

# King County Benchmarks

## 2009

# Environment

### Encouraging Trends Could Benefit Environmental Health

Several factors that influence the health of our environment in King County show sustained positive trends through 2008. Total gasoline consumption in King County declined 4% since 2001, nearly 32 million gallons, despite population gains. Meanwhile, a drop in annual vehicle miles traveled (VMT) per capita is also noticeable, declining 479 miles (5%) from its peak in 1999 to 2007. VMT includes commercial and private vehicles, so both economic activity and personal travel patterns influence the total. Yet certain trends have continued regardless of economic highs or lows.

Because on-road vehicles are responsible for nearly half of all greenhouse gas emissions, the decline in gasoline consumption and VMT per capita are encouraging trends. Concerned about greenhouse gas emissions, the governor signed House Bill 2815 last year, requiring long-term reductions in per capita VMT statewide. In the near future, the downward trends in VMT and gasoline consumption are likely to continue as bittersweet symptoms of a weakened economy.

For instance, the recent drop in diesel consumption likely reflects a decline in commercial traffic. The economic well-being of the region is cause for concern; meanwhile diesel particulate matter is a major contributor to cancer-causing air toxics, and diesel exhaust is a component of greenhouse gas emissions. The goal is to find solutions that sustain both economic and environmental health, as both are important components of a high quality of life.

Worth noting particularly as we head into summer: a distinct downward trend in water consumption continued through 2008. SPU retail customers decreased water consumption more than 40% over the last 18 years. The largest annual change in consumption occurred in 1992 as a result of severe drought conditions and mandatory water use restrictions. Since then, a number of factors have kept water demand down including higher water rates, conservation efforts and improved system operations.

These bright spots should not distract attention away from declining trends in surface water quality, also described inside. This environmental bulletin receives its guiding principles from the King County Countywide Planning Policies which state: "all jurisdictions shall protect and enhance the natural ecosystems through comprehensive plans and policies, and develop regulations that reflect natural constraints and protect sensitive features. Land use and development shall be regulated in a manner which respects fish and wildlife habitat in conjunction with natural features and functions, including air and water quality. Natural resources and the built environment shall be managed to protect, improve and sustain environmental quality while minimizing public and private costs." This report measures countywide progress toward these goals.

#### What's Inside

Over one-half of King County's **Land Cover** is forested (Indicator 9, page 3).

For the last two years, King County has experienced "good" **Air Quality** nearly 80% of the time (Indicator 10, page 4).

Per capita **Energy Consumption** in the form of gasoline has decreased 10% since 2001 (Indicator 11, page 6).

From 1999 to 2007, per capita **Vehicle Miles Traveled** in King County declined 5% (Indicator 12, page 7).

Of the streams monitored in WRIA 8 for **Surface Water Quality**, two-thirds were rated to be of "high concern" in 2007 (Indicator 13, page 8).

Seattle Public Utilities estimates that total **Water Consumption** by retail customers decreased more than 40% in the last 18 years (Indicator 14, page 12).

With wells providing drinking water to almost 30% of the county's population, **Groundwater Quality and Quantity** rated good or higher in monitoring results from 2004 (Indicator 15, page 13).

Due to the lack of new data regarding **Wetland Acreage and Function**, please refer to the 2005 Environmental Bulletin for the most recent analysis.

Almost one-half of King County's acreage consists of publicly protected lands, providing opportunities for the **Continuity of Terrestrial and Aquatic Habitat Networks** (Indicator 17, page 14).

The annual **Number of (Chinook) Salmon** returns remain well below 2055 targets (Indicator 18, page 15).

16% of households in King County identified neighborhood street **Noise** as bothersome in 2004 (Indicator 19, page 16).

In 2007, both **Waste Disposed and Recycled per Capita** increased from the previous year (Indicator 20, page 18).

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## King County Benchmark Program

In 1990 the Washington State Legislature passed the Growth Management Act (GMA). For the first time in the state's history, all urban counties and their cities were required to develop and adopt comprehensive plans and regulations to implement the plans. To achieve an interjurisdictional coordinated countywide plan, GMA further required that King County and its cities first develop framework policies, the King County *Countywide Planning Policies*, to guide the development of the jurisdictions' plans.

The *Countywide Planning Policies* define the countywide vision for the county and cities' plans. The policies were developed by the Growth Management Planning Council, a group of elected officials representing all King County citizens, adopted by the Metropolitan King County Council and ratified by the cities in 1994.

Established by the Growth Management Planning Council (GMPC) in 1995 as required by the WA State Growth Management Act, the King County Benchmark Program monitors 45 indicators that measure the progress of the King County *Countywide Planning Policies*.

The indicators are intended to collectively articulate the impact of land use and development policies and practices on our natural, built and social environment. Rather than focusing on the local programs of the county's 40 jurisdictions, the Benchmarks provide a high level analytical view of change within the geographic boundaries of King County.

As one of the first and most durable efforts at monitoring outcomes in the public sector, the King County Benchmark Program demonstrates how measurement of broad quality-of-life outcomes can help determine if public policy and programs are making a difference. Public outcome monitoring is a strategy for change: it alerts us to what we are doing well and where we need to do better. It is closely connected to both the policy goals that it monitors, and to the strategic planning, programs, and services that are intended to implement those goals.

The Benchmark Program reports cover five policy areas: land use, economic development, transportation, affordable housing and the environment. All reports are available on the Internet at <http://your.kingcounty.gov/budget/benchmrk/bench08/>. For information, please contact Lisa Voight, Program Manager (206) 263-9720 or e-mail: [lisa.voight@kingcounty.gov](mailto:lisa.voight@kingcounty.gov).

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## LAND COVER CHANGES IN URBAN AND RURAL AREAS OVER TIME

### Outcome: Protect and Enhance Natural Ecosystems

#### Countywide Planning Policy Rationale

"The land use pattern for the County shall protect the natural environment by reducing the consumption of land and concentrating development. Urban Growth Areas, Rural Areas, and resource lands shall be designated and the necessary implementing regulations adopted." (FW-6) "All jurisdictions shall protect and enhance the natural ecosystems through comprehensive plans and policies, and develop regulations that reflect natural constraints and protect sensitive features. Land use and development shall be regulated in a manner which respects fish and wildlife habitat in conjunction with natural features and functions, including air and water quality. Natural resources and the built environment shall be managed to protect, improve and sustain environmental quality while minimizing public and private costs." (FW-4)

**Data is not available annually to update this indicator.** Population growth and development have substantially altered the landscape in King County. Of particular interest for the protection of salmon and other aquatic resources is the conversion of forest and natural land cover to hard or impervious surfaces, such as roofs, sidewalks, parking lots and roads. In 2004, the King County Council adopted stormwater, clearing and grading, and critical area regulations designed to maintain forest cover and limit impervious surfaces in rural areas and improve stormwater management in urban areas. These changes reduce the impact of development on the natural environment. In the Rural Area, they protect hydrologically mature forest cover and soil, which in turn absorb rainfall, encourage natural stream flows and provide necessary wildlife habitat in the Rural Area. In the Urban Area, they provide for better infiltration of stormwater, which recharges the groundwater and reduces stormwater impact on streams and wetlands.

King County includes approximately 2,136 square miles of land area. Over 78% of this land area—1,676 square miles—is designated rural land. As shown in figure 9.1, over one-half of King County's geography is forested, including a small percentage of forest cover within the urban growth area. Impervious cover accounts for 14% of the county's land area and another 30% of the land area includes other forms of vegetative cover including grass, wetlands and crops.

Figure 9.2 allocates King County's land cover by Urban and Rural Area. As shown, the Rural Area is largely characterized by vegetative cover, while only 5% of the area is covered with impervious surface. The natural cover of the Rural Area and high rate of impervious cover in the Urban Area can be attributed to development practices that focus growth in the Urban Area and preserve natural space in the Rural Area. It is notable however, that 17% of the Urban Area's geography includes forested land (a characterization determined by canopy density), providing important ecological functions and recreation opportunities for King County residents.

Figure 9.1

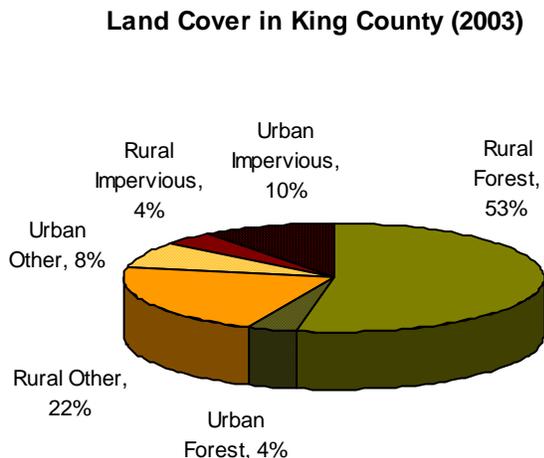
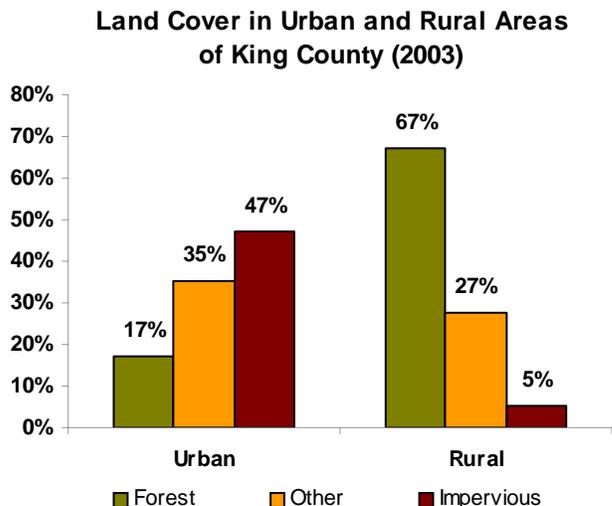


Figure 9.2



## CHANGES IN AIR QUALITY

### Outcome: Improve Air Quality

#### Countywide Planning Policy Rationale

"All jurisdictions, in coordination with Puget Sound Air Pollution Control Agency\* and the Puget Sound Regional Council, shall develop policies, methodologies and standards that promote regional air quality, consistent with the Countywide Policy Plan." (CA-14)

\*Now the *Puget Sound Clean Air Agency*

Air quality is measured for its short, medium and long-term impacts on health and the climate. To monitor daily air quality, the U.S. Environmental Protection Agency (EPA) developed the **Air Quality Index (AQI)**, which establishes national air quality standards of six criteria pollutants. However, the AQI does not measure potentially harmful air toxics and greenhouse gases, which lack national standards for measuring and reporting. Consequently, medium-term health impacts of pollution are evaluated through the measurement of **air toxics**, including over 400 additional pollutants suspected of causing significant health problems such as cancer and respiratory disease. **Greenhouse gases** are monitored due to their long-term effect on climate change.

**Air Quality Index** The AQI measures levels of six criteria pollutants: fine particulate matter; ground-level ozone; carbon monoxide; sulfur dioxide; nitrogen dioxide; and lead.

Of these, particulate matter-- tiny particles in the air such as soot, smoke and dust-- represents the most important air pollutant challenge in the Puget Sound region. Exposure to this particulate matter aggravates asthma and is linked with respiratory infections. In the winter, most particulate matter comes from wood burning stoves and fireplaces; in the summer, vehicle exhaust and outdoor burning contribute most to levels of particulate matter.

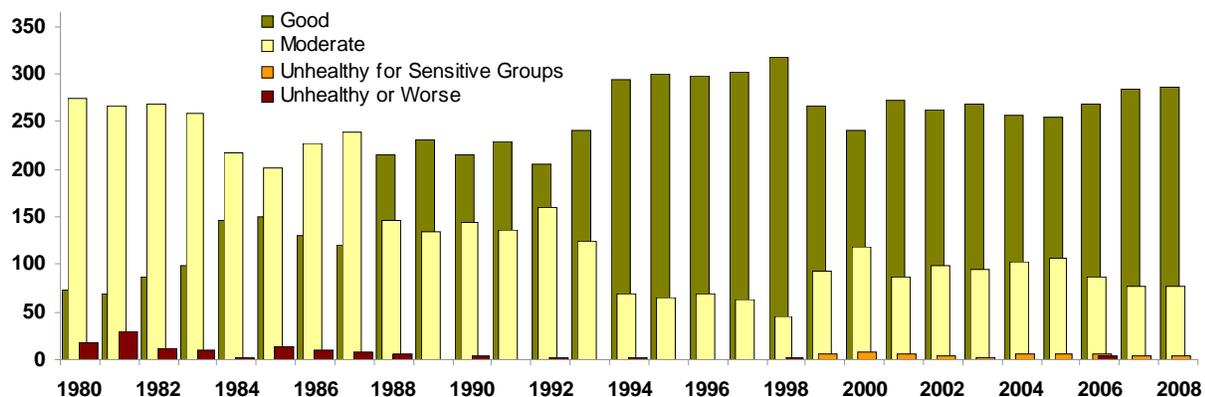
The AQI indicates that air quality in King County improved steadily between 1980 and 1999, when the EPA applied stricter standards and added a category for sensitive groups. In 2008, the EPA strengthened the breakpoints for ozone. Because of changes in EPA standards, comparison from year to year should be done with caution.

As shown in Figure 10.1, from the time of the application of stricter standards the number of days deemed "unhealthy for sensitive groups" has ranged between two and seven days each year. Though the AQI is typically dictated by particulate matter, in 2008, all three days deemed "unhealthy for sensitive groups" were linked to high levels of ozone. King County experienced four days in 2006 that rated "unhealthy", all linked to high ozone levels.

Still, the number of days with "good" air quality has been on the rise of late. In the last two years, King County has experienced "good" air quality nearly 80% of the time.

Figure 10.1

Days Per Year in Each Air Quality Category in King County (1980-2008)



**Air Toxics** The Washington State Department of Ecology has monitored air toxics in the Puget Sound region since 2000, though air toxics do not have federal ambient air quality standards. Trends in air toxics are not yet available.

Consistent with other major metropolitan areas, the U.S. EPA placed the Puget Sound region in the top five percent of the nation for potential cancer risk from air toxics.

Diesel particulate matter—pollution from diesel-fueled trucks, cars, buses, construction equipment, rail, marine and port activities—poses the highest potential cancer risk in the region. The greatest air toxics contributors to cancer risk in our region are shown in figure 10.2.

**Greenhouse Gases** While both naturally occurring and synthetic gases have been increasing in concentration for centuries, attention is drawn to the effects of global population growth and industrialization on greenhouse gas concentrations resulting specifically from human activity. In the state of Washington, carbon dioxide (CO<sub>2</sub>) emissions are the largest type of greenhouse gas emissions.

As shown in Figure 10.3, the transportation sector—including on-road vehicles, ships, trains and planes—contribute more than half of the greenhouse gases emitted in the Puget Sound region. In 2006, the Washington State Department of Community, Trade and Economic Development found that increased freight movement on Washington’s roadways has accounted for an increasing share of on-road transportation carbon dioxide emissions over the last two decades. Despite improved fuel efficiency in passenger cars, the increased use of less-efficient light-duty trucks, SUVs and heavy-duty trucks has contributed to elevated carbon dioxide emissions.

Figure 10.2

**Greatest Air Toxics Contributors to Cancer Risk (2003)**

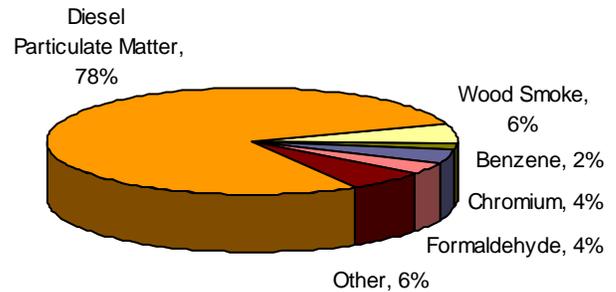
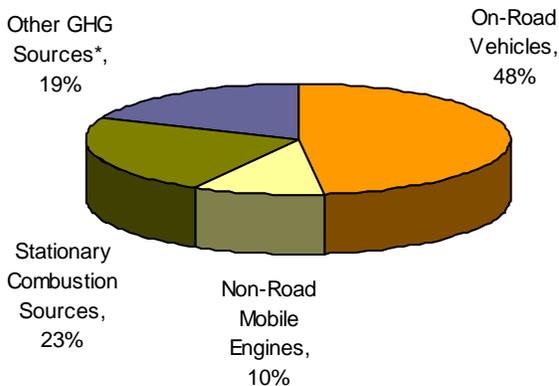


Figure 10.3

**Sources of Greenhouse Gas Emissions in King County (2005)**



As of 2005, the King County region (all residents and businesses) produced approximately 22 million metric tons of carbon dioxide (CO<sub>2</sub>) equivalents annually. This is about one quarter of Washington State’s emissions and roughly 0.3% of the United States’ emissions. Energy and climate mitigation efforts have slowed growth in GHG emissions, but in general they continue at unprecedented levels.

The city of Seattle, responsible for roughly 30% of King County’s overall emissions, reported emissions in 2005 to be 8% below 1990 levels. They attribute this reduction to several factors, such as offsetting the emissions generated by Seattle City Light’s electricity production through innovative emissions reduction projects. They also report that conservation efforts, in conjunction with many residential and commercial users switching from heating oil to lower carbon intensity natural gas, contributed to this progress.

\*Includes landfills, livestock, non-energy petroleum products, e.g.

## ENERGY CONSUMPTION

### Outcome: Improve Air Quality

#### Countywide Planning Policy Rationale

"In cooperation with water and electricity providers, local jurisdictions, including sewer and water districts, shall encourage programs for...power conservation in public facilities and in the private sector." (ED - 11) "Aggressive conservation efforts shall be implemented to address the need for adequate supply for electrical energy and water resources, and [to] achieve improved air quality. Efforts shall include, but not be limited to, public education...conservation credits, and energy efficiency in new and existing buildings." (CO, 6)

This indicator tracks the consumption of energy from gasoline, diesel fuel, natural gas, and electricity in King County. Total energy consumption in King County increased more than 13% from 1996 to 2008. When adjusted for population growth, per capita energy consumption remains roughly the same in 2008 as 1996. Per capita energy consumption was highest in 2000 when King County residents consumed nearly 149 million BTU per person.

**Non-Petroleum Energy** As shown in Figure 11.1, per capita consumption of natural gas peaked in 1999 before experiencing five straight years of decline and dropping 13% through 2004. Since then however, consumption of natural gas has again begun to rise.

Per capita consumption of electricity has similarly experienced a recent upward trend. While per capita consumption of electricity dipped in 2002 to a level not seen in at least the previous 15 years, it has since experienced six years of continued though gradual increase.

**Petroleum Energy** Figure 11.1 shows the steady decline in per capita gasoline consumption since 2001, decreasing more than 10% to about 1.12 gallons per day per person in 2008. Figure 11.2 reflects nearly a 4% decline in total gasoline consumption countywide over this time period, nearly 32 million gallons, despite population gains. Meanwhile, diesel fuel usage has assumed a greater share of energy usage in the last decade.

Figure 11.1

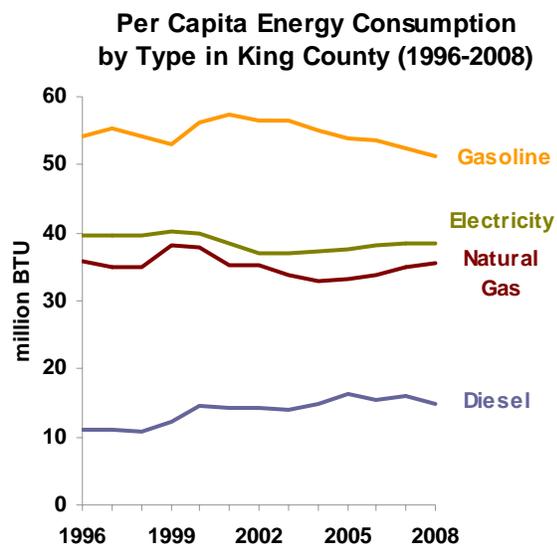
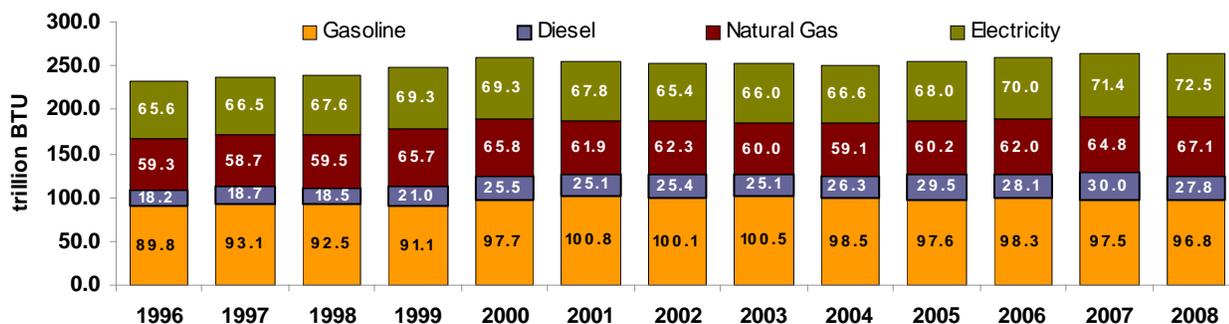


Figure 11.2

#### Total Energy Consumption by Type in King County (1996-2008)



## VEHICLE MILES TRAVELED (VMT) PER YEAR

### Outcome: Improve Air Quality

#### Countywide Planning Policy Rationale

"All jurisdictions, in coordination with Puget Sound Air Pollution Control Agency\* and the Puget Sound Regional Council, shall develop policies, methodologies and standards that promote regional air quality, consistent with the Countywide Policy Plan." (CA-14) "The land use pattern for King County shall protect the natural environment by...concentrating development" (FW-6) "The land use pattern shall be supported by a balanced transportation system which provides for a variety of mobility options....(FW-18) "General capacity improvements promoting only single-occupant vehicle traffic shall be a lower priority." (T-8)

\*Now the Puget Sound Clean Air Agency

The transportation sector is responsible for about half of all greenhouse gas emissions. This indicator measures all vehicle miles traveled (VMT) in a given year on the streets and highways of King County.

VMT includes commercial and private vehicles, so both economic activity and personal travel patterns influence the total. Therefore, factors that influence total VMT include trends in population, economy, fuel cost, land use, employment, and investment in the transportation system.

The total VMT in King County for 2007 was nearly 16.5 billion miles. With the population growing over 17% from 1993 through 2007, VMT in King County has increased by more than 2.6 billion miles. As shown in Figure 12.1, total VMT has leveled off recently, declining slightly in both 2006 and 2007 despite population gains.

Figure 12.1

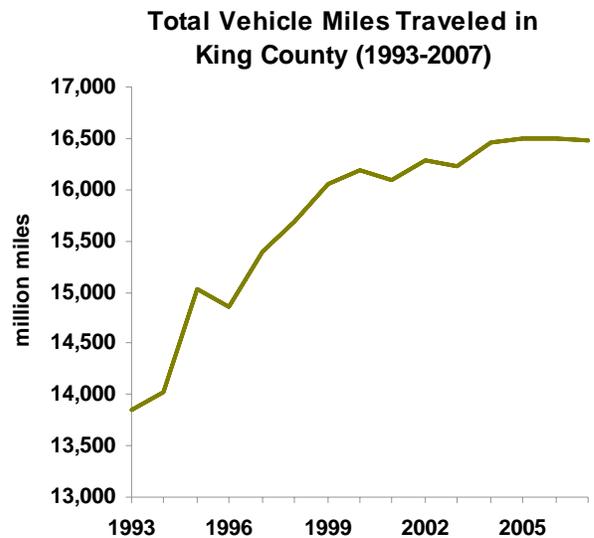
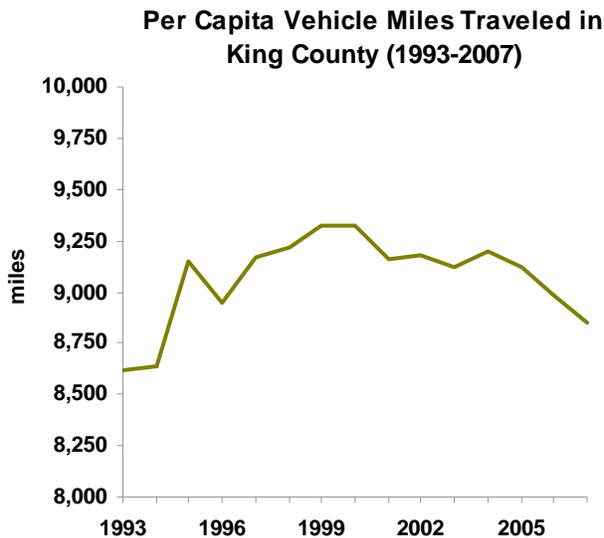


Figure 12.2



Accounting for population growth, a recent drop in annual VMT per capita is noticeable, declining 479 miles (5%) from its peak in 1999 to 2007. In that period, VMT per capita experienced a decline in six of the last eight years.

In contrast, the mid- to late-1990's were characterized by increasing vehicle use. Figure 12.2 shows per capita VMT for the 15 years from 1993 through 2007. Over that period, the average per capita VMT is 9,068 miles per year.

Factors influencing recent declines in per capita VMT may include rising gas prices, particularly as experienced in 2005 through 2007. The continued high cost of gas into 2008, combined with the weakened economy, will likely have a dampening effect on VMT as higher unemployment and decreased commerce take vehicles off the roads.

## SURFACE WATER QUALITY

### Outcome: Protect Water Quality and Quantity

#### Countywide Planning Policy Rationale

"Natural drainage systems including associated riparian and shoreline habitat shall be maintained and enhanced to protect water quality, reduce public costs, protect fish and wildlife habitat, and prevent environmental degradation. Jurisdictions with shared basins shall coordinate regulations to manage basins and natural drainage systems which include provisions to: a. Protect the natural hydraulic and ecological functions of drainage systems, maintain and enhance fish and wildlife habitat, and restore and maintain those natural functions; b. Control peak runoff rate and quantity of discharges from new development to approximate pre-development rates; and c. Preserve and protect resources and beneficial functions and values through maintenance of stable channels, adequate low flows, and reduction of future storm flows, erosion, and sedimentation." (CA-9) "All jurisdictions shall implement the Puget Sound Water Quality Management Plan to restore and protect the biological health and diversity of the Puget Sound Basin." (CA-15) "Each jurisdiction's policies, regulations, and programs should effectively prevent new development and other actions from causing significant adverse impacts on major river flooding, erosion, and natural resources outside their jurisdiction." (CA-12)

The King County Countywide Planning Policies require all jurisdictions to implement the *Puget Sound Water Quality Management Plan* to restore and protect the biological health and diversity of the Puget Sound Basin. The Puget Sound Management Plan identifies jurisdictional actions to maintain and improve Puget Sound's health by: preserving and restoring wetlands and aquatic habitats; preventing increases in the introduction of pollutants to the Sound and its watersheds; and eliminating harm from the entry of pollutants to the waters, sediments and shorelines of Puget Sound. As such, this indicator focuses on the condition of lakes, streams and rivers within King County's watersheds as well as that of Puget Sound itself.

**Marine** Puget Sound water quality is monitored through a variety of means by various stakeholders in Washington state. King County DNRP conducts monthly water quality monitoring at 14 offshore locations in Puget Sound, measuring for temperature, salinity, density, dissolved oxygen, nutrients, chlorophyll and fecal coliform bacteria. In 2007, two of the offshore stations sampled in Quartermaster Harbor on Vashon-Maury Island registered at a high level of concern using this index, while one of the stations sampled in Elliott Bay registered at a level of moderate concern. Meanwhile, fecal bacteria are not a concern in parts of the Puget Sound that surround King County; all ambient and outfall sites met the fecal coliform bacteria geometric mean standard in 2007.

**Lakes** Monitored by the King County Department of Natural Resources and Parks, Carson's Trophic State Index (TSI) assesses the condition of lakes in King County. A lake's trophic state is defined as the total weight of living biological material in its waters and includes measurements of water clarity, phosphorus levels and algal levels.

These attributes provide a good indication of a lake's biological activity, which is influenced by a variety of factors, both natural (including watershed size, lake depth and climate) and man-made (including land development, increases in impervious land surfaces and the introduction of sewage to a lake).

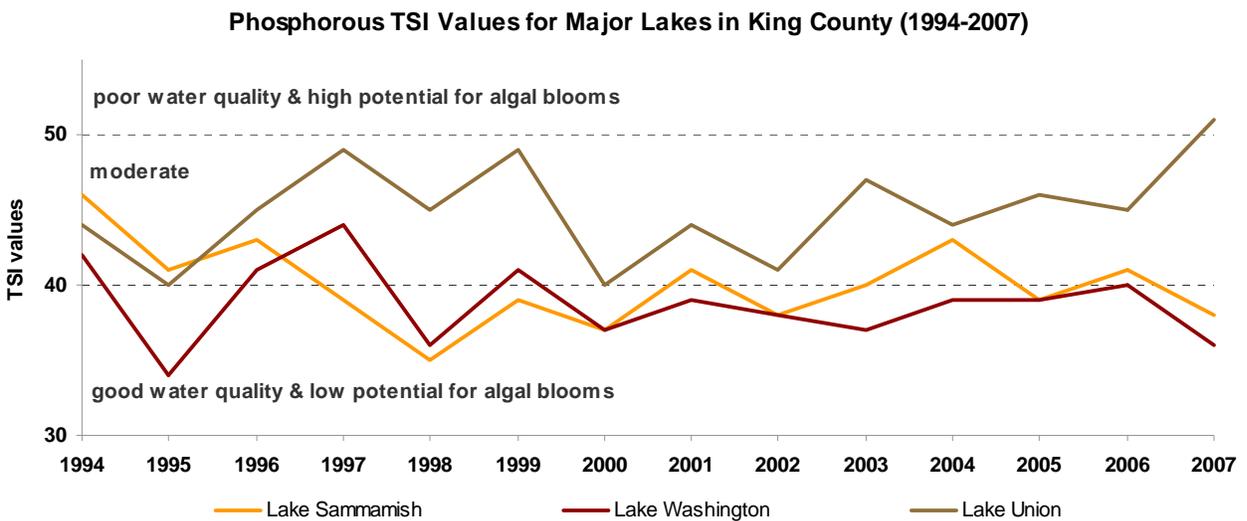
The increase in a lake's biological activity is referred to as eutrophication. Natural eutrophication occurs over centuries and is often not observable in a single human lifetime, but human activity can accelerate these natural processes.

Figure 13.1

Trophic State Index Values and Attributes		
TSI	Trophic State	Attributes
<40	Oligotrophic	<ul style="list-style-type: none"> <li>• high water clarity</li> <li>• low algae values</li> <li>• low phosphorus</li> </ul>
40-50	Mesotrophic	<ul style="list-style-type: none"> <li>• moderate water clarity</li> <li>• moderate algae values</li> <li>• moderate phosphorus</li> </ul>
50-60	Eutrophic	<ul style="list-style-type: none"> <li>• lower water clarity</li> <li>• higher chlorophyll values</li> <li>• higher phosphorus</li> </ul>
>60	Hypereutrophic	<ul style="list-style-type: none"> <li>• low water clarity</li> <li>• high potential for nuisance algae blooms</li> </ul>

**Major Lakes** Figure 13.2 illustrates the annual fluctuations in the Phosphorus TSI value of the county's large lakes. While phosphorus is necessary for plant and animal growth, excessive amounts can increase the likelihood of nuisance algal blooms. Because phosphorus enters water bodies via the discharge of detergents, runoff containing fertilizers, or septic system seepage, efforts to decrease stormwater discharge and to improve wastewater treatment are meant to decrease excessive phosphorus levels in these lakes. As shown, the 2007 phosphorus level in Lake Union increased to the highest value since before 1994, while the phosphorus level in both Lake Washington and Lake Sammamish decreased.

Figure 13.2



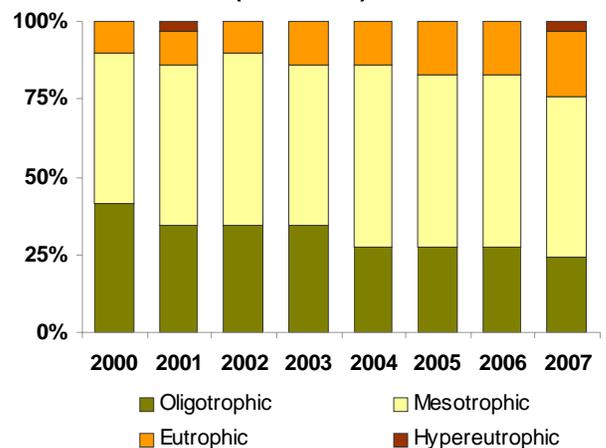
**Small Lakes** Figure 13.3 shows the distribution of 23 small lakes between 2000 and 2007 by phosphorus trophic state. As shown, over two-thirds of the lakes monitored in 2007 had low to moderate phosphorus levels (oligotrophic and mesotrophic TSI values).

Figure 13.3

Overall, 11 of the lakes had lower phosphorus levels in 2007 than their 2000 levels. The number of lakes in the eutrophic range has doubled since 2000, while the number of oligotrophic lakes has decreased by almost half the level in 2000.

In 2007, six lakes were found to have high phosphorus levels (eutrophic TSI values): Killarney and Trout Lakes in South King County; Paradise and Cottage Lakes in North King County; and Francis and Allen Lakes in East King County. All six lakes are within the unincorporated area of King County. Only one, Allen Lake in East King County, was found to have very high phosphorus levels (hypereutrophic TSI values).

Distribution of Small Lakes in King County by Phosphorus TSI Values (2000-2007)



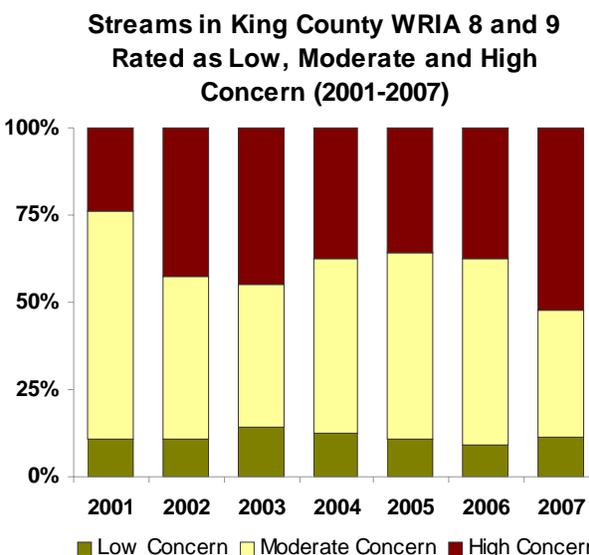
The map on page 11 shows the location of the monitored lakes by trophic state.

**Rivers & Streams** Through the Stream Monitoring Program, King County Department of Natural Resources and Parks routinely monitors the quality of a number of the county’s streams and rivers. Water samples are collected during routine baseflow conditions and are analyzed for a variety of parameters including: temperature, dissolved oxygen, turbidity, total dissolved solids, pH, conductivity and nutrient content. The parameters are aggregated into a single value – the Water Quality Index (WQI)—which allows for comparative analysis over time and across sampling locations. Based on its WQI value, a stream location is identified as being of low, moderate or high concern with regard to its water quality. The map on page 11 shows the location of the stream monitoring stations by quality rating.

This indicator reports stream water quality based on the WQI monitoring performed by the Stream Monitoring Program. The sites reported here are found in Water Resource Inventory Areas (WRIA) 8 and 9. WRIA 8 roughly combines the Lake Washington/ Cedar River and Lake Sammamish/ Sammamish River Watersheds; WRIA 9 roughly combines the Green/ Duwamish Watershed and South Puget Sound Drainage Basin.

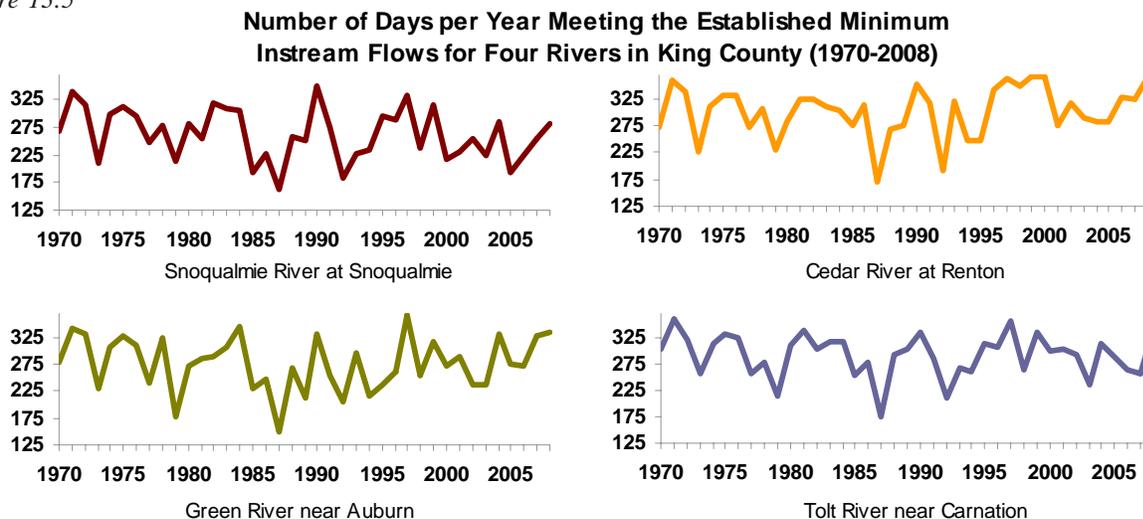
As figure 13.4 illustrates, about half of the streams sampled in 2007 were rated as “low concern” or “moderate concern”. The number of “high concern” stream locations in 2007 have doubled since 2000. Most of the streams of “high concern” are located in WRIA 8, predominantly in highly urbanized areas between Interstate 90 and the King-Snohomish County line. Two thirds of all monitored streams in WRIA 8 rated “high concern” in 2007.

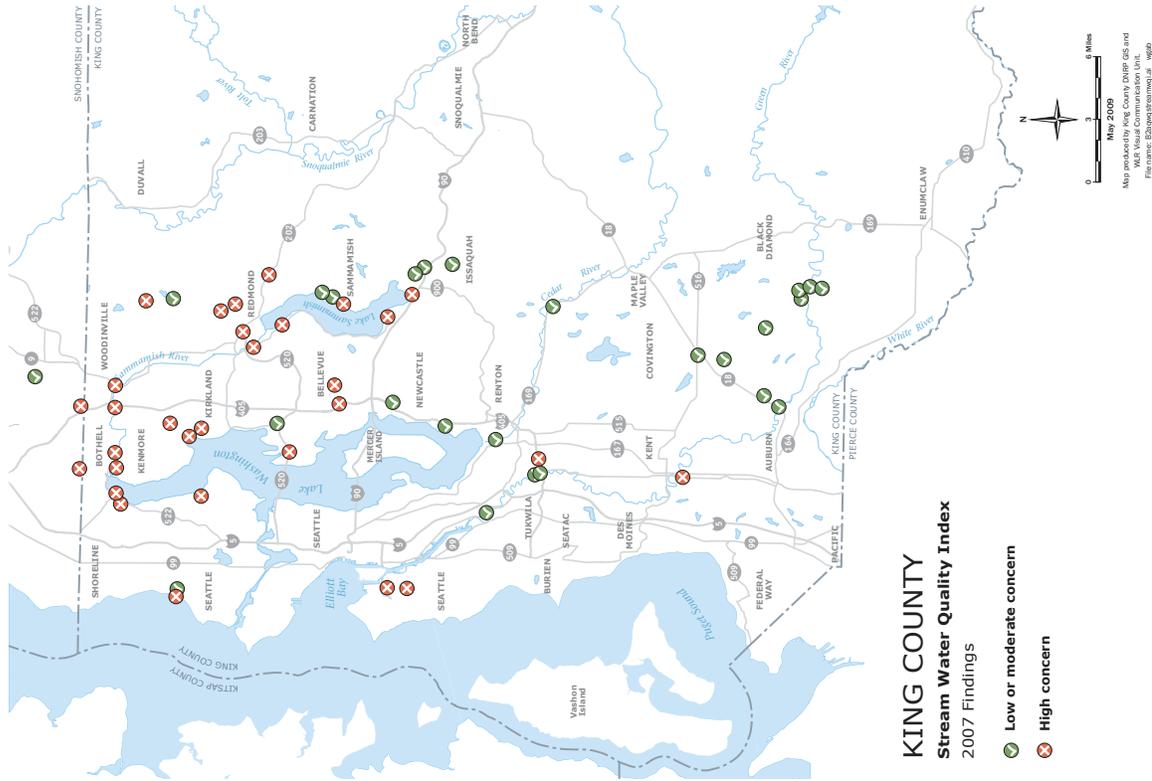
Figure 13.4



Instream flow—a specific stream flow at a specific location and time of year—is another important aspect of water quality. The Washington State Department of Ecology establishes minimum instream flows that are necessary to protect and preserve the resources and uses served by the stream, such as fish, wildlife and recreation. Instream flows fluctuate naturally as a result of weather and climate cycles. They may also be influenced by human activities, such as land use practices, deforestation, water supply withdrawals and stream diversions.

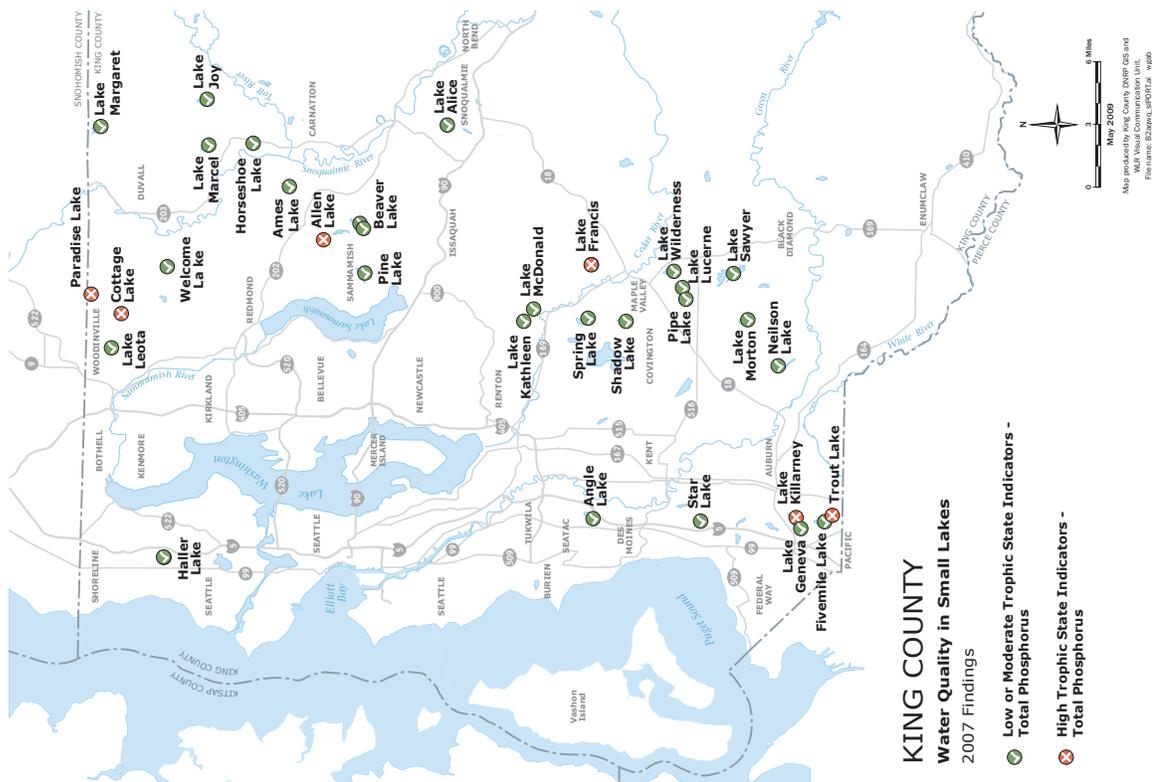
Figure 13.5





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**King County**



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**King County**

**WATER CONSUMPTION**

**Outcome: Protect Water Quality and Quantity**

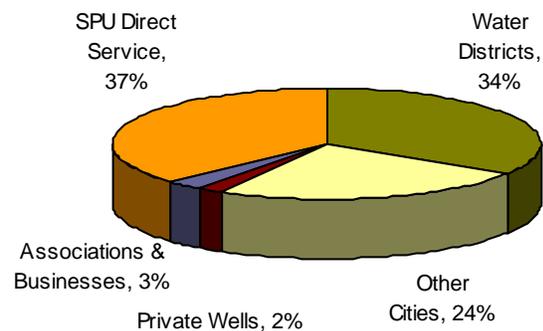
**Countywide Planning Policy Rationale**

“Water supply shall be regionally coordinated to provide a reliable economic source of water and to provide mutual aid to and between all agencies and purveyors. The region should work toward a mechanism to address the long-term regional water demand needs of all agencies and water purveyors.” (CO-5) “Aggressive conservation efforts shall be implemented to address the need for adequate supply for...water resources....Efforts shall include...public education, water reuse and reclamation, landscaping which uses native and drought-resistant plants and other strategies to reduce water consumption...”(CO-6) “Water reuse and reclamation shall be encouraged, especially for large commercial and residential developments, and for high water users such as parks, schools, golf courses, and locks.” (CO-7)

Seattle Public Utilities (SPU) provides potable water for approximately 70% of King County’s population, either through direct service or through wholesale provision by 27 other water utilities. Almost one-half of SPU’s customers are direct, retail customers, with the remainder being wholesale customers. Nearly all of this water is supplied by the Cedar River Watershed and the South Fork Tolt River Watershed in eastern King County. The remaining King County population obtains their potable water from approximately 2,000 other public systems and 12,000 private wells.

Figure 14.1

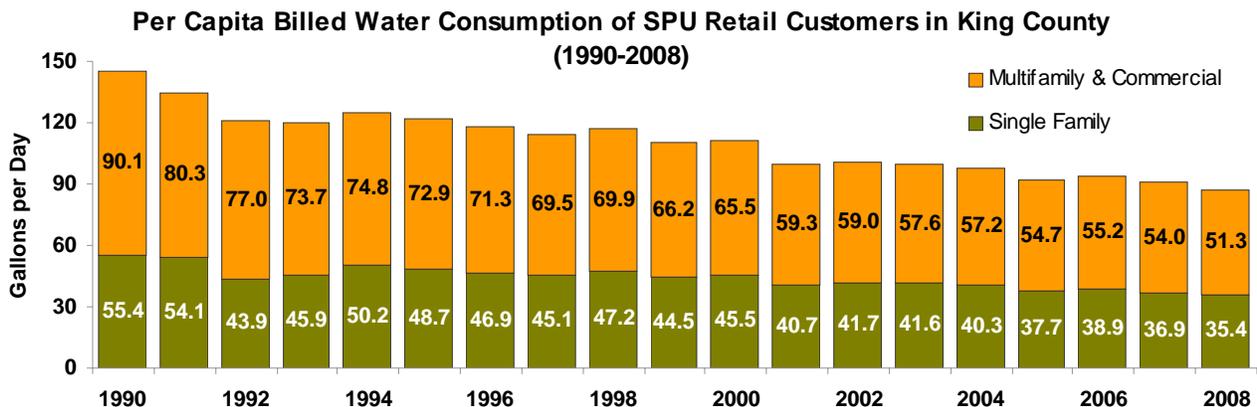
**Drinking Water Provision in King County**



**SPU’s Retail Customers** Figure 14.2 illustrates a distinct downward trend in water consumption by SPU’s retail customers, despite the occurrence of annual fluctuations due partly to summer weather patterns in the region. Accounting for population, SPU’s retail customers decreased water consumption more than 40% over the last 18 years. Per capita, SPU retail customers used nearly 87 gallons of water per day in 2008.

The largest annual change in consumption occurred in 1992 as a result of severe drought conditions and mandatory water use restrictions. Since then, a number of factors have kept water demand down including higher water rates, conservation efforts and improved system operations.

Figure 14.2



## GROUNDWATER QUALITY AND QUANTITY

### Outcome: Protect Water Quality and Quantity

#### Countywide Planning Policy Rationale

“All jurisdictions shall adopt policies to protect the quality and quantity of groundwater where appropriate...” (CA-5) “Land use actions should take into account the potential impacts on aquifers determined to serve as water supplies. The depletion and degradation of aquifers needed for potable water supplies should be avoided or mitigated; otherwise a proven, feasible replacement source of water supply should be planned and developed to compensate for potential lost supplies.” (CA-6)

**Data is not available annually to update this indicator.** From 2001 through 2004, the King County Department of Natural Resources and Parks (DNRP) conducted ambient groundwater monitoring, testing 68 wells for the presence of multiple contaminants including arsenic, nitrate, lead, and fecal coliform. Arsenic was detected in wells throughout the county, though this was not unexpected as arsenic is a naturally occurring component of certain types of soil. In fact, the high levels of arsenic present in over one half of the tested wells in East King County were attributed to the natural geology of the region, rather than contamination from human activity such as industrial manufacturing. As shown in Figure 15.1, only two of the wells in East King County were found to have excessive quantities of nitrate and fecal coliform, leading to good to excellent overall water quality ratings for the monitored wells.

Figure 15.1

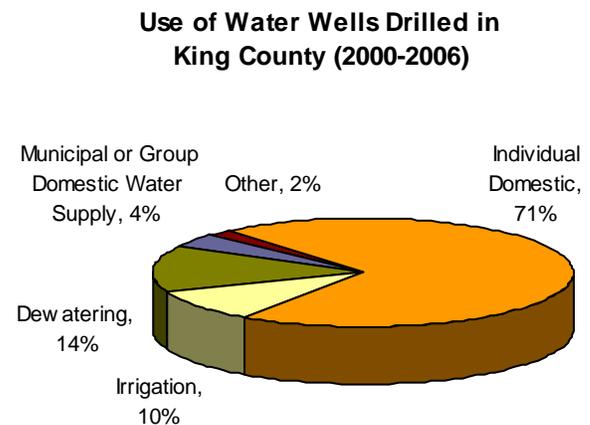
Monitoring Results of Ambient Ground Water Quality in King County (2001-2004)						
Ground Water Management Area (GWMA)	total wells sampled	Wells Not Meeting Standards*				Overall Water Quality
		Arsenic	Nitrate	Lead	Fecal Coliform	
East King County	15	8	1	0	1	Good
Issaquah Creek Valley	15	0	0	0	0	Very Good- Excellent
Redmond- Bear Creek Valley	16	1	0	0	0	Very Good
Vashon-Maury Island	22	2	0	0	0	Good

\* Drinking water standards: arsenic (0.01 mg/L), nitrate (10 mg/L), lead (0.015 mg/L), fecal coliform (any detection of fecal coliform constituted an exceedence of the drinking water standard).

In 2006, King County DNRP partnered with Seattle-King County Public Health to determine the effect of new and existing Group B systems (serving 2 to 14 connections) and other exempt water wells on Group A (15 or more connections) public water utilities. The study identified around 11,500 water wells logged by the Washington State Department of Ecology in King County.

The study showed that over 1,500 new water wells had been drilled since 2000, most for individual domestic use. The majority of these domestic water wells (94% of those drilled over the seven-year period) have been drilled in rural King County. However, a large proportion of the domestic and irrigation wells were drilled within existing water utility service areas. Almost 40% of the domestic and irrigation wells drilled in King County were drilled within the water supply areas of Covington Water District, Cedar River Water and Sewer District, King County Water District 119, Sammamish Plateau Water and Sewer District and Fall City Water District #127.

Figure 15.2



A dewatering well is intended to withdraw or divert groundwater for the purpose of facilitating construction, stabilizing a landslide, or protecting an aquifer.

## CONTINUITY OF TERRESTRIAL AND AQUATIC HABITAT NETWORKS

### Outcome: Protect the Diversity of Plants and Wildlife

#### Countywide Planning Policy Rationale

“Adjacent jurisdictions shall identify and protect habitat networks that are aligned at jurisdictional boundaries. Networks shall link large protected or significant blocks of habitat within and between jurisdictions to achieve a continuous Countywide network. These networks shall be mapped and displayed in comprehensive plans.” (CA-7) “All jurisdictions shall identify critical fish and wildlife habitats and species and develop regulations that a) promote their protection and proper management; and b) integrate native plant communities and wildlife with other land uses where possible.” (CA-8) “Natural drainage systems including associated riparian and shoreline habitat shall be maintained and enhanced to protect water quality, reduce public costs, protect fish and wildlife habitat, and prevent environmental degradation.” (CA-9)

**Data is not available annually to update this indicator.** In addition to designating and protecting critical areas, the Growth Management Act also requires local governments to identify open space corridors within and between urban growth areas that are useful for recreation, wildlife habitat, trails, and connection of critical areas. These open space corridors maintain wildlife connectivity, providing access to larger habitats. When ecosystems become fragmented and lack connectivity, fish and wildlife are prevented from meeting their need for food, water, cover and reproduction.

This indicator focuses on land conservation priorities highlighted by the King County Greenprint Program. These priorities provide stakeholders with guidance regarding strategic land acquisition and conservation goals.

The Greenprint analysis has identified six regionally significant acquisition and conservation priorities in King County. The highest value lands are found throughout the forests of the Cascade foothills and along major riparian corridors. Other priority areas include farmland, the Puget Sound shoreline, regional trails connections and the protection of open space to maintain the Urban Growth Boundary.

As shown in figure 17.1, almost one-half of King County’s 1.4 million acres is permanently protected by local, state and federal land management agencies. King County and local jurisdictions together own and manage almost 175,000 acres of parks, open space and resource lands. An additional 105,000 acres of privately held, working resource lands are under development rights of King County. These lands comprise a variety of natural systems across the county and contribute to the protection of significant ecosystem features, such as water quality and quantity and wildlife habitat.

Figure 17.1

Federal, State, County and City Owned Lands within King County (2005)		
	acres of protected land	% countywide acreage
federal public lands	354,200	26%
city public lands	142,900	10%
state public lands	97,500	7%
King County public lands	31,800	2%
<b>total</b>	<b>626,400</b>	<b>46%</b>

What is Greenprint? The **Greenprint for King County Report** describes a regional conservation strategy that King County plans to apply to protect open space resources for such purposes as salmon recovery, farm and forest preservation, flood hazard reduction, parks and regional trails. The Greenprint strategy is informed by Geographic Information Systems, or GIS, which is used to evaluate the King County landscape to identify land conservation options that provide the greatest public benefits. The **Greenprint for King County Report** also reflects completion of a King County Conservation Finance Study and extensive public outreach. The Greenprint strategy and GIS model were conceived by the Trust for Public Land project team and King County staff. For more information about the Greenprint project, please see <http://www.kingcounty.gov/environment/stewardship/sustainable-building/greenprint.aspx>.

## CHANGE IN THE NUMBER OF SALMON

### Outcome: Increase Salmon Stock

#### Countywide Planning Policy Rationale

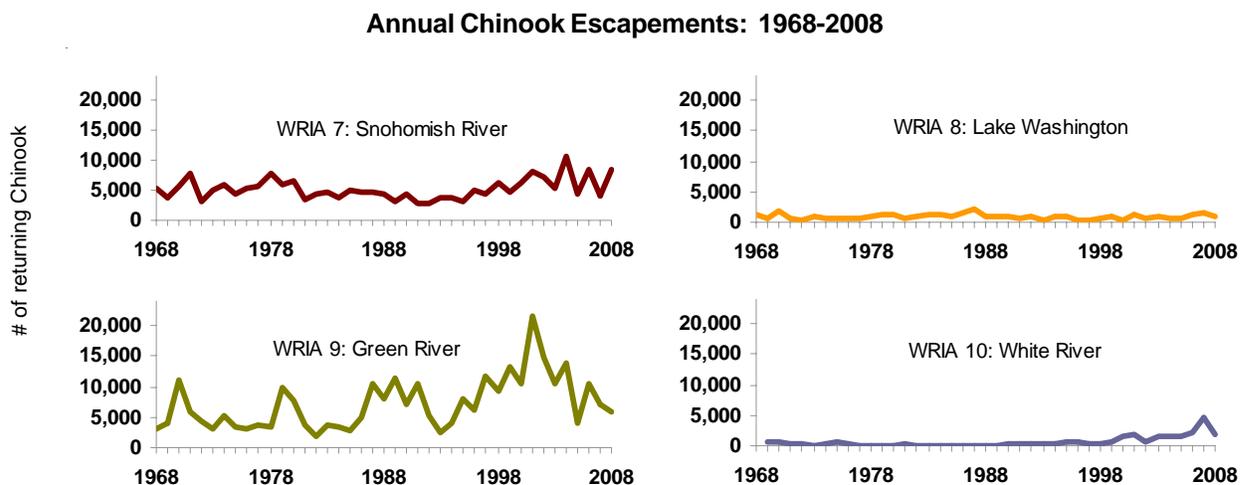
"All jurisdictions shall identify critical fish and wildlife habitats and species and develop regulations that a) promote their protection and proper management; and b) integrate native plant communities and wildlife with other land uses where possible." (CA-8) "Natural drainage systems including associated riparian and shoreline habitat shall be maintained and enhanced to protect water quality, reduce public costs, protect fish and wildlife habitat, and prevent environmental degradation. Jurisdictions within shared basins shall coordinate regulations to manage basins and natural drainage systems which include provisions to: a) protect the natural hydraulic and ecological functions of drainage systems, maintain and enhance fish and wildlife habitat, and restore and maintain those natural functions; b) control peak runoff rate and quantity of discharges from new development to approximate pre-development rates; and c) preserve and protect resources and beneficial functions and values through maintenance of stable channels, adequate low flows, and reduction of future storm flows, erosion, and sedimentation." (CA-9) "...Jurisdictions shall coordinate land use planning and management of fish and wildlife resources with affected state agencies and the federally-recognized Tribes." (CA-11)

Salmonid fish species native to King County include chinook, coho, sockeye/kokanee, pink and chum salmon, rainbow (including steelhead), cutthroat, bull and dolly varden trout and pygmy mountain whitefish. The Endangered Species Act currently identifies both the bull trout and chinook as threatened species in King County waters. Throughout much of Washington state, the maintenance of these fish populations is co-managed by the State of Washington and the treaty Indian tribes. While local jurisdictions do not manage fish populations directly, they do have responsibility for activities, such as land-use regulation, which influence salmon habitats.

This indicator looks at natural chinook escapement (the number of mature, adult chinook returning to their stream of origin to spawn naturally) in King County's four major Watershed Resource Inventory Areas: the Snohomish (WRIA 7), Cedar/ Sammamish (WRIA 8), Green/ Duwamish (WRIA 9) and Puyallup/ White (WRIA 10). Figure 18.1 shows the Chinook escapement from 1968 to 2008 in each WRIA and illustrates the annual variability of fish returns.

Escapement rates are still drastically short of 2055 targets set for chinook populations. As shown below, there is much variability in escapement returns, due in part to natural environmental conditions such as ocean warming cycles and precipitation but also to human activities including land-use practices that alter the natural stream flow. However, harvest and hatchery management efforts may contribute to increasing chinook returns, such as those seen in WRIA 9. Because habitat restoration activities have only just begun and have not yet been implemented in earnest, it is too early to attribute what are considered cyclical trends in chinook populations to these efforts.

Figure 18.1



## CHANGE IN NOISE FROM VEHICLES, PLANES AND YARD EQUIPMENT

### Outcome: Decrease Noise Levels

#### Countywide Planning Policy Rationale

Although the Countywide Planning Policies do not contain specific policy direction for noise, the Benchmark Task Force added this Indicator because there were concerns about noise levels in King County. The Task Force also wanted to monitor how growth management issues affected noise levels.

**Data is not available annually to update this indicator.**

**Street Noise** The *American Housing Survey for the Seattle-Everett Metropolitan Area in 2004* asked respondents about their perception of neighborhood street noise or traffic. Although more than a third of the responding King County households acknowledged the presence of street noise or traffic in their neighborhood, less than half of them declared the condition to be bothersome. However, street noise and traffic is more troubling in Seattle, where over a fifth of the households perceived it as a bothersome condition.

**Aircraft Noise** In a survey conducted on behalf of Puget Sound Regional Council in April 2006, fewer than a third (31%) of residents around Sea-Tac International Airport stated that they notice aircraft noise and found it bothersome. However, over half (56%) stated that while they notice aircraft noise occasionally it doesn't bother them. The remaining respondents claimed not to notice aircraft noise.

Figure 19.1

Perception of Neighborhood Street Noise or Traffic for King County Households (2004)

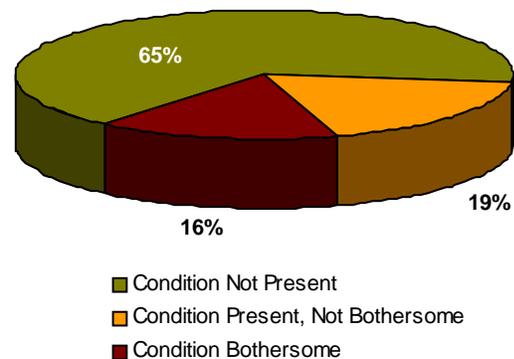
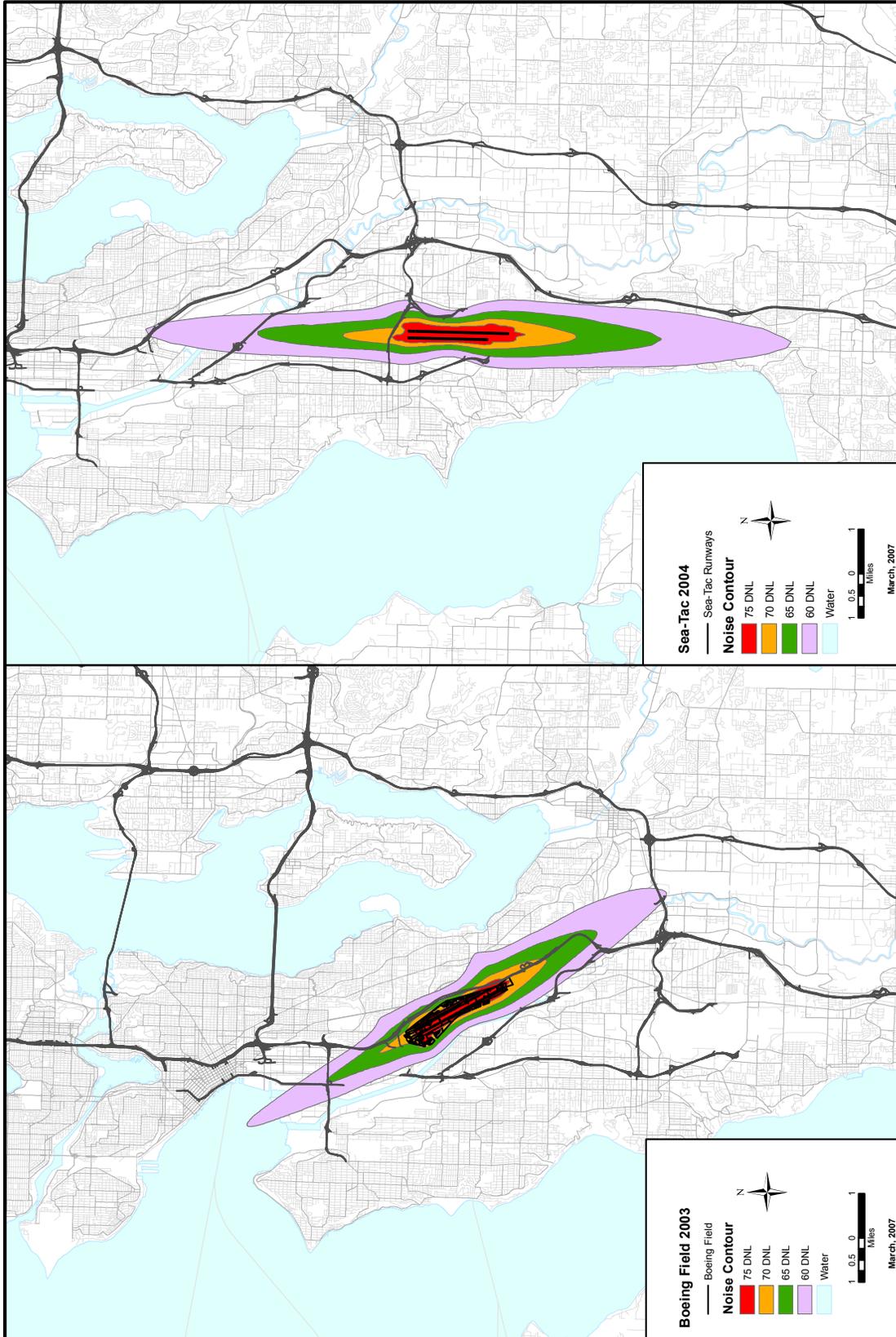


Figure 19.2 shows noise contours for both Boeing Field (2003) and Sea-Tac Airport (2004). Noises contours—established by modeling annual operations at each airport—graphically illustrate noise levels from air traffic by connecting points of equal noise exposure across an area. Noise exposure is measured in terms of **DNL** (Day-Night Average Sound Level) to represent cumulative exposure to aircraft noise over a 24 hour period. DNL is the average sound level in decibels over a given time, and include a 10 decibel penalty for noise occurring at night between the hours of 10 pm and 7 am to account for increased sensitivity to night-time noise.

Federal Aviation Administration (FAA) guidelines consider aircraft noise exposure levels below 65 DNL to be compatible with all land uses. The 65 DNL noise contour around Boeing Field encompassed nearly 3,000 acres, but only about one-sixth of the area is comprised of residential land uses, according to the 2003 modeling study for this airport. In contrast, the 65 DNL noise contour around Sea-Tac Airport encompassed over 4,000 acres. Land uses within the Sea-Tac Airport contours were not provided by the 2004 modeling study.

Other airports and airfields located in King County (but not included in this analysis) include: Auburn Municipal Airport, Bandera State Airport, Crest Airport, Kenmore Air Harbor, Renton Municipal Airport, Skykomish State Airport and Vashon Municipal Airport.



**2003 & 2004  
Noise Contours  
Boeing Field & Sea-Tac Airport**

The information included on this map has been compiled from a variety of sources and is subject to change without notice. King County makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. King County shall not be liable for any general, special, indirect, incidental, or consequential damages, including lost profits, arising from the use or misuse of the information contained on this map. Any sale of this map or information on this map is prohibited except by written permission of King County.

File Name: g:\projects\gis\client\_services\budget\07064\_noisecontourmaps\BoeingField.mxd Mary Ulrich  
March, 2007

**POUNDS OF WASTE DISPOSED AND RECYCLED PER CAPITA**

**Outcome: Decrease Waste Disposal and Increase Recycling**

**Countywide Planning Policy Rationale**

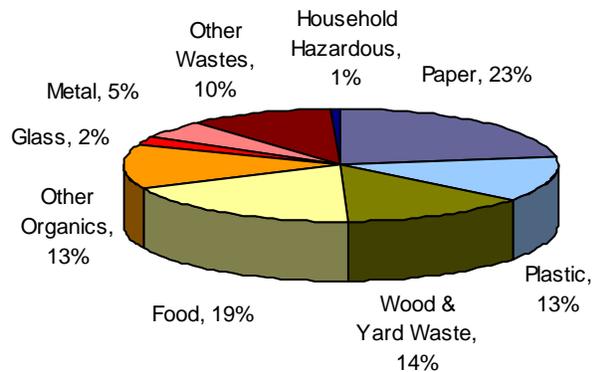
Although the Countywide Planning Policies do not include policy direction for reducing solid waste or promoting recycling programs, the Benchmark Task Force added this Indicator, because recycling and reductions in solid waste save resources and landfill space, and reduce the potential for soil and water contamination due to leakage from landfills.

Due to changes in data collection, information is only available for the service area of King County's Solid Waste Division, an area that covers King County without Seattle. Comparison with data in previous Benchmark reports should be made with caution.

Most of the disposed waste in King County comes from residents and businesses in the form of municipal solid waste (MSW). Industrial waste, construction and demolition materials, and petroleum contaminated soils also contribute to the total waste disposed each year. Figure 20.1 shows the types of materials that residents and businesses threw away in 2007 as MSW. Residential waste, either commercially collected or self-hauled, accounted for 53% of MSW. Paper made up the largest share in both the residential (19%) and non-residential (27%) portions of MSW.

Figure 20.1

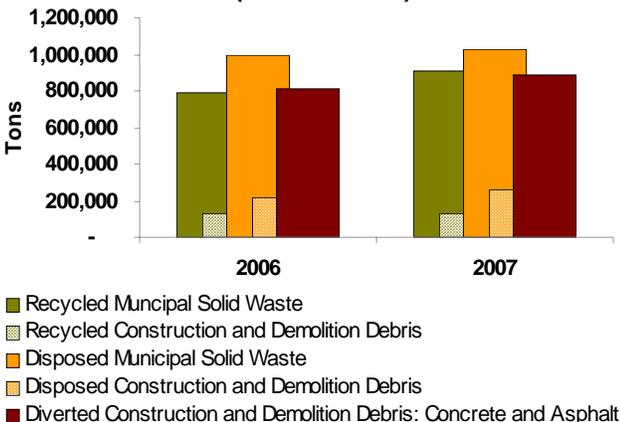
**Waste Characterization in King County (2007)**



More than 2.3 million tons of waste were generated in the service area of King County's Solid Waste Division in 2007, excluding asphalt and concrete (see notes). Waste generation grew about 10% from 2006 to 2007; the recycling rate increased from 43% to 45%. Figure 20.3 shows per capita waste disposal increased to nearly 2,000 pounds annually in 2007, while per capita recycling increased to just over 1,600 pounds. Previous Benchmark reports provided per capita data only for single-family homes; in this report, per capita data include commercial and multifamily customers, and include construction and demolition debris (excluding concrete and asphalt). Influenced by the economy, both disposal and recycling are expected to decline with the recent economic downturn.

Figure 20.2

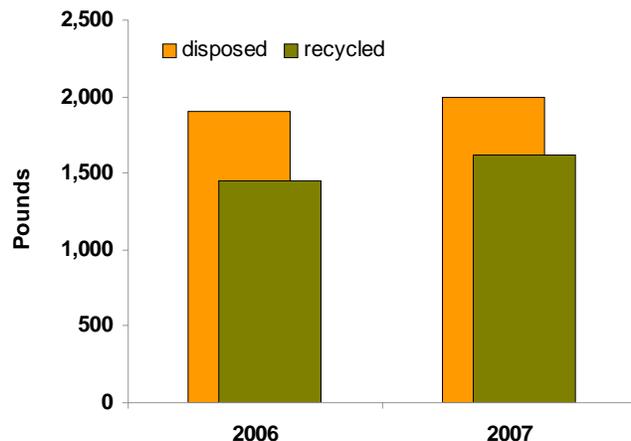
**Annual Waste Disposed and Recycled in Service Area of King County Solid Waste (2006 and 2007)**



\*King County Solid Waste service area does not include Seattle.

Figure 20.3

**Annual Waste Disposed and Recycled in Service Area of King County Solid Waste Per Capita (2006 and 2007)**



## Notes and Data Sources

### Indicator 9: Percent of Land Developed

The Growth Management Act is codified in Chapter 36.70A Revised Code of Washington. For more information about critical areas requirements, see <http://www.gmhb.wa.gov/gma/index.html>. Figures 9.1 and 9.2 data provided by King County Department of Natural Resources and Parks, Water and Land Resources Division (DNRP/WLRD), at <http://www.kingcounty.gov/environment/wlr.aspx>.

### Indicator 10: Air Quality

Figure 10.1 and 10.2 data provided by *2005 Air Quality Summary*, prepared by Puget Sound Clean Air Agency (PSCAA), <http://www.pscleanair.org/news/library/reports/2007AQDSFinal.pdf>. In 1999, the EPA added PM2.5 to the Air Quality Index and divided the “unhealthy” category into “unhealthy” and “unhealthy for sensitive groups” making direct comparability to previous annual ratings inappropriate. Air toxics sources measured in Puget Sound Region in 2002. For information regarding Puget Sound EPA designation of air toxics, refer to the *National Air Toxic Assessment, 1996* from the U.S. EPA at <http://www.epa.gov/ttn/atw/nata/>. State emissions data provided by *Washington’s Greenhouse Gas Emissions: Sources and Trends, 2006*, prepared by the Washington State Department of Community, Trade and Economic Development (CTED), <http://www.cted.wa.gov/energy/archive/papers/wa-ghg99.htm>. Figure 10.3 data provided by King County DNRP, based on *2005 Air Emission Inventory*, [http://www.pscleanair.org/news/library/reports/Air\\_Emission\\_Inventory\\_2005.pdf](http://www.pscleanair.org/news/library/reports/Air_Emission_Inventory_2005.pdf).

### Indicator 11: Energy Consumption

This indicator measures trends in the usage of the four primary energy sources in King County: gasoline, diesel, electricity and natural gas. It does not include renewable energy sources, nuclear-powered sources or usage of other fossil fuels including aviation/ jet fuel or coal in energy production. Due to these exclusions, energy consumption at the county level is not strictly comparable to state and national totals where such measurement is made. Diesel consumption data was not collected until 1996. Improved data collection methodology may be partly responsible for the sharp rise in diesel usage from 1996-2000. Electricity consumption data provided by Puget Sound Energy (PSE) and Seattle City Light. Natural gas consumption data provided by PSE. Gasoline and diesel consumption data provided by Washington State Department of Transportation (DOT) and is based on annual Washington State Office of Financial Management (OFM) population estimates for King County.

### Indicator 12: Vehicle Miles Traveled

Data provided by Washington State Department of Transportation (DOT). Data on statewide trends taken from *Measures, Markers and Mileposts: Transportation Benchmarks 2006 Report* from the WA State DOT, available at [http://www.wsdot.wa.gov/NR/rdonlyres/BD67F128-35A6-4DA7-A27F-764F213C5A84/0/2006\\_Benchmarks.pdf](http://www.wsdot.wa.gov/NR/rdonlyres/BD67F128-35A6-4DA7-A27F-764F213C5A84/0/2006_Benchmarks.pdf). Additional information on the cost of gasoline provided by the Energy Information Administration (EIA), a statistical agency of the U.S. Department of Energy, at <http://www.eia.doe.gov/>.

### Indicator 13: Surface Water Quality

**Marine:** Marine water quality data provided by King County DNRP/WLRD, <http://www.kingcounty.gov/environment/waterandland/puget-sound-marine.aspx>. The 14 offshore sites monitored by King County DNRP for eutrophication and fecal coliform include both ambient (sites away from any known source of pollution) and outfall (those situated close to a know source of pollution) sites. The offshore site testing includes parameters for temperature, salinity, density, dissolved oxygen, nutrients, chlorophyll and fecal coliform bacteria. The State of Washington’s fecal coliform standard indicates that organism counts should not exceed a geometric mean value of 14 colony-forming units (CFU) per 100 ml.

**Lakes:** Lake water quality data provided by King County DNRP/WLRD. For more information about large lakes monitoring, see <http://green.kingcounty.gov/lakes/>. For more information about small lakes monitoring, see <http://www.kingcounty.gov/environment/waterandland/lakes/documents.aspx>. Figure 13.3 includes testing results for 23 lakes that are tested every year. Small lakes testing samples taken in summer months. While each major division (10, 20, 30 etc) of the Trophic State Index (TSI) represents a doubling or halving of algal biomass and is related to nutrients and water clarity, the TSI values are a continuum and some lakes may be in a borderline range, exhibiting some qualities of upper and lower classifications. Subsequently, small lakes with TSI values of 39.9 to 40.1 are included in the oligotrophic range and those with TSI values of 49.9-50.1 are included in the mesotrophic range. Eutrophication is not interpreted here as a statement of water quality but an indication of the conditions existing in lakes.

**Rivers and Streams:** Data about stream water quality was provided by King County DNRP/WLRD. For more detailed information about the results of this testing see <http://green.kingcounty.gov/WLR/Waterres/StreamsData/>. Instream flow data from the WA State Department of Ecology data was provided by King County DNRP. For more information about Instream flows, see Washington State Department of Ecology at <http://www.ecy.wa.gov/programs/wr/instream-flows/isfhtm.html>.

Maps prepared by King County GIS Center, <http://www.kingcounty.gov/operations/gis.aspx>.

### Indicator 14: Water Consumption

Figure 14.1 provided by King County DNRP/WLRD. For more information about water resources in King County, see <http://www.kingcounty.gov/environment/waterandland/drinking-water/sources.aspx>. Figure 14.2 data provided by Seattle Public Utilities (SPU) and analyzes only SPU-provided water consumption.

**Indicator 15: Groundwater Quality and Quantity**

All data provided by King County DNRP/WLRD. Figure 15.1 data taken from the 2001-2004 Ambient Groundwater Monitoring Results Report, available at <http://www.kingcounty.gov/environment/waterandland/groundwater/maps-reports/ambient-monitoring01-04.aspx>.

**Indicator 16: Change in Wetland Acreage and Function**

Indicator 16 is not reported in this bulletin as no new data exists. For the last reported data regarding the change in wetland acreage and function, see the 2005 Environmental Bulletin, available at [http://www.metrokc.gov/budget/benchmark/bench04/Environment/Environment\\_05.pdf#16](http://www.metrokc.gov/budget/benchmark/bench04/Environment/Environment_05.pdf#16).

**Indicator 17: Continuity of Terrestrial and Aquatic Habitat**

Open space corridors are required by the Growth Management Act under RCW 36.70A.160. Figure 17.1 data taken from the March 2005 *Greenprint for King County*, prepared by the Trust for Public Land Northwest for King County DNRP/WLRD available at <http://www.kingcounty.gov/environment/stewardship/sustainable-building/greenprint.aspx>.

**Indicator 18: Increase Salmon Stock**

Figure 18.1 data provided by King County DNRP/WLRD. For more information regarding salmon in King County waters, see <http://www.kingcounty.gov/environment/animalsandplants/salmon-and-trout.aspx>.

**Indicator 19: Change in Noise Levels.**

Figure 19.1 data provided by the *American Housing Survey for the Seattle-Everett Metropolitan Area in 2004* prepared by the American Housing Survey, <http://www.huduser.org/datasets/ahs/Ahs04metroreports/Seattle.pdf>, table 2-8. Figure 19.2. based on the *Sea-Tac Airport Community Impact Survey* conducted by the Puget Sound Regional Council, <http://www.psrc.org/projects/air/pubs/prelimsurveyresults.pdf>. Map prepared by King County GIS Center, <http://www.metrokc.gov/gis/>. Additional information provided by the Sea-Tac International Airport Noise Abatement website, <http://www.portseattle.org/community/environment/noise.shtml> and King County International Airport Noise Abatement website, <http://www.metrokc.gov/airport/noise/>. The FAA has sole authority over national airspace, and their air traffic controllers alone have authority to direct aircraft once airborne. The State of Washington, King County, and the City of Seattle exempt from regulation noise from the manufacture, operation, or testing of aircraft.

**Indicator 20: Waste Disposed and Recycled**

Recycling and diversion data provided by the Washington State Department of Ecology through the King County Department of Natural Resources, Solid Waste Division (DNRP/SWD). Information on construction and demolition debris comes from private facility operators, provided by King County DNRP/SWD. Disposal data for MSW provided by King County DNRP/SWD. For more information regarding solid waste, see <http://your.kingcounty.gov/solidwaste>. Construction and demolition recycling includes materials used for fuel production; MSW recycling does not include fuel uses. Materials excluded from recycling tonnage include landclearing debris, topsoil, and tires burned for energy, and auto bodies. Asphalt and concrete construction and demolition debris reported on the Department of Ecology survey is not included in either recycling or disposal tonnage, since it is unclear whether the material went to an end use that qualifies as beneficial use. Inclusion of concrete and asphalt in recycling figures would have greatly increased the appearance of recycling, and is instead reported separately. Figure 20.1 from *King County Monitoring Program, 2007 Solid Waste Characterization Study*, at <http://your.kingcounty.gov/solidwaste/about/documents/waste-characterization-study-2007.pdf>.