The Commission also looked at Great Lakes Basin water use data, extracted from national databases compiled by the U.S. Geological Survey (USGS)[9] and Environment Canada (EC)[10]. For its five-year reports, the USGS analyzes state data, adjusts the data to compensate for perceived deficiencies, and produces estimates of actual water use for the year of the report. Environment Canada derives its information from Statistics Canada surveys of major water users in the Basin, not from provincial data. Environment Canada's water use data tend to be lower than data provided by the provinces to the GLC's Regional Water Use Data Base, since provincial data are generated from water license permits as opposed to actual withdrawals. Like the USGS, Environment Canada's treatment of data is viewed as consistent over the years. As with the 1994-98 GLC data, the Commission concentrated on Basin aggregate numbers for withdrawals and consumptive use, mainly because of the somewhat different water use sector category and classification systems utilized by the two federal agencies.

Table 1 provides data (rounded) for withdrawals and consumptive use calculated from the various databases above. All tables and charts in this final report now reflect data for the Chicago urban area. The data indicate a range for water use in the Great Lakes Basin. The percentage of water consumed is approximately the same for all data sources, ranging from 4.4 percent to 4.6 percent.

Consumptive Use

For consumptive use, the Commission determined that the 1993 data, now updated with the inclusion of full water use data for Chicago, would be the basis for its final report. The Great Lakes Commission stated that the 1993 data were sufficiently comprehensive and consistent across all jurisdictions, were the product of a quality assurance and control process by its committee of water resource managers, and provided the best possible snapshot of water use in the Basin.

In 1993, consumptive use in the Great Lakes Basin was estimated to be 121 cms (4,270 cfs) as compared to a withdrawal of about 2,493 cms (88,060 cfs) (Figure 2-B). The 1993 consumptive use in the Great Lakes Basin can be summarized as follows:

- By country: Canada, 33 percent, and the United States, 67 percent, with per capita consumptive use being approximately equal for the two countries.
- By jurisdiction: Ontario, 27 percent; Michigan, 21 percent; Wisconsin, 20 percent; Indiana, 7 percent; New York, Quebec, and Ohio, 6 percent each; Illinois, 4 percent; Minnesota, 2 percent; and Pennsylvania, less than 1 percent (Figure 2-C).
- By type of water use: irrigation, 29 percent; public water supply, 28 percent; industrial use, 24 percent; fossil fuel thermoelectric and nuclear uses, 6 percent each; self-supplied domestic use 4 percent; and livestock watering, 3 percent (Figure 2-D).

The percentage of withdrawn water that is consumed within the Great Lakes system varies with the type of use to which the water is put. When water is used for irrigation, over 70 percent is consumed[11]. At the other extreme, when water is used for thermoelectric power, less than 1 percent is consumed. The percentage of water lost to the Basin when it is used for public supply and for industrial purposes—other large water-using categories—is of the order of 10 percent for each (Figure 3). As previously indicated the average consumption rate, considering all types of uses, is approximately 5 percent.

Consumptive use data for groundwater are not available for most jurisdictions. Groundwater withdrawal in the Great Lakes Basin is estimated to be generally between 3 percent and 5 percent of the total water withdrawal in the Basin. This figure, however, greatly understates the importance of groundwater to the Basin population. The USGS estimates that over 8 million people on the U.S. side of the border rely on groundwater as their source of drinking water, and groundwater is the most common source of bottled water. The effects of groundwater withdrawal may therefore be of concern on a local or subregional basis, particularly with respect to urban sprawl, even if withdrawals do not have a major impact on the overall water budget of the Basin[12].

The Commission has developed insights into trends in water use and their impact on potential future water demands. These insights were derived from a simple extension of trends established over the previous decade. The variability in existing data complicates not only analysis of past and present trends, but also the task of predicting the future. All predictions are heavily dependent on the assumptions underlying them and on an accurate understanding of the present starting point. Factors such as climate change could encourage the increased use of water for irrigation and other purposes. On the other hand, continued improvement in water demand management as well as in water conservation might help to slow any increase in withdrawals for consumptive use within the Basin. Because population will increase, there is a greater probability of increasing use in the future than there is of decreasing use. Projections presented below extend to 2020. The Commission believes that water use is likely to increase modestly by 2020 and that projections beyond this point should be considered highly speculative.

Thermoelectric Power Use. At thermoelectric power plants, water is used principally for condenser and reactor cooling. In the United States, thermoelectric withdrawals have remained relatively constant since 1985 and are expected to remain near their current levels for the next few decades. In Canada, modest increases are expected to continue along with population and economic growth.

Industrial and Commercial Use. In the United States, industrial and commercial water use has declined in response to environmental pollution legislation, technological advances, and a change in the industrial mix from heavy metal production to more service-oriented sectors. A similar trend is evident in Ontario, so combined use is expected to gradually decline through 2020.

Domestic and Public Use. In the United States, water use for domestic and

public purposes in the Great Lakes Basin generally increased from 1960 to 1995 and is expected to climb gradually through 2020. In Ontario, however, the modest downward trend established in recent years because of water conservation efforts is expected to continue.

Agriculture. In the United States, water use for agriculture in the Great Lakes region increased fairly steadily from 1960 to 1995 and is expected to continue to grow. In Canada, the rate of increase was somewhat greater, so that combined projections indicate a significant increase by 2020. Climate change could increase even further the competitive advantage in agriculture the Basin has as a result of its relative abundance of water.

Total Water Use. There is agreement that water withdrawal will increase in the future, although it is impossible to say with confidence just how much the increase will be[13]. There is, however, no such agreement on consumptive use. For example:

- The USGS and the U.S. Forest Service both estimate that water withdrawals in the U.S. portion of the Great Lakes Basin could rise about 2 percent from1995 to 2040.
- The USGS forecasts a decline of 2 percent to 3 percent in consumptive use of water in the U.S. section of the Great Lakes by 2020.
- A consultant to the study team developed a trend line for the period 1995-2020 that has consumption rising by 27 percent in the U.S. portion of the Basin, by 19 percent in the Canadian portion of the Basin, and by 25 percent in the whole Basin.
- The same consultant also produced estimates for a "conservation" scenario that projected rises in consumption by 2020 in the U.S. portion of the Basin of 4 percent, in the Canadian section of 1 percent, and in the total Basin of 3 percent.

The above figures may represent a range of possibilities. What is clear is that water managers will need to manage the resource carefully.

Removals

Removals are waters that are conveyed outside their basin of origin by any means. The following paragraphs discuss current removals by diversion, other types of removals such as removal by marine tanker, bottled water, or ballast water, and the potential for future diversions and other removals. Some past diversion and removal proposals are summarized in Appendix 6.

Current Diversions. Water diversions into and out of the Great Lakes Basin are summarized in Figure 4 and by the accompanying data in Table 2.

The U.S. Supreme Court has authorized an average removal of 3,200 cfs (91cms) from Lake Michigan into the Mississippi River system through the Chicago Diversion. This is the only major diversion out of the Great Lakes Basin. From 1981 to 1995, the Chicago Diversion, as reported by the Corps of Engineers, has averaged 3,439 cfs (97 cms), which is 239 cfs (6.9 cms) more