U.S. Water Resources Council

Section 13(b)
Water Assessment Report

Coal Liquefaction Demonstration Plant near Morgantown, W. Va.

wrc

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DISCLAIMER

CONTENTS

PREFACE

The U.S. Water Resources Council staff (WRC) has prepared this report under provisions of Section 13(b) of the 1974 Federal Nonnuclear Energy Research and Development Act, as amended. The report is the result of an assessment of water requirements and water supply availability for a proposed coal liquefaction demonstration project at Fort Martin, near Morgantown, West Virginia.

WRC was requested to perform this assessment by the U.S. Department of Energy (DOE) on February 11, 1980. WRC entered into a Memorandum of Agreement with the Ohio River Basin Commission (ORBC) to perform technical phases of the assessment and to prepare a technical report. The ORBC formed a study committee including representation from the States of West Virginia and Pennsylvania, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, and U.S. Department of Energy. The technical report, completed and approved by the ORBC in June 1980, was the principal supporting document for this report.

The draft report was published in the August 21, 1980, Federal Register as mandated under provisions of Section 13 to enable public review and comment during a 30-day period. After the review period, the WRC staff analyzed the comments received and forwarded the comments, the WRC staff analysis, and this final water assessment report to the Secretary of Energy.

DOE's industrial partner, Pittsburg and Midway Coal Mining Company (a subsidiary of Gulf Oil), expects that -- subject to a successful demonstration of the technical operability, economic viability, and environmental acceptability of the solvent-refined coal (SRC) process -- the project will be expanded to a full-scale commercial plant. If the decision is made to go full-scale, pursuant to Subsection 13(c) of the above-cited Act, WRC then will prepare a subsequent full assessment of the water resources available for the commercial-scale coal liquefaction development. This 13(b) report includes only a preliminary assessment of the commercial project as currently planned. Final design of the commercial facility will be based largely on the experience gained from operation of the SRC-II demonstration project.

CHAPTER I. PRINCIPAL FINDINGS

A. Introduction

After the draft WRC water assessment was published in the Federal Register, the Department of Energy and the SRC-II industrial partner, Pittsburg and Midway Coal Mining Company, changed certain design features and operational modes of the proposed project. These modifications include plans for onsite electric power generation and for some treated wastewater discharges, primarily cooling water blowdown, to the Monongahela River during periods of suitable river conditions. During times of low flow and high levels of total dissolved solids in the river, onsite retention and evaporation will decrease or eliminate wastewater discharge. An extensive monitoring program during the demonstration phase will ensure that there will be no adverse impacts on water quality.

Under the revised operating mode with modified plant design, the revised water consumption estimates for this final WRC assessment are 8 cubic feet per second (cfs) for the demonstration project and 28 cfs for the commercial project. These consumptive figures are 8 percent smaller and 22 percent greater, respectively, than the figures used in the draft WRC assessment published in the Federal Register. The consumptive estimates take into account summer conditions concurrent with low-flow conditions.

Streamflow assessments at low-flow conditions have not been adjusted for water conservation measures for offstream users or low-flow augmentation from Stonewall Jackson Reservoir, which is under construction (i.e., primarily land acquisition) and presently under litigation. The streamflow conditions do include current augmentation. Thus, this assessment is based on a "worst case" condition for water availability for the SRC-II project.

B. SRC-II Demonstration Project

Under most flow conditions, the Monongahela River has enough water to support the combined effect of the SRC-II demonstration project and the increased consumption by other sectors of the economy through 1990 without reduction to streamflow below that projected to meet navigation requirements (including SRC-II barge traffic) and to meet water quality standards in West Virginia and Pennsylvania.

There are, however, exceptions during various low-flow conditions. For example, during minimum navigation flow (i.e., recurrent drought of record with present low-flow augmentation), the projected total consumption will reduce streamflow 13 percent below 1990 navigation needs at Maxwell lock and dam. Half of this deficit would be contributed by the SRC-II demonstration project and associated barge traffic.

In addition, the Monongahela River at lock and dam 4 in Pennsylvania does not currently have the estimated streamflow necessary to achieve the total dissolved solids standard during 7-day, 10-year low-flow conditions. The SRC-II demonstration project would contribute about 1 percent to the projected streamflow deficit by 1990.

The projected increase in new offstream consumptive uses in the basin will be approximately 18 cfs by 1990. The SRC-II demonstration project will account for 44 percent of this increase. The 8 cfs consumptive withdrawal, however, is only 6 percent of the total 133 cfs consumption (existing and new uses including SRC-II) projected for 1990.

The 8 cfs represents about 2 percent of the 7-day, 10-year low flow (360 cfs) at lock and dam 8 and about 1 percent of the present 7-day, 10-year low flow (650 cfs) downstream at lock and dam 4.

The economic capacity of lock and dam 7 (Pennsylvania) is projected to be exceeded by 1988 with or without the SRC-II demonstration project. Economic capacity is determined by factors such as congestion at the lock, competing traffic modes, etc., rather than the availability of water.

Groundwater at the site is insufficient to meet project water requirements. Further investigation should determine whether groundwater can be used as a supplemental source of water during low-flow conditions.

C. SRC-II Commercial Project

During low flows, the SRC-II commercial project, together with other consumptive uses projected for the basin by 2020, will worsen the streamflow deficits at Maxwell lock and dam, without further augmentation. During minimum navigation flow, the total projected consumption will reduce streamflow 30 percent below 2020 navigation needs at Maxwell lock and dam. Nearly 90 percent of this deficit would be contributed by the SRC-II commercial project and associated barge traffic.

Moreover, the Monongahela River at lock and dam 8 near the plantsite will not have sufficient flow to meet the dissolved oxygen standard in West Virginia for the 7-day, 10-year low flow. At lock and dam 4, the project would contribute about 2 percent to the estimated deficit under the 7-day, 10-year low-flow conditions in 2020 required to meet Pennsylvania's total dissolved solids standard. Also at lock and dam 4, the project would contribute to a marginal flow deficit to meet Pennsylvania's dissolved oxygen standard.

The projected new consumptive uses in the basin will increase to 57 cfs in 2020. The SRC-II commercial project will account for 28 cfs or about half of the increase. This 28 cfs, however, is only 16 percent of the total 172 cfs consumption (existing and new uses including SRC-II) projected for 2020. The consumptive withdrawal for the commercial project is about 8 percent of the 7-day, 10-year low flow at lock and dam 8 and about 4 percent of the 7-day, 10-year low flow downstream at lock and dam 4.

If the demonstration project is proven successful, and the decision is made to go full-scale, then a followup Section 13(c) water assessment will be conducted to more accurately assess the water availability and related water impacts of the proposed SRC-II commercial project.

D. Further Action Needed

A plan of operation should be developed for the SRC-II demonstration project (and ultimately the commercial project) to allow for reduced water consumption and/or alternate water sources during critical low flows in the Monongahela River. Offstream storage and conjunctive use of groundwater are two options to consider.

DOE would consider curtailing plant operations entirely during critical low-flow conditions. Plant turnarounds for maintenance could be scheduled during the shutdown periods. In addition, DOE and the industrial partner have expressed interest in utilizing a portion of the plantsite for limited onsite water storage.

Unless substantive action is taken during critical flow periods, projected river flow with SRC-II under present basin conditions will not be sufficient to meet in 2020 the dissolved oxygen standard for West Virginia and Pennsylvania at lock and dam 8 and 4, respectively, the Pennsylvania total dissolved solids standard for 1990 and 2020 at lock and dam 4, and the projected navigation flow required at Maxwell lock and dam in 1990 and 2020.

To resolve the basin's present and future water problems, West Virginia and Pennsylvania need to develop a coordinated water management program for the Monongahela River Basin. Under a basin-wide plan, the impacts of competing water uses during the critical low-flow conditions could be reduced (or offset) by various water management options. The options include: low-flow augmentation from Stonewall Jackson Reservoir;

water conservation; temporary curtailment of offstream uses; additional storage and/or reallocation of storage at basin reservoirs, including Stonewall Jackson, Tygart, and Stonecoal; additional water storage sites; and development of supplemental groundwater resources. (The DOE would be receptive to interstate/interagency cooperative agreements to reduce project feed rates and if necessary, curtail plant operations entirely during periods of critical low flow.)

The water management program should balance all competing uses against available water supplies. Particular attention should be given to providing critical flows at key points along the river. A predictable water budget would help provide for beneficial economic, social and environmental conditions throughout the basin.

In addition to developing a water budget, West Virginia, Pennsylvania, the Ohio River Sanitation Commission, and the U.S. Environmental Protection Agency (EPA) should establish a water quality program that would provide for additional water quality monitoring and analysis (particularly total dissolved solids) along the Monongahela River. The monitoring and analysis should provide the information needed to identify and characterize water quality problems in specific stream reaches. This effort can also lead to further coordination of water quality policies between West Virginia and Pennsylvania.

The instream needs of fish and wildlife must be included in a water management program. Under a Section 13(c) assessment, a streamflow management study should be conducted to assess the SRC-II commercial project and other consumptive uses for their combined effects on fish and wildlife habitat in the Monongahela River.

CHAPTER II. PROJECT DESCRIPTION

A. Location

The proposed project site is located near Morgantown at Fort Martin, West Virginia, along the Monongahela River, approximately 2 miles south of the West Virginia - Pennsylvania State line. Figure 1 shows the Monongahela River Basin where the proposed project is to be located. Figure 2 illustrates a general site plan of the proposed project. The project site is bounded on the southeast by the Monongahela River, on the east by the Fort Martin Power Plant (Monongahela Power Company), on the north by the West Virginia - Pennsylvania State line, and on the west and south by land in private or corporate ownership. Except for a narrow floodplain along the river, the site is hilly, at an elevation of about 1108 feet mean sea level or 311 feet above the river.

B. SRC-II Project

The demonstration project facilities have been designed to produce a solvent-refined coal (SRC) product of low-sulfur distillate fuel oil from Pittsburgh seam coal. The demonstration plant will produce approximately 20,000 barrels of oil equivalent per day and the commercial plant approximately 100,000. By-products include synthetic natural gas, mixed liquid butanes, propane, naphtha, ammonia, elemental sulfur, and tar acids.

Figure 1
Map of Monongahela River Basin

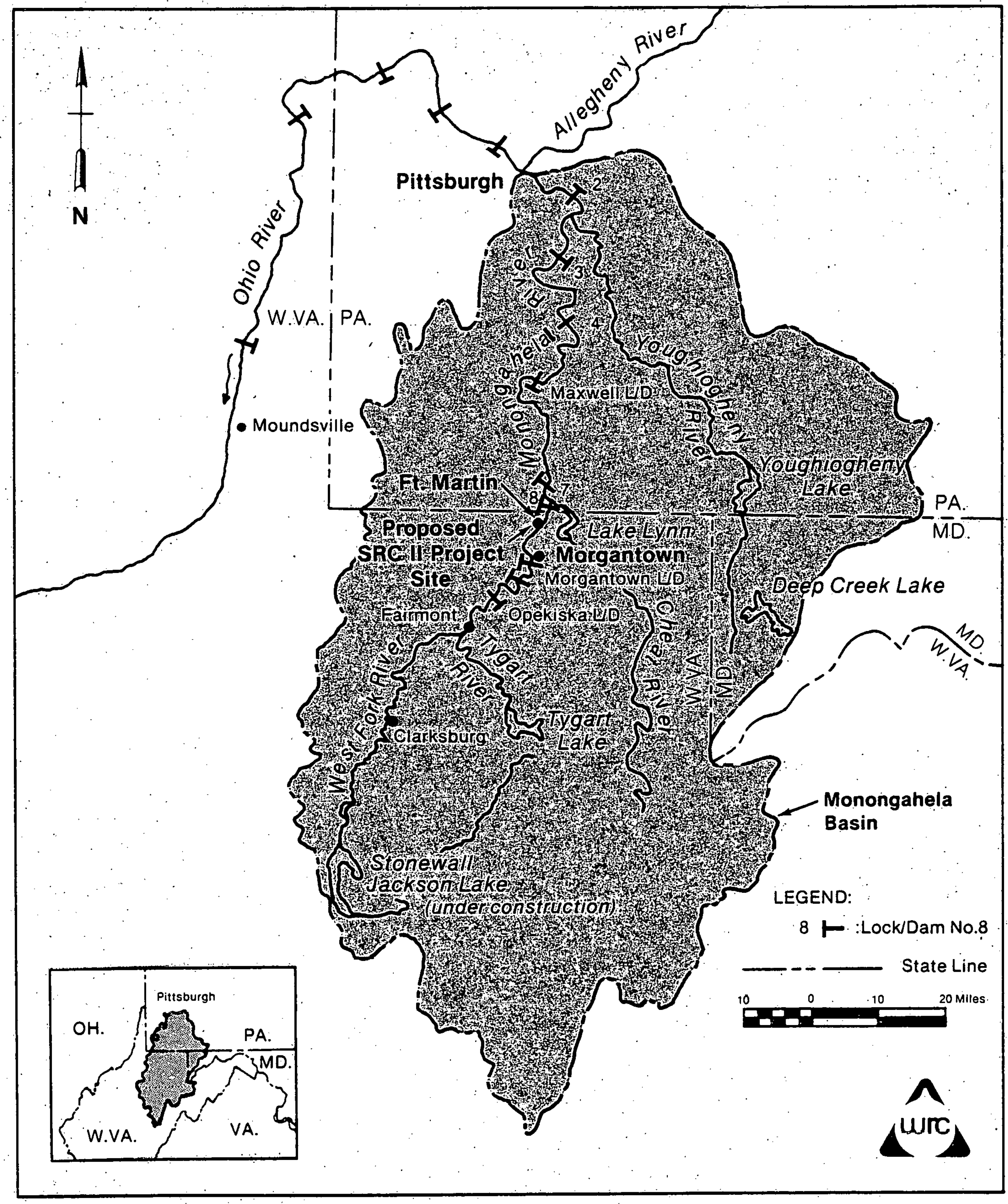
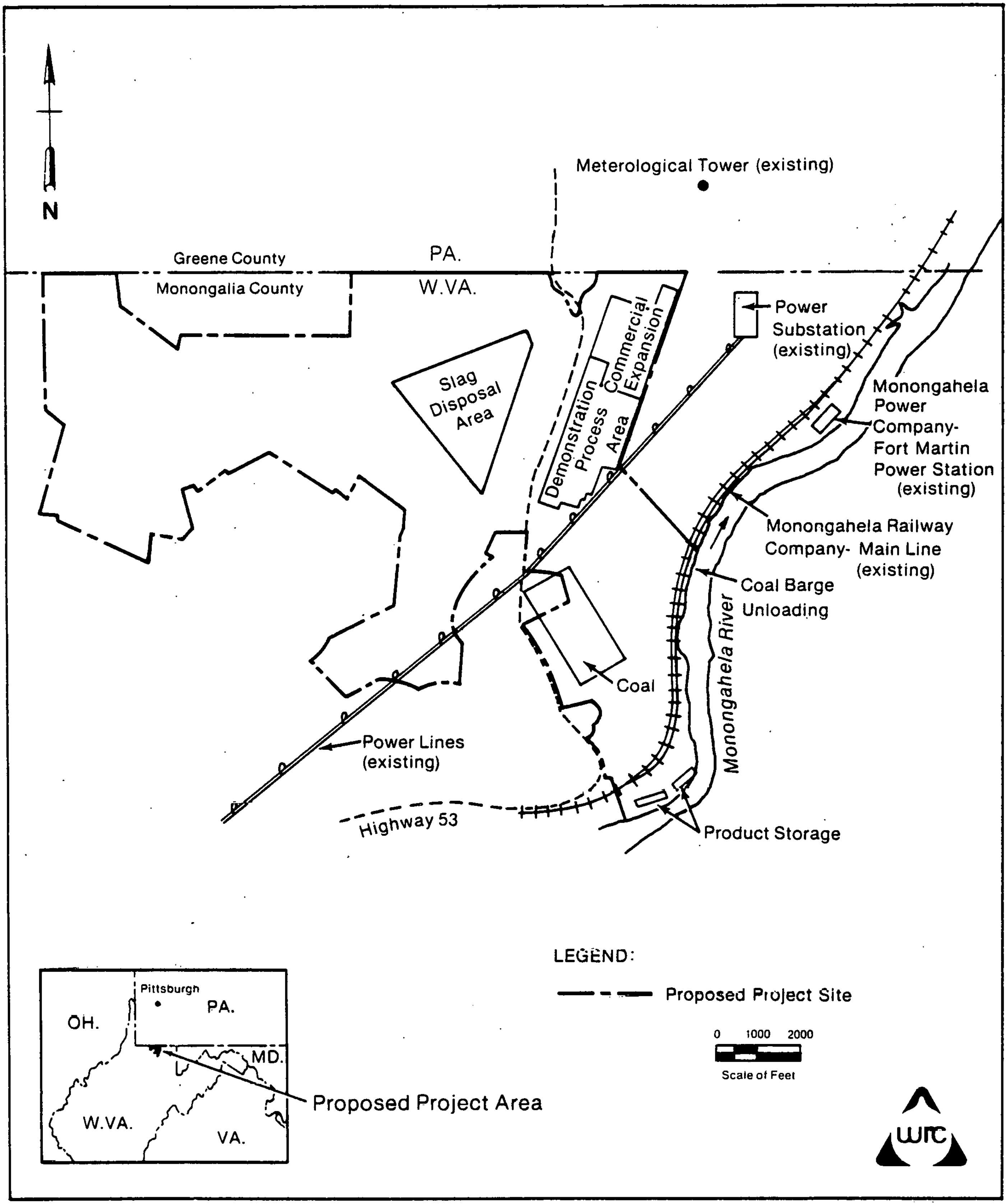


Figure 2
Site Plan of Proposed Project



C. Coal Preparation

Coal will be delivered by barge to a storage area where conveyors will transport the coal to pulverizing-drying equipment. The fine coal is then transferred to surge storage bins from which it is withdrawn for slurry mixing.

D. Liquefaction Process

The demonstration SRC-II facility will liquefy 6000 tons of bituminous coal per day. The pulverized feed coal is mixed with a recycled hydrocarbon-mineral residue slurry stream from the process and, together with hydrogen-rich gases, the mixture is pumped through a preheater to the dissolver. In the dissolver, hydrogenation and liquefaction reactions convert the coal into liquid and gas. By a series of separation, distillation, and gasification steps, the process produces: (1) a high-purity hydrogen stream that is recycled to the dissolver, (2) a methane-rich stream that is upgraded to produce a pipeline-quality synthetic natural gas, and (3) a methane-rich stream, part of which is used as plant fuel; the rest is converted to synthetic natural gas in the methanation step.

E. Water Reclamation

The water reclamation system will treat: process wastewater, leachates from the slag disposal area and coal storage piles, and contaminated rain runoff from the process area and from all product storage and shipping areas. The system will also treat process liquids spilled in the main process area and in the product storage and shipping areas.

F. Waste Containment and Treatment

The demonstration plant has facilities to contain and reclaim runoff from a 24-hour rainfall event having a 10-year recurrence (the 10-year, 24-hour storm).

Wastewaters will be treated by a water reclamation and recovery system. Some treated wastewater will be eliminated through evaporation in the cooling towers and onsite retention ponds.

Condensates produced in the evaporation process will be recovered for reuse, while sludge from the treatment processes will be incinerated to destroy organic materials. Residue from the incinerator will be disposed of in accordance with the requirements of the Resource Conservation and Recovery Act (Public Law 95-609) and other applicable laws and regulations. Operation experience from the demonstration project should help resolve questions on the efficiency of wastewater treatment and disposal, including solid wastes.

Some treated wastewaters, primarily cooling water blowdown, will be discharged to the Monongahela River during periods of suitable river conditions.

The Department of Energy and the SRC-II industrial partner, the Pittsburg and Midway Coal Mining Company, have reconsidered the operational practicality of the "zero discharge" concept originally proposed for this project. Although it might be possible to equalize evaporative cooling and process consumption to plantsite precipitation and variable river withdrawals over a relatively short period of time, the normal discontinuity of operations that can be expected for a process like SRC-II, particularly in a demonstration program, would make such a water balance concept unrealistic over any significant period of time. This problem would be further compounded by the variable weather patterns characteristic of the Morgantown area.

Thus, plans for wastewater management have now been revised to allow for some treated wastewater discharges, primarily cooling tower blowdown, during periods when river conditions will allow, and for a zero process water discharge mode during periods of low flow and high total dissolved solids (TDS) concentrations in the river.

An extensive monitoring program is proposed during the demonstration phase to assure that water quality is not adversely impacted by plant discharges. A complete description of the revised wastewater management for the SRC-II project will be included in the final DOE Environmental Impact Statement.

G. Base Resources

The source of water for the SRC-II project will be the Monongahela River. The raw water quality requires some pretreatment before it is acceptable for project use.

Coal for the demonstration project will be mined near the Ohio River at Moundsville, West Virginia (see Figure 1). The source of coal for the commercial phase may also be Moundsville, depending on how well the coal characteristics meet the requirements of the demonstration project. Approximately 6,000 tons per day (tpd) will be required for the demonstration phase and 30,000 tpd for the commercial phase. This tonnage is based on a 90-percent load factor for the SRC-II project.

Electrical power for the SRC-II project operation will be generated onsite. The demonstration project will require about 50 megawatts (MW) and the commercial project about 225 MW. Backup electrical power will be provided by a public electric utility.

H. Schedule

If the decision is to proceed with the demonstration project, preliminary site preparation will begin in late 1980, with actual construction beginning in the spring of 1981. Scheduled operational startup would be in 1985. The demonstration phase would operate for approximately 5 years. If the demonstration phase is successful, the project will be expanded to a full-scale commercial facility. Operation of the commercial phase would begin around 1990.

CHAPTER III. PROJECT WATER REQUIREMENTS

Consumptive water use from the Monongahela River is estimated to be 8 cfs for the demonstration plant and 28 cfs for the commercial plant.

A. Process and Cooling Water

The cooling towers consume the largest amount of water. The second largest use is the process reaction, primarily for the production of hydrogen. Water is also lost in vents as steam, in the incinerators from combustion, and in the water reclamation system. In the demonstration phase, approximately 10 percent of the water is consumed for processing and 90 percent for cooling. The commercial phase is conceptually planned to have similar percentages of water use.

B. Electric Power Generation

Estimated water consumption for the demonstration and commercial projects include cooling water consumed by the onsite electric power generation system.

C. Coal Mining and Land Reclamation

Estimated water consumed for coal mining and land reclamation at Moundsville, West Virginia, is insignificant compared to the available nearby water supply of the Ohio River mainstream.

D. Navigation

Current plans call for coal to be barged to the SRC-II project. For this assessment, coal traffic along the Ohio and Monongahela Rivers was assumed to be 6,000 tpd from 1985 to 1989 when the demonstration SRC-II is in operation and 30,000 tpd from 1990 to 2020 when the commercial SRC-II is in operation. The lock and dam (L&D) system on the Monongahela River does not generate hydroelectric power. (Upstream L&Ds are numbered higher than those downstream.)

CHAPTER IV. WATER SUPPLY AVAILABILITY

A. Background

The Monongahela and the Allegheny Rivers comprise the headwaters of the Ohio River. The Monongahela River drains 7,384 square miles. It lies in the eastern portion of the Ohio River Basin, and includes southwestern Pennsylvania, northern West Virginia, and extreme western Maryland.

The U.S. Army Corps of Engineers (Corps) maintains and operates a series of locks and dams along the Ohio and Monongahela Rivers. Presently, seven locks and dams in Pennsylvania (including Emsworth on the Ohio River) and three in West Virginia provide a minimum 9-foot depth for navigation along the Monongahela River from Pittsburgh, Pennsylvania, upstream to Fairmount, West Virginia. The proposed project site is located in the navigation pool of lock and dam 8 (see Figure 1). The Monongahela River and its two major upper tributaries, the West Fork and Tygart Valley Rivers, drain the 2,700 square-mile drainage area upstream of the project.

The West Fork River drains 882 square miles. Its flow is essentially uncontrolled except for two U.S. Soil Conservation Service small watershed projects and Stonecoal Lake. With the completion of Stonewall Jackson Reservoir, approximately 12 percent of the West Fork Basin will be controlled.

Stonewall Jackson Reservoir is under construction (i.e., primarily land acquisition) by the Corps and is presently scheduled for completion by 1987, although the project is presently under litigation. (In brief, on July 11, 1974, the Upper West Fork River Watershed Association filed suit in the U.S. District Court for the Northern District of West Virginia seeking an injunction against further prosecution of the project base, primarily on alleged inadequacy of the project EIS. On May 3, 1976, the Federal District Court dismissed the action by the Upper West Fork River Watershed Association. The Plaintiff appealed before the U.S. Court of Appeals (Fourth Circuit) on January 13, 1977. The U.S. Court of Appeals (Fourth Circuit) affirmed the decision of the District Court on May 9, 1977. The Upper West Fork River Watershed Association and other environmental interest groups filed suit on April 21, 1980, in the U.S. District Court of the District of Columbia, alleging that the Corps used the wrong interest rate for the project, exceeded the Congressional authorization in the scope of the project, and wrongfully included water quality benefits.) The 75,000 acre-foot storage reservoir is to be located in northern West Virginia on the West Fork River, upstream of the proposed SRC-II site. The reservoir project is authorized for flood control, water supply, water quality maintenance, and recreation. Up to 80 cfs will be released during low-flow periods for water quality augmentation.

Tygart Dam controls 86 percent of the 1,374 square mile drainage area of the Tygart Valley Basin. In 1938, the Corps constructed Tygart Lake for flood control and low-flow augmentation. The Corps presently regulates flow at Tygart Lake Dam to maintain a minimum flow of 340 cfs at L&D 8, about 2.5 miles downstream of the project site. During periods of minimum navigation flow (i.e., recurrent drought of record with present low-flow augmentation), most of the Monongahela River flow upstream of its confluence with the Youghiogheny River comes from controlled releases from Tygart Lake. The approximate storage at Tygart Lake is 279,000 acre-feet.

B. Surface Water

The Corps has developed several flow frequencies for the Monongahela River. Table 1 shows these figures for six locks and dams (L&D). See Figure 1 for the location of the L&Ds. Streamflows are based on existing (1980) levels of basin development, including present augmentation.

Table 1

FLOW DATA FOR MONONGAHELA RIVER[a]

(in cfs)

Lock and Dam	River Mile	Mean	80% Exceedence	7-day, 10-year	7-day, 50-year	Minimum Navig. Flow
2	11.2	12300	2970	1150	910	750
4	41.5	8980	1700	650	510	315
Maxwell	61.2	8580	1620	620	495	325
7	85.0	8090	1520	590	480	340
8	90.8	4580	790	360	350	340
Opekiska	115.4	4300	740	340	340	340

[a] Low-flow augmentation at Stonewall Jackson Reservoir not included.

The project site is approximately 2.5 miles upstream of L&D 8. Present mean flow at L&D 8 is 4580 cfs; the 7-day, 10-year low flow is 376 cfs; and the minimum navigation flow is 340 cfs.

C. Groundwater

Although available information is insufficient for a complete assessment of groundwater quantity and quality, several general observations can be made.

Pittsburgh & Midway Coal Mining Company, the project industry participant, has recently explored the groundwater availability. Their September 1979 investigation concluded that local deposits of unconsolidated materials (alluvium, soils, and mine spoils) "are not an important source of groundwater because of limited areal extent and thickness, or impermeability..." Springs and shallow wells in the area reportedly yield from 0.0022 to 0.0067 cfs. Recent data are unavailable for deeper Allegheny and Pottsville aquifers; however, according to earlier investigations, the Allegheny aquifer would yield less than 0.0056 cfs, which may be sufficient for some industrial and public water use in central and northeastern Monongalia County. The Pottsville aquifer reportedly yields upwards of 0.56 cfs, with an average of about 0.10 cfs in portions of Monongalia County near the proposed project site.

Groundwater should be further investigated as supplemental water source for meeting SRC-II water requirements during low river flow conditions.

D. Basin Consumptive Use

There is no water use allocation program in operation for the Monongahela River Basin. The Pennsylvania Department of Environmental Resources has proposed such a program, which will be brought before the State legislature in 1980. The program would affect offstream users withdrawing 10,000 gallons per day or more.

Based on best available information, present and future total consumptive withdrawals have been estimated for the basin, including those by the municipal, industrial, power, and agricultural sectors. Table 2 presents the cumulative consumptive withdrawals from selected L&Ds in the basin.

Table 2
Estimated Cumulative Consumptive Withdrawals from Monongahela River[a/]
(in cfs)

West Virginia	1980	1990	2020
L&D 8	78	80	87
Pennsylvania			
L&D 7	82	84	91
L&D 4	115	121	133
L&D 2	115	124	144

[a/] Does not include SRC-II project.

The estimated consumption of the Monongahela River downstream to the plantsite (referenced at L&D 8) will increase 2 cfs by 1990 and 9 cfs by 2020. The estimated consumption in the basin (referenced at L&D 4 in Pennsylvania) will increase approximately 9 cfs by 1990 and 29 cfs by 2020.

Information on future consumptive groundwater withdrawals in the basin is not available. However, the quantity is expected to be relatively small. Less recent use data (1964) on surface and groundwater sources suggest that groundwater supplied less than 3 percent of the water used in the basin. Groundwater supplied farm, domestic, and industrial water users, but groundwater has not been used to meet large water requirements of powerplants.

E. Water Quality Conditions

Water quality policies for the Monongahela River are governed by the West Virginia Department of Natural Resources and the Pennsylvania Department of Environmental Resources. From the water quality plans of both States, three parameters were selected as pertinent to this assessment: dissolved oxygen (DO), pH, and total dissolved solids (TDS). Table 3 presents the current standards for these parameters at two streamflow points for which adequate data were available. West Virginia specifies streamflows to maintain minimum water quality standards at L&D 8. For the stretch of the Monongahela River in Pennsylvania, streamflows to maintain minimum water quality standards were projected for L&D 4. This is the location in Pennsylvania with the most available data, but not necessarily the worst water quality conditions.

Table 3

SELECTED WATER QUALITY STANDARDS

MONONGAHELA RIVER

	Water Quality Criteria	Standard	Specified Streamflow (cfs) 1980	1990	2020
West Virginia					
L&D 8	DO	$\geq$5 mg/l	345	345	345
	pH	$\geq$6	345	345	345
	TDS	none	none	none	none
Pennsylvania					
L&D 4	DO	$\geq$5 mg/l	1140	400[a/]	600[a/]
	pH	6-9	--	--	--
	TDS	<500 mg/l month avg.	1660	2230	2800
		<750 mg/l daily avg.	1100	1490	1860

a/ State-recommended treatment levels would reduce flow requirement.

The overall water quality as measured by DO, pH, and TDS in the Monongahela River is generally improving. The Ohio River Sanitation Commission (ORSANCO), an interstate water quality agency, assessed water quality data from 1962 to 1976 downstream for L&D 4 in Pennsylvania. Based on these results, violations for DO and TDS were most often recorded in the 1960s, but the trend toward acceptable limits improved in the 1970s. The Monongahela River is poorly buffered and therefore sensitive to acid water input, particularly from major tributaries such as the Cheat River. Although the frequency of instream pH violations has also improved, some local pH problems still remain. Moreover, the pH relationship to flow has not been clearly established as indicated in Table 3.

Future reductions in streamflow and/or increases in land use activity (i.e., mining, industry) could cause an adverse change in water quality.

Recent (1977-1979) water quality data from the Storage and Retrieval (STORET) system of the U.S. Environmental Protection Agency (EPA) show a continued improvement in river quality. Average values for DO, pH, and TDS at L&D 4, L&D 7, L&D 8, and Morgantown L&D were within State water quality standards, although extreme values for pH dropped below the standard several times at L&D 7 and once at L&D 8.

Of particular concern in the Monongahela River is the accumulative concentration of TDS. (Sulfates are a major component of TDS in the Monongahela River although there is no instream standard for sulfate.) Unlike many other pollutants, TDS are not "assimilated" in streams, so the accumulated TDS create a loading problem downstream.

This is particularly significant, because the Monongahela River flow does not substantially increase except at the confluence with the Cheat and Youghiogheny Rivers (see Figure 1). Thus, the TDS loadings are not well diluted along significant portions of the river. In West Virginia, the Monongahela River TDS loadings are not presently a water quality problem. Downstream in Pennsylvania, the TDS accumulation is a problem until flow from the Youghiogheny River dilutes the loadings.

Both States recognize that increased monitoring of TDS and other water quality parameters in the Monongahela River is needed to better characterize TDS problems.

The Pennsylvania TDS instream standards of less than 500 milligrams per liter (mg/l) average monthly and 750 mg/l daily are based on EPA secondary guidelines for potable water. Most public water utilities along the river do not treat raw water to remove TDS. Therefore, Pennsylvania has applied the drinking water TDS standard as an instream standard to ensure that the TDS concentration in potable water coming from municipal water treatment facilities is acceptable.

Pennsylvania estimates that the Monongahela River now contains up to five times the TDS concentration than is expected from natural conditions. The State projects that TDS loadings from coal mining will continue to increase, so that by 2020 approximately 80 percent of the TDS problem will come from new mining activities and from the treatment required to satisfy discharge requirements for acid mine drainage.

Coal mined for the SRC-II demonstration project would not contribute to this specific TDS problem because the coal would be mined outside the Monongahela River Basin.

F. Policy For Consumptive Use Makeup

The Pennsylvania Department of Environmental Resources has an administrative policy requiring that water users make up consumptive use losses during low-flow conditions. West Virginia presently has no policy on makeup water during low flow.

Under the Pennsylvania policy, when the river flow drops below the streamflow necessary to meet water quality standards, offstream diversions of new or increased consumptive uses, including interbasin transfers, shall not further diminish the flow of the stream. Under such flow conditions, either consumptive uses are curtailed or compensating releases must be provided from storage. Streamflow criteria are specified to meet water quality standards. If streamflow criteria for various water quality standards differ, the higher streamflow may be required to: protect public health; control water quality; conserve fisheries, aquatic habitats, and recreation; and protect instream and downstream water uses. The policy for consumptive use makeup presently is enforced by Pennsylvania for municipal water supply users along the river and for all users who withdraw from reservoirs in the Monongahela River Basin. This policy is under review to include all water users along the Monongahela River in Pennsylvania.

CHAPTER V. WATER-RELATED IMPACTS

A. SRC-II Versus Other Offstream Uses

The SRC-II project will be a significant new water consumer in the basin. The SRC-II demonstration project is estimated to account for about half of new offstream consumptive uses from 1980 to 1990 and 6 percent of the total offstream consumptive uses (existing and new) by 1990. The commercial project is estimated to account for about half of the new offstream consumptive uses from 1980 to 2020 and 16 percent of the total offstream consumptive uses by 2020.

B. Navigation

For this assessment, the SRC-II coal traffic on the Ohio and Monongahela Rivers is currently projected to be 6000 tpd from 1985 to 1989 when the demonstration SRC-II is in operation and 30,000 tpd from 1990 to 2020 when the commercial SRC-II is in operation. The Corps estimated streamflow requirements for projected navigation on the Monongahela River, both with and without coal barge traffic for the SRC-II project. Table 4 presents these requirements. Flow estimates are based on existing locks, current operating practices, and average tow size.

During the 1980s, the Corps intends to develop a water conservation plan that includes improvements to reduce water losses in the lock and dam system. These improvments would reduce the flow required to support navigation at Maxwell L&D from 341 cfs to 290 cfs without SRC-II traffic

Table 4

STREAMFLOW REQUIREMENTS FOR PROJECTED

NAVIGATION ON THE MONONGAHELA RIVER

(in cfs)

Lock and Dam	Min. Navig. Flows	1985 Without SRC-II	1985 With Demo. SRC-II	1990 Without SRC-II	1990 With Comm. SRC-II	2020 Without SRC-II	2020 With Comm. SRC-II
2	750	174	184	184	238	264[a]	264[a]
3	NA	111	116	123	136[a]	136[a]	136[a]
4	315	185	195	206	257	247	264
Maxwell	325	314	327	290[b]	350[b]	325[b]	385[b]
7	340	75	79	80[c]	80[a]	80[a]	80[a]
8	340	88	100	103	108[a]	108[a]	108[a]
Morgantown	NA	75	75	80	80	83	NA
Hildebrand	NA	84	84	87	87	90	NA
Opekiska	340	71	71	73	73	74	NA

a/ Demand exceeds estimated economic lock capacity.

b/ Includes conservation measures proposed by Corps.

c/ Demand exceeds estimated lock capacity by 1988 without SRC-II traffic.

NA: Not analyzed for this assessment.

and from 403 to 350 cfs with SRC-II traffic by 1990. By 2020, the required navigation flow at Maxwell will be 325 cfs without SRC-II and 385 cfs with SRC-II. The Corps reports that the Maxwell L&D will remain the critical flow site of the navigation system, even if other locks are enlarged in the future. Maxwell currently has the largest lock on the Monongahela River.

Table 5 summarizes the estimated water availability (or deficit) of the Monongahela River for meeting navigation and water quality instream flow needs in 1990 and 2020. The estimates are based on selected low-flow conditions, existing basin conditions, and projected offstream consumptive uses. Streamflows have not been adjusted for curtailment of offstream uses during critical low-flow conditions or augmentation at Stonewall Jackson Reservoir. The "without SRC-II" excludes the consumptive withdrawal of the SRC-II project, whereas the "with SRC-II" includes the project water uses.

Maxwell L&D will be the critical lock in the Monongahela River navigation system during low-flow conditions. Except for Maxwell L&D, current projections indicate that the Monongahela River can satisfy offstream uses and navigation flow requirements through 2020, even with the SRC-II project and associated barge traffic. However, as Table 5 illustrates, drought of record conditions without further upstream augmentation would result in flows 13 percent and 30 percent below minimum navigation needs at Maxwell L&D for 1990 and 2020, respectively. Implementation of the Corps water conservation plan will not fully offset the estimated streamflow deficits.

Table 5

ESTIMATED WATER AVAILABILITY[a]
SURPLUS (+)/DEFICIT (-) in cfs

-1990-

NEED	LOW FLOW COMPARISON	PROJECT SITE/L&D 8 WITHOUT SRC-II	PROJECT SITE/L&D 8 WITH SRC-II	MAXWELL L&D WITHOUT SRC-II	MAXWELL L&D WITH SRC-II	L&D 4 WITHOUT SRC-II	L&D 4 WITH SRC-II
NAVIGATION	7-day, 10-year	+255	+247	+275	+267	+438	+430
Without SRC-II Demo Traffic	7-day, 50-year	+245	+237	+150	+142	+298	+290
	Min. Navig. Flow	+235	+227	- 20	- 28	+103	+ 95
	7-day, 10-year	+250	+242	+262	+254	+428	+420
With SRC-II Demo Traffic	7-day, 50-year	+240	+232	+137	+129	+288	+280
	Min. Navig. Flow	+230	+222	- 33	- 41	+ 93	+ 85
WATER QUALITY							
Dissolved Oxygen (DO)	7-day, 10-year	+ 13	+ 5	NA	NA	+244	+236
Total Dissolved Solids (TDS)	7-day, 10-year	NS	NS	NA	NA	-846	-854

-2020-

NEED	LOW FLOW COMPARISON	PROJECT SITE/L&D 8 WITHOUT SRC-II	PROJECT SITE/L&D 8 WITH SRC-II	MAXWELL L&D WITHOUT SRC-II	MAXWELL L&D WITH SRC-II	L&D 4 WITHOUT SRC-II	L&D 4 WITH SRC-II
NAVIGATION	7-day, 10-year	+243	+215	+284	+256	+385	+357
Without SRC-II Demo Traffic	7-day, 50-year	+233	+205	+159	+131	+245	+217
	Min. Navig. Flow	+223	+195	- 11	- 39	+ 50	+ 22
	7-day, 10-year	NA	NA	+224	+196	NA	NA
With SRC-II Demo Traffic	7-day, 50-year	NA	NA	+ 99	+ 71	NA	NA
	Min. Navig. Flow	NA	NA	- 71	- 99	NA	NA
WATER QUALITY							
Dissolved Oxygen (DO)	7-day, 10-year	+ 6	- 22	NA	NA	+ 24	- 4
Total Dissolved Solids (TDS)	7-day, 10-year	NS	NS	NA	NA	-1236	-1264

a/ Low-flow augmentation at Stonewall Jackson Reservoir not included.

NS: No Standard.

NA: Not Analyzed for this assessment.

C. Water Quality

Low-flow, 7-day, 10-year conditions combined with projected offstream uses may leave insufficient flow in the river to meet water quality standards of West Virginia and Pennsylvania.

In West Virginia, the 7-day, 10-year low flow at L&D 8 is 360 cfs (Table 1). With the West Virginia dissolved oxygen standard based on 345 cfs at L&D 8, an estimated 15 cfs is "available" for other uses. The SRC-II project and increased water use by the municipal, industrial, and agricultural sectors will consume an estimated 10 cfs in 1990 and 37 cfs in 2020. Thus, there will be an estimated 5 cfs available at L&D 8 by 1990; however, the SRC-II commercial project will contribute to a 22 cfs "deficit" by 2020. The West Virginia Department of Natural Resources anticipates that low-flow augmentation from Stonewall Jackson will compensate for this deficit.

At L&D 4 in Pennsylvania, projected streamflows with the SRC-II project will be sufficient to meet the dissolved oxygen standard in 1990 but marginally deficient in 2020. The TDS standard is not projected to be met at L&D 4, with or without SRC-II. The demonstration project will account for about 1 percent of the 854 cfs deficit in 1990 and the commercial project will account for about 2 percent of the 1264 cfs deficit in 2020.

A preliminary analysis of flow projections at L&D 2 indicates that flow augmentation from the Youghiogheny River will be sufficient to meet Pennsylvania water quality standards at that L&D.

Estimated future streamflows at L&D 8 will be sufficient to meet the West Virginia pH standard. Pennsylvania has not established a relationship of pH to flow.

Because the navigation system maintains a minimum depth of 9-feet, it is assumed that minimal instream low-flow needs for fish, wildlife, and recreation will be satisfied if water quality and navigation requirements are met.

The Pennsylvania Department of Environmental Resources recommends that the present authorized allocation of water for water quality and water supply from Stonewall Jackson Reservoir should not be considered available for consumptive use by the SRC-II project. Rather, the State would prefer the development of a reservoir management plan that would use other designated storage (e.g., recreational or flood control storage) to provide releases for SRC-II consumptive use. Similar potentials may exist at Tygart Reservoir and other existing reservoirs in West Virginia. If such an option is not found feasible, Pennsylvania would then recommend further exploration of augmenting the size of Tygart or Stonewall Jackson Reservoir or providing additional storage in Stonecoal Reservoir as a means for providing releases to support downstream consumptive water users, including the SRC-II project.