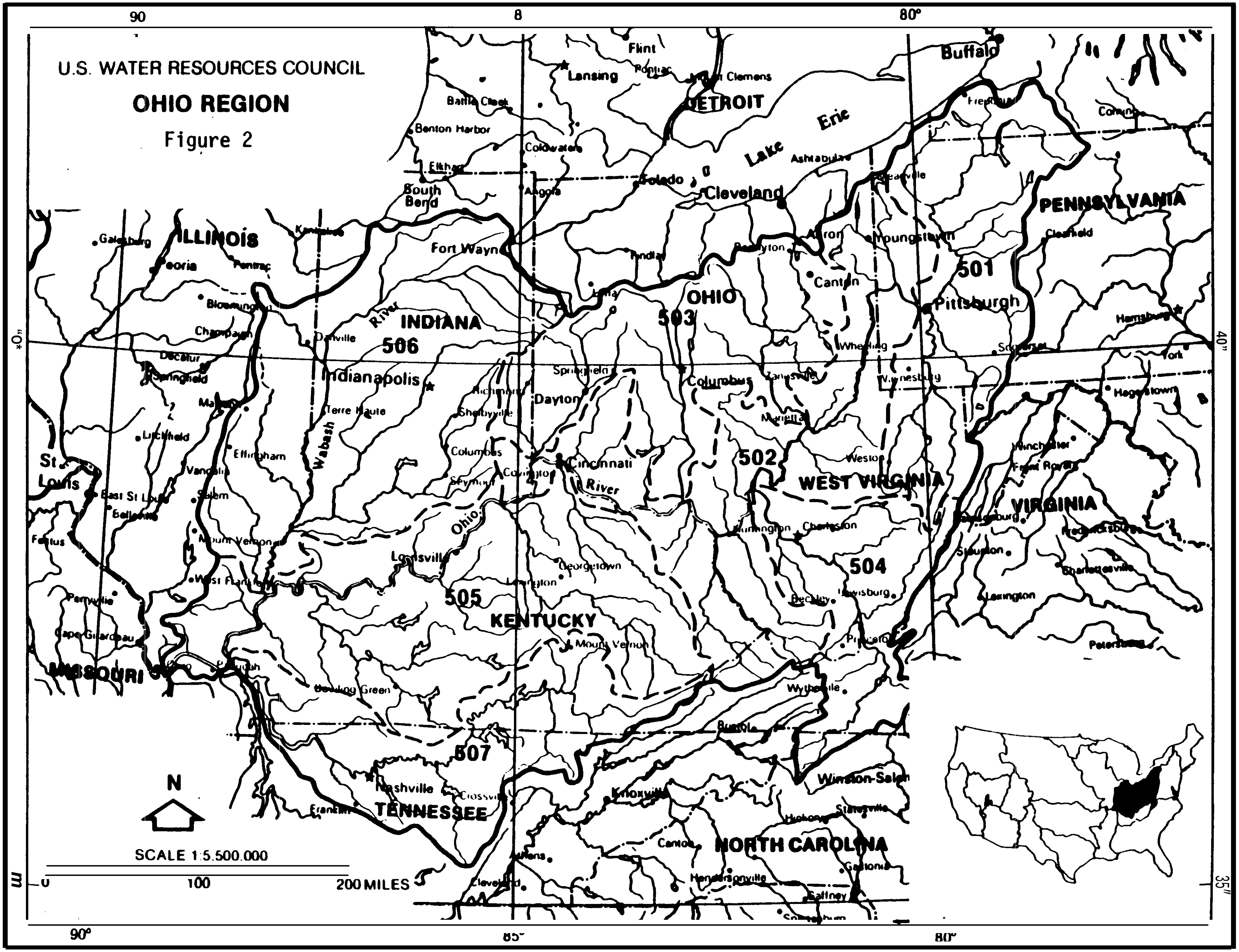
SECTION III
OHIO/TENNESSEE RIVER BASINS

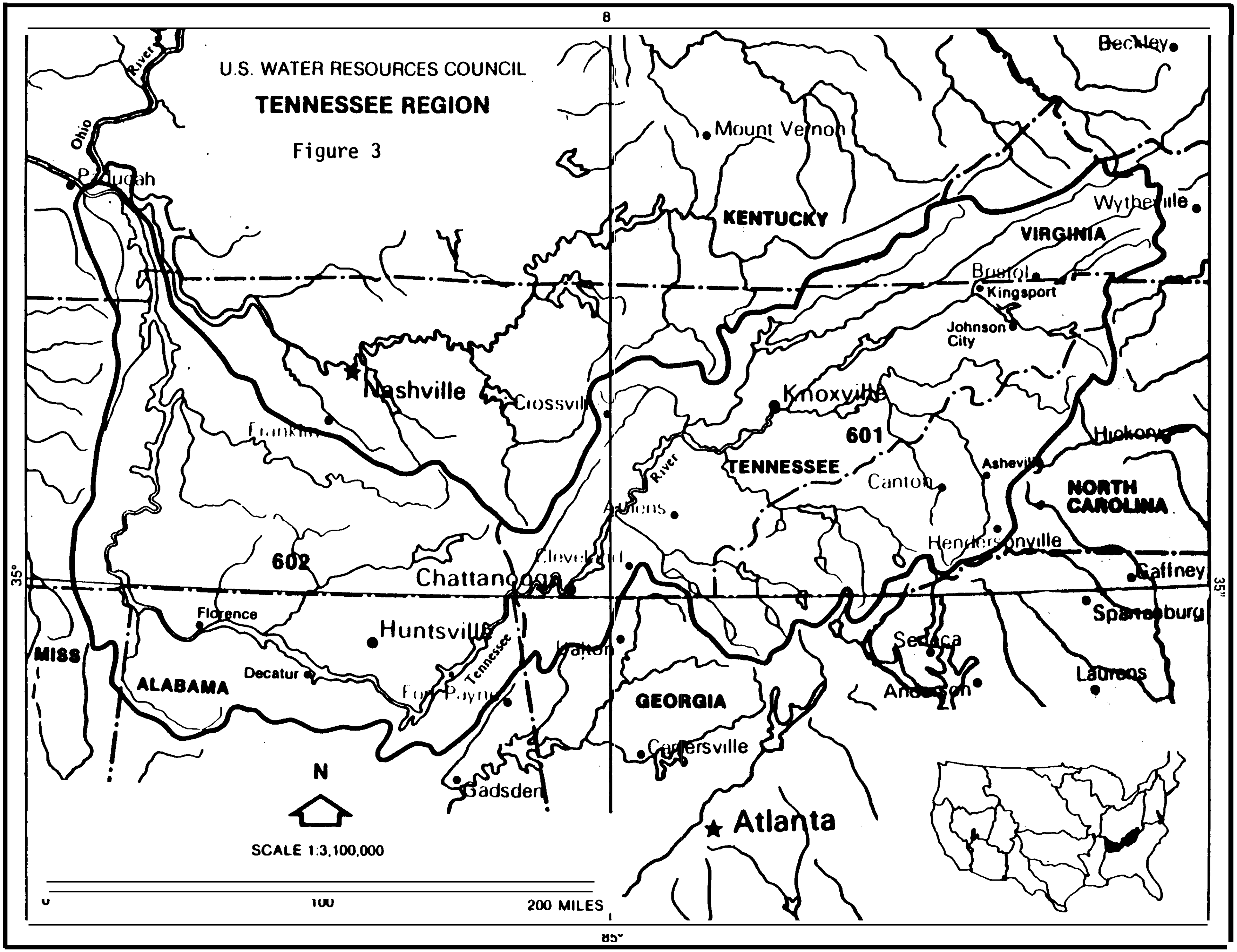
BACKGROUND

The Ohio River Basin covers 102 million acres in New York, Pennsylvania, Maryland, North Carolina, West Virginia, Ohio, Kentucky, Tennessee, Indiana, and Illinois (Figure 2). The Ohio River is formed by the confluence of the Allegheny and the Monongahela Rivers at Pittsburg and flows in a southwesterly direction to join the Mississippi at Cairo, Illinois. Overall, the basin has excellent potential for water supply (U.S. Water Resources Council 1978, Vol. 2, p. V-30) . The Ohio River contains vast coal resources, about 70 percent of the national reserves. Water withdrawals for mining of fuels are projected to increase from less than one percent of total withdrawals in 1975 to about two percent in 2000 (U.S. Water Resources Council, 1978, Vol. 2, p. V-30).

The Tennessee River Basin covers an area of 27 million acres (Figure 3). Seven major, and numerous small, rivers feed the Tennessee River as it makes its U-shaped course through the region. Parts of seven States are drained by the Tennessee River -- more than half of Tennessee and smaller portions of Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia. The Second National Assessment of the U.S. Water Resources Council indicates that estimated natural outflow from the Tennessee River Basin is about 46 million acre-feet per year. Estimated consumptive use of this total flow is less than one percent for 1975 conditions and about three percent for 2000 (U.S. Water Resources Council, 1979, Vol. 1, p. 55). In terms of monthly low flow conditions, consumptive use in 2000 is estimated to be about five percent of the monthly flow which on the average will be exceeded in 80 years of a 100-year period (U.S. Water Resources Council, 1978, Vol. 3, p.61). Because of the large available water supplies in the Tennessee Basin, there is little available information and no published reports concerning water availability for synfuel *or* energy development.



Source: Second National Assessment of the Nation's Water Resources



Source: Second National Assessment of the Nation's Water Resources

Based on the information and reports supplied by TVA (see below), it was concluded that no basin-wide problem existed in the Tennessee basin concerning water availability for coal conversion or synfuel development. If water availability problems do exist, they are of a local or site specific nature. The Tennessee Valley Authority has no published information concerning local water availability problems resulting, or expected to result, from synfuel development.

Therefore, this analysis concentrates on the Ohio River Basin and focuses on several investigations and published reports concerning water availability for synfuel and energy development in various areas of the Ohio Basin. Although the analysis herein concentrates on these investigations and reports, the resulting discussion and conclusions are applicable to the entire basin and the potential conflicts over water supply.

The major reports reviewed were:

1) Ohio River Basin Commission, "Synfuels in the Ohio River Basin, a Water Resources Assessment of Emerging Coal Technologies," (Prepared for U.S. Water Resources Council), January, 1980.

2) Ohio River Basin Commission, "Water Assessment for Monongahela Synfuel Plant," Ohio River Basin Commission, (Prepared for U.S. Water Resources Council.), June 6, 1980.

3) U.S. Water Resources Council, "Project Independence Report" (Tennessee Region 6), prepared for the Federal Energy Administration, November, 1974.

4) Tennessee Valley Authority, "Valley-Wide Assessment of Water Needs," 1974.

5) U.S. Water Resource Council, Second National Assessment of the Nation's Water Resources, 1975-2000. 1979.

In addition, the following two reports were reviewed for both the Ohio and Upper Mississippi Basins:

1) Brill, E. Downey, Jr., Glenn E. Stout, Robert W. Fuessle, Randolph M. Lyon, and Keith E. Wojarowski, "Issues Related to Water Allocation in the Lower Ohio River Basin," Vol. III-G, Phase 1, Ohio River Basin Energy Study, 1977.

2) Brill, Downey E. Jr., Shoou-Yuh Chang, Robert W. Fuessle, and Randolph M. Lyon, 'Potential Water Quantity and Water Quality Impacts of Power Plant Development Scenarios on Major Rivers in the Ohio Basin," Ohio River Basin Energy Study, 1980.

These latter reports form a major basis for the Upper Mississippi River Basin analysis herein since they cover the entire State of Illinois. General findings are not repeated in this section concerning the Ohio River Basin; only those findings specific to the Ohio are included.

The "Synfuels in the Ohio River Basin" report is a very broad report primarily useful for programmatic decisions concerning synfuel development in the Ohio River Basin. In contrast, the 'Water Assessment for the Monongahela Synfuel Plant" report is a site specific study useful for analyzing water demands and environmental impacts of this proposed plant.

Basin-Institutions

Ohio. In the Ohio River Basin, the relevant institutions are comparable to those in the Upper Mississippi (see Section II herein). For example, in the State of Ohio, the Federal agencies are the same and the water resources functions (research, data acquisition, regulatory, etc.) are concentrated in the Ohio Department of Natural Resources.

Tennessee. In the Tennessee River Basin, the Tennessee Valley Authority occupies a unique position in the management of water resources. As a result, Federal agencies, such as the Army Corps of Engineers, play a reduced role. State agencies, such as the Tennessee Department of Conservation, have responsibilities comparable to the agencies discussed in Section 11 herein.

Organization of Section

The analysis of the Ohio River Basin includes discussion of the physical availability; water quality; and institutional, legal and economic factors.

PHYSICAL AVAILABILITY AND WATER QUALITY

The major data base for the "Synfuels in the Ohio River Basin" and "Water Assessment for the Monongahela Synfuel Plant" reports primarily consists of 7-day, 10-year low flows. Use of a low flow parameter, such as the 7-day, 10-year low flows, rather than mean annual or mean monthly flows is desirable for rivers such as the Ohio and its tributaries which have relatively small amounts of storage in comparison to their annual flows. The 7-day, 10-year minimum low flow data are based on historical data and, as indicated in the review of the Upper Mississippi River Basin, will probably overestimate future minimum low flows of the same frequency because of future increased consumptive use in the Ohio River or its tributaries. The effect of this deficiency is not noted in either of these reports concerning the Ohio Basin.

The 7-day, 10-year minimum flow data are a convenient measure since this data base corresponds to criteria used in Federal water pollution control programs. The appropriateness of the 7-day, 10-year minimum flow as a statistical measurement of low flows is briefly discussed in Section II.

A major limitation of "Synfuels in the Ohio River Basin" is that it concentrates almost exclusively on plant sites on the mainstem of the Ohio River with little consideration of synfuel plant sites on the tributaries. While this assumption is apparently justified on the premise that it is cheaper to bring the coal to the water than the water to the coal, no information is presented in the report to support this premise. The report demonstrates the adequacy of mainstem flows for energy development and indicates that reservoir storage would be needed for tributary plant site water supply, but it provides few details. However, as demonstrated by the SRC-11 Plant at Morgantown, West Virginia, synfuel and other energy facilities are proposed for sites on the Ohio River tributaries. Consequently, this concentration on the mainstem of the Ohio significantly reduces the usefulness of the "Synfuels in the Ohio Basin" report.

The "Synfuel in the Ohio Basin" report states its purpose as: "...to define constraints and impacts relative to the development of emerging coal technologies in the Ohio River region." By limiting its scope to the Ohio mainstem, the report does not meet this stated objective. Furthermore, by limiting the scope of analyses to the mainstem of the Ohio, the conclusion of adequate water availability of synfuel development is nearly preordained because of the significant water availability in the mainstem. For example, the estimated mean annual discharge from the Ohio Basin is about 20 million acre-feet per year. Consumptive use for 2000 is expected to be about 0.2 percent of mean daily flow by the year 2000 or about 0.3 percent of low flow where low flow is the daily flow with a 95 percent chance of exceedence (U.S. Water Resources Council, 1980, Vol, p. 15). With 20 million acre-feet per year average annual flow and a 0.3 percent consumptive use, severe water availability problems should not be expected to arise. Even the highly aggregated data for the Ohio tributaries in the Water Resources Council's Second National Assessment suggest that the real water availability problem for synfuel development will be in the tributaries and not the main stem. For example, consider the Wabash River, a tributary of the lower Ohio which has substantial coal deposits in Illinois and Indiana (Assessment subregion 506). Expected streamflow depletion during a dry, critical month at present (1975) is about 9 percent and is expected to increase to 21 percent by 2000 (U.S. Water Resources Council, 1978, Volume 3, Appendix II, p. 141). Comparison of this forecasted 21 percent depletion with the 0.3 percent on the mainstem tends to confirm the conclusion that the water availability problem will be in the tributaries.

Therefore, based on this aggregated data, it appears that the "Synfuels in the Ohio Basin" report ignored the area with potential water availability problems for synfuel development.

Both the "Synfuels in the Ohio River Basin" and the "Monongahela Synfuel Plant" reports are based on data aggregated by Water Resources Council water accounting units. This highly aggregated data is of limited use for individual siting decisions and for forecasting hydrologic impacts at the specific sites. The aggregated data is only useful for estimating water availability for the entire water accounting unit (generally a river basin).

Water quality data and analysis in the "Synfuels in the Ohio River Basin" report is somewhat superficial and would be of limited use in either programmatic or site specific decisions, Only very limited water quality data are presented in the "Synfuels in the Ohio River Basin" report for the mainstem of the Ohio, and none is presented for the tributaries. The data presented for the mainstem (pp. 20-22) is in conflict with comparable data presented by Bri 11, et al (1980, p. 7-13). It is also clear that more severe water quality problems occur on the tributaries and not the main stem (see Brill, et al., 1980, Table 7. 4, p. 7-11). This omission of water quality data further indicates that the ''Synfuels in the Ohio River Basin" report ignores the real problem: water availability for synfuel development and water quality in the tributaries.

In the 'Water Assessment for Monongahela Synfuel Plant" report, a disparity between water quality data available for Pennsylvania and West Virginia is noted. The report indicates that the only water quality parameters considered significant for this assessment were dissolved oxygen, pH, and total dissolved solids. It appears that significantly less data and information are available for the West Virginia portion of the Monongahela basin than for the Pennsylvania portion. Furthermore, West Virginia has no standards for total dissolved solids, and the data presented do not clearly indicate what the impacts will be on TDS in West Virginia. Because of the disparity in data availability and standards between the two states, forecasts of future water quality impacts would appear to be somewhat uncertain and the report does not highlight this uncertainty.

As discussed in Section IV herein, the cost of water is probably not a major factor in developing a synfuel plant because the cost of necessary water is very low relative to other factors. Cost data for alternative sources of water supply, however, are probably the most important parameter--next to legal and physical availability--in deciding on water supply sources for synfuel development. Consequently, cost data are important in analyzing the various trade offs, among water supply sources. Dependable cost data, however, are not easily assembled and the "Synfuels in the Ohio River Basin" report contains only minimal cost data. The lack of data for specific tributary reservoir sites is a major deficiency.

The difficulty in estimating the cumulative effect of depletions on water availability is exacerbated by the interstate nature of the Monongahela Basin and the inherent problems in coordinating forecasts of future consumptive use between two states. If the estimates of cumulatative impacts of synfuel development and other consumptive users of water are to be useful to the decision- makers, then the many inherent assumptions and certainties in these estimates of cumulative impacts must be clearly spelled out. This is not the case in either the "Synfuels in the Ohio Basin" report or the "Water Assessment for the Monongahela Synfuel Plant." There is a need for clearly indicating the accumulated impacts of future consumptive use and the uncertainties inherent in these estimates of future consumptive use, since any individual consumptive use, including that of a demonstration plant such as the SRC-11 plant, "is so small that it is difficult if not impossible to measure an adverse impact traceable solely to that use" (p.2 "Monongahela Synfuel Plant" Report).

Another complicating factor for forecasting future availability of water for synfuel development is the uncertainty surrounding future demand for lockage water on navigable rivers such as the Monongahela. Estimating demand for future lockage water is dependent upon complex projections of future demand for waterway transportation. The requirement for forecasting future in-stream demands for navigational lockage water, and the resulting uncertainty of this forecast, is a problem characteristic of eastern river basins. Navigation lockage requirements must be added to other instream demands (fish and wildlife habitat, recreation, and hydropower) when assessing water availability for synfuel development.

INSTITUTIONAL, LEGAL AND ECONOMIC FACTORS

The institutional and legal factors affecting water availability are less extensive and complex in eastern basins such as the Ohio than in western basins. This situation results because: (1) there are relatively few interstate compacts or Supreme Court decrees affecting water availability, (2) Federal or Indian reserved rights problems are absent, (3) riparian based state water law for Ohio Basin states is less complex than the appropriation doctrine of western states and (4) there are fewer entities (e.g., river districts, irrigation districts, Federal and State agencies, etc.) involved in water resources in the Ohio Basin states than in the west.

Institutional and legal constraints do, however, affect water availability for synfuel development in the Ohio Basin, but the reports reviewed do not address these constraints. Some consideration should have been given to this matter.

The operating policies of Federal reservoirs introduce institutional uncertainty into the assessment of water availability in the Ohio River Basin for synfuel development. Approximately 520,000 acre-feet of water supply storage exists in six Federal reservoirs in Ohio and Indiana (Ohio River Basin Commission, 1980, P.18). (In comparison, a 250 mi 1 lion scf/day coal gasification plant can be. assumed to have a consumptive use of about 15,000 acre-feet/year). The water marketing and operating policies for these Federal reservoirs can be surrounded with considerable uncertainty since the Federal government and the local project sponsor (generally the local or state government) share responsibility of water marketing and reservoir operation depending on the individual project. In the case of the SRC-11 coal conversion plant in the ‘Water Assessment for the Monongahela Synfuel Plant” report, reservoir operating and water marketing policies for the proposed Stonewall Jackson Reservoir are critical in analyzing the hydrological effects of water demands for the SRC-11 plant. Uncertainties surrounding the marketing of water from the Stonewall Jackson Reservoir (e.g. price, priority, and availability) and the operating policy of this reservoir are major sources of uncertainty concerning water availability and future water quality conditions in the Monongahela River below the SRC-11 plant.

Uncertainty over water availability also results because, in general, we do not have institutions or mechanisms to produce dependable and uniform data on water availability for river systems which cross state boundaries. This problem of reconciling data between two states and the resulting uncertainty is demonstrated in the Monongahela Synfuel Plant Report where there is a significant disparity between water quality data in Pennsylvania and West Virginia. Probably a more important problem resulting from this continuing lack of coordination among the states is the lack of dependable information and data concerning future cumulative impacts of synfuel and other development on water availability. What is needed is a mechanism to bridge the gap on a continuing basis between the site specific report and general basin-wide analysis.

None of the reports reviewed included economic data on the cost of developing reservoirs. Since the potential for siting synfuel plants on tributaries is ignored in the "Synfuels in the Ohio River Basins," and, consequently, no reservoir storage is required, the report concludes (p. 56):

> The ready availability of water in the basin requires no unusual expenditures for synfuel development; therefore, costs have not been estimated. If facilities are located where water is not available, the costs for providing that water, such as building a reservoir, are part of the economic trade-off analysis which must be made for each site specific plant.

CONCLUSIONS

The water availability situation in the Ohio and Tennessee Basins is comparable to that in the Upper Mississippi. From a regional perspective sufficient water is available for projected synfuel development but localized problems or deficiencies may occur for synfuel plant sites on tributaries. The extent and nature of these deficiencies can only be predicted with site specific studies.

The Ohio River Basin Commission "Synfuels in the Ohio River Basin" report is of marginal utility to realistic decision-making situations since it ignores the areas where water availability for synfuel development may be a problem, the tributaries of the Ohio River, and instead concentrates on the mainstem where there is no apparent availability problem. The report contains no economic data and no discussion of political, institutional, or legal factors affecting water availability.

The Monongahela Synfuel Plant report is a straight-forward and generally adequate assessment of water availability for the proposed SRC-11 plant in Morgantown, West Virginia.

The Brill, et al. reports (1977 and 1980) are more useful reports for assessing water availability and are discussed in the Upper Mississippi River Basin section herein.