UNIVERSITY of WISCONSIN
UWMILWAUKEE

The State of Milwaukee's Environment:

Preliminary Report

A Report Prepared by:
The University of Wisconsin-Milwaukee
Center for Economic Development
September 13, 2004

About This Report

This report was produced at the University of Wisconsin-Milwaukee Center for Economic Development (UWMCED), a unit of the College of Letters and Science at the University of Wisconsin-Milwaukee. The College established UWMCED in 1990, with the assistance of a grant from the U.S. Department of Commerce, Economic Development Administration's "University Center" program, to provide university research and technical assistance to community organizations and units of government working to improve the Greater Milwaukee economy. In 2000, UWMCED also became part of UWM's "Milwaukee Idea," as one of the core units of the "Consortium for Economic Opportunity." The analysis and conclusions presented in this report are solely those of UWMCED and do not necessarily reflect the views and opinions of UW-Milwaukee or the U.S. Department of Commerce.

The author of this report is Christopher De Sousa, assistant professor of Geography and Urban Studies and Co-Director of the Brownfields Research Consortium. Dr. De Sousa has been involved in several sustainability reporting projects and gathered the environmental information here as preliminary background for a more comprehensive State of the City report to be carried out in the future by UWMCED. Ryan Ranker, a research assistant at the Center, and Deanna Benson, Bethany Poprocky, and Jeff Barke, students in Geography and Urban Studies, provided indispensable assistance.

UWMCED strongly believes that informed public debate is vital to the development of good public policy. The Center publishes briefing papers, detailed analyses of economic trends and policies, and "technical assistance" reports on issues of applied economic development. In these ways, as well as in conferences and public lectures sponsored by the Center, we hope to contribute to public discussion of economic development policy in Southeastern Wisconsin.

Further information about the Center and its reports and activities is available at our web site: www.ced.uwm.edu

THE STATE OF MILWAUKEE'S ENVIRONMENT: PRELIMINARY REPORT

Christopher A. De Sousa
Department of Geography
Urban Studies Program
University of Wisconsin - Milwaukee

Center for Economic Development Briefing Paper &
Department of Geography Occasional Paper

2004

Table of Contents

Introduction & Acknowledgements

This report examines the state of Milwaukee's environment based on a review of air, water, and land indicators. Data from published sources was gathered periodically between 2000 and 2002 as preliminary background for a more comprehensive State of the City report to be carried out in the future by UW-Milwaukee's Center for Economic Development, which will examine a broader array of social, economic, and environmental indicators.

Initially, an attempt was made to gather information for the city of Milwaukee exclusively, so that it could be compared with other cities in the "frostbelt" (i.e., Detroit, Boston, Chicago, Pittsburgh, Philadelphia, Buffalo, Cleveland, Baltimore, St. Louis, Minneapolis, Cincinnati, Indianapolis, Columbus). However, due to the paucity of comparable environmental data from other cities, it was decided to compile information that was relevant to Milwaukee's situation and compare it to only those cities that had similar data. In addition, environmental data is not always recorded according to city boundaries, so readers should be aware that the information reported here may concern the city of Milwaukee, the county, or another geographic unit defined by the organization responsible for collecting the data.

Information for the present report was gathered by the author and by several students to whom I extend my utmost gratitude, including: Deanna Benson, Bethany Poprocky, and Jeff Barke.

Readers with data that might be useful for future updates of this study are strongly encouraged to contact the author.

Note, any errors or omissions this report may contain are the sole responsibility of the author.

Christopher De Sousa
Assistant Professor
Department of Geography
University of Wisconsin-Milwaukee
Bolton Hall, Room 410
PO Box 413
Milwaukee, WI
53201-0413 USA
Phone (414) 229-4874
Fax (414) 229-3981
E-mail desousa@uwm.edu

The State of Milwaukee's Air

Increasingly, as media reports dramatize the ill effects of air pollution on a regular basis, there is serious concern over the effects that pollution has been wreaking on human health and the natural environment. This concern has been especially noticeable in urban areas, which have been identified by scientific research as greatly at risk, since it is estimated that air pollution in such areas is responsible for causing thousands of deaths per year and costing millions of dollars in health care. Table 1.0 summarizes some of the documented effects that air pollution has had on health, the environment, and quality of life.

In this section of the report, key pollution indicators of Milwaukee's air quality are identified and discussed. The data are presented as averages of concentrations found in certain monitoring sites located in each "Metropolitan Statistical Area established by the US EPA (2000). Data on urban transportation (mobility) and air pollution emissions by manufacturing facilities are also discussed, given that these are major sources of pollution. For most of the indicators discussed below, the Frostbelt jurisdictions are compared and ranked on the basis of the percent change witnessed between 1990 and 2000. There are many other approaches for analyzing and comparing trend data and many are more sensitive to annual fluctuations and trends over time than the one utilized here. However, the percentage change value is easy to understand and helps us answer the simple question, what is our situation in 2000 compared with that in 1990? For the air quality data however, the percentage change value (1990 and 2000) and the general trend description reported by the US EPA (1998a) for 1989 – 1998 (up, down, not significant) are listed in Figures 1.0 and 1.1.

Table 1.0

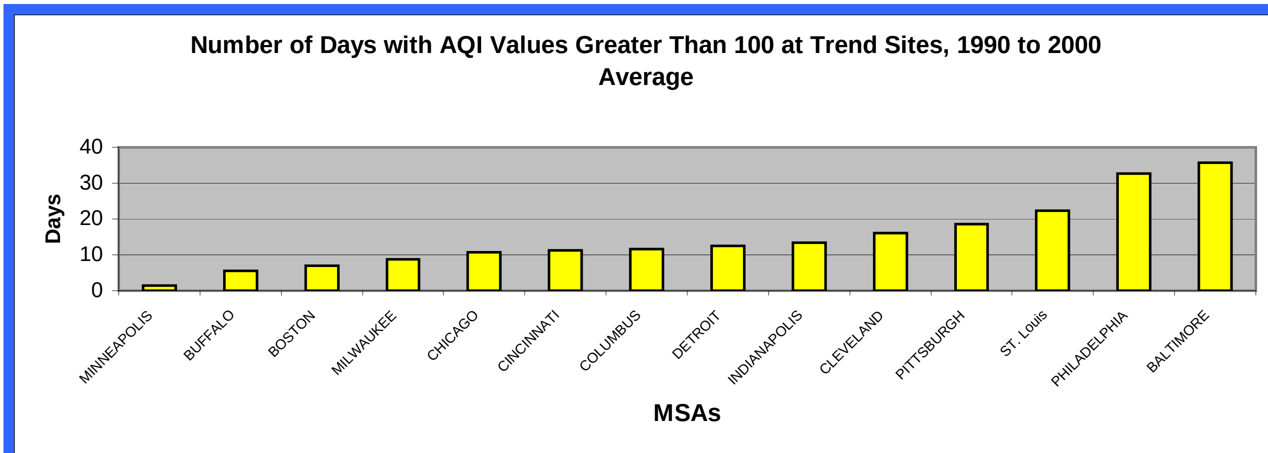
	Primary Sources (US EPA 1997, 1998a)	Urban Air Quality	Smog	Health	Global Warming	Aesthetics	Acid Deposition
Carbon Monoxide	▪ Transportation (79%) ▪ Fuel Combustion (6%) ▪ Industrial (5%)	✓		✓			
Lead	▪ Industrial (74%) ▪ Transportation (13%) ▪ Fuel combustion (13%)	✓		✓			
Oxides of Nitrogen	▪ Transportation (53%) ▪ Fuel Combustion (42%) ▪ Industrial (4%)	✓	✓	✓	✓	✓	✓
Ozone	▪ NOx and VOCs	✓	✓	✓	✓		
Particulates	▪ Fuel Combustion (39%) ▪ Industrial (36%) ▪ Transportation (25%)	✓	✓	✓	✓	✓	✓
Sulfur Dioxide	▪ Fuel Combustion (85%) ▪ Industrial (8%) ▪ Transportation (7%)	✓	✓	✓	✓	✓	✓

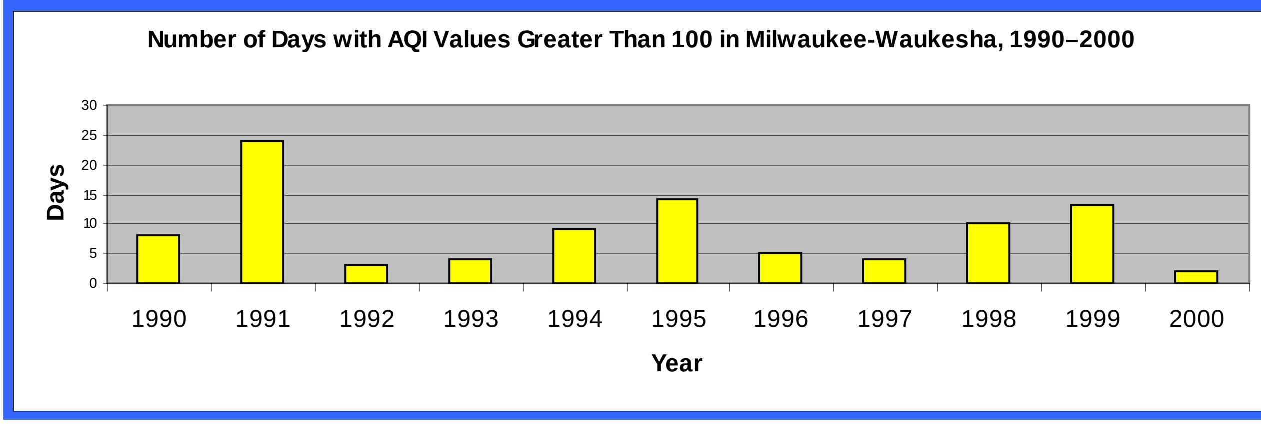
General Air Quality

The EPA employs an Air Quality Index (AQI) to report on daily air quality. The AQI makes it possible to identify the human health effects that ensue after only a few hours of exposure to polluted air. The Index ranges from 0 to 500, taking into account five of the major air pollutants listed above that are regulated by the Clean Air Act: ground-level ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrogen dioxide. The higher the Index reading, the greater the risk to human health. An AQI value of 100 is the level the EPA has set as the upper threshold: i.e. AQI values below 100 are considered to have few adverse effects, while those above 100 are considered to entail risks of various kinds, especially for "high risk categories" of people such as children, elderly individuals, people with asthma, etc.

During the 1990s, the Milwaukee MSA typically experienced between 2 to 15 days in which the AQI values exceeded the EPA standard. The Milwaukee AQI was lower on average than that recorded by other Frostbelt cities during the same period.

Figures 1.0 & 1.1



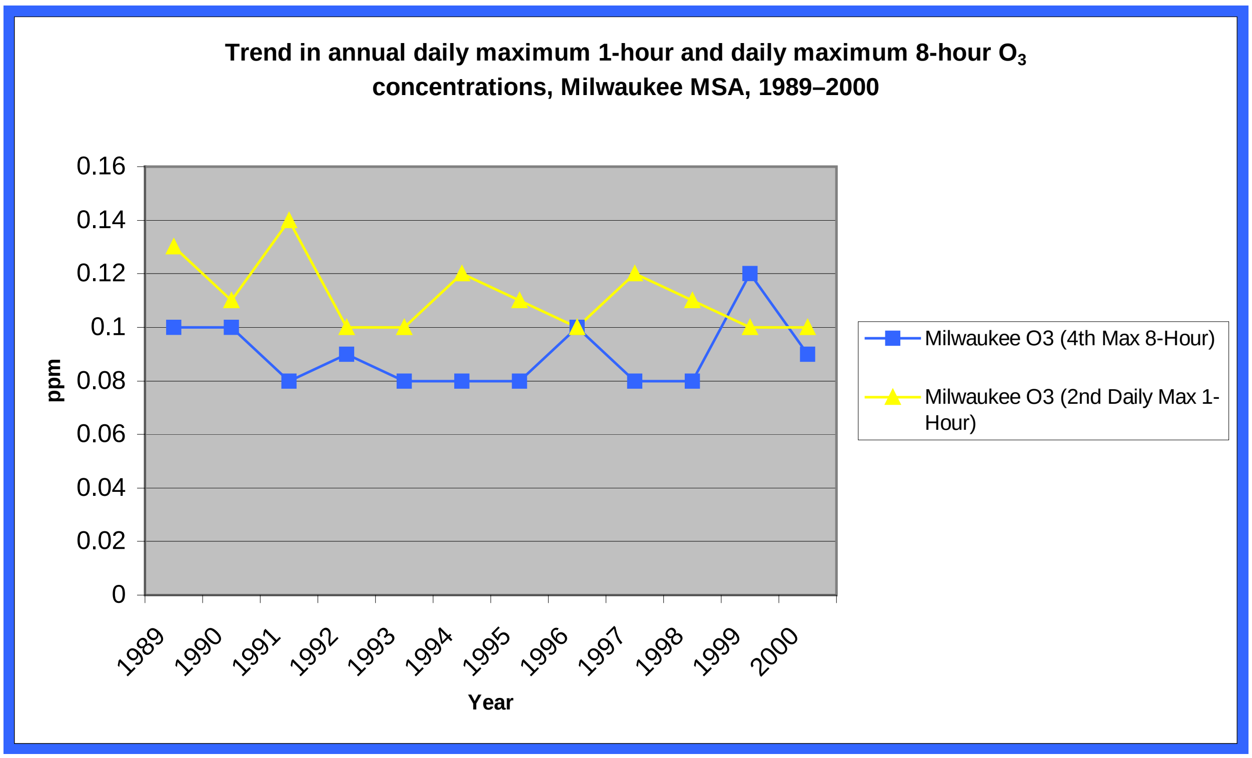


Ozone

Ozone is perhaps the air pollutant of greatest concern in urban areas because it is the primary component of the smog that plagues cities on hot summer days. Ground-level ozone is formed in the atmosphere by the reaction of Volatile Organic Compounds and Nitrogen Oxides in the presence of heat and sunlight, which are most abundant in the summer. It contributes to a host of negative health, ecological, and overall well-being effects, including lung irritation, difficulty in breathing, damage to vegetation, and poor visibility. Ten to twenty percent of all summertime respiratory-related hospital visits in the northeastern US are linked to ozone pollution effects (US EPA 1997). Generally, ozone levels are considered unhealthy for sensitive categories of people when they exceed an 8-hour concentration of 0.085ppm or a 1-hour concentration of 0.125 ppm.

The trend information for the Milwaukee MSA reveals that like the other Frostbelt MSAs the concentration of ozone remained quite stable during the 1990s. However, these concentrations hovered along both the 1-hour and the 8-hour maximum concentrations considered healthy for sensitive groups. On the positive side, Milwaukee witnessed slightly less of an increase in daily maximum 8-hour concentrations and a greater reduction in daily maximum 1-hour concentrations than most other Frostbelt cities over the decade (see Figure 1.2).

Figure 1.2

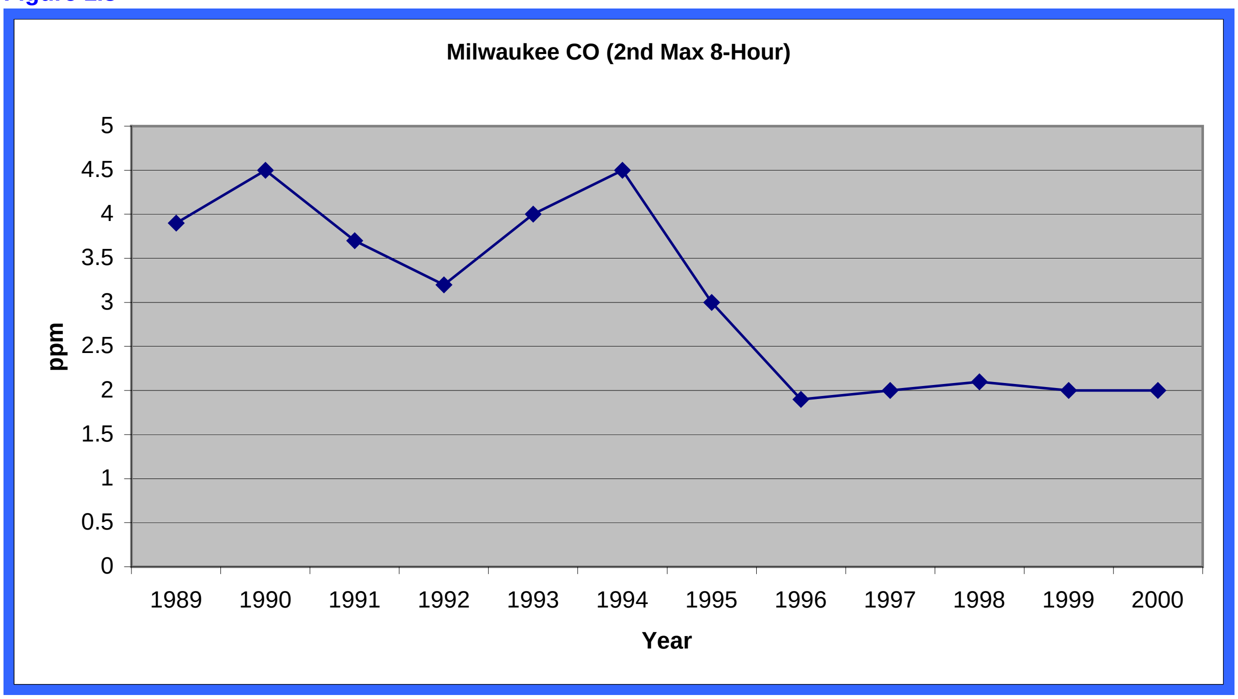


Carbon Monoxide

Carbon Monoxide is a colorless, odorless, tasteless and poisonous gas produced by the incomplete combustion of fossil fuels. Levels are typically high in urban areas during periods of heavy traffic congestion. Exposure to elevated levels of this gas may cause dizziness, impairment of the ability to learn, and difficulty in performing complex mental tasks. Ambient CO (8 hour average) is unhealthy for sensitive groups at 9.5 ppm, especially among those suffering from cardiovascular diseases.

Figure 1.3 reveals that Milwaukee's level of CO in 2000 was almost 50% lower than in 1989, remaining at concentrations considered moderate by the EPA. This declining trend is similar to the one document for most of the other Frostbelt cities and is due largely to improved vehicle emission standards.

Figure 1.3

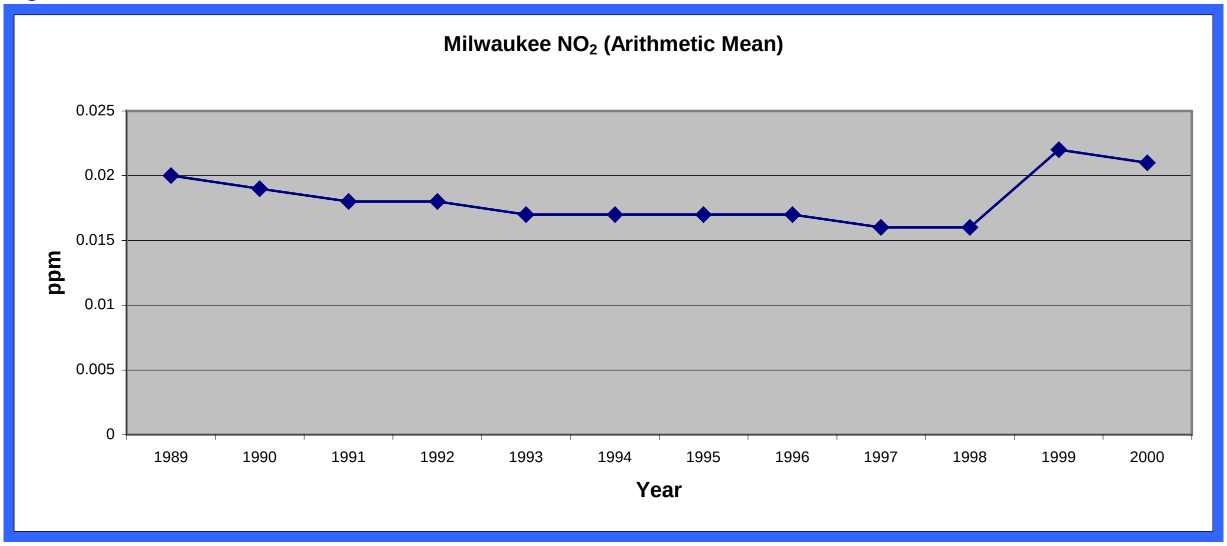


Nitrogen Dioxide

Nitrogen is an abundant, harmless gas in the earth's atmosphere. However, when it is combusted at extremely high temperatures (e.g. through the burning of coal, oil and gas), various oxides of nitrogen (NO and NO_2) may result, constituting dangerous sources of urban air pollution. NO_2 is a product of NO that produces odor, reacts with hydrocarbons in sunlight to form ozone, and may further oxidize to form nitric acid, a component of acid rain. The primary health concern associated with NO_2 is an increase in respiratory problems in sensitive groups and an increase in respiratory conditions and illnesses among children. Nitrogen oxides also contribute to a host of environmental and general well-being effects including the corrosion of materials, adverse effects on vegetation, and the eutrophication or acidification of terrestrial and aquatic habitats.

Data for NO_2 (annual mean concentrations) in Milwaukee reveal that there was a steady decline in levels up to 1998, followed by an increase in 1999 and 2000 (see Figure 1.4). These levels remained below the national air quality standard of 0.053 ppm. As with other Frostbelt cities, Milwaukee witnessed an increase in NO_2 levels in 2000 compared with 1989, but the overall trend according to the US EPA was downward or not significant between the 1989 and 1998 period.

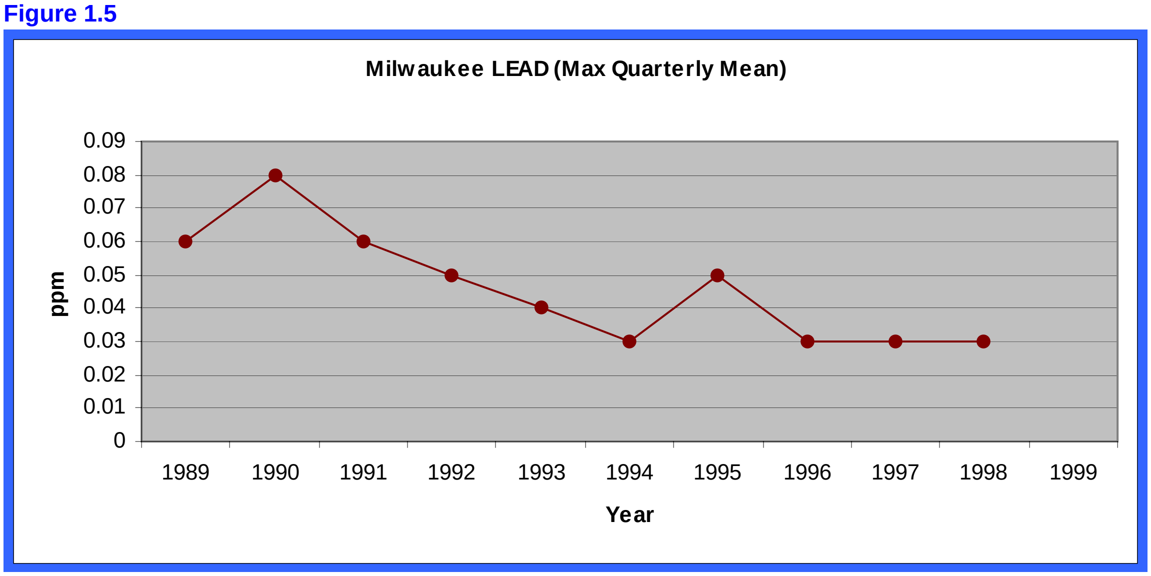
Figure 1.4



Lead

Historically, lead has been a pollutant of concern in urban areas because of the fact that it has been shown to have serious impacts on health and the natural environment. Lead has been found to adversely affect the kidneys, the liver, the nervous system, and other organs; to cause neurological impairments such as seizures, mental retardation, behavioral disorders; and to damage the central nervous systems of fetuses and children. With regard to the environment, lead has been found to inhibit plant growth, to cause soil acidification, and to invade the food chain, making it dangerous to consume certain types of lake fish. Efforts to remove lead from paint and gasoline have had a considerable impact on reducing its concentration in the built and natural environment. Nevertheless, the high level of industrial activities and the growing numbers of motor vehicles continue to be abundant sources of this pollutant. Lead levels dropped in Milwaukee between 1989 to 1998, remaining well below the quarterly average concentration of 1.5 µg/m considered to be a safe level (no data was available from the EPA for 1999 and 2000 when it was beiong compiled for this report) (See Figure 1.5). A similar downward trend was recorded for virtually all of the Frostbelt cities examined.

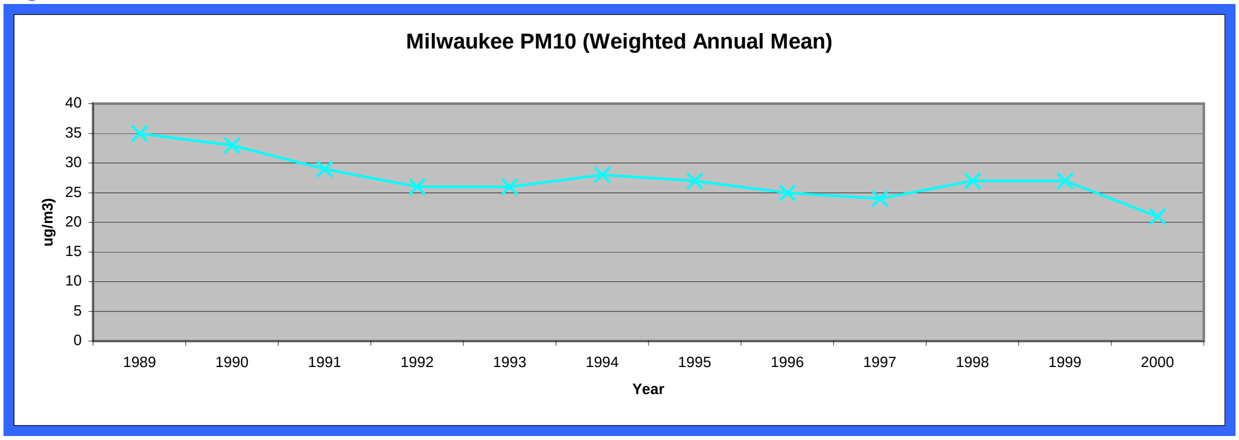
Figure 1.5



Particulates

Particulate matter (PM) is the general term used to designate a mixture of solid particles and liquid droplets found in the air. These come in a wide range of sizes and shapes, and they originate from a variety of stationary, mobile and natural sources. They are emitted directly into the atmosphere by a single source or are formed in the atmosphere by the activity of precursor emissions. The concentration of particulate matter in urban air is an issue of growing concern in the US given that it is the type of air pollution most prominently linked to premature death, in addition to a wide array of respiratory problems, ailments, and diseases. Fine particulate matter can also alter the nutrient balance and acidity of the environment, thus affecting visibility, and eroding and soiling substances and objects (automobiles, clothes, etc.). Figure 1.6 shows a decrease in the average annual mean PM_{10} concentrations in Milwaukee between 1989 and 2000. A downward movement in the PM_{10} annual average is apparent between 1989 and 1992, leveling off thereafter. Most of the other cities witnessed a declining trend between 1989 and 1998, with a further drop in 2000 levels. However, while the concentration of PM has declined in Milwaukee, and falls well below the level of 155 µg/m 3 considered unhealthy, a recent review of PM standards by the US government indicates that more protection is needed to guard Americans from the adverse health effects it brings about.

Figure 1.6

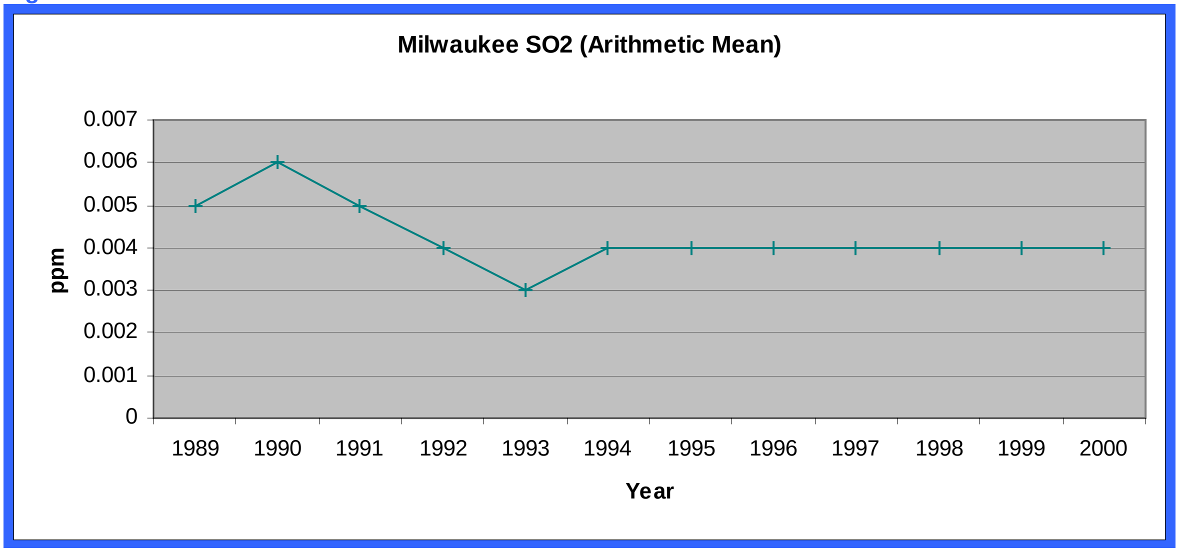


Sulfur Dioxide

SO_2 is a colorless gas largely recognizable by its strong, pungent odor. Along with other oxides of sulfur, it is formed when fuel that contains sulfur (mainly coal and oil) is burned, especially during metal smelting and other kinds of industrial processes employing this chemical. Sulfur oxides contribute to a host of negative health, environmental, and public well-being effects, such as breathing discomfort, respiratory illnesses, reduced lung function, acid rain, decreased plant growth and yield, reduced visibility, and unpleasant odors.

Both the daily and long-term levels of SO_2 have stabilized in Milwaukee at levels considered good by the EPA (see Figure 1.7). This declining trend is similar to that witnessed by most of the other Frostbelt cities.

Figure 1.7



Urban Mobility

Needless to say, transportation is a major source of air pollution, generating most of the carbon monoxide and nitrogen oxide pollutants, as well as ozone. Automobile use also has a variety of other undesirable impacts, including the depletion of non-renewable fuel resources, and the overall risks that car-driving entails (too numerous even to list partially here).

A recent study of urban mobility carried out by the Texas Transportation Institute (2001) has found that congestion levels on major road systems in urban areas throughout the US increased dramatically between 1982 and 1999. Of the various indicators examined in their study, four in particular provide a good picture of the urban mobility situation in Milwaukee (Daily Vehicle-Miles Traveled, the Travel Rate Index, the Travel Time Index and the Percent of Daily Travel in Congestion). While the study does not discuss pollution emissions from motor vehicles specifically, it can logically be assumed that there is a direct correlation between increased urban congestion and air pollution. Daily Vehicle-Miles Traveled is a comprehensive measure of how many miles are traveled by motor vehicles on principal streets and freeways in an urban area. The distance traveled in Milwaukee rose considerably during the 1980s, but tapered off during the 1990s (Figure 1.8). Indeed, growth in the vehicle-miles traveled in Milwaukee from 1982 to 1999 was somewhat lower than that reported by several other Frostbelt cities (Figure 1.9).

Figure 1.8

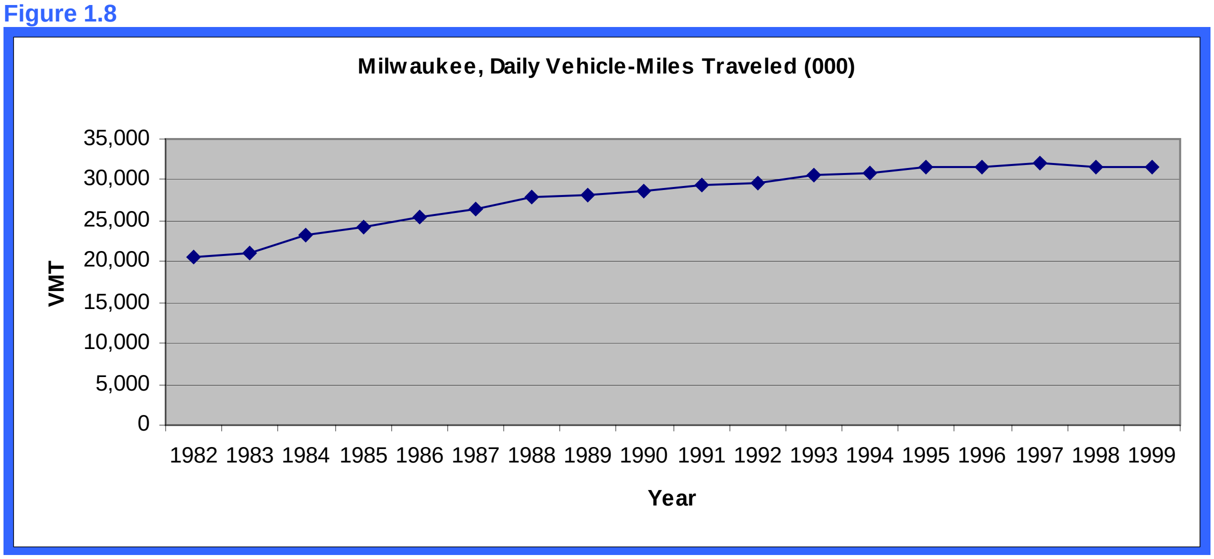
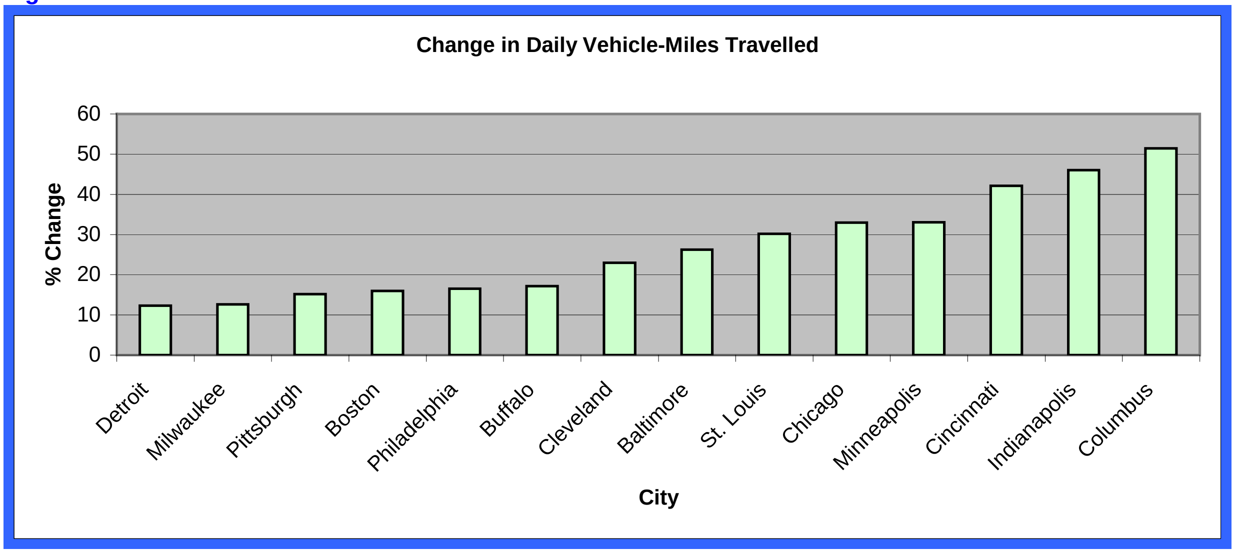


Figure 1.9



The Travel Rate Index (TRI) measures the amount of additional time needed to make a trip during a congested peak travel period rather than at other times of the day. For instance, if a trip takes 10 minutes to complete during non-peak (free-flow) periods and 15 minutes during the peak period, then the TRI equals 1.5. This measure is based solely on the regular traffic congestion on the roadways (Figure 1.10). The Travel Time Index (TTI) is similar to the TRI, except that in addition to the time lost due to congestion caused by regular traffic, it also includes the delay caused by roadway incidents. The TTI therefore gives an idea of how much of the change in traffic congestion is due to the combined effect of more cars using the roadways in tandem with the number of roadway incidents. As the chart below clearly reveals, it is increasingly taking Milwaukeeans more time to get where they want to go during busy times of the day and that this delay is often due to roadway incidents, not just to increased congestion. The authors of the report compared cities on the basis of both long-term (1982 to 1999) and short-term (1992 to 1999) change in TRI and TTI measures. Milwaukee ranked 7th over the long term and 10th over the short term for TRI and 10th long-term and 11th short term for TTI when compared with the other Frostbelt cities (Table 1.1).

Figure 1.10

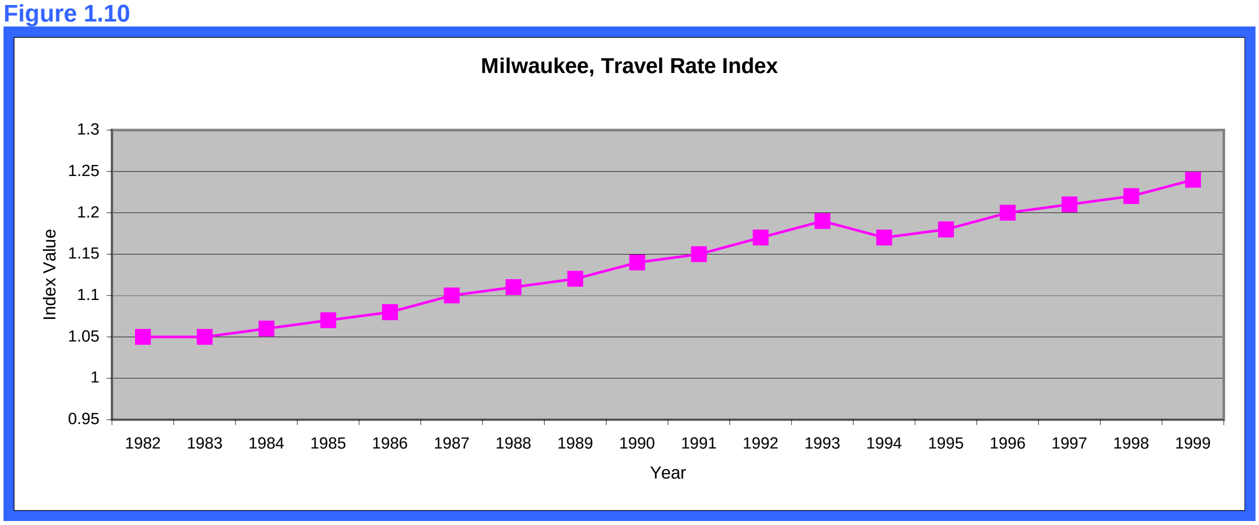


Table 1.1

	TRI		TRI short		TTI long		TTI short
1	Minneapolis-St. Paul, MN	27	Minneapolis-St. Paul, MN	18	Boston, MA	53	Minneapolis-St. Paul, MN
2	Boston, MA	27	Indianapolis, IN	14	Minneapolis-St. Paul, MN	52	Boston, MA
3	Chicago, IL-Northwestern, IN	23	St. Louis, MO-IL	13	Detroit, MI	41	St. Louis, MO-IL
4	Indianapolis, IN	22	Boston, MA	12	Cincinnati, OH-KY	40	Indianapolis, IN
5	Cincinnati, OH-KY	22	Cleveland, OH	11	Chicago, IL-Northwestern, IN	39	Cincinnati, OH-KY
6	Detroit, MI	21	Chicago, IL-Northwestern, IN	9	Indianapolis, IN	38	Cleveland, OH
7	Milwaukee, WI	19	Cincinnati, OH-KY	9	St. Louis, MO-IL	33	Chicago, IL-Northwestern, IN
8	St. Louis, MO-IL	18	Baltimore, MD	8	Baltimore, MD	33	Columbus, OH
9	Baltimore, MD	18	Columbus, OH	7	Columbus, OH	32	Baltimore, MD
10	Columbus, OH	18	Milwaukee, WI	7	Milwaukee, WI	32	Philadelphia, PA-NJ
11	Cleveland, OH	16	Detroit, MI	5	Philadelphia, PA-NJ	28	Milwaukee, WI
12	Philadelphia, PA-NJ	13	Philadelphia, PA-NJ	5	Cleveland, OH	27	Detroit, MI
13	Buffalo-Niagara Falls, NY	4	Buffalo-Niagara Falls, NY	2	Buffalo-Niagara Falls, NY	7	Buffalo-Niagara Falls, NY
14	Pittsburgh, PA	3	Pittsburgh, PA	1	Pittsburgh, PA	6	Pittsburgh, PA

So how many hours is the average Milwaukeean losing in his/her car due to congestion and roadway incidents each year? In 1999, the average annual delay for the typical Milwaukeean was 22 hours. This was 8 hours more than was lost in 1992 and 18 hours more than in 1982. While this lost time can never be regained, one may take solace in knowing that the situation is worse in other Frostbelt cities
.

Figure 1.11

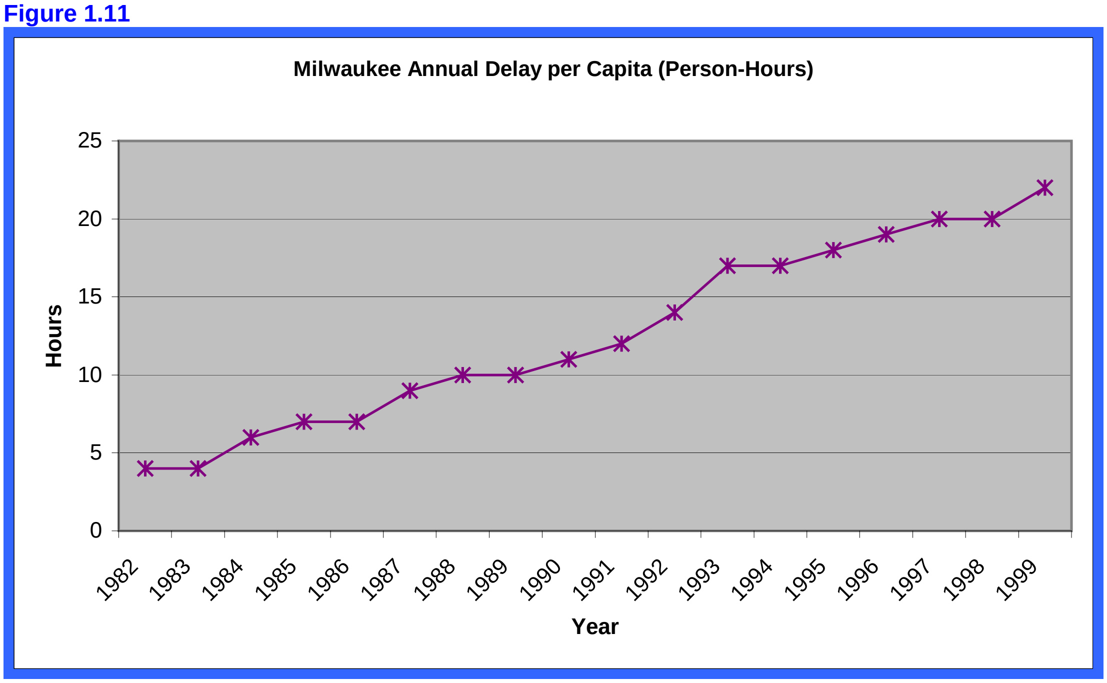


Table 1.2

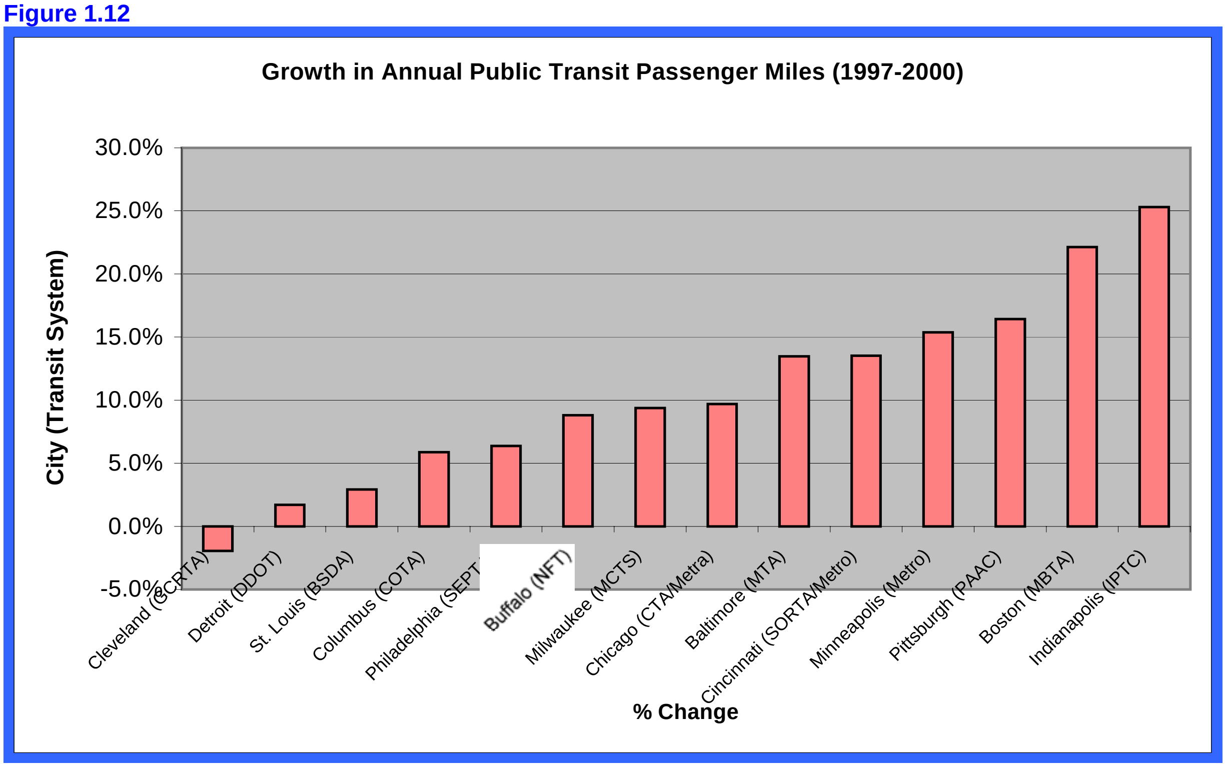
Population Group	Long-term change	Population Group	Short-term change
Minneapolis-St. Paul, MN	35	St. Louis, MO-IL	24
St. Louis, MO-IL	34	Indianapolis, IN	22
Indianapolis, IN	34	Minneapolis-St. Paul, MN	20
Boston, MA	30	Cincinnati, OH-KY	14
Detroit, MI	29	Boston, MA	12
Cincinnati, OH-KY	28	Cleveland, OH	12
Columbus, OH	26	Columbus, OH	12
Chicago, IL-Northwestern, IN	23	Chicago, IL-Northwestern, IN	9
Baltimore, MD	23	Milwaukee, WI	8
Cleveland, OH	19	Philadelphia, PA-NJ	8
Philadelphia, PA-NJ	18	Baltimore, MD	6
Milwaukee, WI	18	Buffalo-Niagara Falls, NY	4
Pittsburgh, PA	8	Detroit, MI	4
Buffalo-Niagara Falls, NY	6	Pittsburgh, PA	3

Public Transit Use

Cities throughout the world have been putting more effort into enhancing public transit systems and promoting their use in an effort to reduce emissions and miles traveled by automobiles. Getting people out of their cars and into transit is seen as essential not only because people are choosing to drive larger cars, but also because they often drive these cars alone. Clearly, mass transportation presents a viable, energy saving, and pollution reducing alternative.

Data collected by the US Federal Transit Administration (2002) reveal that the use of public transit increased in Milwaukee between 1997 and 2000, rising from roughly 188 million passenger miles in 1997 to 205.5 million in 2000. This growth is better than that witnessed by many other Frostbelt cities (Figure 1.12).

Figure 1.12



Toxic Releases into the Atmosphere

The Toxics Release Inventory (TRI)(2001) provides information on more than 650 toxic chemicals that are being used, manufactured, treated, transported, or released into the environment. Manufacturers of these chemicals in the US are required to report the locations and quantities of chemicals stored on-site to state and local governments. The EPA then compiles a database on air emissions, surface water discharges, land releases, underground injections, and transfers to off-site locations. Air release information includes the total releases of all TRI chemicals emitted by a plant from both its smoke stack(s) (point sources) as well as "fugitive" (non-point) sources (such as leaking valves) (Note: data is reported at the county level). From 1988 to 1997, Milwaukee County witnessed a decline in the level of toxic releases into the natural environment from manufacturing facilities. This was followed by a sharp rise in 1998 to levels evocative of those of the late 1980s, followed by a slight dip in 2000 (Figure 1.13). In comparison to the other Frostbelt cities, Milwaukee ranks in the middle of the group (Figure 1.14). It should also be noted that all of the cities examined have witnessed a significant decline in toxic air releases between 1988 and 2000.

Figure 1.13

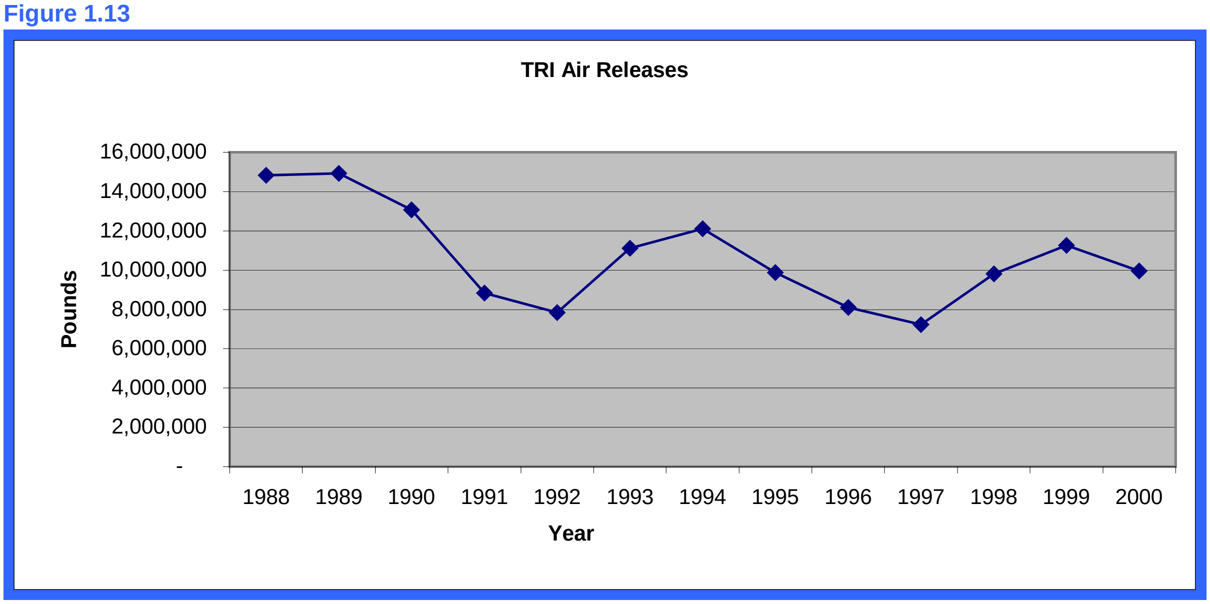
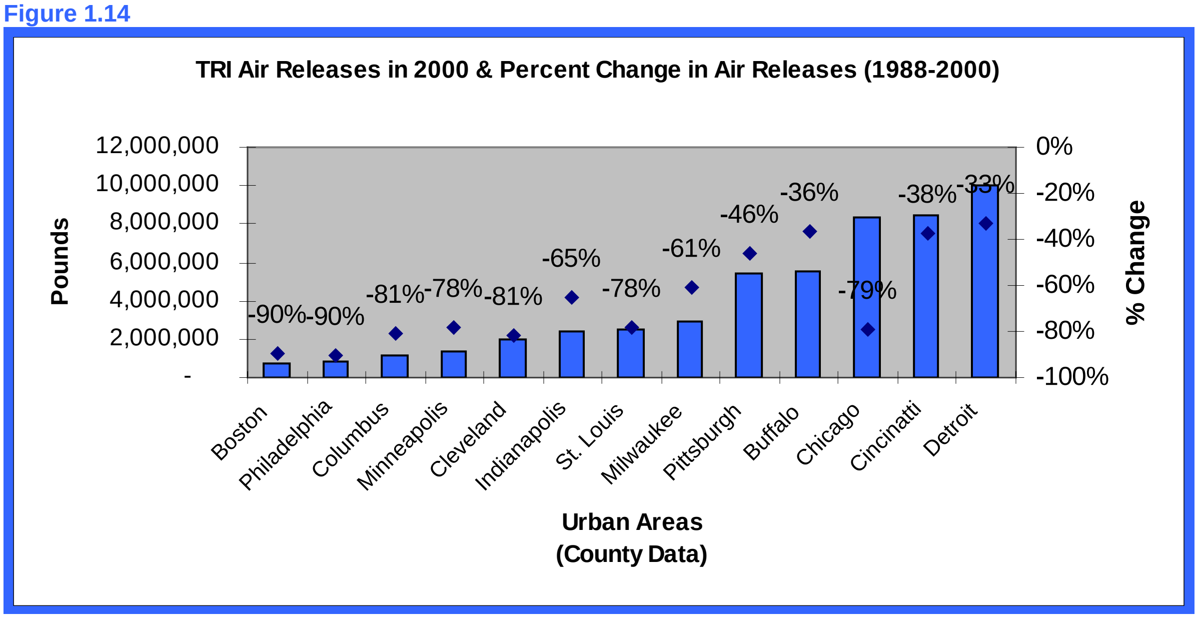


Figure 1.14



Final Remarks

While the data reveal that air quality in Milwaukee has generally improved over the last decade, it is also clear that emission levels for many harmful pollutants have become stable over the past few years. This trend is similar across most other Frostbelt cities and can be explained by the simple fact that reductions in emissions resulting in gains in efficiency are being overtaken by increased motor vehicle use, higher congestion levels on our roads, and increasing pollution levels from manufacturing activities during this strong economic period.

Table 1.3

OZONE 4th Max 8-hour		
MSA	**% Change 1989 - 00**	**US EPA trend 1989 - 98**
Boston	-11	Down
Detroit	-11	NS
Milwaukee	-10	NS
Chicago	0	NS
Cincinnati	0	NS
Cleveland	0	NS
Columbus	0	NS
Indianapolis	0	NS
Minneapolis	0	NS
Philadelphia	0	NS
Pittsburgh	0	NS
Baltimore	11	NS
Buffalo	13	NS
St. Louis	13	NS

Table 1.4

OZONE 2nd daily Max 1-hour		
MSA	**% Change 1989 - 00**	**US EPA trend 1989 - 98**
Boston	-25	Down
Milwaukee	-23	NS
Detroit	-17	NS
Indianapolis	-9	NS
Baltimore	0	NS
Chicago	0	NS
Cincinnati	0	NS
Minneapolis	0	NS
Philadelphia	0	NS
Pittsburgh	0	NS
Columbus	9	NS
St. Louis	9	NS
Buffalo	10	NS
Cleveland	10	NS

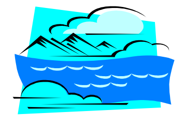
Table 1.5

CARBON MONOXIDE 2nd Max 8-Hour		
MSA	**% Change 1989 - 00**	**US EPA trend 1989 - 98**
Boston	-60	Down
Cincinnati	-59	Down
Buffalo	-55	Down
Baltimore	-54	Down
Milwaukee	-49	Down
Columbus	-47	Down
Minneapolis	-44	Down
Philadelphia	-44	Down
Pittsburgh	-43	Down
St. Louis	-18	
Detroit	-17	Down
Chicago	-11	NS
Indianapolis	0	Down
Cleveland	36	Down

Table 1.6

Nitrogen Dioxide Arithmetic mean		
MSA	**% Change 1989 - 00**	**US EPA trend 1989 - 98**
Baltimore	-31	Down
Cincinnati	-8	NS
Cleveland	-8	Down
Boston	-6	Down
Indianapolis	-6	NS
Buffalo	0	NS
Philadelphia	4	NS
Milwaukee	5	Down
Pittsburgh	9	Down
Detroit	14	NS
Chicago	23	NS
Minneapolis	29	NS
St. Louis	37	NS
Columbus	No Data	

The State of Milwaukee's Water



Water is an integral element in the ecosystem on which all wildlife, vegetation, and human beings depend for their survival. Milwaukee County contains a portion of four watersheds (Lake Michigan, Manitowoc-Sheboygan, Milwaukee and Pike-Root) and it's main rivers and creeks include the Milwaukee River, Underwood Creek, the Menomonee River and the Kinninckinnic River. The EPA (2000) classifies each of Milwaukee's watersheds as having serious water quality problems and low vulnerability to pollution and stressors. Based on a review of several key water quality indicators (i.e., Assessed Use Attainment, Fish and Wildlife Consumption Advisories, Ambient Water Quality and Wetlands Loss Index), the EPA found serious problems in one or more of Milwaukee's watersheds. However, EPA indicators for future impacts found Milwaukee's watersheds less vulnerable to future urban runoff, pollutants, and hydrologic modification (Environmental Defense Fund 2001).

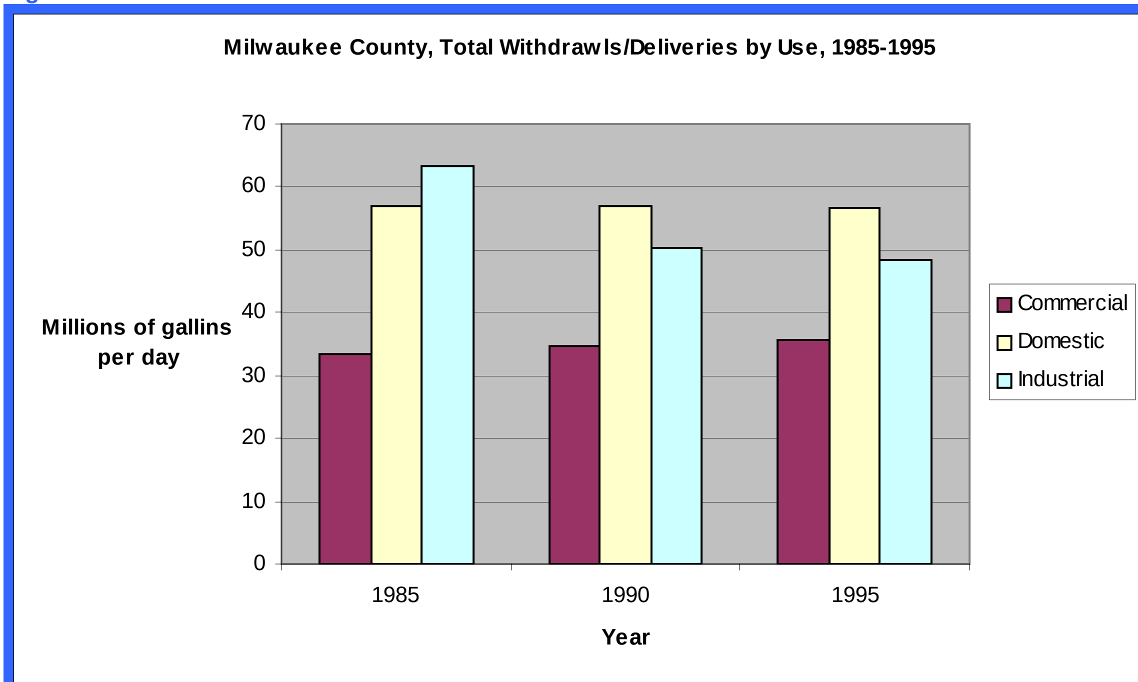
The majority of Milwaukee County residents and all city residents receive their drinking water from the City of Milwaukee Water Works. The Milwaukee Water Works serves 845,000 people in 15 area communities including Brown Deer, Butler, Greendale, Menomonee Falls, Shorewood, Wauwatosa, and West Allis. Portions of Mequon, Greenfield, Hales Corners, St. Francis, West Milwaukee and Franklin are also served by Milwaukee. Milwaukee Water Works pumps its water from two intakes in Lake Michigan (City of Milwaukee 2001). Approximately 95,000 residents of Milwaukee County are served by four other main water systems that also pump water from Lake Michigan, including the Cudahy Waterworks, North Shore Water Commission, Oak Creek Waterworks and South Milwaukee Waterworks. The remainder of Milwaukee County residents are served by small, local wells (Wisconsin DNR 2001).

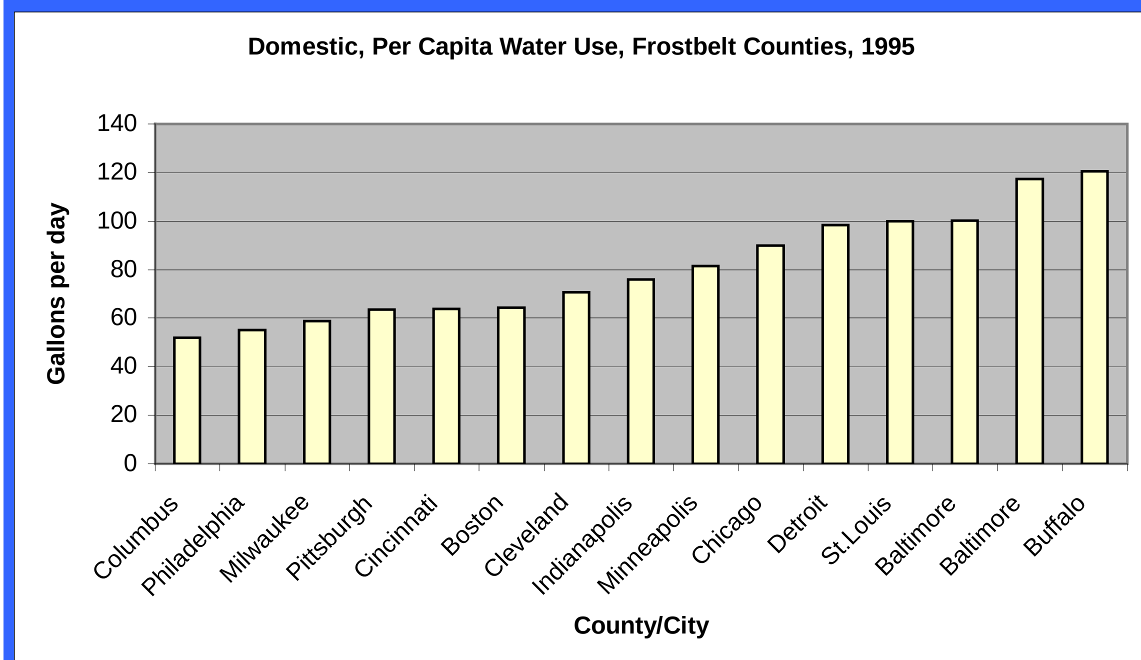
The source of most of Milwaukee's drinking water is Lake Michigan. Water flows through rivers, streams, and over land surfaces into Lake Michigan. Milwaukee's urban areas pose particular challenges to those responsible for managing and preserving clean water given the wide range of users and pollution sources. Several key indicators related to water use, quality and pollution are examined below in order to provide a better understanding of the current state of Milwaukee's water environment.

Water Quantity

The quality of our water and the costs associated with delivering and treating it are directly related to the level of human use. Since 1985, the amount of water withdrawn and delivered to residents and industries in Milwaukee County declined, but the amount used for commercial purposes increased slightly (Figure 2.0)(USGS 1999). This downward trend may be the result of several factors, including the downturn experienced in the economy during the period, conservation, weather patterns, and/or the use of more efficient fixtures. Although water use in Milwaukee County is high by international standards, it is relatively lower than quantities used by those in most other Frostbelt counties examined (Figure 2.1).

Figures 2.0 & 2.1

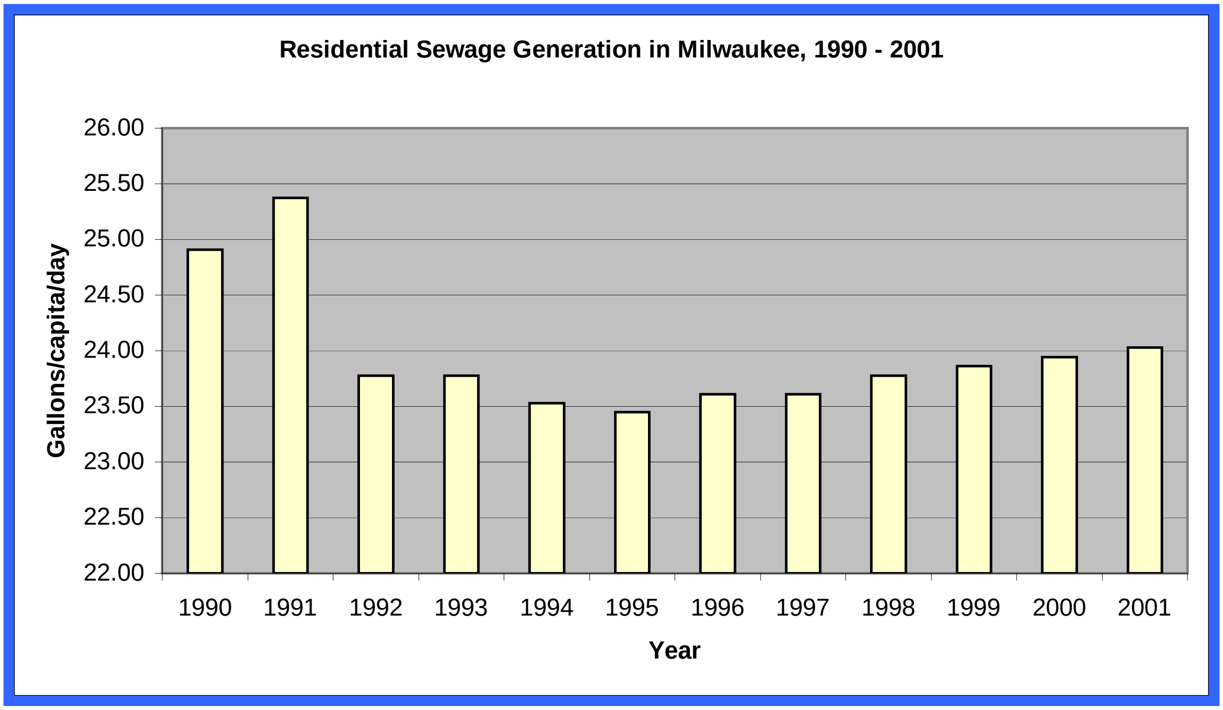




Source: USGS 1999

The amount of wastewater we discharge into the environment is another indicator of our water use habits. The Milwaukee Metropolitan Sewerage District serves all cities and villages within Milwaukee County except the City of South Milwaukee and ten municipalities in surrounding counties (MMSD 2000). More than 200 million gallons of wastewater is treated at the Jones Island and South Shore treatment plants daily. All residential, commercial, and industrial properties in the city of Milwaukee discharge their sanitary sewage through sanitary or combined sewer systems. The wastewater discharged from these so-called point-sources include human, household, industrial, and commercial wastes containing a variety of pollutants including solids, bacteria, nutrients, metals and organic compounds. Data on sewage generation by households in the city of Milwaukee show that quantities have risen over the last few years, despite a decrease from 1990 to 1995 (Figure 2.2). This likely corresponds to an increase in water use after 1995, although 2000 data was not available when data for this report was compiled.

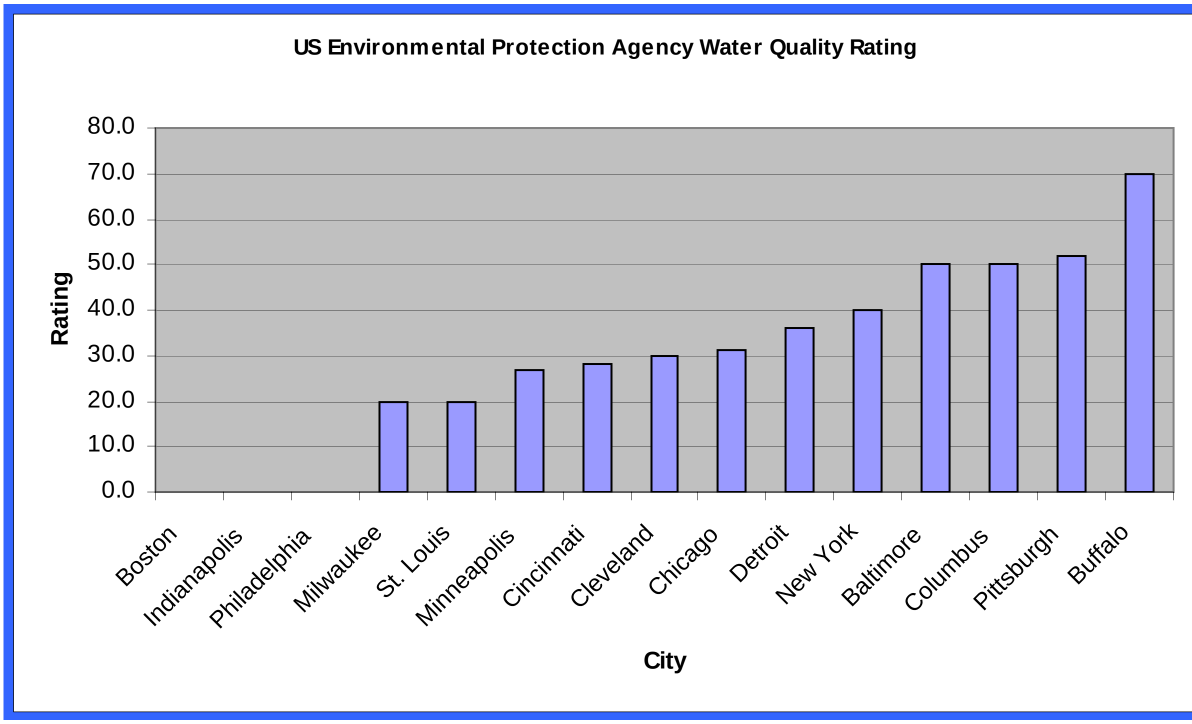
Figure 2.2



Water Quality

Preserving and enhancing water quality in urban areas is a particularly challenging task. Centuries of channeling and altering these watercourses, along with mass construction of impervious surfaces (e.g., buildings and roadways), have hampered the ability of the natural environment to properly absorb and filter water. Consequently, runoff following rain events quickly makes its way into our rivers and streams, picking up a host of organic and inorganic pollutants from lawns, roadways, rooftops and other areas along the way. While local and state governments are primarily responsible for managing water quality in Milwaukee, the US EPA also regulates water quality through the Clean Water Act and is active in monitoring watershed quality. To provide an overall rating of water quality, the EPA uses a complex method to synthesize the impacts of numerous indicators such as pollutants, turbidity, sediments, and toxic discharges. Unfortunately, Milwaukee County's water quality does not score well in comparison to the other Frostbelt cities (higher values are more favorable) (Figure 2.3).

Figure 2.3



Source: US EPA data reported by BestCities 2001

Data in Table 2.0 below shed light on some of the leading pollutants and "stressors" affecting surface waters (rivers, stream, creeks) in Milwaukee County as reported by the Environmental Defense Fund (2001). The data specify the percentage of water bodies affected by particular pollutants/stressors in Milwaukee and a few other Frostbelt counties selected for comparison. They reveal that over half of the surface waters in Milwaukee are affected by pollution from metals and pathogens, and that most suffer stress caused by habitat loss and degradation. Metals enter the water from vehicle exhaust, pesticides, sewage and a variety of other sources and bioaccumulate in the food chain posing serious risks to human health and the natural environment. Pathogens originate from human and animal wastes and can cause gastrointestinal infections and beach closings. Habitat loss and degradation affects the overall viability of the aquatic ecosystem and can result from a variety of activities, including construction, road building and littering. The data below also reveal that surface waters in Milwaukee County are adversely affected by sediments (may fill-in water bodies and reduce clarity), organic compounds (may destroy plant life), flow alterations (may speed up flow and cause erosion), low dissolved oxygen levels (may kill fish) and nutrients (may cause eutrophication). Unfortunately, all of the other Frostbelt cities face a similar water quality challenges, including those listed in the table below.

Table 2.0

Pollutant/Stressor	Milwaukee	Chicago (Cook County)	Cleveland (Cuyahoga County)	St. Louis (St. Louis County)
Metals	55	58	11	61
Degradation, Loss & Alternation of Aquatic Habitat, Impaired Biological Community	55	73	21	57
Pathogens	55	38	9	4
Sediments	36	57	33	74
Organic Compounds	27	15	16	48
Flow Alterations	18	33	10	4
Low Dissolved Oxygen/Organic Enrichment	18	51	54	22
Nutrients	18	87	31	65
Pesticides	n/r	2	1	n/r
Ammonia	n/r	39	16	9

Source: Environmental Defense Fund Scorecard 2001

Beach Closings

The cleanliness of our beaches has an influence on how most of us perceive the quality of our water. Even though our drinking water is treated and is drawn from deep inside Lake Michigan, most of us cannot help question the overall quality of the lake's water when hundreds of beach advisories and closings are issued throughout the region every year. Beach advisories and closings are typically caused by elevated levels of certain indicator organisms (e.g., pathogens, micro-organisms) that are released from a variety of sources, including sewage discharges, animal wastes, and stormwater runoff, and can cause infection and disease when bathers and other recreational water users are exposed to them.

Unfortunately, the scale of the beach-closing problem has increased considerably in Milwaukee over the past half-decade (Figure 2.4) (Milwaukee & Racine Health Departments 2001). South Shore Beach located near downtown Milwaukee has been particularly affected, with so-called "Poor" water quality closing the beach 75 times in 2000 and 28 times in 2001, up from 15 days in 1995 (note: the decline in 2001 can be partially attributed to the fact that beach closures were not reported for May and September as they had been in previous years). Data for Bradford and McKinley beaches collected in 1999 and 2000 also show an increase in beach closings, with a slight dip in 2001. Unfortunately, the situation is similar in other Frostbelt cities along the Great Lakes. Research conducted by the US EPA (1999) found that there is a need for stronger beach monitoring programs, improved water quality standards and broader public guidance on recreating in the Great Lakes. Data collected for this study reveal that from 1983 to 1994 the situation at the six Milwaukee beaches examined was generally better than that in the other counties examined, with only two of its beaches (24%) experiencing at least one closing during the season. In Wayne County (Detroit), Cayuga County (Cleveland) and Erie County (Buffalo), virtually every beach experienced at least one closing during the season (Figure 2.5). It should be noted that the US EPA, the USGS and Great Lake states are currently in the process of standardizing their beach testing and reporting procedures.

Figure 2.4

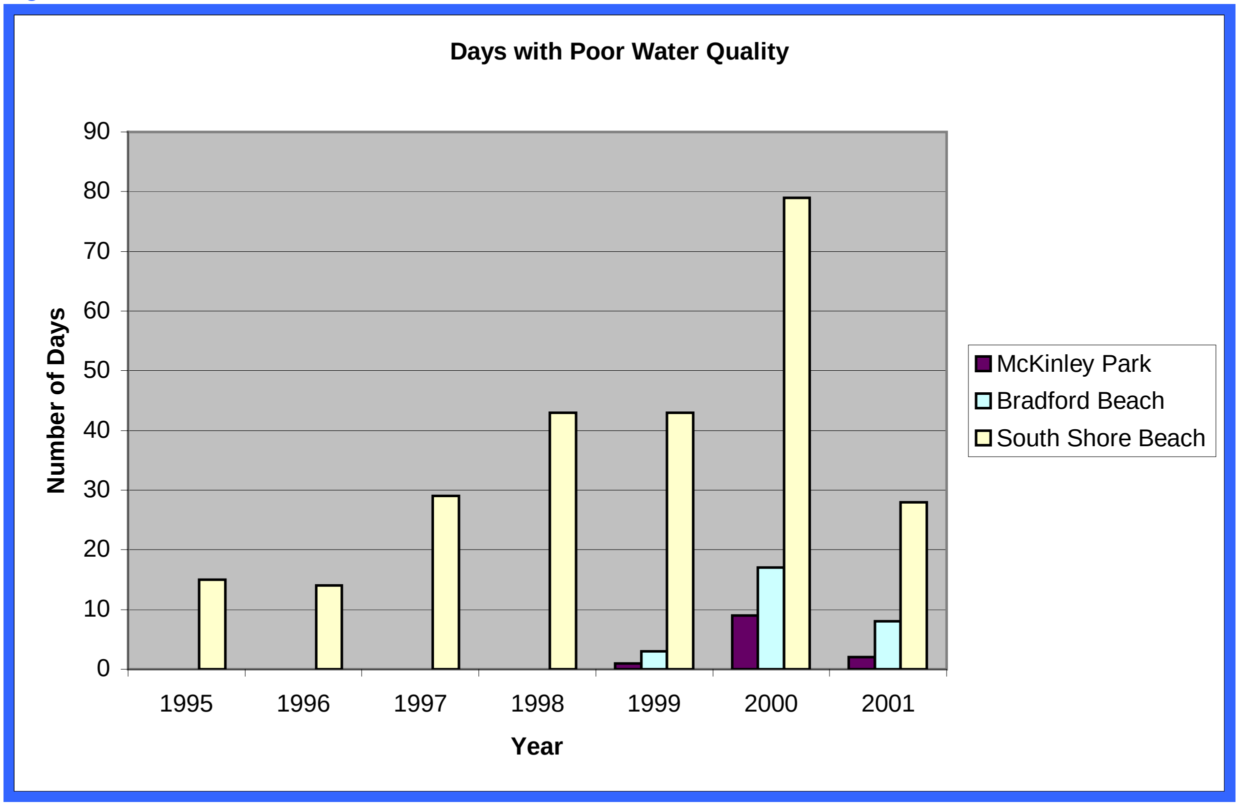
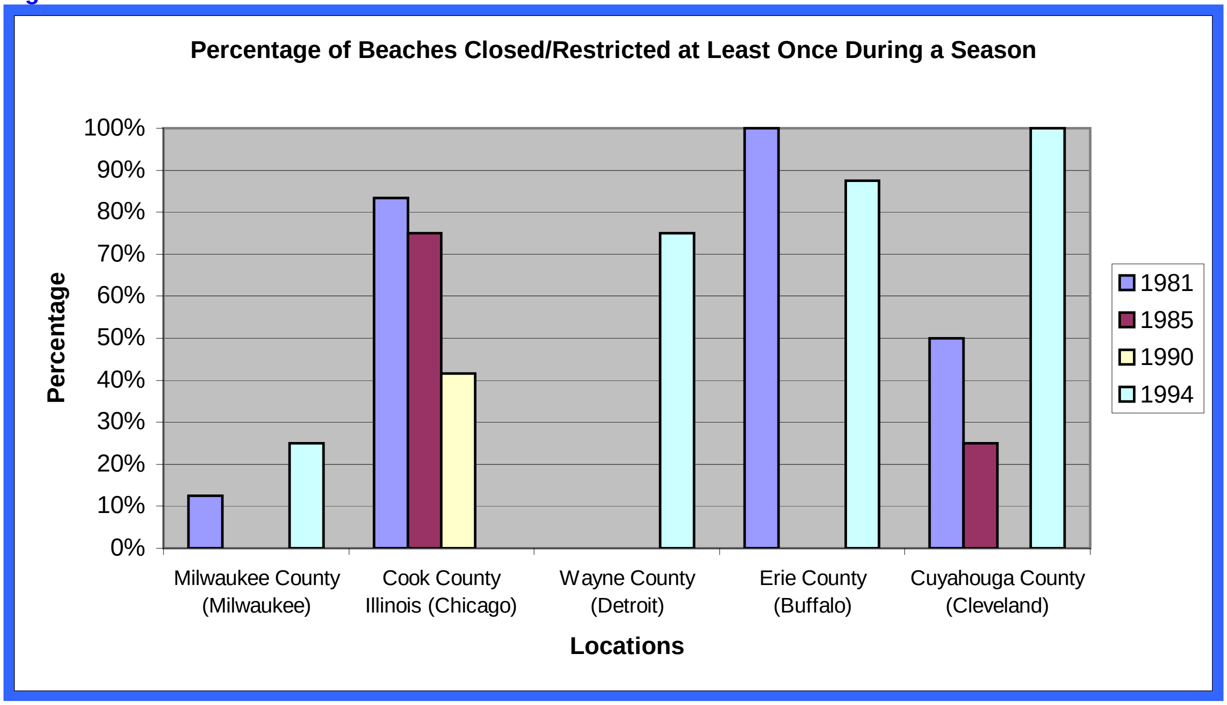


Figure 2.5



Poor water quality responsible for closing beaches was often attributed to the discharge of untreated sewage into Lake Michigan following heavy rainstorms. During these events, water in storm sewers often mixes with wastewater in sanitary sewers, thus increasing the flow of sewage traveling to treatment plants. Unable to treat this excess flow, both stormwater and raw sewage are released directly into the lake introducing high concentrations of pathogens. To deal with this problem, Milwaukee, and several other cities along the Great Lakes, have constructed so-called "deep-tunnels" to store excess sewage during heavy rain events so that they can be treated when capacity is available. The construction of a deep tunnel has indeed decreased the number of sewage overflows occurring in Milwaukee during the last decade, down from over 60 in 1991 to 3 in the year 2001 (Figures 2.6 & 2.7)(MMSD 2000). But if the tunnel has reduced sewage overflows, then why does the number of beach closings continue to rise? A study conducted by the University of Washington on 339 bacteria strains taken from Blossom Heath Beach in the Detroit found that the waste from birds, dogs and other animals were responsible for 69 percent of E. coli. contamination affecting that beach, while human waste only appeared in 5.3 percent of the tests (Schabath and Cardenas 2001). Recent studies in Milwaukee, Racine, and Chicago also found that seagull droppings and storm water runoff were the two major sources of E.coli levels at local beaches. Needless to say, these studies suggest that managing waste from these sources will prove to be a much more difficult task for the city.

Figure 2.6

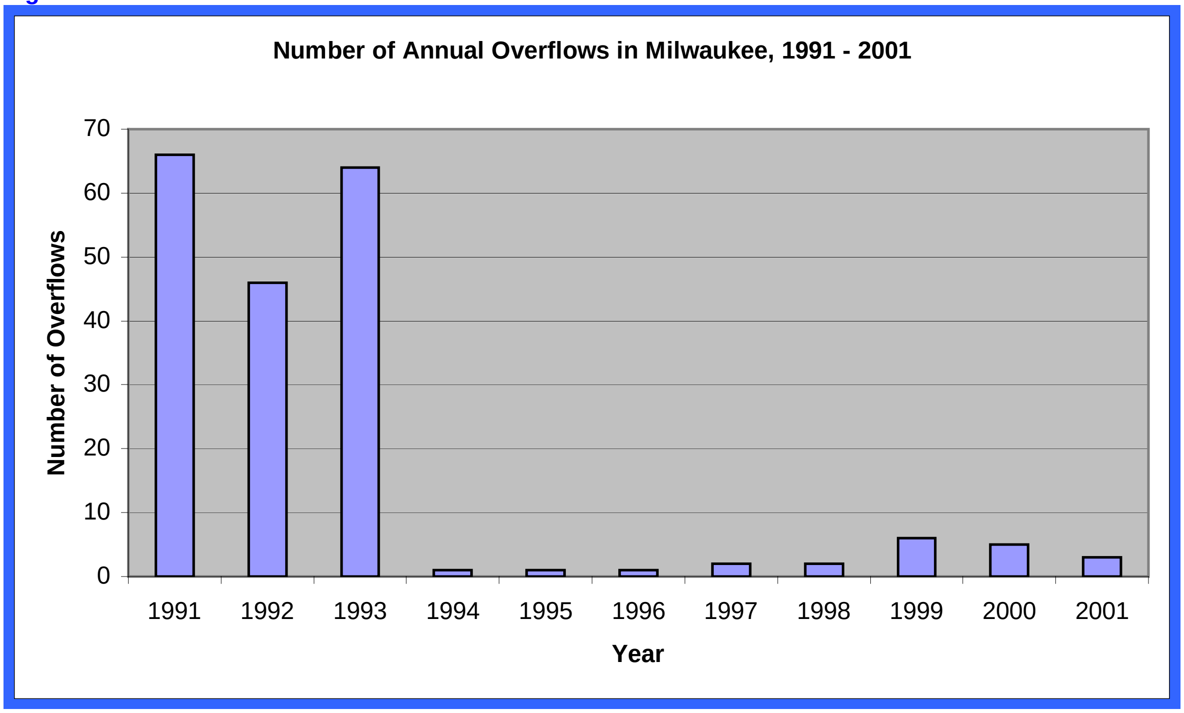
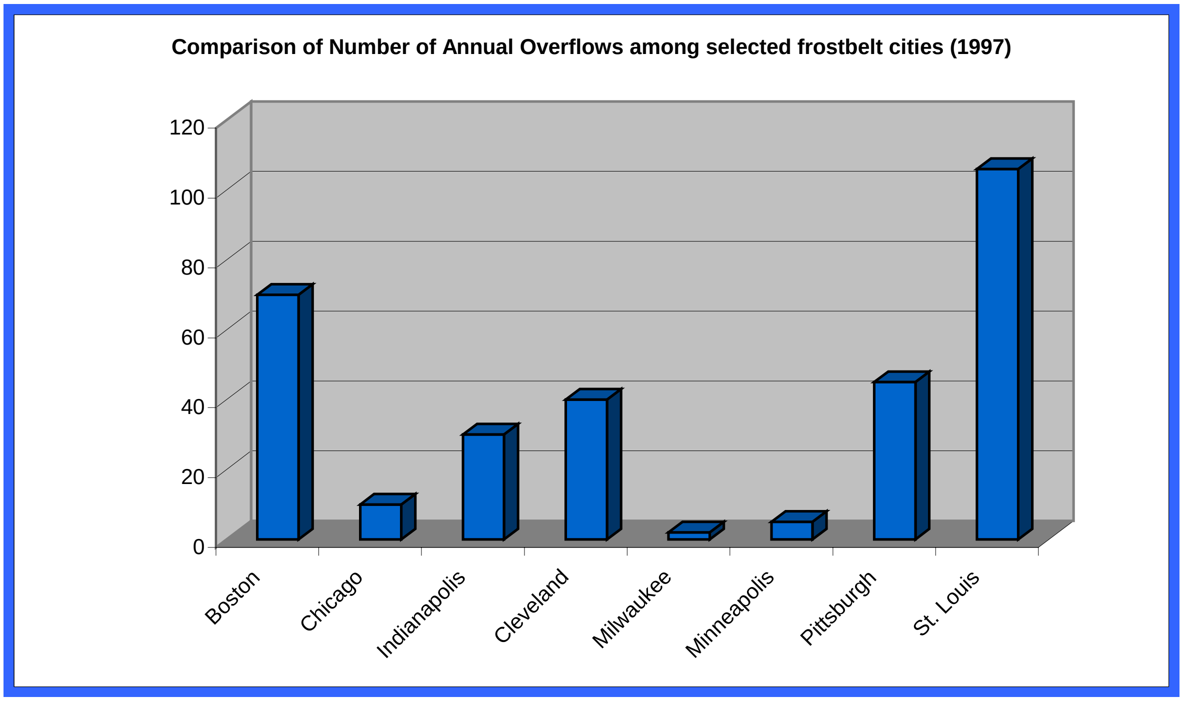


Figure 2.7



Toxins Released into Water

Growing concerns over impact of toxic chemicals on water quality have led to the development and implementation of numerous policies and programs aimed at limiting their release into surface water. Chemicals such as lead, cadmium, and benzene pose severe threats to both humans and the natural environment. Despite this, toxic wastes continue to make their way into our water supply inadvertently.

As with air and land pollution, the US EPA (2001) tracks the release of these toxic substances into the water through the Toxic Release Inventory program. The data from this inventory show that the release of toxins into the water has declined significantly in Milwaukee County and most other Frostbelt counties, except Pittsburgh (Figures 2.8 & 2.9).

Figure 2.8

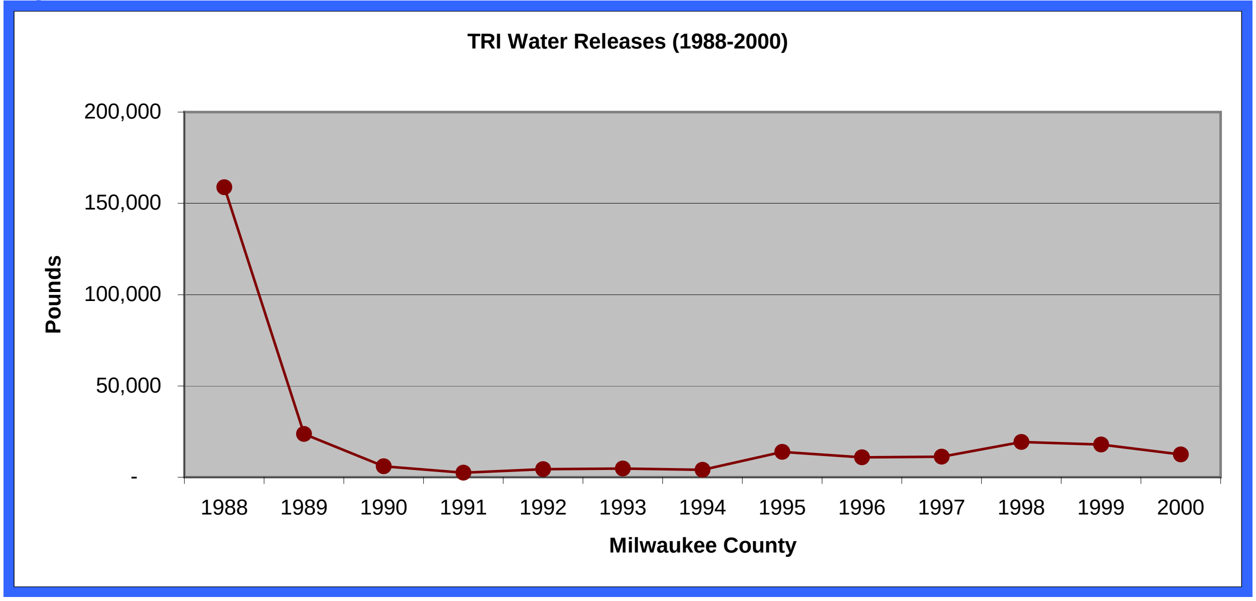
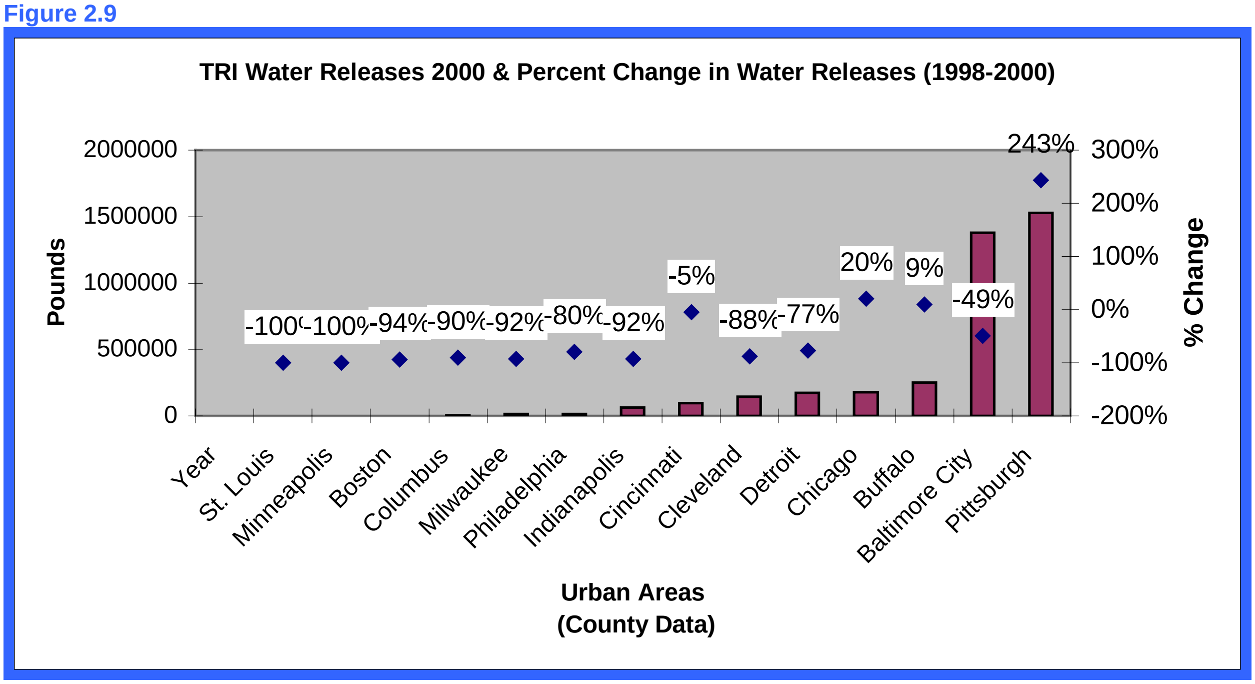


Figure 2.9



The State of Milwaukee's Land

The condition of Milwaukee's land environment rests on how well we are able to protect and conserve open space, maintain healthy soil conditions, and reduce solid waste generation and disposal. These indicators are described in more detail below.

Open Space and Recreation

In an effort to promote healthy and more livable urban environments, more and more cities in the US are investing in maintaining and expanding their urban parks and green space system. These lands not only provide a place for recreation and relaxation, but also help rekindle the connection between the urban and the natural environment.

Currently, 9.7% of the total land area (over 15,111 acres) in Milwaukee County is in parks and open space, which amounts to slightly over 16 acres of parks and open space for every 1000 Milwaukeeans (Harnik 2001). The 136 parks managed by the Milwaukee County Department of Parks, Recreation and Culture (2000) encompass over 7,780 acres and range in size from 0.6 to 640 acres, with most in the 1 to 20 acre range. Parkways/Greenways comprise an additional 7,112 acres stretching alongside Milwaukee's lakes, rivers and creeks. As for the city of Milwaukee, public parks and open space covered approximately 5,049 acres of land in 1985 (SEWRPC 1991). Overall, the quantity of parks and open space, as a proportion of county land and per 1000 residents, is comparable to other Frostbelt cities. Although it should be noted that Harnik (2001) had to compare the less-dense Milwaukee County to the typically more dense Frostbelt cities, given that data for the city was not available (approximately 8.2% of the city of Milwaukee is in parks and open space if the 1985 figures are used) see Figure 3.1. The only unsatisfactory statistic for Milwaukee county is that public expenditures on parks and open space are almost three times lower that neighboring Minneapolis and Chicago see Figure 3.2.

In addition to parks, wetlands, and woodlots are important indicators of the condition of urban open space. Wetlands are critical habitats to sustaining wildlife, fish, amphibian, and reptile species. They are also essential for storing floodwaters, protecting surface and groundwater quality, recreation, and providing scenery characteristic of the Great Lakes Bioregion. SEWRPC estimates that wetlands covered 3.1% (or 4,883 acres) of county land and 1.3% (or 796 acres) of city land in 1995. Woodlots also provide many habitat and recreational benefits. In 1995, these sites covered 3% (or 671 acres) of county land and 1.1% (or 671 acres) of city land. On the more positive side, it should be noted that both the city and the county witnessed a slight increase in wetland area between 1990 and 1995, however woodlot area in the city dropped slightly during the period, while county woodlots increased slightly.

Figure 3.1

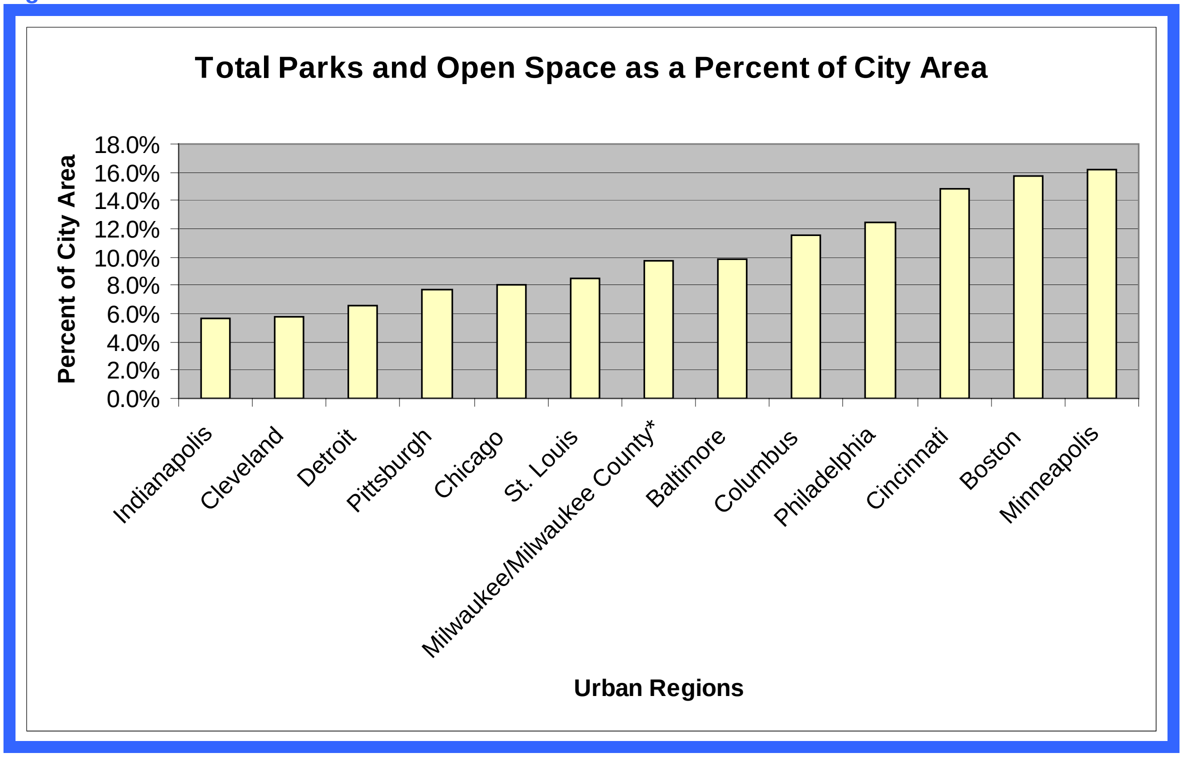
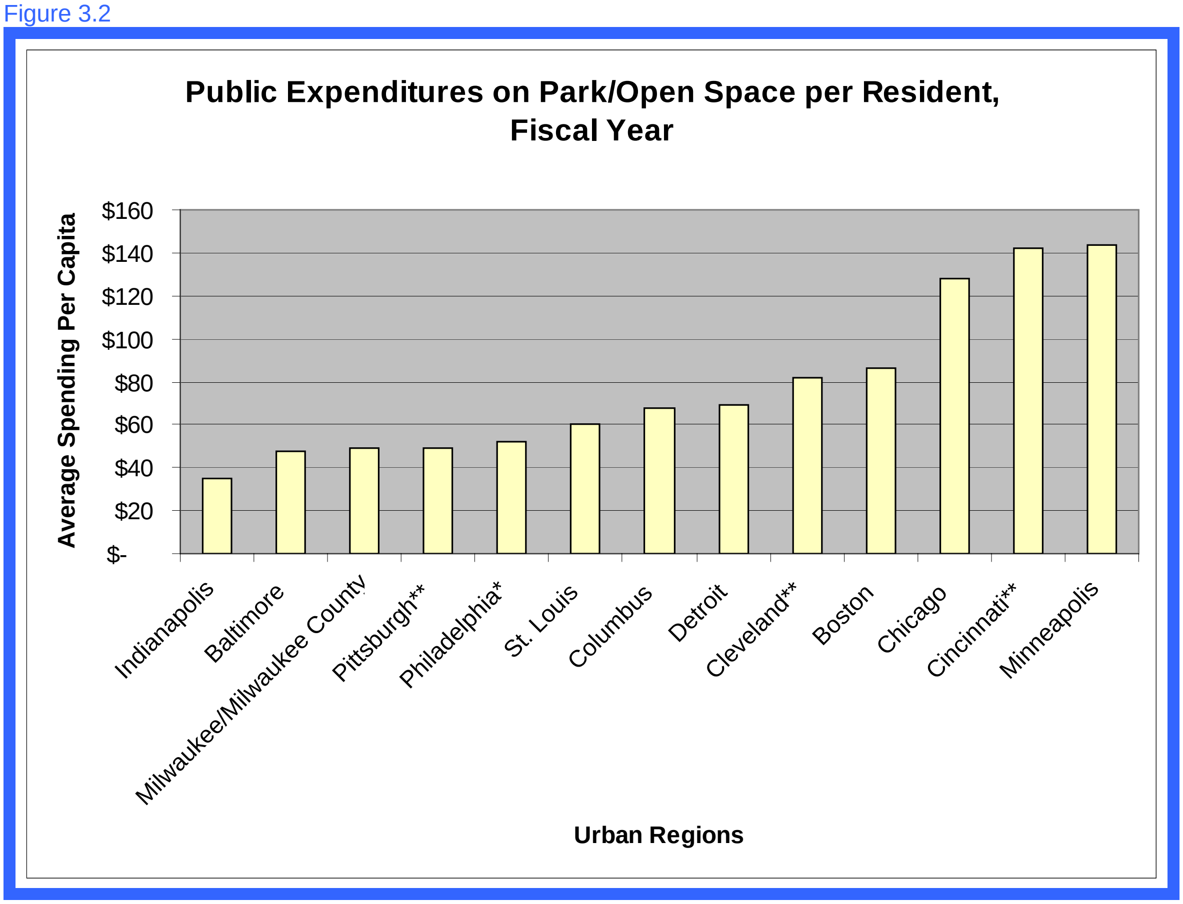


Figure 3.2



Brownfields and Contaminated Sites

Over the last two decades, Americans have been paying more attention to methods designed to foster smart growth in their cities. One proposal that has gained widespread support is the redevelopment of brownfield sites. These are abandoned or under-utilized properties where past land uses have caused real or perceived contamination of soil and/or groundwater. They are mainly located in the core sections of large urban areas where municipal services (e.g. roads, sewers, water supply) already exist, making them prime candidates for urban revitalization efforts. Furthermore, redeveloping these sites will promote higher densities in existing urban areas and reduce development pressure on open space and agricultural land in the periphery. A comprehensive study conducted by Simons (1998) estimates that in 1994 Milwaukee had over 2,171 acres of industrial, commercial and residential brownfield sites, taking up 4% of the city's land area. This is significantly less than that found in most other frostbelt cities, including larger ones such as Chicago, which had over 18,435 acres or 13% of its city in brownfields in 1994 (Simons1998) see Figure 3.3.

While the level of contamination at most brownfield sites is minimal or non-existent, there are a handful of sites in every city that have very high levels of contamination that pose a significant risk to human health and the environment. These sites are placed on the US EPA's *National Priorities List* and are commonly referred to as Superfund sites. In 2002, Milwaukee County had 12 so-called active superfund sites (does not include sites removed from the original superfund list that have been archived due to clean-up, risk re-assessment, or other factors). Indeed, most of the other Frostbelt counties have fewer than 20 sites, except for the larger ones including Detroit, St. Louis, Chicago and Philadelphia see Figure 3.4. For more up-to-date estimates of the number of brownfields in Major US cities (excluding Milwaukee) see US Conference of Mayors (2000) *Recycling America's Land*. http://www.usmayors.org

Figure 3.3

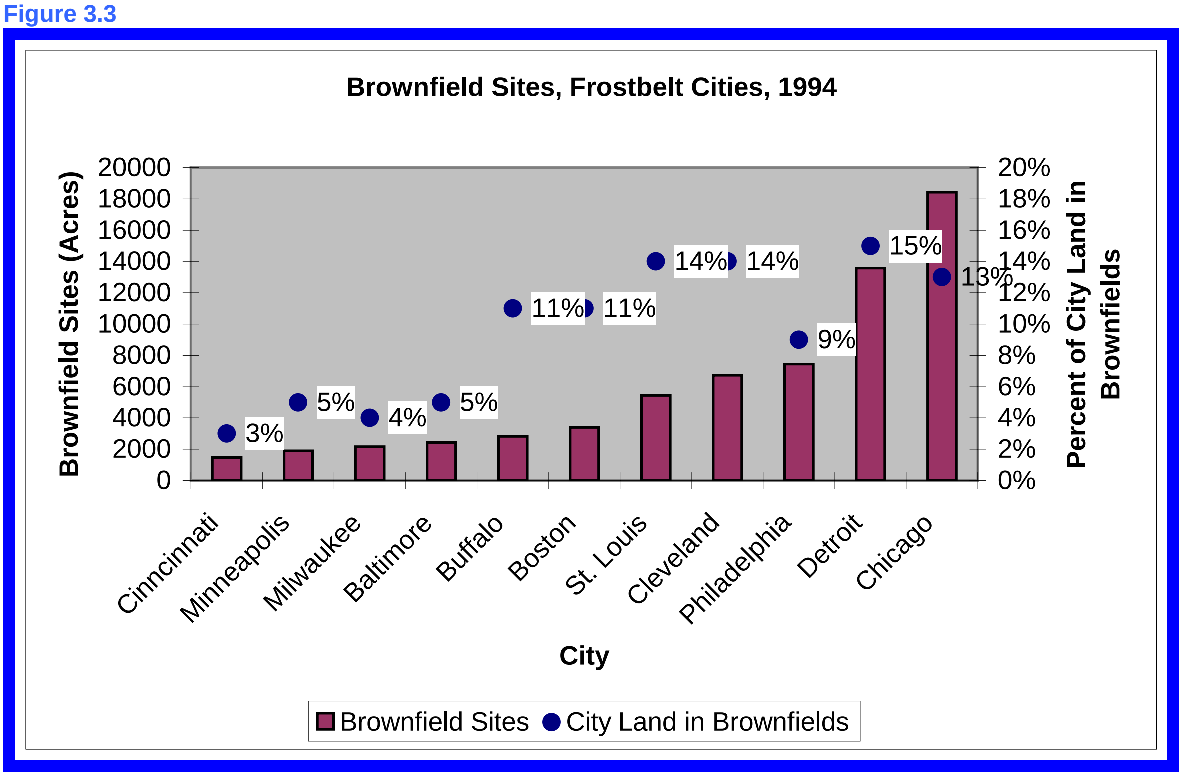
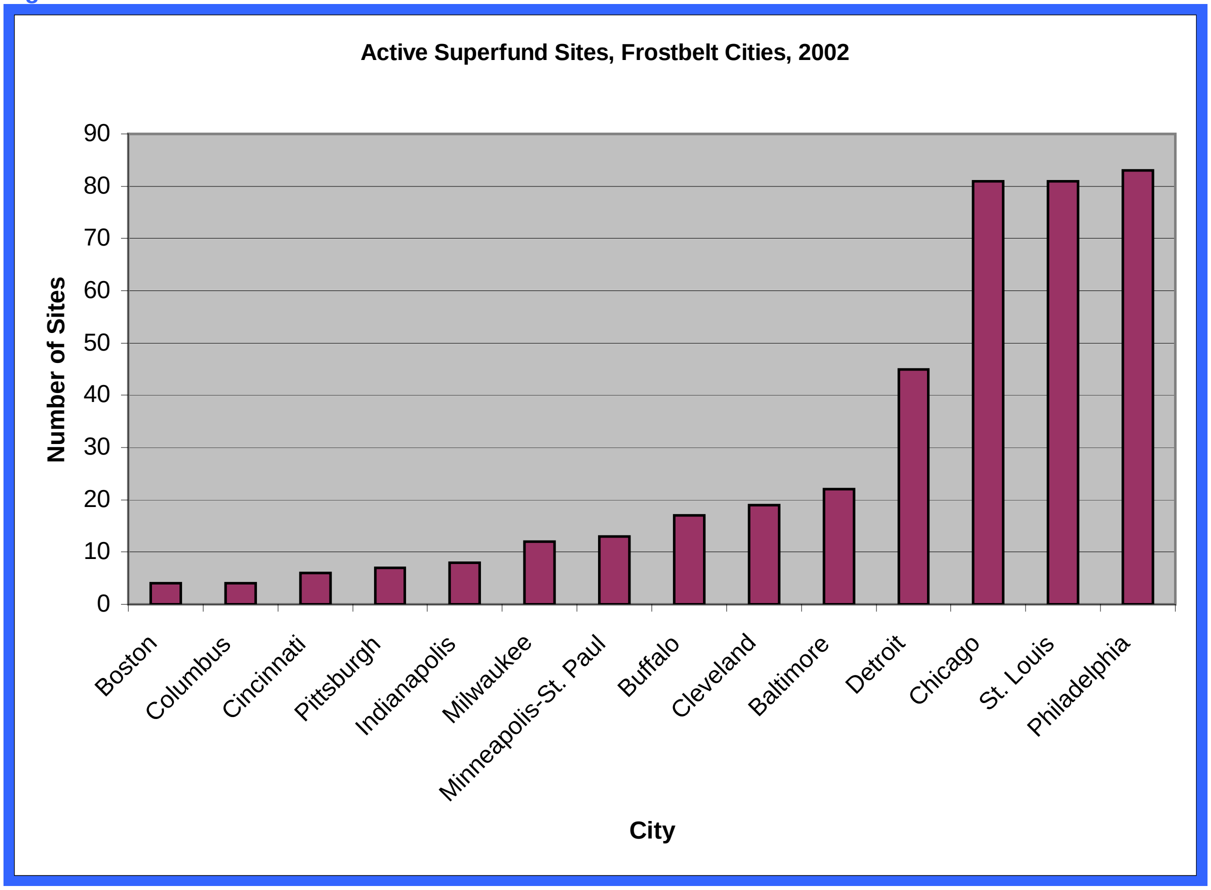


Figure 3.4



Waste Management

Americans are considered to be one of the largest generators of waste in the world. Municipal solid waste (MSW) generation is particularly high due to the "throw-away" habits of our consumer society. MSW is the term commonly used to refer to the waste generated by residents and some businesses within a municipality. Other categories of waste that have a negative impact on the environment include household hazardous waste and ICI (Institutional, Commercial, and Industrial) waste, the latter being typically managed by the private sector. In the city of Milwaukee (DPW Sanitation 2001), MSW generated by those living in residential households increased slightly from 1995 to 1997, dipped in 1998 and 1999, and rose slightly again in the 2000 and 2001 see Figure 3.5. Unfortunately, recycling rates are also quite flat during the period. While the recycling of so-called "other" recyclables (e.g., appliances, tires and yard waste) was at its highest since 1997, the recycling of cans, newspapers, and other mixed residential materials has not changed significantly. Overall, therefore, Milwaukeean's are diverting slightly less waste in this decade, than in the previous one.

Unlike many of the other indicators examined in this report, it is difficult to compare MSW generation and recycling activity among different jurisdictions because there is no standard definition for what constitutes MSW. For instance, the city of Milwaukee defines MSW as waste generated by residents living in dwellings under 5 stories, the DNR's definition includes all residential and commercial wastes, and national data includes residential, commercial and "some" industrial wastes (Wisconsin DNR 2001, US EPA 1998b). The key reason for this difference is that waste is collected and managed by a variety of public and private organizations, making data collection and management difficult. While this makes comparison difficult, it is still useful to see how Milwaukeeans' compare to the state and national average. Figure 3.6 below reveals that Milwaukeean's recycle slightly less than the state and national averages.

Figure 3.5

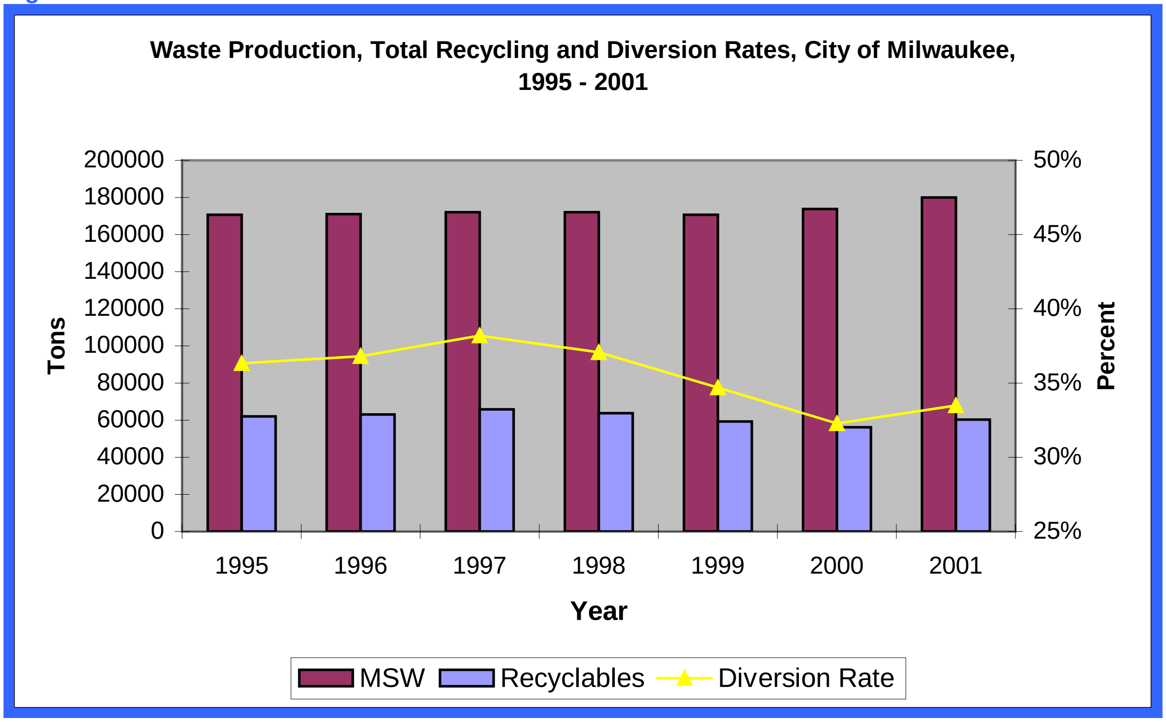
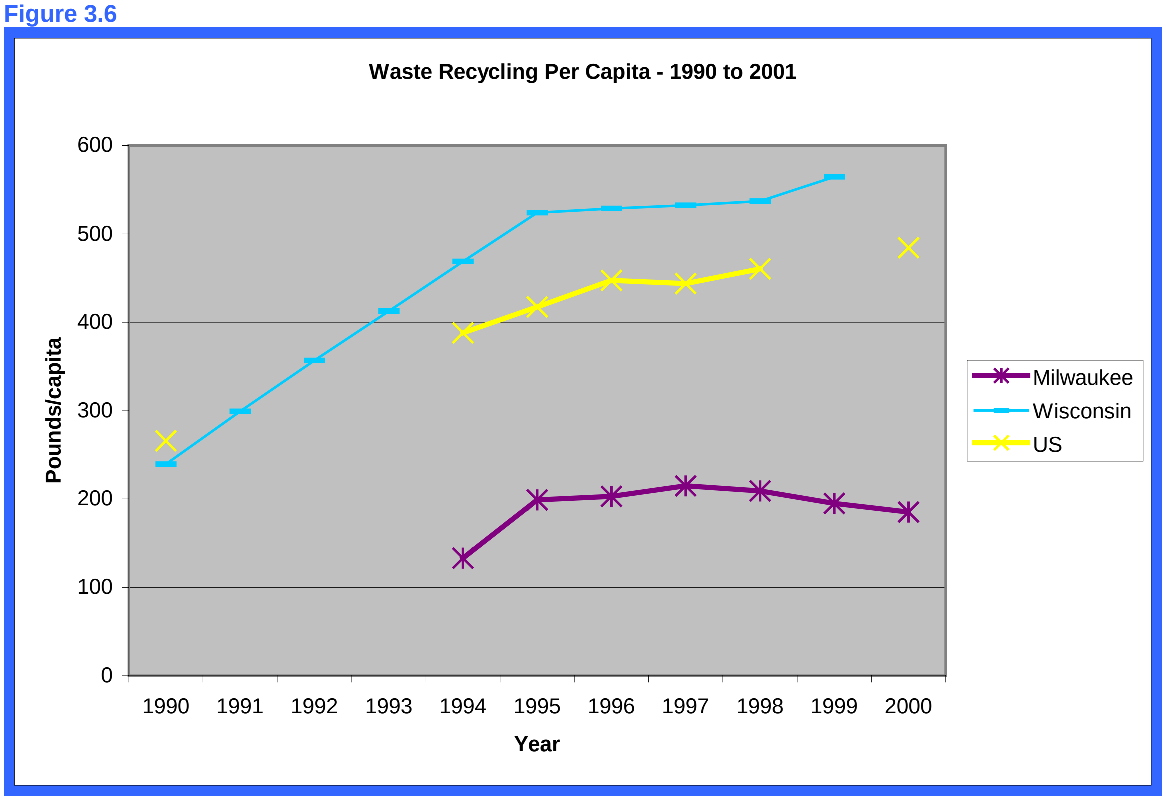


Figure 3.6



Toxins Released into Land

Since 1988, the US EPA has tracked the release of toxic waste to land from certain industrial sectors. The data includes disposal of toxic chemicals in landfills, land treatment /application farming (in which a waste containing a listed chemical is applied to or incorporated into soil), surface impoundments (which are uncovered holding areas used to volatilize and/or settle materials), and other land disposal methods (such as waste piles) or releases to land (such as spills or leaks) (US EPA 2001). Unlike other indicators, the rate of toxic releases to land does not seem to follow a consistent trend. Indeed, release rates in Milwaukee County were low from 1988 to 1992 and from 1995 to 1997, but were several times higher in 1993/1994 and 1998/2000, and down again in 2001 see Figure 3.7. Overall, the data reveal a slight decrease in the amount of toxic waste released to land in Milwaukee County in 2001. Over half of the other Frostbelt counties examined also witnessed an increase between 1988 and 2000 (particularly Detroit), while the other half witnessed considerable declines see Figure 3.8.

Figure 3.7

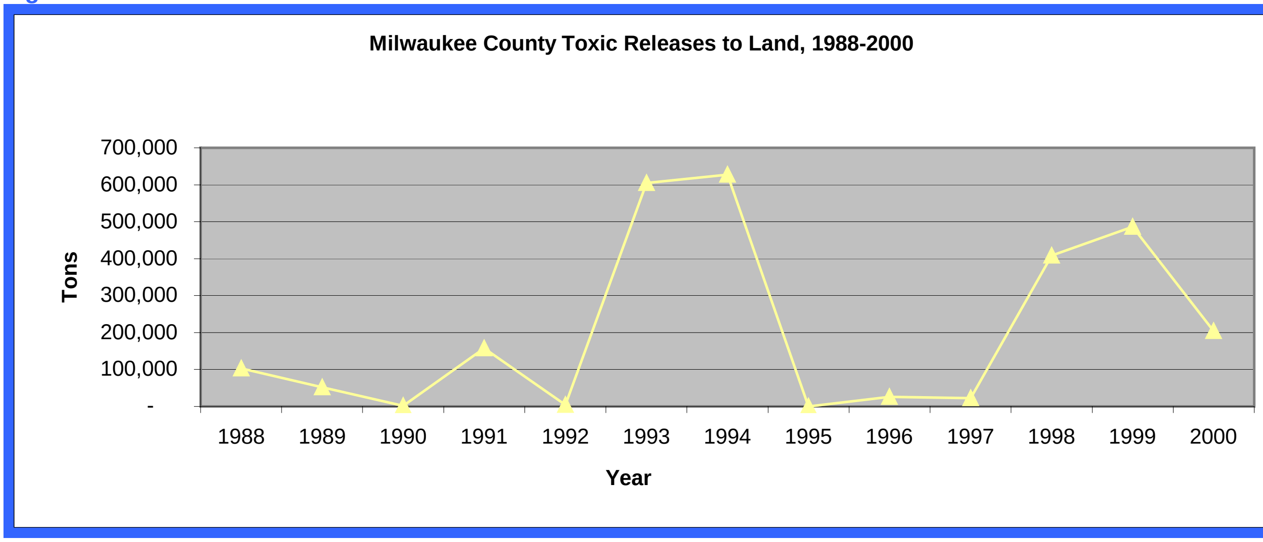
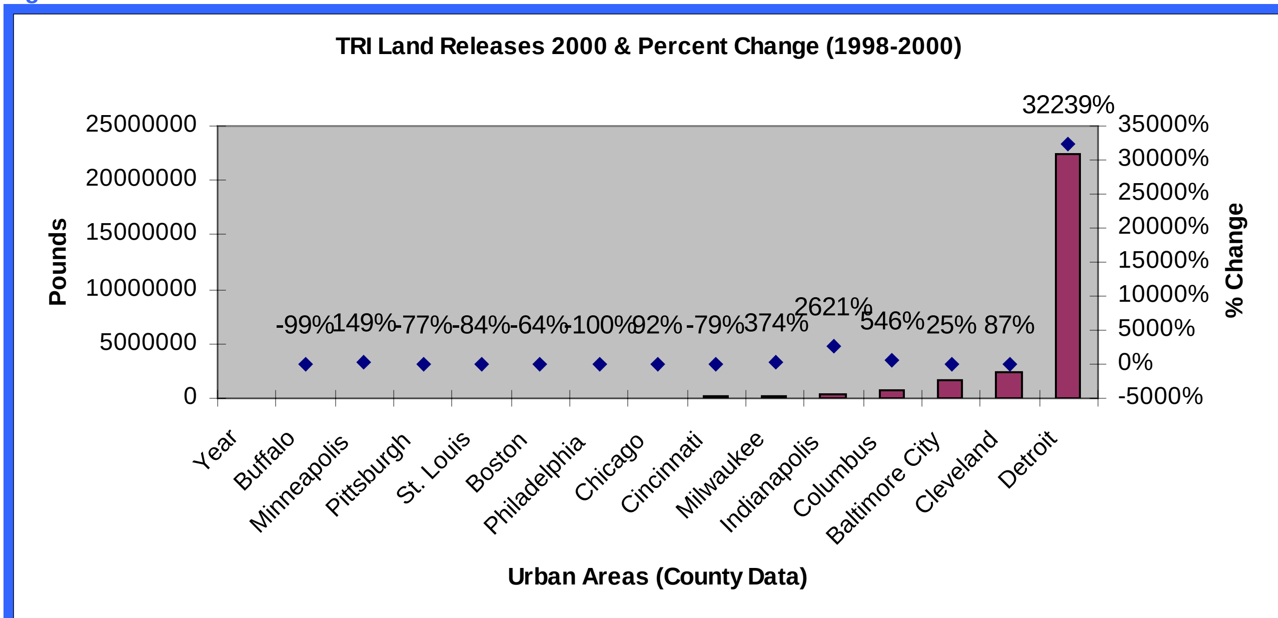


Figure 3.8



References

BestCities (2001). *BestCities 2001 Report*.

City of Milwaukee Department of Public Works (2001) *Milwaukee Water Works*. Retrieved June 19, 2001 from http://www.mpw.net/Pages/WaterWorks.html.

City of Milwaukee DPW Sanitation Division (2001). Data Provided May 2001.

Environmental Defense (2001) *Environmental Defense Scorecard*. Retrieved June 13, 2001 from www.scorecard.org.

Harnik, P. (2001) *Inside City Parks, New Data on City Parks*. Washington, Trust for Public Land http://www.tpl.org

Milwaukee and Racine Health Departments (2001) *Beachhealth Web Site*. Retrieved from http://infortrek.er.usgs.gov/pls/beachhealth/.

Milwaukee County Department of Parks, Recreation and Culture. (April 2000) *Milwaukee County Park System Map*. Wauwatosa, WI: Milwaukee County Department of Parks, Recreation and Culture.

Milwaukee Metropolitan Sewerage District (2000) *MMSD Web Site*. Retrieved June 19, 2001 from http://www.mmsd.com/about/about.html.

Schabath, G and Cardenas, E. (2001) "Animals Polluting Lake Water." *The Detroit News* May 9, 2001.

Simons, Robert A. (1998) *Turning Brownfields into Greenbacks*. Washington, D.C.: The Urban Land Institute.

Southeastern Wisconsin Regional Planning Commission (1991) *A Park and Open Space Plan for Milwaukee County*. Community Assistance Report #132. Waukesha, WI: Southeastern Regional Planning Commission.

Texas Transportation Institute (May 2001) *The 2001 Urban Mobility Report*. College Station, Texas: Texas Transportation Institute, The Texas A & M University System. Retrieved from http:/mobility.tamu.edu.

US Conference of Mayors (2000) *Recycling America's Land*. Retrieved from http://www.usmayors.org/uscm/news/press_releases/documents/brownfields022400_final.asp.

US Environmental Protection Agency (1997) *Health and Environmental Effects of Ground-Level Ozone*. Retrieved from http:/www.epa.gov/ttn/oarpg/naaqsfin/.

US Environmental Protection Agency (1998a) *National Air Quality and Emissions Trends Report*. Washington, DC: US Environmental Protection Agency. Retrieved from http://www.epa.gov/oar/aqtrnd98/.

US Environmental Protection Agency (1998b) *Characteristics of MSW in the US, 1998 Update*. Washington, D.C.: US Environmental Protection Agency, Office of Solid Waster, Report prepared by Franklin & Associates.

US Environmental Protection Agency (1999) *Action Plan for Beaches and Recreational Waters.* Washington, D.C.: Office of Research and Development and office of Water, US EPA.

US Environmental Protection Agency (2000) *Milwaukee, WI Water Data*. Retrieved June 18, 2001 from www.epa.gov/surf3/counties/55079/.

US Environmental Protection Agency (2000) *Air Data*. http://www.epa.gov/air/data/

US Environmental Protection Agency (June 2001) *1999 Toxic Release Inventory: Community Right-to-Know*. Retrieved from http://www.epa.gov/tri/.

US Federal Transit Administration (2002) Transit Data and Info. http://www.fta.dot.gov/14512_ENG_HTML.htm

US Geological Survey (2002) *Beahhealth Website*. http://infotrek.er.usgs.gov/.

US Geological Survey (February 1999) *1985, 1990, and 1995 Water-Use Data Files*. Retrieved June 13, 2001 from http://water.usgs.gov/watuse/.

Wisconsin Department of Natural Resources (April 2001) *Milwaukee County Public Water Supply Systems Data*. Retrieved June 19, 2001 from http://oraweb.dnr.state.wi.us/inter1/plsql/pws2$.startup.

Wisconsin DNR (2001) *Waste Management Program Recycling Facts and Figures*. http:www.dnr.state.wi.us/org/aw/wm/publications/recycle/publce163.htm, Downloaded May 29, 2001.