

Southern Illinois Water Quality

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This report presents a comparative analysis of the 2002 and 2004 biannual ambient surface water quality¹ and groundwater susceptibility data for corresponding watersheds in Southern Illinois in order to characterize the water quality of watersheds and to understand changes in water quality over time. Such information provides a critical dimension to the overall assessment of opportunities and threats across the region. The data on ambient surface water quality was obtained from the United States Environmental Protection Agency (USEPA) National Assessment Database.² Groundwater susceptibility data was obtained from the Illinois Environmental Protection Agency (ILEPA) 2004 and 2006 Illinois Water Quality Reports³, since the same criteria were used for assessment in the mentioned years.

Key Findings:

- A large portion of the assessed rivers, streams, and creeks in Southern Illinois remained “impaired” between 2002 and 2004. The average proportion of “impaired” assessed rivers, streams, and creeks in Southern Illinois was higher than the state average, and was estimated at 70.5% and 73.9% in 2002 and 2004, respectively.
- Almost all the assessed lakes, ponds, and reservoirs in the Southern Illinois watersheds were “impaired”. In 2004, the water quality of the Southern Illinois region (94.8% impaired) became comparable to the state (94.1% impaired).
- Causes of impairment in the assessed rivers in all watersheds in 2002 were chemical and physical. These causes of impairment primarily affected aquatic life and public water supply. In 2004, microbial contamination was also reported in 29.4% of assessed rivers, and does not support primary contact with water, such as swimming. As for lakes, ponds, and reservoirs, the potential causes of impairment were also chemical and physical, affecting aquatic life and public water supplies. Microbial contamination for lakes, ponds, and reservoirs was

¹ Data was available for 2006 from the EPA but errors were discovered and causes and sources of impairment were not included. Thus, 2006 data was not included in this report. Ambient surface water quality refers to the “55 universal parameters including field pH, temperature, specific conductance, dissolved oxygen, suspended solids, nutrients, fecal coliform bacteria, and total and dissolved metals”. Ambient water quality monitoring is conducted every six weeks (ILEPA, 2006, p. 29; <http://www.epa.state.il.us/water/water-quality/report-2006/2006-report.pdf>).

² http://iaspub.epa.gov/waters/w305b_report_control.get_report?p_state=IL

³ <http://www.epa.state.il.us/water/water-quality/index.html>

minimal. The level of impairment caused by any chemical or physical causes of impairment for all waterbodies varied across watersheds.

- In 2002, the top 10 probable sources of impairment of rivers included (a) agricultural activities, such as crop production, non-irrigated crop production, off farm animal holding/management; (b) resources extraction in the form of surface mining and petroleum activities; and (c) unknown sources affecting 29.4% of the assessed waters. In 2004, unknown sources affected 46.2% of the assessed rivers, streams, and creeks. Other sources included agricultural activities, hydro-modification, such as channelization and stream bank modification, resources extraction, such as surface mining and petroleum activities, and municipal point sources.
- As for lakes, the probable sources of impairment for 2002 involved agricultural activities, habitat modification, hydro-modification, recreation and tourism, municipal point sources, contaminated sediments, run off from forests, grasslands, and parklands, and land disposal. In 2004, the largest probable sources of impairment were unknown according to EPA data and affected 87.1% of the assessed lakes, ponds, and reservoirs. Other sources of impairment included agricultural activities, hydro-modification, contaminated sediments, recreation and tourism activities (other than boating), urban runoff/storm sewers, on-site treatment systems (septic systems and similar decentralized systems), forests, grasslands, and parkland runoffs, industrial point source discharge, and other sources.
- On average, 25%, 52%, and 22% of the assessed total groundwater source water area in the region are considered to be of low susceptibility, moderate susceptibility, and high susceptibility, respectively. The watershed whose groundwater is most considered to be highly susceptible is the Saline watershed.
- According to ILEPA, the probable sources of contamination are industrial and commercial activities, fuel storage, agricultural practices, and mining activities.

Introduction

This report presents a comparative analysis of the United States Environmental Protection Agency (USEPA) 2002 and 2004 biannual surface water quality data for corresponding watersheds in the Southern Illinois region, in order to characterize the water quality of watersheds and to look for changes in water quality over time. The data was obtained from the USEPA National Assessment Database.⁴ This database is a compilation of data generated by all U.S. states. Such information provides a critical dimension to the overall assessment of opportunities and threats across Southern Illinois. The report also included an assessment of groundwater susceptibility. The data was obtained from the Illinois Environmental Protection Agency (ILEPA) 2004 and 2006 Illinois Water Quality Reports⁵, since the same criteria were used for assessment in the

⁴ http://iaspub.epa.gov/waters/w305b_report_control.get_report?p_state=IL

⁵ <http://www.epa.state.il.us/water/water-quality/index.html>

mentioned years. A detailed analysis of the water quality status of groundwater sources was not feasible since data on groundwater quality was not available. However, the susceptibility data can help project the situation of groundwater sources in the Southern Illinois region.

Southern Illinois included Alexander, Edwards, Franklin, Gallatin, Hamilton, Hardin, Jackson, Jefferson, Johnson, Massac, Perry, Pope, Pulaski, Randolph, Saline, Union, Wabash, Wayne, White and Williamson counties. These counties are located within the boundaries of 13 watersheds: Big Muddy, Cache, Cahokia-Joachim, Little Wabash, Lower Mississippi-Memphis, Lower Ohio, Lower Ohio-Bay, Lower Kaskaskia, Lower Wabash, Middle Kaskaskia, Saline, Skillet, and Upper Mississippi-Cape Girardeau. Many of these watersheds (e.g. Cahokia Joachim, Little Wabash, Lower Mississippi-Memphis, Lower Ohio, Lower Ohio-Bay, and Lower Wabash) are not restricted to the boundaries of the state, but are rather shared with other states. More information on watersheds, the counties they involve, and the states that share these watersheds are presented in Table 1.

The 13 watersheds belong to the 8-digit hydrologic unit code (HUC), which is “the smallest element in the hierarchy of hydrologic units.”⁶ The 8-digit HUC represents “a geographic area representing part of all of a surface drainage basin, a combination of drainage basins, or a distinct hydrologic feature”.⁷ The USEPA and the United States Geologic Survey (USGS) use the 8-digit HUC to collect data and characterize watersheds.

⁶ USGS, 2006; p. 1; <http://water.usgs.gov/GIS/huc.html>

⁷ (USGS, 2006; p.1)

Table 1. Watersheds and their Corresponding Counties and States in the Southern Illinois Study Area

<i>Watershed</i>	<i>County/Counties</i>	<i>States Sharing Watershed</i>
Big Muddy	Franklin, Hamilton, Jackson, Johnson, Jefferson, Perry, Randolph, Union, and Williamson	Illinois
Cache	Alexander, Johnson, Pulaski, and Union	Illinois
Cahokia Joachim	Randolph	Illinois and Missouri
Little Wabash	Edwards, Gallatin, Wayne, and White	Illinois and Indiana
Lower Mississippi-Memphis	Alexander	Arkansas, Illinois, Kentucky, Missouri, Mississippi, and Tennessee
Lower Ohio	Alexander, Johnson, Massac, Pope, Pulaski, and Union	Illinois, Kentucky, and Missouri
Lower Ohio-Bay	Gallatin, Hardin, Johnson, Massac, Pope, and Saline	Illinois and Kentucky
Lower Kaskaskia	Perry and Randolph	Illinois
Lower Wabash	Edwards, Gallatin, Wabash, and White	Illinois, Indiana, Kentucky
Middle Kaskaskia	Jefferson	Illinois
Saline	Franklin, Gallatin, Hamilton, Hardin, Johnson, Pope, Saline, White, and Williamson	Illinois
Skillet	Hamilton, Jefferson, Wayne, and White	Illinois
Upper Mississippi-Cape Girardeau	Alexander, Jackson, Perry, Randolph, and Union	Illinois and Missouri

Surface Water Quality in the Designated Southern Illinois Watersheds

Proportion of Assessed Waters in the Watersheds of Southern Illinois

The USEPA 2002 and 2004 biannual surface water quality reports show that not all the rivers, streams, and creeks in Southern Illinois were assessed for ambient surface water quality. On average, ambient water quality monitoring was conducted for 56.1% and 55.2%, of the total size of rivers, creeks, and streams (Table 2a), and 88.6% and 83.8% of the total size of lakes ponds and reservoirs (Table 2b), in 2002 and 2004, respectively.

Table 2a. Size of Assessed Rivers, Streams, and Creeks for 2002 and 2004.

<i>Watershed</i>	<i>Rivers/Streams/Creeks</i>					
	<i>2002</i>			<i>2004</i>		
	<i>Total Size (Miles)</i>	<i>Assessed Size (Miles)</i>	<i>Assessed Rivers (%)</i>	<i>Total size (Miles)</i>	<i>Assessed Size (Miles)</i>	<i>Assessed Rivers (%)</i>
Big Muddy	1,255.12	801.96	63.90	1,249.78	831.21	66.50
Cache	213.73	125.02	58.49	213.86	125.11	59.58
Cahokia Joachim	526.24	303.41	57.66	536.31	310.95	57.98
Little Wabash	1266.15	576.93	45.57	1,270.26	586.23	46.15
Lower Mississippi-Memphis	*_	*_	*_	*_	*_	*_
Lower Ohio	332.18	201.93	60.79	335.74	202.66	60.36
Lower Ohio-Bay	449.54	247.47	55.05	456.56	241.38	52.87
Lower Kaskaskia	836.48	501.66	59.97	841.74	498.00	59.16
Lower Wabash	360.50	178.83	49.61	368.53	200.87	54.50
Middle Kaskaskia	962.5	518.88	53.91	963.97	437.67	45.40
Saline	584.84	370.09	63.28	578.80	331.15	57.21
Skillet	589.06	199.77	33.91	588.67	224.25	38.09
Upper Mississippi-Cape Girardeau	403.81	341.67	84.62	353.39	290.63	82.24
Total	7,780.15	4367.62	56.14%	7,757.61	4280.11	55.17

*Data on the Lower Mississippi – Memphis watershed is not available

Table 2b. Size of Assessed Lakes, Ponds, and Reservoirs for 2002 and 2004.

<i>Watershed</i>	<i>Lakes/Ponds/Reservoirs</i>					
	<i>2002</i>			<i>2004</i>		
	<i>Total Size (Acres)</i>	<i>Assessed Size (Acres)</i>	<i>Assessed Lakes (%)</i>	<i>Total size (Acres)</i>	<i>Assessed Size (Acres)</i>	<i>Assessed Lakes (%)</i>
Big Muddy	35,881.52	35,255.00	98.25	35,940.27	35,403.55	98.50
Cache	1,970.00	1,960.00	99.49	1,970.00	1,960.00	99.49
Cahokia Joachim	3,226.10	3,197.10	99.10	3,260.50	3,199.50	98.13
Little Wabash	4,680.00	4660.00	99.57	4,702.00	4,682.00	99.57
Lower Mississippi- Memphis	*_	*_	*_	*_	*_	*_
Lower Ohio	628.40	628.40	100.00	628.40	628.40	100.00
Lower Ohio-Bay	418.00	243.00	58.13	549.00	402.00	73.22
Lower Kaskaskia	2,569.10	2569.10	100.00	2,618.10	630.60	24.09
Lower Wabash	48.00	48.00	100.00	48.00	48.00	100.00
Middle Kaskaskia	26,907.10	26,781.80	99.53	27,025.10	26,919.80	99.61
Saline	3,039.5	2,958.80	97.34	3,039.5	2,958.80	97.34
Skillet	726.00	719.00	99.03	734.00	727.00	99.05
Upper Mississippi- Cape Girardeau	711.60	91.3	12.83	711.6	117.10	16.46
TOTAL	80,805.32	79,111.50	97.90	81,226.47	77,676.75	95.63

*Data on the Lower Mississippi – Memphis watershed is not available

Surface Water Quality Status Categorization

After assessing all water uses, the USEPA developed three categories to designate watersheds' surface water quality status. The water uses considered were: aquatic life protection and propagation; recreation; public water supply; and aquatic life harvesting. Waters can have: (a) "Good Status" if all "the water uses are fully supporting"; (b) "Impaired Status" if "one water use is not supporting, or not attainable"; and (c) "Threatened Status" if the water sources are neither "Good" nor "Impaired".⁸

Surface Water Quality Status in the Southern Illinois Watersheds

Water Quality of Rivers, Streams, and Creeks

On average, there were no significant changes in the water quality of rivers, streams, and creeks between 2002 and 2004 at the regional and state level. A large portion of the assessed rivers, streams, and creeks in Southern Illinois remained impaired. The average proportion of impaired rivers in Southern Illinois was higher than the state average, and

⁸ USEPA, 2004; http://iaspub.epa.gov/waters/w305b_report_control.get_report?p_state=IL

was estimated at 70.5% in 2002 and 73.9% in 2004. The portion designated as threatened in 2002 constituted around 0.2% of the assessed rivers, streams, and creeks, and was no longer ‘threatened’ in 2004 (Figure 1a).

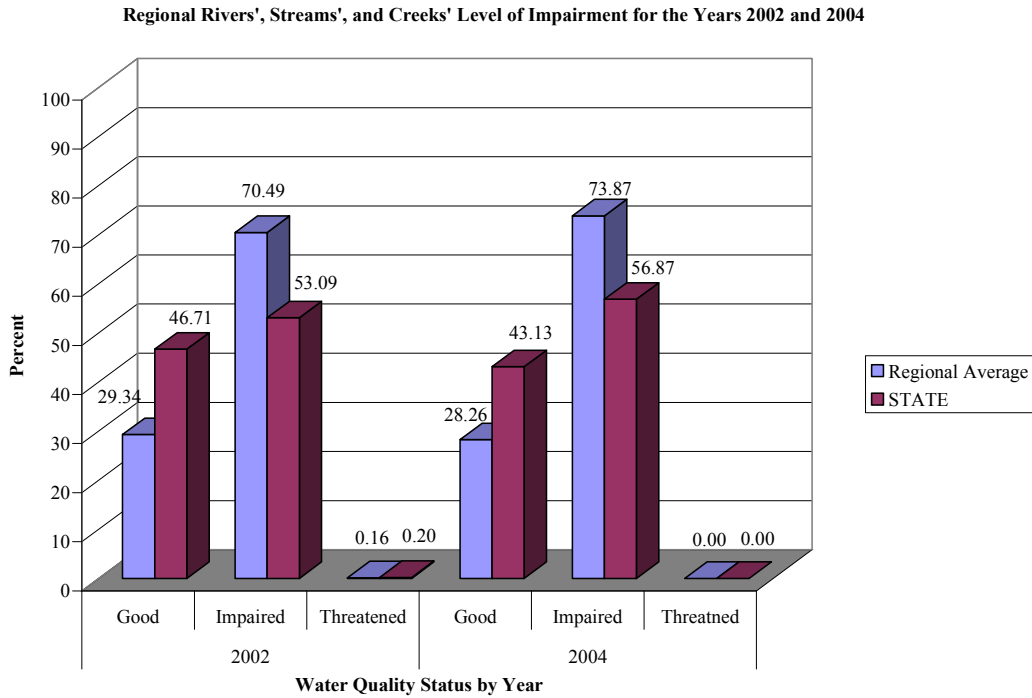


Figure 1a. Water Quality Status for the Rivers, Streams, and Creeks of the Southern Watersheds for 2002 and 2004

In the Skillet watershed, all the assessed rivers, streams, and creeks were found to be impaired in 2002 and 2004. In the Lower Wabash watershed, the water quality for the assessed rivers, streams, and creeks declined in 2004, as they became totally impaired (100%). Declines in water quality occurred in the Little Wabash watershed and Lower Kaskaskia watershed. A slight improvement in water quality occurred in the Lower Ohio, Middle Kaskaskia, and Upper Mississippi – Cape Girardeau watersheds. The only watershed which contained ‘threatened’ waters was the Middle Kaskaskia watershed, where 2.0% of the rivers and streams were designated as ‘threatened’ in 2002, but were no longer designated as such by 2004 (Table 3a).

Table 3a. Water Quality Status for the Rivers, Streams, and Creeks of the Southern Watersheds for 2002 and 2004

<i>Watershed</i>	2002			2004		
	% Good	% Impaired	% Threatened	% Good	% Impaired	% Threatened
Big Muddy	28.27	71.73	.00	27.03	72.97	.00
Cache	37.25	62.75	.00	36.94	63.06	.00
Cahokia Joachim	15.07	84.93	.00	17.41	82.59	.00
Little Wabash	25.43	74.57	.00	17.91	82.09	.00
Lower Mississippi-Memphis	*_	*_	*_	*_	*_	*_
Lower Ohio	43.46	56.54	.00	50.88	49.12	.00
Lower Ohio-Bay	62.74	37.26	.00	62.66	37.78	.00
Lower Kaskaskia	27.13	72.78	.00	24.28	98.70	.00
Lower Wabash	25.40	74.60	.00	0.00	100.00	.00
Middle Kaskaskia	28.36	69.69	1.95	36.08	63.92	.00
Saline	36.50	63.50	.00	37.62	62.38	.00
Skillet	0.00	100.00	.00	0.00	100.00	.00
Upper Mississippi-Cape Girardeau	22.47	77.53	.00	26.42	73.58	.00
Regional Average	29.34	70.49	.16	28.26	73.87	.00
STATE	46.71	53.09	.20	43.13	56.87	.00

*Data on the Lower Mississippi – Memphis watershed is not available

Water Quality of Lakes, Ponds, and Reservoirs

Almost all the assessed lakes, ponds, and reservoirs in the Southern Illinois watersheds were found to be impaired. In 2004, the level of lake water impairment in the Southern Illinois region (94.8% of assessed lakes) became comparable to that of the state (94.1%) (Figure 1b).

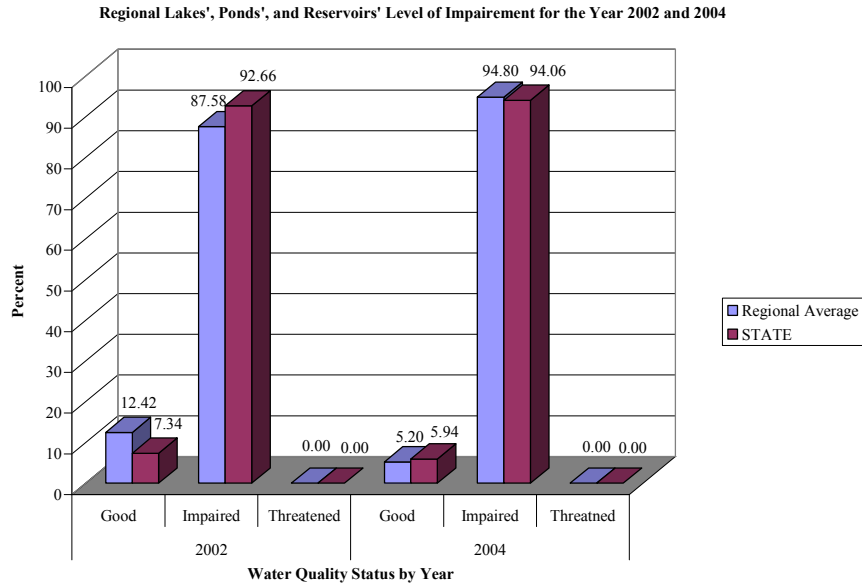


Figure 1b. Water Quality Status for the Lakes, Ponds, and Reservoirs of the Southern Watersheds for 2002 and 2004

Slight changes in water quality occurred between 2002 and 2004 for lakes, ponds, and reservoirs. The water quality declined in 2004, where, on average, 94.8% of the assessed lakes, ponds, and reservoirs were impaired. The highest decline in water quality occurred in the Lower Ohio-Bay and Saline watersheds, where in 2004, 29.9% of the Lower Ohio Bay watershed and 4.5% of the Saline watershed were designated as good, compared to 61.3% and 78.7% in 2002, respectively. The only improvement in water quality occurred in Upper Mississippi Cape Girardeau, where between 2002 and 2004 22.0% of the assessed rivers, streams, and creeks changed from impaired to good quality (Table 3b).

Table 3b. Water Quality Status for the Lakes, Ponds, and Reservoirs of the Southern Illinois Watersheds for 2002 and 2004

<i>Watershed</i>	2002			2004		
	% Good	% Impaired	% Threatened	% Good	% Impaired	% Threatened
Big Muddy	5.52	94.48	.00	3.31	96.69	.00
Cache	0.51	99.49	.00	0.51	99.49	.00
Cahokia Joachim	3.06	96.94	.00	.00	100.00	.00
Little Wabash	.00	100.00	.00	0.34	99.66	.00
Lower Mississippi-Memphis	*_	*_	*_	*_	*_	*_
Lower Ohio	.00	100.00	.00	.00	100.00	.00
Lower Ohio-Bay	61.32	38.68	.00	29.85	70.15	.00
Lower Kaskaskia	.00	100.00	.00	.00	100.00	.00
Lower Wabash	.00	100.00	.00	.00	100.00	.00
Middle Kaskaskia	.00	100.00	.00	.00	100.00	.00
Saline	78.67	21.33	.00	4.48	95.52	.00
Skillet	.00	100.00	.00	.00	100.00	.00
Upper Mississippi-Cape Girardeau	.00	100.00	.00	22.03	77.97	.00
Regional Average	12.42	87.58	.00	5.20	94.80	.00
State	7.34	92.66	.00	5.94	94.06	.00

*Data on the Lower Mississippi – Memphis watershed is not available

Causes of Impairment

The Illinois EPA set guidelines to specify the causes of impairment in the water bodies of in the state watersheds.⁹ Upon examining the 2002 and 2004 guidelines, it was found that the guidelines and the categorization of the causes of impairment were not consistent across 2002 and 2004. This led to differences in the identification and ranks of the top causes of impairment for the two years presented in this report. Therefore, across-year comparisons for the causes of impairment were not possible. This presented a major limitation for the comparative assessment presented in this report.

In 2002, the top causes of impairment of the assessed rivers, streams, and creeks were primarily chemical and physical. Microbial contamination (specifically fecal coliform) was minimal. The chemical and physical causes of impairment typically have negative impacts on aquatic life.¹⁰ Parameters that affect both aquatic life and public water supplies are chemicals, such as PCBs and metals. In 2004, fecal coliform contamination increased and affected larger portions of the assessed rivers, streams, and creeks (29.3%). The presence of such microbes does not support primary water contact, such as

⁹ ILEPA, 2002 <http://www.epa.state.il.us/water/water-quality/report-2002/305b-2002.pdf>; ILEPA, 2004 <http://www.epa.state.il.us/water/water-quality/305b/305b-2004.pdf>

¹⁰ ILEPA, 2002; ILEPA, 2004

swimming (Tables 4a). As for lakes, ponds, and reservoirs, the causes of impairment in both 2002 and 2004 were chemical and physical. Microbial contamination in both years was either minimal or not reported (Table 4b).

The impaired proportions of waterbodies caused by any chemical or physical cause of impairment varied across watersheds. More information on the range of proportions of ‘impaired’ assessed waters by watersheds is presented in Tables 4a and 4b.

Probable Sources of Impairment

In 2002, the probable sources of impairment of rivers were identified in the data. Agricultural activities, such as crop production, non-irrigated crop production, off farm animal holding/management, and pasture grazing contributed most to the impairment of the assessed rivers, streams, and creeks. Also, resources extraction in the form of surface mining and petroleum activities contribute to the impairment of these waters. Unknown sources were also found to contribute to the impairment of 29.4% of the assessed waters. In 2004, the largest probable source of impairment of the assessed rivers, streams, and creeks was unknown sources, affecting 46.2% of the size of the latter assessed waters, followed by agricultural activities, hydro-modification, such as channelization and stream bank modification, resources extraction, such as surface mining and petroleum activities, municipal point sources (Figure 2a). Detailed information regarding the percentage range of effected proportions of assessed waters by any probable source of impairment in each watershed is presented in Tables 4a and 4b.

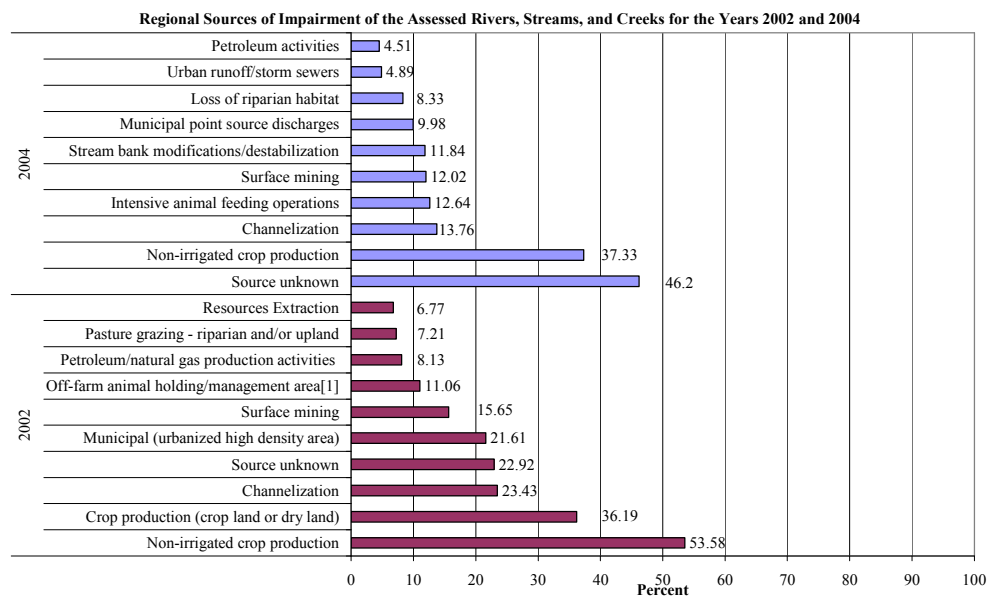


Figure 2a. Regional Probable Sources of Impairment of the Assessed Rivers, Streams, and Creeks for 2002 and 2004

As for lakes, the probable sources of impairment for 2002 involved agricultural activities, such as crop production and non-irrigated crop production, habitat modification, hydro-modification, such as stream bank modification, recreation and tourism, municipal point sources, contaminated sediments, run offs from forests, grasslands, and parklands¹¹, and land disposal. In 2004, the largest probable source of impairment was unknown, affecting 87.1% of the assessed lakes, ponds, and reservoirs; followed by agricultural activities, particularly non -irrigated crop production, hydro-modification, such stream bank modifications/destabilization, contaminated sediments, recreation and tourism activities (other than boating), urban runoff/storm sewers, on-site treatment systems (septic systems and similar decentralized systems), forests, grasslands, and parkland, industrial point source discharge, and other sources (Figure 2b). Detailed information regarding the percentage range of affected proportions of assessed waters by any probable source of impairment in each watershed is presented in Tables 5a and 5b.

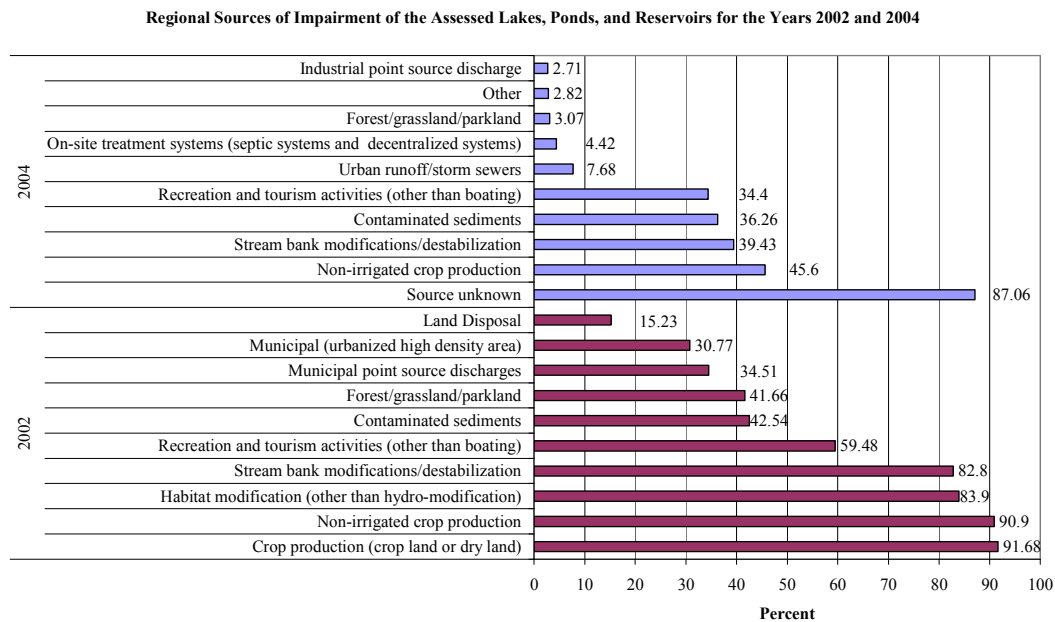


Figure 2b. Regional Probable Sources of Impairment of the Assessed Lakes, Ponds, and Reservoirs for 2002 and 2004

Groundwater Quality

Groundwater resources in the Southern Illinois region were found by the ILEPA to be susceptible to contamination. It is important to note that the level of groundwater

¹¹ Forest/grassland/parkland: “Watershed related non-point source runoff other than from previously specified sources (e.g., lawn or parkland fertilization, leaf litter/forest bed runoff) based upon actual observation and/or other existing data” (ILEPA, 2004, p. 44, <http://www.epa.state.il.us/water/water-quality/305b/305b-2004.pdf>).

susceptibility did not change between 2004 and 2006. Moreover, groundwater susceptibility data is not available to all watersheds.

On average, 25%, 52%, and 22% of the assessed total groundwater source water area in the region is considered to be of low susceptibility, moderate susceptibility, and high susceptibility, respectively. The Saline watershed's groundwater is considered to be the most highly susceptible (Table 6).

According to ILEPA, the probable sources of contamination are: industrial and commercial activities, fuel storage, agricultural practices, and mining activities.

Table 6. Groundwater Susceptibility by Watershed for 2004 and 2006

<i>Watershed</i>	<i>Low susceptibility</i>	<i>Moderate susceptibility</i>	<i>High susceptibility</i>
Middle Kaskaskia	6%	58%	36%
Lower Kaskaskia	37%	57%	7%
Big Muddy	54%	46%	0%
Mississippi South Basin	61%	39%	0%
Wabash/Skillet Fork Basin	26%	56%	18%
Saline River Bay Creek Basin	4%	44%	51%

Conclusion

This assessment reveals most of the assessed surface water bodies in the watersheds of Southern Illinois are impaired. The average level of impairment of the Southern Illinois' rivers, creeks, streams, lakes, ponds, and reservoirs did not change between 2002 and 2004 and was higher than the state's average. Improvements in the water quality did not occur from 2002 to 2004. Known and unknown sources of pollution contributed to the impairment of the assessed surface water bodies in the region.

Therefore, there is a need for the development of effective measures that can control sources of impairment to improve the availability of water in terms of quantity and quality. Collaborative watershed management schemes may be one approach to this situation. These schemes empower communities (farmers, local residents, industries, businesses, etc.), and encourage them to be involved in planning, decision making, and implementation phases of the management process. Empowering community members to get involved in the management process is essential to strengthen their commitment towards their communities and the environment, in order to improve the social, ecological, economic, and health wellbeing.

Table 4a. The Top Ten Causes of Impairment in the Assessed Rivers, Streams, and Creeks in Southern Illinois for 2002 and 2004

Rank	Cause of Impairment	2002			2004			
		Size Affected (Miles)	% Size Affected	Affected Watersheds*	Cause of Impairment	Size Affected (Miles)	% Size Affected	Affected Watersheds*
1	Nutrients ¹²	3,921.89	89.79	BM, CH, LK , LW, LO, LWW, MK, LOB, SA, SK, UMCG	PCBs	1,867.96	40.02	CJ, LO, LOB , LWW , SK , UMCG
2	Organic enrichment/ Low Dissolved Oxygen	3,267.89	74.82	BM , CH, CJ, LW , LK, LO, MK, LOB, LWW, SK , UMCG	Low Dissolved Oxygen (DO)	1713.03	43.64	BM , CH, CJ, LW , LK , LO, MK , LOB, LWW, SK , UMCG
3	Other habitat alterations	2,770.70	63.44	BM, CH , CJ , LO, LW, LK, LWW, LOB, MK, SA, SK , UMCG	Fecal coliform	1,257.21	29.37	BM, CH, CJ, LW, LK, LWW, MK, UMCG .
4	PCBs (Aquatic life, Public Water Supply)	2,020.23	46.25	CJ, LO, LWW , LOB, SK , UMCG	Sedimentations/Siltation	1,130.81	26.42	BM, CH, CJ, LW , LK , LO, LOB, LWW, MK, SA, SK, UMCG
5	Sedimentations/ Siltation (Aquatic life)	1,794.06	41.08	BM, CH, CJ, LK , LW, LO, MK, LOB, LWW, SA, SK, UMCG,	Phosphorus	946.63	22.12	CJ, LK , LW , LO, MK, LWW, SA, UMCG
6	Phosphorus (elemental)	1,543.44	35.34	CH, CJ, LK, LW, LO, MK, LWW, SA, SK, UMCG,	Habitat Assessment ¹³	926.98	21.66	BM, CH , CJ, LO, LW, LOB, SA, SK.
7	Total Suspended Solids (TSS)	992.5	22.72	BM, CH, CJ, LK, LW, LWW, MK, SA, SK, UMCG,	Manganese	673.85	15.74	BM , CH, CJ, LW , LK, LOB, LWW, MK, SA, SK, UMCG
8	Nitrogen, Ammonia (Total Ammonia)	762.08	17.45	BM, CH, CJ, LK, LO, LW, LWW, LOB, MK, SA, SK, UMCG,	Total Suspended Solids (TSS)	602.00	14.07	BM, CH, LW, LK, MK, LWW, SA, SK, UMCG
9	Metals ¹⁴ (Aquatic life, Public Water Supply)	742.39	17.00	BM , CH, CJ, LW, LK, LOB, MK, SA, SK,	Nitrogen (Total) (Aquatic life)	514.54	12.02	CJ, LK, LO, LWW, MK
10	Nitrates	611.88	14.01	CJ, LK, LO, LW, MK, SA, UMCG	Mercury (Aquatic life, Public Water Supply)	470.41	10.99	LO, LOB, LWW

¹² Nutrients; include Total Phosphorus, Total Ammonia-N, Inorganic-N, and Nitrates

¹³ Habitat assessment (streams) “usually indicates alterations in streamside or littoral vegetative covers” (ILEPA, 2006; p.103, <http://www.epa.state.il.us/water/water-quality/report-2006/2006-report.pdf>)

¹⁴ Metals include (barium, boron, iron, manganese, nickel, silver or any of Arsenic, Cadmium, Copper, Chromium, Lead, Mercury, Selenium, Zinc (ILEPA, 2002 <http://www.epa.state.il.us/water/water-quality/report-2002/305b-2002.pdf>))

* BM: Big Muddy; CH: Cache; CJ: Cahokia Joachim; LW: Little Wabash; LO: Lower Ohio; LOB: Lower Ohio Bay; LK: Lower Kaskaskia; LWW: Lower Wabash; MK: Middle Kaskaskia; SA: Saline; SK: Skillet; UMCG: Upper Mississippi Cape Girardeau

*Not bold; if a cause of impairment affected <40.00% of the assessed rivers, streams, and creeks.

*Bold; if a cause of impairment affected 40.00% to 69.00% of the assessed rivers, streams, and creeks.

*Bold and underlined; if a cause of impairment affected 70.00% to 100.00% of the assessed rivers, streams, and creeks.

Table 4b. The Top Ten Causes of Impairment in the Assessed Lakes, Ponds, and Reservoirs of Southern Illinois for 2002 and 2004

Rank	Cause of Impairment	2002		Affected Watersheds	Cause of Impairment	2004		Affected Watersheds
		Impaired Acres	% Size Affected			Impaired Acres	% Size Affected	
1	Nutrients	68,354.20	86.40	<u>BM, CH, CJ, LW, LK, LO, LWW, MK, SA, SK, UMCG</u>	Manganese	57,424.30	74.04	<u>BM, CJ, LW, LK, LO, LOB, MK, SA, SK, UMCG</u>
2	Sedimentation/siltation	66,987.20	84.67	<u>BM, CH, CJ, LK, LW, LO, LOB, LWW, MK, SA, SK</u>	Phosphorus (total)	36,131.7	46.59	<u>BM, CJ, LW, LK, LO, LOB, MK, SA, SK</u>
3	Total suspended solids (TSS)	52,794.40	66.73	<u>BM, CH, CJ, LW, LWW, LK, LO, LOB, MK, SA, SK, UMCG</u>	Excess algal growth	36,123.5	46.58	<u>LW, LK, LO, MK, SA, SK</u>
4	Organic enrichment/low DO	49,574.70	62.66	LK, LW, <u>LOB, LWW, MK, SA, SK</u>	Total suspended solids (TSS)	35,137.7	45.30	<u>BM, CJ, LW, LK, LO, LOB, MK, SA, SK</u>
5	Suspended algae	44,023.70	55.65	<u>BM, CH, CJ, LW, LO, LK, LWW, MK, SA, SK, UMCG</u>	Phosphorus	35,022.7	45.16	<u>BM, CJ, LW, LK, LO, MK, SA, SK</u>
6	Phosphorus, elemental	40,493.00	51.18	<u>BM, CH, CJ, LW, LK, LO, LWW, MK, SA, SK, UMCG</u>	Polychlorinated biphenyls	9,329.00	12.03	<u>BM, CJ</u>
7	Non-native aquatic plants	25,619.90	32.38	<u>LO, LWW, MK, SA, UMCG</u>	Mercury	6,125.00	7.90	<u>BM</u>
8	Low Dissolved Oxygen	21,153.00	26.74	<u>BM, CH, CJ, LO</u>	pH	3,032.00	3.91	<u>CJ, MK</u>
9	Nitrogen, ammonia (total ammonia)	14,151.40	17.89	<u>CH, CJ, LO, LK, LW, MK, SA, SK, UMCG</u>	Non-native fish/animals	2,187.00	2.82	<u>CJ</u>
10	Priority organics (such as Endrin, Dieldrin, Heptachlor, etc.)	11,199.70	14.16	<u>BM, CJ, LW, LK, LO, MK, SA,</u>	Heptachlor	2,107.00	2.72	<u>CJ</u>

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*Bold; if a cause of impairment affected 40.00% to 69.00% of the assessed lakes, ponds, and reservoirs.

*Bold and underlined; if a cause of impairment affected 70.00% to 100.00% of the assessed lakes, ponds, and reservoirs.

Table 5a. Probable Sources of Impairment in the Assessed Rivers, Streams, and Creeks in Southern Illinois for 2002 and 2004

Rank	Source of Impairment	2002			2004			
		Size Affected (Miles)	% Size Affected	Affected Watersheds*	Source of Impairment	Size Affected (Miles)	% Size Affected	Affected Watersheds*
1	Non-irrigated crop production	2,339.97	53.58	BM, CH, CJ, LK, LO, <u>LW</u>, MK, LOB, LWW, SA, <u>SK</u>, UMCG	Source unknown	1,977.48	46.20	BM, CH, CJ, LO, <u>LW</u>, LK, LOB, <u>LWW</u>, MK, SA, SK, UMCG
2	Crop production (crop land or dry land)	1,580.53	36.19	BM, CH, CJ, LK, LO, <u>LW</u>, MK, LWW, LOB, SA, <u>SK</u>, UMCG	Non-irrigated crop production	1,597.59	37.33	BM, CH, CJ, LW, LK , LWW, LO, LOB, MK, SA, SK, UMCG
3	Channelization	1,023.40	23.43	BM, CH, CJ, LO, LK, LW, LWW, LOB, SA, SK , UMCG	Channelization	589.08	13.76	BM, CH, CJ, LO, LW, LK, LOB, LWW, SA, SK, UMCG
4	Source unknown	1,001.04	22.92	CJ, BM, LO, LK, LW, LOB, SA, SK , UMCG	Intensive animal feeding operations	540.86	12.64	BM, CH, CJ, LK, LW, LO, LWW, SK, UMCG
5	Municipal (urbanized high density area)	943.78	21.61	CJ, BM, LK, LO, LW, MK, SA, UMCG	Surface mining	514.54	12.02	BM , LK, SA, SK, UMCG
6	Surface mining	683.66	15.65	BM, LK, SA, SK, UMCG	Stream bank modifications/destabilization	506.93	11.84	BM, CH, CJ, MK, LW, LO, LK, SA
7	Off-farm animal holding/management area ¹⁵	483.01	11.06	BM, CH, CJ, LO, LW, LWW, SA, SK , UMCG	Municipal point source discharges	427.36	9.98	BM, CJ, LK, LO, LW, MK, SA, UMCG
8	Petroleum/natural gas production activities	355.02	8.13	BM, LW, MK, SA	Loss of riparian habitat	356.4	8.33	BM, CJ, LW, SA, UMCG
9	Pasture grazing - riparian and/or upland	314.98	7.21	BM, CH, CJ, LO, LK, LW, SK, UMCG	Urban runoff/storm sewers	209.33	4.89	BM, CJ, LK, LO, LW, MK, SA, UMCG
10	Resources Extraction	295.99	6.77	BM, LW, MK, SA	Petroleum activities	192.85	4.51	BM, LW, LWW, SA

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*Not bold; if a source of impairment affected <40.00% of the assessed rivers, streams, and creeks.

*Bold; if a probable source of impairment affected 40.00% to 69.00% of the assessed rivers, streams, and creeks.

*Bold and underlined; if a probable source of impairment affected 70.00% to 100.00% of the assessed rivers, streams, and creeks.

¹⁵ Animal Holding: "Animal holding buildings and impervious areas based upon satellite land use, actual observation and/or other existing data." (ILEPA, 2004, p. 41, <http://www.epa.state.il.us/water/water-quality/305b/305b-2004.pdf>)

Table 5b. Probable Sources of Impairment in the Assessed Lakes, Ponds, and Reservoirs in Southern Illinois for 2002 and 2004

Rank	Source of Impairment	2002		Affected Watersheds*	Source of Impairment	2004		Affected Watersheds*
		Size Affected (Acres)	% Size Affected			Size Affected (Acres)	% Size Affected	
1	Crop production (crop land or dry land)	71,214.80	91.68	<u>BM, CH, CJ, LW, LK, LO, LWW, LOB, MK, SA, SA, UMCG</u>	Source unknown	67,624.80	87.06	<u>BM, CJ, LW, LK, LO, LOB, MK, SA, SK, UMCG</u>
2	Non-irrigated crop production	70,608.80	90.90	<u>BM, CH, CJ, LK, LW, LO, LOB, LWW, MK, SA, SK, UMCG</u>	Non-irrigated crop production	35,424.20	45.60	<u>BM, CJ, LW, LK, LO, MK, SA, SK</u>
3	Habitat modification (other than hydro-modification)	65,172.10	83.90	<u>BM, CH, CJ, LW, LO, LOB, MK, SA, SK, UMCG</u>	Stream bank modifications/destabilization	30,626.70	39.43	<u>BM, CJ, LW, MK, SA, SK</u>
4	Stream bank modifications/destabilization	64,313.10	82.80	<u>BM, CH, CJ, LW, LO, MK, SA, SK, UMCG</u>	Contaminated sediments	28,162.00	36.26	<u>CJ, LK, MK</u>
5	Recreation and tourism activities (other than boating)	46,200.00	59.48	<u>BM, CJ, LW, MK, SK</u>	Recreation and tourism activities (other than boating)	26,718.30	34.40	<u>BM, CJ, LW, MK, SK</u>
6	Contaminated sediments	33,042.30	42.54	<u>BM, CJ, LO, LK, LWW, MK, SA</u>	Urban runoff/storm sewers	5,967.40	7.68	<u>BM, CJ, LW, MK, SA</u>
7	Forest/grassland/parkland	32,361.40	41.66	<u>BM, CH, CJ, LO, LW, LOB, MK, SA, SK, UMCG</u>	On-site treatment systems (septic systems and similar decentralized systems)	3,431.00	4.42	<u>BM, CJ, LW, MK</u>
8	Municipal point source discharges	26,806.00	34.51	<u>BM, CJ, LW</u>	Forest/grassland/parkland	2,382.50	3.07	<u>BM, CJ, LW, LO, LOB, SK, SA</u>
9	Municipal (urbanized high density area)	23,901.40	30.77	<u>BM, CJ, LK, LW, MK, SA</u>	Other	2,187.00	2.82	<u>CJ</u>
10	Land Disposal	12050.50	15.23	<u>BM, CH, CJ, LW, LWW, MK, SA, SK</u>	Industrial point source discharge	2,107.00	2.71	<u>CJ</u>

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*Bold; if a cause of impairment affected 40.00% to 69.00% of the assessed lakes, ponds, and reservoirs.

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