover; severe bank erosion
Tonquish Creek, at Joy Rd.	10	G	P		Little instream cover; severe bank erosion

*E = excellent; G = good; F = fair; P = poor; VP = very poor

- The 1995 MDNR fish monitoring survey sampled fish populations at 4 locations in the Middle 3 subwatershed; two on the main stem and two on Tonquish Creek (attached figure, and table, above). Using the MDEQ GLEAS 51 scoring procedure, the fish community was characterized as “Good” at all four locations. The Index of Biotic Integrity scores were consistently lower than the GLEAS scores, and were felt to better reflect the status of the fish communities. Rock bass, a sensitive species, was found only at the two main stem locations.
- The size and diversity of the fish community in this subwatershed is constrained by the dams at Newburgh Lake and Nankin Lake, which prevent fish passage within the subwatershed.
- Future fish monitoring: Increasing populations of almost any fish (except exotic rough fish like carp or goldfish) would be an indication of improving environmental conditions in the river. Certain species, however, are especially useful for demonstrating improving conditions. These species tend to be sensitive to turbidity, prefer cleaner, cooler water, and their distribution in the Rouge Watershed is currently quite limited. The table below lists these species for the entire watershed, and those in bold have been found in the Middle 3 subwatershed.

Sensitive Fish Species of the Rouge River Watershed.

Common Name	Scientific Name
American brook lamprey	<i>Lampetra appendix</i>
Redside dace*	<i>Clinostomus elongatus</i>
Spotfin shiner	<i>Cyprinella spiloptera</i>
Hornyhead chub	<i>Nocomis biguttatus</i>
Northern hog sucker	<i>Hypentelium nigricans</i>
Stonecat	<i>Noturus flavus</i>
Mottled sculpin	<i>Cottus bairdi</i>
Starhead topminnow	<i>Fundulus dispar</i>
Rock bass	<i>Ambloplites rupestris</i>

* Listed as "Threatened" on the MDNR's list of endangered, rare, and threatened species

Fish Community – Middle 3 Subwatershed (continued)

- A 1995 MDNR fish monitoring survey reported that a fish kill was conducted in Newburgh Lake in 1967, to remove an extensive rough fish population and stunted panfish community. The impoundment was then restocked with brown trout, largemouth bass, bluegill, and channel catfish. Post-treatment surveys in 1971 and 1975 found a warm water fishery dominated by pumpkinseed sunfish, bluegill, black crappie, white sucker, and bullheads. Largemouth bass, trout, and northern pike were found in low numbers. In 1995, 12 species were captured, and again the fish community was dominated by bluegill, pumpkinseed, and white suckers. Panfish species were stunted, but pike were growing faster than observed elsewhere in the state. Interestingly, carp made up only 1% of the population captured in 1995, compared to __ % of the population collected in 199_ during the Newburgh Lake remediation. This is probably due to the collection methods employed in 1995; nets and limited electroshocking.

Chemical Contaminants – Middle 3 Subwatershed

- Fish consumption advisories: The Michigan Department of Natural Resources and the Department of Community Health have established fish consumption advisories for the fish listed in the table below. MDCH defines “general population” as men, boys older than 15, and women beyond childbearing years, and “women and children” as women who are pregnant or breastfeeding, women who intend to have children, girls older than 15, and all children under 15.

Fish Consumption Advisories for the Middle 3 Subwatershed.

Location	Species	Contaminant(s)	Specifics of Advisory
Nankin Lake (This is the generic advice for any Michigan impoundment.)	Rock bass, yellow perch, crappie	Mercury	For fish over 9": one meal per month for women and children; one meal per week for general population.
	Bass, walleye, northern pike or muskie		For fish of any size: one meal per month for women and children; one meal per week for general population.
Between Newburgh Lake and the confluence with the Main Branch	Carp, catfish, suckers	PCBs	For fish of any size: no consumption by women, children, or the general population.
	Largemouth and smallmouth bass		No consumption of fish between 14" and 30" by women, children, or the general population.
	Northern pike		No consumption of fish longer than 22" by women, children, or the general population.
	All other species		For fish of any size: no consumption by women and children; one meal per week for the general population.

Toxic Chemicals in Water and Sediment

- In 1996, RPO measured the concentrations of potentially toxic metals and organic compounds in water and sediment at one location in the Middle 3 subwatershed, and also performed water and sediment toxicity tests (table, below). The water sample was not toxic to either fathead minnows or to green algae, and it did not contain significant concentrations of the contaminants measured. The sediment tested was also not toxic to amphipods or aquatic insect larvae (midges), though it did contain elevated concentrations of PAHs (cyclic compounds derived from fossil fuel combustion).

Results of the 1996 RPO Toxics Survey: Middle 3 Subwatershed

Location	Toxic in Water Bioassay?	Toxic in Sediment Bioassay?	Significant* Toxics in Water	Significant** Toxics in Sediment
Hines Drive, near Ford Road	No	No	None	PAHs

* Exceeded MDEQ criteria for wildlife exposure

** Exceeded NOAA guideline sediment quality values

- Sediment cores from Nankin Lake were also collected and analyzed for contaminants as part of this study (table, below). Some of the subsamples exceeded NOAA sediment quality guideline values for certain metals and PAHs. Collection and analysis of additional cores would be warranted prior to any dredging activities in this lake.

Concentrations of Metals and PAHs from Nankin Lake Cores

Core Subsample	Arsenic (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)
ER-L	33	35	30	225	350
ER-M	88	110	50	1,380	2,200
#1; 0-5"	13	13	6.5	500	740
#1; 5-24"	63	29	23	---	---
#2; 0-14"	45	81	33	2,400	2,300
#2; 14-31.5"	(Sample lost)				

* NOAA guideline values; ER-L = potentially toxic to sensitive aquatic organisms; ER-M = potentially toxic to most aquatic organisms

--- = Non-detect

- In 1993, RPO staff collected and analyzed 25 surficial sediment samples from the Middle 3 subwatershed. All samples were analyzed for PCBs, PAHs, and 12 metals. None of the samples exceeded the NOAA ER-M sediment quality values for any of the contaminants. In general, surficial sediments in the Middle 3 are fairly uncontaminated.

Other Aquatic Life – Middle 3

Macroinvertebrate Community

- The most recent MDNR macroinvertebrate survey with extensive coverage of the watershed was performed in 1986. (Note that the MDEQ has changed its scoring protocol since this report, and that the '86 data have not been re-scored.) Results for the four Middle 3 subwatershed stations are below.

Results of the 1986 MDNR Macroinvertebrate Survey

Location Sampled	Score	Comments
Tonquish Creek u/s of Newburgh Rd.	Very Poor	Problem = storm sewers u/s of Wayne Rd., and elsewhere.
Wayne Rd.	Poor-Very Poor	
Inkster Rd.	Poor-Very Poor	
Outer Dr.	Poor-Very Poor	

- In 1999 RPO staff collected macroinvertebrates (aquatic insects and other organisms) from 7 locations in the vicinity of the separated and unseparated sewer areas along the Middle 3. Collected data were used to calculate a score for the communities at each location, using the MDEQ GLEAS 51 protocol (table, below). Two tentative conclusions were reached: (1) the macroinvertebrate communities in the separated sewer areas do not differ substantially from those in the unseparated area; (2) The presence of macroinvertebrates is completely dependent on the presence of hard substrate (rocks, logs, etc.). No organisms were found in the sandy substrate that makes up most of the river bottom in this area. Future macroinvertebrate surveys may want to employ artificial substrate samplers.

Results of the 1999 RPO Macroinvertebrate Survey.

Location	Macroinvertebrate Community Score	Score Interpretation
Hines Dr. & Wayne Rd.	-1	“Tending towards poor”
Hines Dr. & Stark Rd.	-5	“Poor”
Hines Dr. & metal bridge d/s of Nankin Lake dam	-2	“Tending towards poor”
Hines Dr. & Merriman Rd.	-5	“Poor”
Hines Dr. & Middlebelt Rd.	-3	“Tending towards poor”
Hines Dr. & Inkster Rd.	-4	“Tending towards poor”
Hines Dr. & Beech-Daly Rd.	-2	“Tending towards poor”

- Beds of several mussel species used to occur between Newburgh Lake and Nankin Lake, but were eliminated by the chemical fish kill conducted as part of the Newburgh Lake remediation. These species will not re-establish on their own, due to the dams at the lakes.
- Normal populations of macrophytes (aquatic plants) are important to lake environments, providing habitat for aquatic insects, shelter for larval fishes, etc. They are extremely common in Nankin Lake, suggesting excessive nutrient inputs, especially of phosphorous. Macrophytes have also been replanted in Newburgh Lake after its remediation.
- Phytoplankton (floating microscopic algae) populations in Newburgh Lake in 1994-95 were often dominated by species associated with eutrophic conditions, and with taste and odor problems.

Rouge River Report Card Indicators – Middle 3 Subwatershed

The Rouge Remedial Action Plan Advisory Council (RRAC) has written a Rouge River Watershed Report Card, which summarizes data and objectives for 18 indicators of watershed conditions, ranging from water quality to government stewardship. Eight of these indicators address factors that biological and ecological conditions in the watershed. The report card takes a watershed-wide perspective on these indicators. The table below summarizes these eight indicators for the Middle 3 subwatershed.

Status of Selected Rouge River Report Card Indicators in the Middle 3 Subwatershed.

Indicator	Status	Watershed Trend*
5. Toxic Chemicals & Fish Consumption Advisories	- Newburgh Lake remediated - Sediments relatively uncontaminated - Fish consumption advisories still in effect	↑
6. Water Quality – Aquatic Life	- DO was monitored continuously at 1 location in 1998, and was below 5 mg/L 10.3 % of the time (see the 1998 Baseline Data Summary Report for additional data). - Excessive phosphorous concentrations = eutrophic conditions in impoundments - Concentrations of toxic chemicals low	↔
7. Riparian Zone	- Existing parks provide habitat protection - Excessive erosion degrading riparian zone	↓
8. Wetlands, Woodlands, & Meadows	Existing parks provide habitat protection	↓
9. Wildlife	- Existing parks provide good woodland habitat - Nankin Mills reports badger sighting - Cormorants seen on Newburgh Lake	↓
10. Stream Flow & Habitat	Excessive flow variation = bank erosion, instream habitat loss, etc.	↓
11. Fish	- Impoundment dams interfere with fish passage - Newburgh Lake restocked with fish	↔
12. Benthos	- Mussel populations lost during Newburgh Lake remediation - Habitat inadequate in much of subwatershed; too few riffles and pools, and instream substrates	↓

* ↑ = condition improving; ↓ = condition deteriorating; ↔ = condition unchanged; ? = insufficient data to evaluate recent trend.

Biological and Ecological Features, and Ecological Impairments

Lower 1 Subwatershed

Introduction

This document summarizes the information available on the status of the aquatic biology and ecological impairments in the Rouge River Main 1-2 subwatershed. It emphasizes data gathered since the Rouge River National Wet Weather Demonstration Project began, and is mostly drawn from reports issued by the Rouge Program Office (RPO), the Michigan Department of Environmental Quality (MDEQ) and the Department of Natural Resources (MDNR) during the 1990s.

This document summarizes information for the following topics for the Lower 1 subwatershed:

- Aquatic habitat quality
- Fish community
- Other aquatic life
- Chemical contamination
- Rouge River Report Card

Aquatic Habitat Quality – Lower 1 Subwatershed

- In 1996, RPO staff evaluated aquatic habitat quality at 12 locations in the Lower 1 subwatershed, using the MDEQ's GLEAS 51 protocol (see attached map). Two location was determined to have "Good" aquatic habitat; three had "Fair" habitat; and the remaining seven locations had "Poor" habitat. Identified habitat problems included excessive flow variation and siltation, a lack of riffles and pools, and a lack of instream cover.
- Reducing post-storm peak flows is the most important factor in improving aquatic habitat quality.

Fish Community – Lower 1 Subwatershed

Summary of the 1995 MDNR Fish Monitoring Survey; Lower 1

Location	# Species	GLEAS Score*	IBI Score*	Intolerant Species Found?	Comment
Sheldon Rd.	7	G	P		Severe bank erosion
Canton-Center Rd.	12	E	G-F	X	Severe bank erosion
Denton Rd.	3	F	P-VP		
Van Born Rd.	6	G	P		

*E = excellent; G = good; F = fair; P = poor; VP = very poor

- The 1995 MDNR fish monitoring survey sampled fish populations at 4 locations in the Lower 1 subwatershed; one on the main stem, One on Fellows Creek, one on Fowler Creek, and one on Canton Creek (attached figure, and table, above). Using the MDEQ GLEAS 51 scoring procedure, the fish community was characterized as “Excellent” at one location (Fellows Creek), “Good” at two locations, and “Poor” at one location. The Index of Biotic Integrity scores were consistently lower than the GLEAS scores, and were felt to better reflect the status of the fish communities. A single mottled sculpin, a sensitive species, was found at Canton-Center Road.
- Limited numbers of Chinook salmon (a.k.a. king salmon) migrate up the Lower Branch every fall. Limited numbers of steelhead (actually anadromous rainbow trout that breed in streams and live their lives in large lakes) have also been seen in the Branch. Both species are native to the Pacific coast, and have been stocked in the Great Lakes states since the 1870s. These fish were probably originally stocked in Lake Erie, and are not likely to breed successfully in the Lower Branch due to warm summer water temperatures, excessively variable water flows, and inappropriate bottom substrate (sand rather than the preferred large gravel). They do provide a small recreational fishery each year, however.
- Future monitoring: Increasing populations of almost any fish (except exotic rough fish like carp or goldfish) would be an indication of improving environmental conditions in the river. Certain species, however, are especially useful for demonstrating improving conditions. These species tend to be sensitive to turbidity, prefer cleaner, cooler water, and their distribution in the Rouge Watershed is currently quite limited. The table below lists these species for the entire watershed, and those in bold have been found in the Lower 1 subwatershed.

Sensitive Fish Species of the Rouge River Watershed.

Common Name	Scientific Name
American brook lamprey	<i>Lampetra appendix</i>
Redside dace*	<i>Clinostomus elongatus</i>
Spotfin shiner	<i>Cyprinella spiloptera</i>
Hornyhead chub	<i>Nocomis biguttatus</i>
Northern hog sucker	<i>Hypentelium nigricans</i>
Stonecat	<i>Noturus flavus</i>
Mottled sculpin	<i>Cottus bairdi</i>
Starhead topminnow	<i>Fundulus dispar</i>
Rock bass	<i>Ambloplites rupestris</i>

* Listed as "Threatened" on the MDNR's list of endangered, rare, and threatened species

Chemical Contaminants – Lower 1

- Fish consumption advisories: The Michigan Department of Natural Resources and the Department of Community Health have established fish consumption advisories for the fish listed in the table below. MDCH defines “general population” as men, boys older than 15, and women beyond childbearing years, and “women and children” as women who are pregnant or breastfeeding, women who intend to have children, girls older than 15, and all children under 15.

Fish Consumption Advisories for the Lower 1 Subwatershed.

Location	Species	Contaminant(s)	Specifics of Advisory
Entire Lower Branch	Carp, suckers	PCBs	No consumption of fish of any size by women, children, or the general population.

Toxic Chemicals in Water and Sediment

- In 1996, RPO measured the concentrations of potentially toxic metals and organic compounds in water and sediment at one location in the Lower 1 subwatershed, and also performed water and sediment toxicity tests (table, below). The water sample was toxic to fathead minnows but not to green algae, and it did not contain significant concentrations of the contaminants measured. The sediment tested was also toxic to amphipods but not to aquatic insect larvae (midges), and it contained elevated concentrations of PAHs (cyclic compounds derived from fossil fuel combustion).

Results of the 1996 RPO Toxics Survey: Lower 1 Subwatershed

Location	Toxic in Water Bioassay?	Toxic in Sediment Bioassay?	Significant* Toxics in Water	Significant** Toxics in Sediment
Sines Drain, at Sheldon Road	Yes	Yes	None	PAHs

* Exceeded MDEQ criteria for wildlife exposure

** Exceeded NOAA guideline sediment quality values

- In 1993, RPO staff collected and analyzed 11 surficial sediment samples from the Lower 1 subwatershed. All samples were analyzed for PCBs, PAHs, and 12 metals. Only two samples exceeded the NOAA ER-M sediment quality values for any of the contaminants; near Haggerty Road and Lotz Road, for PCBs. In general, surficial sediments in the Lower 1 are fairly uncontaminated.

Other Aquatic Life – Lower 1 Subwatershed

Macroinvertebrate Community

- The most recent MDNR macroinvertebrate survey with extensive coverage of the watershed was performed in 1986. (Note that the MDEQ has changed its scoring protocol since this report, and that the '86 data have not been re-scored.) Results for the one Lower 1 subwatershed station are below.

Results of the 1986 MDNR Macroinvertebrate Survey

Location Sampled	Score	Comments
Sheldon Rd.	Poor	Similar to conditions in 1978.

Rouge River Report Card Indicators – Lower 1 Subwatershed

The Rouge Remedial Action Plan Advisory Council (RRAC) has written a Rouge River Watershed Report Card, which summarizes data and objectives for 18 indicators of watershed conditions, ranging from water quality to government stewardship. Eight of these indicators address factors that biological and ecological conditions in the watershed. The report card takes a watershed-wide perspective on these indicators. The table below summarizes these eight indicators for the Lower 1 subwatershed.

Status of Selected Rouge River Report Card Indicators in the Lower 1 Subwatershed.

Indicator	Status	Watershed Trend*
5. Toxic Chemicals & Fish Consumption Advisories	- Fish consumption advisories still in effect - Contaminant concentrations in sediments relatively low - Toxicity observed in water and sediments from Sines Drain at Sheldon Rd.	↑
6. Water Quality – Aquatic Life	- DO was continuously monitored at 2 locations in 1994, and was below 5 mg/L 12 % to 20 % of the time (see 1998 Baseline Data Summary Report for additional data). - Toxicity observed in water from Sines Drain at Sheldon Rd.	↔
7. Riparian Zone	Habitat loss due to bank erosion and continuing development a concern	↓
8. Wetlands, Woodlands, & Meadows	Habitat loss due to continuing development a concern	↓
9. Wildlife	Habitat loss due to continuing development a concern	↓
10. Stream Flow & Habitat	Increase in flow variation due to continuing development a concern	↓
11. Fish	- Fairly low number of species found - Small numbers of salmon and steelhead migrate into river each year, but almost certainly can not reproduce	↔
12. Benthos	Habitat loss due to stream degradation a concern	↓

* ↑ = condition improving; ↓ = condition deteriorating; ↔ = condition unchanged; ? = insufficient data to evaluate recent trend

Biological and Ecological Features, and Ecological Impairments

Lower 2 Subwatershed

Introduction

This document summarizes the information available on the status of the aquatic biology and ecological impairments in the Rouge River Main 1-2 subwatershed. It emphasizes data gathered since the Rouge River National Wet Weather Demonstration Project began, and is mostly drawn from reports issued by the Rouge Program Office (RPO), the Michigan Department of Environmental Quality (MDEQ) and the Department of Natural Resources (MDNR) during the 1990s.

This document summarizes information for the following topics for the Lower 2 subwatershed:

- Aquatic habitat quality
- Fish community
- Other aquatic life
- Chemical contamination
- Rouge River Report Card

Aquatic Habitat Quality – Lower 2 Subwatershed

- In 1996, RPO staff evaluated aquatic habitat quality at seven locations in the Lower 2 subwatershed, using the MDEQ's GLEAS 51 protocol (see attached map). One location was determined to have "Good" aquatic habitat; two had "Fair" habitat; and the remaining four locations had "Poor" habitat. Identified habitat problems included excessive flow variation, a lack of riffles and pools, unstable banks, and a lack of streamside cover.
- Reducing post-storm peak flows is the most important factor in improving aquatic habitat quality.

Fish Community – Lower 2 Subwatershed

Summary of 1995 MDNR Fish Monitoring Survey; Lower 2

Location	# Species	GLEAS Score*	IBI Score*	Intolerant Species Found?	Comment
Newburgh Rd.	10	G	P-VP		Severe erosion; petroleum odor
Ford Field Park	11	F	P		Sewage and petroleum odors

*E = excellent; G = good; F = fair; P = poor; VP = very poor

- The 1995 MDNR fish monitoring survey sampled fish populations at 2 locations in the Lower 2 subwatershed (see attached figure, and table, above). Using the MDEQ GLEAS 51 scoring procedure, the fish community was characterized as “Good” at one location, and “Fair” at one location. The Index of Biotic Integrity scores were consistently lower than the GLEAS scores, and were felt to better reflect the status of the fish communities.
- Limited numbers of Chinook salmon (a.k.a. king salmon) migrate up the Lower Branch every fall. Limited numbers of steelhead (actually anadromous rainbow trout that breed in streams and live their lives in large lakes) have also been seen in the Branch. Both species are native to the Pacific coast, and have been stocked in the Great Lakes states since the 1870s. These fish were probably originally stocked in Lake Erie, and are not likely to breed successfully in the Lower Branch due to warm summer water temperatures, excessively variable water flows, and inappropriate bottom substrate (sand rather than the preferred large gravel). They do provide a small recreational fishery each year, however.
- Future monitoring: Increasing populations of almost any fish (except exotic rough fish like carp or goldfish) would be an indication of improving environmental conditions in the river. Certain species, however, are especially useful for demonstrating improving conditions. These species tend to be sensitive to turbidity, prefer cleaner, cooler water, and their distribution in the Rouge Watershed is currently quite limited. The table below lists these species for the entire watershed, and those in **bold** have been found in the Lower 2 subwatershed.

Sensitive Fish Species of the Rouge River Watershed.

Common Name	Scientific Name
American brook lamprey	<i>Lampetra appendix</i>
Redside dace*	<i>Clinostomus elongatus</i>
Spotfin shiner	<i>Cyprinella spiloptera</i>
Hornyhead chub	<i>Nocomis biguttatus</i>
Northern hog sucker	<i>Hypentelium nigricans</i>
Stonecat	<i>Noturus flavus</i>
Mottled sculpin	<i>Cottus bairdi</i>
Starhead topminnow	<i>Fundulus dispar</i>
Rock bass	<i>Ambloplites rupestris</i>

* Listed as "Threatened" on the MDNR's list of endangered, rare, and threatened species

Chemical Contaminants – Lower 2

- Fish consumption advisories: The Michigan Department of Natural Resources and the Department of Community Health have established fish consumption advisories for the fish listed in the table below. MDCH defines “general population” as men, boys older than 15, and women beyond childbearing years, and “women and children” as women who are pregnant or breastfeeding, women who intend to have children, girls older than 15, and all children under 15.

Fish Consumption Advisory for the Lower 2 Subwatershed.

Location	Species	Contaminant(s)	Specifics of Advisory
Entire Lower Branch	Carp, suckers	PCBs	No consumption of fish of any size by women, children, or the general population.

Toxic Chemicals in Water and Sediment

- In 1996, RPO measured the concentrations of potentially toxic metals and organic compounds in water and sediment at one location in the Lower 2 subwatershed, and also performed water and sediment toxicity tests (table, below). The water sample was not toxic to fathead minnows or to green algae, though it did not contain significant concentrations of PCBs and PAHs (cyclic compounds derived from fossil fuel combustion). The sediment tested was not toxic to amphipods or aquatic insect larvae (midges), though it contained elevated concentrations of PAHs.

Results of the 1996 RPO Toxics Survey: Lower 2 Subwatershed

Location	Toxic in Water Bioassay?	Toxic in Sediment Bioassay?	Significant* Toxics in Water	Significant** Toxics in Sediment
Military Road	No	No	PAHs, PCBs	PAHs

* Exceeded MDEQ criteria for wildlife exposure

** Exceeded NOAA guideline sediment quality values

- In 1993, RPO staff collected and analyzed 25 surficial sediment samples from the Lower 2 subwatershed. All samples were analyzed for PCBs, PAHs, and 12 metals. Several samples exceeded the NOAA ER-M sediment quality values for certain contaminants, especially between Beech-Daly Road and Outer Drive, for PCBs, lead, nickel, and zinc, and two stations between Middlebelt Road and Inkster Road, for zinc. In general, surficial sediments in the downstream portion of the Lower 2 are moderately contaminated – and more contaminated on average than sediments in the Lower 1 subwatershed.

Other Aquatic Life – Lower 2 Subwatershed

Macroinvertebrate Community

- The most recent MDNR macroinvertebrate survey with extensive coverage of the watershed was performed in 1986. (Note that the MDEQ has changed its scoring protocol since this report, and that the '86 data have not been re-scored.) Results for the three Lower 2 subwatershed stations are below.

Results of the 1986 MDNR Macroinvertebrate Survey

Location Sampled	Score	Comments
Newburgh Rd.	Poor	Slightly improved since 1978.
Between Beech-Daly Rd. and Telegraph Rd.	Poor	
Downstream of Outer Dr., near Brady St.	Poor	

Rouge River Report Card Indicators – Lower 2

The Rouge Remedial Action Plan Advisory Council (RRAC) has written a Rouge River Watershed Report Card, which summarizes data and objectives for 18 indicators of watershed conditions, ranging from water quality to government stewardship. Eight of these indicators address factors that biological and ecological conditions in the watershed. The report card takes a watershed-wide perspective on these indicators. The table below summarizes these eight indicators for the Lower 2 subwatershed.

Status of Selected Rouge River Report Card Indicators in the Lower 2 Subwatershed.

Indicator	Status	Watershed Trend*
5. Toxic Chemicals & Fish Consumption Advisories	- Fish consumption advisory still in effect - Contaminated sediments between Beech-Daly and Outer Dr. - Sediments in general are moderately contaminated; more so than in Lower 1	↑
6. Water Quality – Aquatic Life	- DO was continuously monitored at 1 location in 1998, and was below 5 mg/L 33.4 % of the time (see 1998 Baseline Data Summary Report for additional data).	↔
7. Riparian Zone	- Existing parklands protect habitat - Bank erosion a problem	↓
8. Wetlands, Woodlands, & Meadows	Existing parklands protect habitat	↓
9. Wildlife	- Existing parklands protect habitat - Mink observed at Hix Rd.	↓
10. Stream Flow & Habitat	Continuing development, especially in Lower 1, will increase flow variability, erosion, instream habitat degradation, etc.	↓
11. Fish	Small numbers of salmon and steelhead migrate into river each year, but almost certainly can not reproduce	↔
12. Benthos	Habitat loss due to stream degradation a concern	↓

* ↑ = condition improving; ↓ = condition deteriorating; ↔ = condition unchanged; ? = insufficient data to evaluate recent trend

References

- Adaniya, N., and J. Rathbun. 1998. RPO Technical Report – Aquatic Habitat Survey. RPO-WMGT-TR10.00. 100 pp. + appendices.
- Beam, J. and J. Braunscheidel. 1998. Rouge River Assessment. MDNR Fisheries Division Special Report No. 22. 174 pp. + 61 page appendix document.
- Catalfio, C., K. Chaffin, E. Kluitenberg, and L. Regenmorter. 1998. RPO Technical Memorandum – 1997 Baseline Data Summary for the Rouge River. RPO-WMGT-TM30.00. 63 pp. + appendices.
- Catalfio, C., Kluitenberg, E., Rathbun, J., and Aryan, S. (*In preparation*) Technical Memorandum - 1998 Baseline Data Summary. RPO-WMGT-TM34.00.
- Leonardi, Joseph M. 1996. An Assessment of the Rouge River Fish Community – 1995. MDNR Fisheries Division, Lansing, MI. 208 pp.
- Michigan Department of Natural Resources. 1987. Rouge River Quality: 1973 – 1986. MDNR Surface Water Quality Division, Report No. MI/DNR/SWQ-87/043. 47 pp. + appendices.
- Michigan Department of Natural Resources. 1989. Biological Survey of Johnson Drain –Washtenaw and Wayne Counties, Michigan – May 18, 1988. MDNR Surface Water Quality Division, Report No. MI/DNR/SWQ-89/020. 15 pp. + appendix.*
- Michigan Department of Natural Resources. 1989. Biological Survey of the Upper Section of Johnson Drain in Washtenaw County – June 7, 1989. MDNR Surface Water Quality Division, Report No. MI/DNR/SWQ-89/099. 5 pp. + appendix.*
- Michigan Department of Natural Resources. 1990. A Biological and Sediment Survey of Evans' Ditch, a Tributary to the Main Branch of the Rouge River, Oakland County, Michigan – October 4, 1989. MDNR Surface Water Quality Division, Report No. MI/DNR/SWQ-91/006. 13 pp. + appendix.*
- Michigan Department of Natural Resources and Southeast Michigan Council of Governments. 1989. Remedial Action Plan for the Rouge River Basin. (Multiple volumes.)
- Michigan Department of Natural Resources and Southeast Michigan Council of Governments. 1994. Rouge River Remedial Action Plan Update. 136 pp.
- Rouge River RAP Advisory Council. 1999. Rouge River Watershed Report Card – Interim Report. [*Final document in preparation*]
- Smith, V.E., and five others. 1995. RPO Technical Memorandum – Rouge River Watershed Sediment Reconnaissance Survey. RPO-MOD-TM38.00. 22 pp. + appendices.
- Wiley, M., P. Seelbach, and S. Bowler. 1998. Ecological Targets for Rehabilitation of the Rouge River. Submitted to the Rouge River Program Office. 79 pp.*