

DISTRICT OF COLUMBIA  
DEPARTMENT OF ENVIRONMENTAL SERVICES  
ENGINEERING AND CONSTRUCTION ADMINISTRATION  
BLUE PLAINS FEASIBILITY STUDY PHASE - 1  
EPA NO. C 110040

Study Memorandum II-3  
Wastewater Quantities and Characteristics

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April, 1982

1. Introduction

This memorandum summarizes studies made to estimate future wastewater quantities and characteristics that will require treatment and disposal within the Blue Plains Service Area (BPSA) through the year 2005. The BPSA, together with areas estimated to require sanitary sewer service, are shown on Figure 1. Also shown on Figure 1, is the area within the District of Columbia served by combined sewers. Flow received for treatment at the Blue Plains Wastewater Treatment Plant (WWTP) comprises two principal elements as shown on Figure 2 and summarized as follows:

- a. Flow from stormwater events occurring in the combined sewer area within the District of Columbia.
- b. Flow from wastewater sources, which in turn is comprised of the following:
  - \* Water lost out of the District of Columbia's distribution system and which enters the sanitary sewer system by way of leaking and otherwise malfunctioning household and building plumbing systems.
  - \* Groundwater pumped from under and around foundations of several buildings located in the "Federal Triangle" area of the District of Columbia.
  - \* Groundwater or storm induced infiltration into sanitary sewer systems in the BPSA.

- \* Wastewater from sanitary sources which includes household and employment associated flow (commercial, government and industrial facilities) in the BPSA and flow associated with visitors to the District of Columbia.

Principal considerations related to estimates of future wastewater quantities and characteristics are summarized as follows:

- a. Wastewater Quantities. Annual average wastewater quantities have been estimated for the several user jurisdictions within the BPSA through the year 2005. These data will be used to evaluate requirements for wastewater treatment and disposal facilities. The studies also include estimates of maximum rates of wastewater flows since facilities for treatment and disposal of effluents will require hydraulic capacity to convey maximum flow rates.
- b. Wastewater Characteristics. Annual average wastewater characteristics have been estimated through the year 2005 for use in evaluating process capacity requirements of wastewater treatment units. Estimates of wastewater characteristics include the elements as follows:
  - \* Suspended Solids (SS)
  - \* Five-day Biochemical Oxygen Demand (BOD<sub>5</sub>)
  - \* Total Nitrogen (N)
  - \* Total Phosphorus (P)
  - \* Wastewater Temperature (Degrees C)
  - \* Wastewater Alkalinity (CaCO<sub>3</sub>)

The studies include estimates of load variations of the various characteristics as necessary to evaluate specific treatment processes.

Additionally, estimates have been made of storm event related flow rates coupled with wastewater flows which may be conveyed to the Blue Plains WWTP.

Principal user jurisdictions of the Blue Plains WWTP are summarized as follows:

- a. All of the District of Columbia.
- b. In Virginia, parts of Arlington County, Fairfax County and Loudoun County.
- c. In Maryland, parts of Montgomery County and Prince George's County through the Washington Suburban Sanitary Commission (WSSC).

## 2. Data Sources

Data sources used to develop and prepare estimates of future wastewater quantities and characteristics are summarized as follows:

- a. Study Memorandum II-2, Population and Land Use - Blue Plains Service Area
- b. Study Memorandum II-4, Combined Sewer Overflow and I/I Studies and Plans
- c. Operating records - Blue Plains WWTP
- d. Metropolitan Washington Council of Governments (COG) computer based Sewer Evaluation Simulation model (SES) for forecasts of wastewater quantities associated with households and employment activities. Projections of wastewater flows associated with resident populations and commercial-industrial activity were based on household and employment forecasts made by COG. These forecasts, together with water use records, were used as basic data for the COG Sewer Evaluation Simulation model (SES). The methodology, for the COG projections, together with estimates of future quantities, are included in Appendix A.
- e. District of Columbia Office of Planning and Development and Department of Environmental Services for forecasts of wastewater quantities associated with visitors to the District of Columbia.

- f. Report on Capacity Evaluation of the Blue Plains Wastewater Treatment Plant, October, 1977 - Metcalf & Eddy, Engineers (Capacity Evaluation Report).

### 3. Sewered Population

Estimates of population requiring sanitary sewer service in the BPSA were presented in Study Memorandum II-2, Population and Land Use - Blue Plains Service Area. Sewered population estimates are summarized in Table 1 and as follows:

Area	<u>Estimated Sewered Population - 1000 Persons</u>					
	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>	<u>2005</u>
Virginia	172.1	194.8	222.0	241.2	260.8	278.9
Maryland (WSSC)	890.6	924.9	984.8	1,038.9	1,075.2	1,111.3
District of Columbia	<u>702.0</u>	<u>724.0</u>	<u>734.0</u>	<u>734.0</u>	<u>733.0</u>	<u>732.0</u>
Total-BPSA	1,764.7	1,843.7	1,940.8	2,014.1	2,069.0	2,122.2

Forecasts of sewered population are shown on Figure 3 together with previous forecasts considered in planning of treatment requirements for the Blue Plains WWTP. Current forecasts (based on COG Round II and BEA projections) indicate a more moderate need for future sanitary sewer service than previously anticipated. Also shown on Figure 3 is an estimate of past population (sewered) tributary to the Blue Plains WWTP which is summarized as follows:

<u>Year</u>	<u>Estimated Tributary Population Blue Plains WWTP - 1000 Persons</u>
1969	1,419.3
1970	1,450.7
1971	1,482.1
1972	1,513.5
1973	1,544.9
1974	1,576.3
1975	1,607.7
1976	1,639.1
1977	1,670.5
1978	1,701.9
1979	1,733.3
1980	1,764.7

#### 4. Record of Wastewater Quantities and Characteristics

Data related to wastewater quantities and characteristics are based on raw wastewater analyses after screening and grit removal at the Blue Plains WWTP. Plant records and information included in the Capacity Evaluation Report were used in compiling data for the years 1969 through 1975. Plant records were used in compiling data for the years 1976 through 1980. The record data for the years 1976 through 1980 (and part of 1981), together with statistical analyses of the data, are included in Appendix B which has been separately bound.

The record of annual average wastewater quantities and characteristics compiled from the foregoing data, together with estimated sewered population, are summarized for the years 1969 through 1980 in Table 2 and as follows:

Annual Average Per Capita  
Wastewater Quantities and Characteristics (1)

<u>Item</u>	<u>Flow GCD</u>	<u>Pounds Per Capita Per Day</u>			
		<u>SS</u>	<u>BOD<sub>5</sub></u>	<u>N(2)</u>	<u>P</u>
Avg. for 1969-1980	180	0.23	0.24	0.033	0.0104

(1) Based on estimated sewer populations

(2) Avg. for 1972-1980

As shown in Table 2, flow meter problems developed at the Blue Plains WWTP in 1979 and quantities have since been estimated based on pumping rates and times. The District is engaged in a program to correct the deficiencies in flow metering and these problems do not appear to have significantly impacted the record data for purposes of facility planning. Although there is a substantial difference in flows reported in 1980 (351 mgd by D.C. BWT and adjusted to 296 mgd), per capita contributions computed from the higher flow value appear to compare favorably to data for previous years. Wastewater quantities billed to the principal user jurisdictions of the Blue Plains WWTP for the years 1976 through 1980 have been tabulated in Table 3. Flows from user jurisdictions outside the District of Columbia are individually metered and the District's flow is computed (in general, by subtracting metered users flows from flow metered at Blue Plains WWTP) by the D. C. Department of Environmental Services. As shown in Table 3, the D. C. Flow for 1980 has

been based on the D. C. BWT adjusted flow. It is considered, therefore, that competent flow measurement should be re-established at the Blue Plains WWTP as soon as practicable to insure the validity of plant records and preclude potential controversy concerning user flows.

The record of wastewater temperature and alkalinity at the Blue Plains WWTP for the years 1976 through 1980 are tabulated in Table 4, shown on Figures 4 and 5, and summarized as follows:

<u>Item</u>	<u>Value</u>
Minimum Day Wastewater Temperature - °C	10.7
Minimum Day Wastewater Alkalinity(1) - MG/L	49.2
Annual Average Wastewater Alkalinity - MG/L	133.0

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(1)As CaCO<sub>3</sub>

The record of variations in loading at the Blue Plains WWTP for 1-day, 3-day and 30-day moving average conditions is tabulated in Table 5. The data are shown for minimum, average and maximum values for each moving average condition.

##### 5. Future Annual Average Wastewater Quantities and Characteristics

Forecasts of annual average wastewater quantities have been made on several bases as follows:

- a. COG projections (included in Appendix A) for household, employment and D. C. visitors contributions.

- b. Infiltration and other flows based on the studies included in Study Memorandum II-4, Combined Sewer Overflow and Infiltration/Inflow Studies and Plans.

The forecasts of annual average wastewater quantities for the principal Blue Plains user jurisdictions are summarized in the several tables as follows:

- a. Table 6, which summarizes the forecast of annual average wastewater quantities for the Virginia communities in Fairfax, Arlington and Loudoun Counties.
- b. Table 7, which summarizes the forecast of annual average wastewater quantities for the Maryland communities of the WSSC.
- c. Table 8, which summarizes the forecast of annual average wastewater quantities for the District of Columbia. Estimated annual average wastewater quantities associated with visitors to the District of Columbia are summarized in Table 9.

The forecast of annual average wastewater quantities for the BPSA is included in Table 10, shown on Figure 6 (together with record quantities) and summarized as follows:

<u>Item</u>	<u>Blue Plains Service Area - Forecast of Annual Average Wastewater Quantities</u>				
	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>	<u>2005</u>
Sewered Population - 1000 Persons	1,843.7	1,940.8	2,014.1	2,069.0	2,122.2
Sanitary Flow - MGD(1)	213.93	229.52	245.22	260.25	276.23
Infiltration - MGD	51.80	53.00	54.05	54.92	55.78
Groundwater Pumpage - MGD(2)	4.71	4.71	4.71	4.71	4.71
Lost Water - MGD(2)	<u>41.88</u>	<u>31.88</u>	<u>31.88</u>	<u>31.88</u>	<u>31.88</u>
Total for BPSA - MGD	312.32	319.11	335.86	351.76	368.60
- GCD	169	164	167	170	174
Rounded Forecast - MGD	312	319	336	352	370

(1) Includes households, employment and D. C. visitors  
(2) From District of Columbia only

As shown on Figure 6 and indicated in the foregoing summary, the forecast conforms with the historic trend if the questionable 1980 reported flow is disregarded and the projected elimination of D. C. lost water is considered. Furthermore, the forecast indicates, overall, a generally constant per capita contribution.

Forecasts of annual average wastewater characteristics have been made based on estimates of per capita contributions. The recent record of average per capita contributions, together with previously developed values and estimated future contributions (proposed for Feasibility Study), are summarized as follows:

<u>Item</u>	<u>Per Capita Quantities - PCD(1)</u>			
	<u>SS</u>	<u>BOD<sub>5</sub></u>	<u>N</u>	<u>P</u>
Recent Record (See Table 2)	0.23	0.24	0.033	0.0104
Board of Engineers, 1964 Report(2)	0.27	0.23	-	-
M&E, 1969 Report	0.25	0.22	-	-
M&E, 1971 Basis of Design	0.217	0.238	0.026	0.0097
M&E, 1976 Capacity Evaluation	0.22	0.22	0.030	0.0090
Proposed for Feasibility Study	0.25	0.25	0.033	0.0090

(1) Pounds per Capita per Day

(2) For Year 2000

The recent record and forecast of per capita quantities are shown on Figure 7 for suspended solids and BOD<sub>5</sub> and on Figure 8 for total nitrogen and phosphorus. Some considerations related to the forecast of per capita contributions are as follows:

- a. The record average per capita quantities of SS and BOD<sub>5</sub> are about equal. Future quantities have been estimated as equal with some moderate increase to allow for wider use of such household appliances as garbage grinders and other increased residential/commercial organic loads.
- b. The forecast of per capita nitrogen quantities has been based on the average of the recent record.
- c. The recent record of per capital phosphorus quantities indicates a marked decrease between about 1969 to 1975 and a general leveling out thereafter. The forecast of per capita phosphorus quantities has been based on the estimated prevailing per capita values for the latter period (1975 through 1980) of the recent record.

The recent record and forecasts of total annual average quantities of SS, BOD<sub>5</sub>, N and P are shown on Figures 9, 10, 11 and 12, respectively.

The forecast of annual average wastewater quantities and characteristics for the BPSA is summarized in Table 11 and as follows:

Item	Blue Plains Service Area - Forecast of Annual Average <u>Wastewater Quantities &amp; Characteristics</u>				
	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>	<u>2005</u>
Wastewater Quantities - MGD	312	319	336	352	370
Wastewater Characteristics - 1000 LBS/Day					
Suspended Solids	460.9	485.2	503.5	517.3	530.5
BOD <sub>5</sub>	460.9	485.2	503.5	517.3	530.5
Total Nitrogen	60.8	64.0	66.5	68.3	70.0
Total Phosphorus	16.6	17.5	18.1	18.6	19.1

#### 6. Variations in Loadings

Estimates have been made of variations in the quantities and characteristics of wastewater based on the records of the Blue Plains WWTP. The data compiled in Table 5 have been used as tabulated in Table 12 to develop variations in loadings between annual average and maximum conditions. Variations for several process loading conditions have been prepared as follows:

- a. Annual Average, which has been computed as the average of total yearly quantities divided by 365 days.
- b. Maximum Month, which has been computed as the highest maximum 30-day moving average to annual average ratio in nine years of record data (1972-1980).

- c. 3-Day Maximum, which has been computed as the median (50% frequency of occurrence) ratio of the 3-day moving average to annual average in nine years of record data (1972-1980).
- d. Maximum Day, which has been computed on the same basis as the 3-Day Maximum using the 1-day moving average.

Ratios of maximum to annual average variations for the several process loading conditions are shown on Figures 13, 14, 15, 16 and 17, summarized in Table 13, and as follows:

<u>Process Loading Condition</u>	<u>Load Variations - Ratio to An. Avg.</u>				
	<u>MGD</u>	<u>SS</u>	<u>BOD<sub>5</sub></u>	<u>N</u>	<u>P</u>
Annual Average	1.00	1.00	1.00	1.00	1.00
Maximum Month	1.20	1.33	1.34	1.33	1.40
3-Day Maximum	1.35	1.60	1.74	1.53	1.55
Maximum Day	1.38	2.25	2.00	1.58	1.78

## 7. Maximum Flow Rates

Estimates of maximum flow rates have been based on data developed in the documents as follows:

- a. Report on Improvements to Sewerage System, Board of Engineers (BOE), 1957.
- b. D. C. Combined Sewer Overflow Study, O'Brien and Gere Engineers, Inc., 1979.

Maximum flow rates will result from storm events (in the D. C. combined sewer area) and peak flows from wastewater sources. As shown on Figure 18, estimates by the BOE indicate that peak wastewater flows may be estimated at 2 times annual average

for the range of wastewater quantities forecast for the BPSA. Peak flow rates which may be expected at the Blue Plains WWTP due to storm events in the D. C. combined sewer area are shown on Figure 19. These data have been taken from the D. C. Combined Sewer Overflow Study and include peak rates for three alternative projects developed for abatement of combined sewer overflows. Estimated peak flow rates which may be expected at the Blue Plains WWTP and their duration due to storm events have been tabulated in Table 14, shown on Figure 20 and summarized as follows:

<u>CSO Abatement Project</u>	<u>Peak 15-min Storm Event Flow Rate - MGD</u> <u>For Maximum 60-min Intensity - INS/HR</u>			
	<u>0.50</u>	<u>1.00</u>	<u>1.50</u>	<u>2.00</u>
Future No Action	278	339	355	355
BMP + Potomac Pump Station Expansion	422	477	527	577
Swirl No. 2 + 88 mgd NE Boundary Relief Sewer	500	560	610	659

Based on the foregoing, the maximum peak rate of flow would be that rate due to the simultaneous occurrence of the maximum storm event peak and the maximum wastewater peak. For the year 2005 peak wastewater quantity ( $370 \times 2 = 740$  mgd), such a rate (at 2.00 ins/hr storm event) would vary from 1095 mgd to 1399 mgd depending on which CSO abatement project was implemented. Collection system studies indicate, however, that the capacity

of facilities to convey flow to the Blue Plains WWTP would be limited to a range from about 710 mgd to about 1259 mgd, again, depending to what degree the collection system capacity is increased and which CSO abatement project is implemented. Furthermore, the likelihood of the maximum storm peak rate and maximum wastewater peak rate occurring simultaneously is fairly remote. A more realistic combined storm/wastewater peak flow rate would be one due to the occurrence of a storm event and a wastewater rate which is greater than annual average but less than the 2 times annual average maximum. It is considered that such a maximum wastewater rate would be the normal maximum occurring during dry weather periods or at most the maximum prevailing during wet years where prolonged effects of rainfall induced infiltration might be greatest. Flow data for dry day periods included in the Capacity Evaluation Report are summarized as follows:

<u>Year(2)</u>	<u>Dry Days Flow(1) - MGD</u>		
	<u>Avg.</u>	<u>Max.</u>	<u>Max/Avg.</u>
1972	284.1	324.0	1.14
1973	281.9	315.0	1.12
1974	272.3	321.0	1.18
1975	284.4	358.0	1.26

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(1) Dry days flow computed by averaging daily values after eliminating the day before, the day of and the day after each recorded rainfall in excess of 0.1 inch.

(2) 1972 and 1975 were extremely wet years and 1973 and 1974 were slightly dryer than normal.

Based on the foregoing, peak flow rates to the Blue Plains WWTP could be expected to be as follows:

(Storm Event Peak) + (1.12 to 1.26 times An. Avg.  
Wastewater Flow)

Combined storm/wastewater peak rates are shown on Figure 21. As shown on Figure 21, the existing conveyance system capacity (710 mgd) is not adequate to convey peak storm/wastewater rates. Arrangements available to expand the existing system can, however, provide capacity to handle peak rates from the most effective CSO abatement project coincident with a 1.26 times annual average (370 mgd x 1.26 = 466 mgd) year 2005 wastewater peak.

#### 8. Summary

Forecasts of future wastewater quantities and characteristics have been made for the BPSA. The forecasts include estimates of annual average quantities and characteristics together with estimates of load variations in annual average quantities. Additionally, peak flow rates have been developed for wastewater and for combined storm/wastewater flows. The forecast of future wastewater quantities and characteristics for the BPSA is summarized in Table 15.

TASK STUDY MEMO II-3 PHASE \_\_\_\_\_

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY \_\_\_\_\_ DATE \_\_\_\_\_ CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 1 OF 2

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TASK STUDY MEMO II-3 PHASE \_\_\_\_\_

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

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TASK <u>STUDY MEMO II-3</u> PHASE <u>I</u>	DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY
SUBJECT <u>WASTEWATER QUANTITIES AND CHARACTERISTICS</u>	FIRM <u>GEH</u>

COMP BY REB DATE 4.18.81 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 1 OF 1

TABLE 1  
BLUE PLAINS SERVICE AREA  
ESTIMATED SEWERED POPULATION - 1000 PERSONS<sup>(1)</sup>

AREA	1980	1985	1990	1995	2000	2005
<u>VIRGINIA</u>						
1. Fairfax & Arlington Cos.	141.2	152.6	165.5	176.4	184.5	193.5
2. Loudoun Co.	30.9	41.1	56.5	64.8	76.3	85.4
Subtotal - Virginia	172.1	194.8	222.0	241.2	260.8	278.9
<u>MARYLAND</u>						
3. Montgomery Co.	534.9	560.8	611.5	656.4	690.6	724.6
4. Prince George's Co.	355.7	364.1	373.3	382.5	384.6	386.7
Subtotal - Maryland	890.6	924.9	984.8	1038.9	1075.2	1111.3
5. District of Columbia	702.0	724.0	734.0	734.0	733.0	731.0
<b>Total - Blue Plains Service Area</b>	<b>1764.7</b>	<b>1843.7</b>	<b>1940.8</b>	<b>2014.1</b>	<b>2069.0</b>	<b>2122.2</b>

<sup>(1)</sup> SOURCE: COG  
 SM II-1, POPULATION AND LAND USE - BPSA

TABLE 2  
 BLUE PLAINS WWTP - RECORD OF ANNUAL AVERAGE WASTEWATER QUANTITIES AND CHARACTERISTICS

ITEM	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	12-YR. AVG.
Estimated Sewered Population - 1000's	1419.3	1450.7	1481.1	1513.5	1544.9	1576.3	1607.7	1639.1	1670.5	1701.9	1733.3	1764.7	-
Wastewater Quantity - MGD (BWT) <sup>(1)</sup>	246	255	272	288	285	277	291	294	277	300	311	351	-
- MGD (BWT ADJ.) <sup>(2)</sup>	-	-	-	-	-	-	-	-	-	-	-	296	-
- GCD (BWT)	173	176	184	190	185	176	181	179	166	176	179	199	180
Suspended Solids - MG/L <sup>(3)</sup>	176	185	168	166	138	151	145	148	152	157	131	138	-
- 1000 LBS/DAY	361	393	382	359	329	348	353	364	351	393	340	403	-
- PCD <sup>(4)</sup>	0.25	0.27	0.26	0.26	0.21	0.22	0.22	0.22	0.21	0.23	0.20	0.23	0.23
BOD <sub>5</sub> - MG/L	175	192	211	174	159	162	149	174	153	145	140	118	-
- 1000 LBS/DAY	360	408	478	419	377	374	362	427	353	362	362	344	-
- PCD	0.25	0.28	0.32	0.28	0.24	0.24	0.23	0.26	0.21	0.21	0.21	0.19	0.24
Total Nitrogen - MG/L	-	-	-	13.8	19.9	23.1	25.0	22.7	24.0	22.5	19.8	20.7	-
- 1000 LBS/DAY	-	-	-	45.1	47.4	53.6	60.6	55.6	55.4	56.4	51.3	60.6	-
- PCD	-	-	-	0.030	0.031	0.034	0.038	0.034	0.033	0.033	0.030	0.034	0.033
Total Phosphorus - MG/L	10.0	9.3	8.7	7.1	7.1	6.7	5.6	5.7	6.4	5.6	4.7	5.3	-
- 1000 LBS/DAY	20.5	19.7	19.7	17.4	17.0	15.4	13.6	14.0	14.9	14.1	11.3	13.4	-
- PCD	0.014	0.014	0.013	0.012	0.011	0.010	0.009	0.009	0.009	0.008	0.007	0.009	0.004

(1) D.C. Bureau of Waste Treatment Reported Flow (BWT)  
 (2) D.C. BWT Adjusted MGD = (1.06 x BMT) - 273.43 (Started Nov. 1979, meters out of service)  
 (3) Concentrations Computed  
 (4) PCD - POUNDS PER CAPITA PER DAY (9) 9-YR. AVG.

TASK STUDY MEMO II-3 PHASE \_\_\_\_\_

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM \_\_\_\_\_

COMP BY REB DATE 4.10.81 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 1 OF 1

TABLE 3

RECORD OF ANNUAL AVERAGE WASTEWATER  
QUANTITIES FROM DISTRICT OF COLUMBIA  
DEPARTMENT OF ENVIRONMENTAL SERVICES<sup>(1)</sup>  
FOR PRINCIPAL BLUE PLAINS WWTP USERS<sup>(1)</sup>

AREA	WASTEWATER QUANTITIES - MGD				
	1976	1977	1978	1979	1980
Virginia Communities <sup>(2)</sup>	14.98	15.63	17.56	18.84	17.63
Maryland (WSSC)	126.35	114.27	125.96	134.70	122.53
District of Columbia	152.00	146.54	155.77	157.43	155.10
Other <sup>(3)</sup>	0.39	0.39	0.41	0.48	0.35 <sup>(4)</sup>
Total	293.72	276.83	299.71	311.45	295.61

(1) From DES Billing Records

(2) Includes Fairfax and Loudoun Counties and Town of Vienna

(3) Includes Dulles Airport, National Parks Service, U.S. Navy

(4) 1980 Total for "Other" does not include U.S. Navy

TABLE 4  
BLUE PLAINS WWTP - RECORD OF WASTEWATER  
TEMPERATURE AND ALKALINITY

ITEM	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
<b>I. TEMPERATURE - °C</b>												
1976 - AVG	14.9	15.4	17.0	18.7	21.4	24.5	26.6	27.1	25.8	22.4	17.3	15.2
- MIN	13.2	13.4	15.4	16.3	19.6	22.7	25.8	26.6	24.3	19.1	15.5	13.1
- MAX	15.6	16.8	17.7	21.3	22.2	27.3	27.6	28.0	27.0	24.9	18.3	16.8
1977 - AVG	13.4	13.3	15.7	18.1	21.2	23.3	25.7	26.2	25.5	22.3	19.3	15.7
- MIN	10.9	12.2	14.4	16.0	19.0	22.0	24.9	25.0	24.4	19.7	13.9	13.4
- MAX	15.2	14.6	17.5	20.4	24.0	24.7	26.8	29.2	27.1	25.5	22.0	18.2
1978 - AVG	14.0	13.3	13.6	16.6	18.7	23.5	25.0	25.9	25.0	22.3	19.8	16.8
- MIN	11.8	12.2	12.2	15.0	16.4	21.6	22.1	24.4	22.7	20.7	17.6	14.3
- MAX	16.5	15.2	15.4	20.0	21.1	25.9	27.5	27.9	26.8	24.4	22.0	18.7
1979 - AVG	14.3	12.7	14.9	17.0	20.6	22.0	24.4	24.7	23.8	-	19.4	17.4
- MIN	12.6	10.7	12.4	15.0	17.9	20.9	22.4	21.6	20.5	-	17.8	16.1
- MAX	16.6	15.4	17.0	19.3	21.6	23.6	26.4	26.7	25.7	-	21.8	18.9
1980 - AVG	14.7	14.0	14.7	17.3	20.1	22.7	25.5	26.3	26.1	22.9	19.4	16.6
- MIN	12.7	12.0	12.8	14.8	17.7	20.2	21.7	25.3	24.2	20.0	17.4	14.9
- MAX	16.4	15.3	16.0	18.7	23.4	25.0	27.2	27.6	27.7	23.9	21.0	17.2
<b>5-YR AVG. TEMP - °C</b>												
MIN - °C	10.9	10.7	12.2	14.8	16.4	20.2	21.7	21.6	20.5	19.1	13.9	13.1
MAX - °C	16.6	16.8	17.7	21.3	24.0	27.3	27.6	29.2	27.7	29.9	22.0	19.2
<b>II. ALKALINITY - MG/L</b>												
1976 - AVG	86.0	110.5	108.3	113.1	126.7	125.3	-	-	-	113.6	135.7	140.8
- MIN	49.2	78.4	76.7	56.3	81.1	105.7	-	-	-	75.6	115.0	104.0
- MAX	119.2	151.7	158.8	136.3	177.5	170.6	-	-	-	130.5	153.0	169.0
1977 - AVG	159.9	171.1	129.5	128.9	154.1	160.5	144.0	150.2	154.2	169.3	145.8	132.0
- MIN	132.9	153.5	97.9	95.1	126.6	142.6	122.3	124.5	135.3	111.4	125.8	94.6
- MAX	187.3	186.6	158.8	159.7	166.3	179.9	180.1	181.6	175.8	198.8	174.4	162.8
1978 - AVG	116.6	114.1	133.6	140.0	133.7	133.2	122.1	122.7	144.3	164.5	175.0	136.9
- MIN	67.5	84.4	83.5	120.7	100.2	101.8	99.0	93.0	105.7	148.1	154.3	67.5
- MAX	140.3	139.5	171.0	180.2	187.7	154.7	141.8	149.9	169.5	185.1	212.8	212.8
1979 - AVG	111.9	117.6	109.2	122.2	129.0	127.0	139.8	136.1	129.5	-	138.9	126.9
- MIN	87.3	67.3	75.0	97.5	104.4	94.6	116.8	106.9	89.9	-	111.3	67.3
- MAX	142.4	139.6	167.0	138.9	148.4	154.7	160.2	156.2	147.4	-	159.9	167.0
1980 - AVG	111.7	138.3	111.6	111.2	115.1	127.4	131.9	134.6	132.9	138.5	148.0	121.1
- MIN	79.6	121.6	68.0	84.0	89.0	92.0	106.0	110.0	108.0	115.0	125.0	86.0
- MAX	134.0	149.9	144.0	132.0	146.0	165.0	161.0	182.0	156.0	161.0	172.0	162.0
<b>5-YR. AVG. ALKAL - MG/L</b>												
MIN. - MG/L	49.2	67.3	68.0	56.3	81.1	92.0	99.0	93.0	89.9	75.6	111.3	67.5
MAX. - MG/L	187.3	186.6	171.0	180.2	187.7	179.9	180.1	182.0	175.8	198.8	212.8	212.8

TABLE 5

BLUE PLAINS WWTP - RECORD OF WASTEWATER  
LOADING VARIATIONS

ITEM	YEAR	1-DAY MOVING AVERAGE			3-DAY MOVING AVERAGE			30-DAY MOVING AVERAGE		
		MIN.	AVG.	MAX.	MIN.	AVG.	MAX.	MIN.	AVG.	MAX.
FLOW (MGD)	1972	244.0	287.8	325.0	253.7	287.8	319.3	265.1	287.8	311.9
	1973	232.0	285.1	332.0	244.3	285.1	318.3	258.6	285.7	302.4
	1974	222.0	276.5	329.0	229.0	276.6	321.3	245.9	277.5	299.6
	1975	234.0	290.8	397.0	252.0	290.8	397.3	273.4	291.4	323.6
	1976	243.0	293.7	411.0	251.7	293.6	366.0	265.9	294.0	313.7
	1977	233.0	276.5	429.0	240.7	276.4	417.3	254.5	274.4	309.1
	1978	292.0	299.5	414.0	260.7	299.5	406.0	274.0	300.4	328.7
	1979	222.0	311.0	486.0	232.3	311.0	436.0	267.3	309.9	371.3
	1980	283.0	351.1	524.0	285.0	350.7	471.7	285.0	349.6	396.1
	AVG.			296.9			296.8			296.9
TEMP (°C)	1976	13.1	20.7	28.0	13.8	20.7	27.8	14.7	21.1	27.1
	1977	10.9	20.3	29.2	11.9	20.3	27.2	12.8	20.0	26.3
	1978	11.8	19.6	27.9	12.1	19.6	27.4	13.2	19.6	26.7
	1979	10.7	19.2	26.7	11.2	19.2	26.1	12.7	19.3	25.2
	1980	12.0	20.1	27.7	12.6	20.1	27.6	14.0	20.1	26.4
	AVG.		20.0			20.0			20.0	
SUSP. SOLIDS (1000 LB/D)	1972	119.0	399.0	1557.0	181.3	398.6	1,058.7	297.3	394.8	525.7
	1973	87.0	329.1	679.0	146.0	329.3	489.3	272.8	328.4	381.3
	1974	185.0	348.3	789.0	235.0	348.3	533.7	307.7	349.4	392.9
	1975	170.0	352.8	640.0	210.0	352.8	566.7	306.1	353.6	445.3
	1976	162.6	363.6	650.9	176.4	363.7	535.0	306.3	365.5	416.4
	1977	162.1	351.2	878.8	184.9	351.1	657.0	277.0	348.7	411.3
	1978	178.8	393.1	724.1	215.9	391.4	620.9	320.9	393.1	514.6
	1979	157.5	340.3	759.6	202.9	341.1	539.7	272.9	337.7	385.3
	1980	139.9	402.6	1131.6	203.1	402.3	748.1	203.1	399.5	503.9
	AVG.		364.5			364.3			363.4	

(Continued)

TASK STUDY MEMO I-3 PHASE \_\_\_\_\_

SUBJECT \_\_\_\_\_

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

TABLE 5 (cont'd)

FIRM G&H

COMP BY LEB DATE 4-11-84 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 2 OF 1

ITEM	YEAR	1-DAY MOVING AVERAGE			3-DAY MOVING AVERAGE			30-DAY MOVING AVERAGE		
		MIN.	AVG.	MAX.	MIN.	AVG.	MAX.	MIN.	AVG.	MAX.
BOD <sub>5</sub> (1000 LB/D)	1972	182.0	412.9	739.0	214.0	418.9	627.3	331.2	421.1	490.5
	1973	122.0	376.5	774.0	176.0	376.6	656.7	277.1	373.7	429.7
	1974	122.0	374.4	735.0	220.3	373.8	550.3	337.0	373.3	422.1
	1975	128.0	361.9	719.0	208.7	362.1	601.7	286.5	363.2	475.6
	1976	146.3	426.9	863.4	195.3	427.5	843.0	312.3	434.0	539.8
	1977	162.5	352.9	818.3	207.1	352.3	671.7	264.7	348.2	440.1
	1978	181.3	362.1	666.5	226.6	362.1	544.0	301.3	366.5	454.9
	1979	176.4	362.4	657.4	187.5	361.9	692.3	290.5	361.7	478.5
	1980	124.6	344.2	870.4	139.9	342.3	736.0	157.2	341.7	458.1
	AVG.			375.6			375.3			376.0
TOTAL NITROGEN (1000 LB/D)	1972							35.3	45.1	50.8
	1973							38.8	47.4	54.6
	1974							45.4	53.6	63.1
	1975							54.7	60.6	74.7
	1976	37.1	55.6	87.6	39.4	55.5	85.3	47.6	54.7	71.6
	1977	37.3	55.4	93.3	38.6	55.4	90.7	42.8	54.8	70.3
	1978	37.4	56.4	88.0	40.0	56.5	86.3	45.7	56.8	69.8
	1979	34.1	51.3	70.6	34.1	51.4	70.6	44.5	52.0	64.2
	1980	23.7	60.6	95.8	23.7	60.3	85.9	24.3	59.7	70.2
	AVG.		55.9			55.8			53.9	
TOTAL PHOSPHORUS (1000 LB/D)	1972	8.5	17.4	32.5	10.1	17.4	28.6	14.7	17.3	22.5
	1973	6.8	17.0	41.5	10.6	17.0	39.5	14.8	17.0	20.9
	1974	6.0	15.4	26.8	7.5	15.4	22.6	11.6	15.5	18.9
	1975	4.7	13.6	32.1	6.3	13.6	23.0	10.9	13.5	17.3
	1976	2.4	14.0	24.9	4.4	14.0	21.7	11.7	14.0	15.8
	1977	7.7	14.9	22.9	10.4	14.9	20.9	13.3	14.9	16.8
	1978	9.5	14.1	19.0	9.8	14.1	17.8	12.8	14.0	15.8
	1979	3.2	12.3	18.0	3.2	12.3	17.6	6.7	12.6	17.6
	1980	2.7	15.4	43.3	2.9	15.2	42.2	5.4	15.2	24.9
	AVG.		14.9			14.9			14.9	
ALKALINITY (MG/L)	1976	49.2	117.5	177.5	61.9	117.5	169.8	84.9	118.3	140.6
	1977	94.6	149.2	198.8	104.7	149.3	186.8	118.1	149.9	171.7
	1978	67.5	139.6	212.8	86.4	137.0	194.2	106.3	136.7	175.6
	1979	67.3	126.9	167.0	70.6	127.1	156.7	101.0	127.6	146.1
	1980	68.0	126.7	182.0	86.7	126.7	163.7	106.3	127.1	148.3
	AVG.		132.0			131.5			131.9	

TASK <u>STUDY MEMO II-3</u> PHASE <u>I</u>	DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY
SUBJECT <u>WASTEWATER QUANTITIES &amp; CHARACTERISTICS</u>	FIRM <u>G &amp; H</u>

COMP BY REB DATE 4.10.81 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 1 OF 1

TABLE C  
SUMMARY - FORECAST OF ANNUAL AVERAGE  
WASTEWATER QUANTITIES - VIRGINIA (FAX, ARUN, LOU COs)

ITEM	1985	1990	1995	2000	2005
Estimated Sewered Pop. - 1000 PERSONS	194.8	222.0	241.2	260.8	278.9
Wastewater Quantities					
Households (Domestic) - MGD	15.07	17.45	20.71	23.09	25.35
(Computed) - GCD	77	79	86	89	91
Employment - MGD	3.40	4.27	5.38	6.41	7.39
- 1000 PERSONS	76.8	95.6	116.1	138.0	157.6
- GCD (Computed)	44	45	46	46	47
Infiltration					
1980 Infiltration - MGD	4.95	4.95	4.95	4.95	4.95
1980 Sewered Pop. - 1000 PERS.	170.2	170.2	170.2	170.2	170.2
1980 Infiltration - GCD	29	29	29	29	29
Future Infiltration - MGD <sup>(1)</sup>	0.38	0.76	1.06	1.40	1.73
Future Sewered Pop. - 1000 PERS.	22.7	49.9	69.1	88.7	106.8
Future Infiltration - GCD	17	15	15	16	16
Total Infiltration - MGD	5.33	5.71	6.01	6.35	6.68
Total Wastewater Quantities - MGD	23.80	27.43	32.10	35.86	39.41
(Computed) - GCD	122	124	133	137	141

(1) Based on 300 GPD/IN-DIA/MILE OF SEWER

TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM GCH

COMP BY REP DATE 4-10-82 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

TABLE 7  
SUMMARY - FORECAST OF ANNUAL AVERAGE  
WASTEWATER QUANTITIES - MARYLAND (WSSC)

ITEM	1985	1990	1995	2000	2005
Estimated Sewered Pop. - 1000 PERSONS	924.9	984.8	1038.9	1075.2	1111.3
Wastewater Quantities					
Households (Domestic) - MGD	78.14	84.14	90.13	94.35	98.45
(Computed) - GCD	84	85	87	88	88
Employment - MGD	25.04	28.72	30.76	34.66	38.78
- 1000 PERSONS	481.3	545.4	588.1	648.9	709.4
- GCD (Computed)	52	53	52	53	55
Infiltration					
1980 Infiltration - MGD	41.04	41.04	41.04	41.04	41.04
1980 Sewered Pop. - 1000 PERS.	890.6	890.6	890.6	890.6	890.6
1980 Infiltration - GCD	46	46	46	46	46
Future Infiltration - MGD <sup>(1)</sup>	0.63	1.45	2.20	2.73	3.26
Future Sewered Pop. - 1000 PERS	34.3	94.1	148.3	184.6	220.7
Future Infiltration - GCD	18	15	15	15	15
Total Infiltration - MGD	41.67	42.49	43.24	43.77	44.30
Total Wastewater Quantities - MGD	144.85	155.35	164.23	172.78	181.53
(Computed) - GCD	157	158	158	161	163

(1) Based on 300 GPD/IN-DIA/MILE OF SEWER

TASK <u>STUDY MEMO II-3</u>	PHASE <u>I</u>	DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY
SUBJECT <u>WASTEWATER QUANTITIES &amp; CHARACTERISTICS</u>		
		FIRM <u>G&amp;H</u>

COMP BY REB DATE 4.10.84 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

**TABLE B**  
SUMMARY - FORECAST OF ANNUAL AVERAGE  
WASTEWATER QUANTITIES - DISTRICT OF COLUMBIA

ITEM	1985	1990	1995	2000	2005
Estimated Sewered Pop - 1000 PERSONS	724.0	734.0	734.0	733.0	732.0
<b>Wastewater Quantities</b>					
Households (Domestic) - MGD	67.80	68.83	70.07	71.07	72.07
- GCD	74	74	76	77	78
Employment - MGD	19.51	19.93	20.26	20.60	20.94
- 1000 PERSONS	665.0	679.0	690.0	702.0	712.0
- GCD (Computed)	29	29	29	29	29
Visitors (See Table 2) - MGD	4.97	6.18	7.81	10.06	13.25
Infiltration <sup>(1)</sup> - MGD	4.80	4.80	4.80	4.80	4.80
- GCD (Computed)	6	6	6	6	6
Groundwater Pumpage <sup>(1)</sup> - MGD	4.71	4.71	4.71	4.71	4.71
Water Distribution System Lost Water <sup>(1)</sup> - MGD	41.88	31.88	31.88	31.88	31.88
Subtotal, Infiltration + Groundwater Pumpage + Lost Water - MGD	51.39	41.39	41.39	41.39	41.39
(Computed) - GCD <sup>(2)</sup>	71	56	56	56	56
<b>Total Wastewater Quantities - MGD</b>	<b>143.67</b>	<b>136.33</b>	<b>139.53</b>	<b>143.11</b>	<b>147.65</b>
- GCD	<b>198</b>	<b>186</b>	<b>190</b>	<b>195</b>	<b>201</b>

<sup>(1)</sup> See Study Memo II-4, CSO and I/I Studies and Plans  
<sup>(2)</sup> General equivalent to GCD for Infiltration in Maryland and Virginia

TABLE 9

DISTRICT OF COLUMBIA - FORECAST OF ANNUAL AVERAGE  
WASTEWATER QUANTITIES FROM VISITORS TO D.C.<sup>(1)</sup>

YEAR	OVERNIGHT - SOCIAL				OVERNIGHT - BUSINESS				DAYTIME VISITORS				TOTAL AN. AVG. FLOW MGD. (2)		
	1000 VISITORS PER YR.	VISITORS PER DAY	DAYS PER STAY	GPD PER VIS.	AN. AVG. FLOW MGD	1000 VISITORS PER YR.	VISITORS PER DAY	DAYS PER STAY	GPD PER VIS.	AN. AVG. FLOW MGD	1000 VISITORS PER YR.	VISITORS PER DAY		DAYS PER STAY	GPD PER VIS.
1980	4,135	11,329	2.03	90	2,070	7,183	2.70	90	1.746	3,447	9,444	1.50	15	0.214	4.03
1985	5,189	14,216	2.03	90	2,597	8,792	2.70	90	2.136	3,757	10,293	1.50	15	0.231	4.97
1990	6,589	18,052	2.03	90	3,298	10,846	2.70	90	2.636	4,040	11,068	1.50	15	0.249	6.18
1995	8,533	23,378	2.03	90	4,271	13,482	2.70	90	3.276	4,250	11,644	1.50	15	0.262	7.81
2000	11,355	31,109	2.03	90	5,684	16,868	2.70	90	4.099	4,409	12,079	1.50	15	0.274	10.06
2005	15,613	41,775	2.03	90	7,815	21,125	2.70	90	5.158	4,453	12,100	1.50	15	0.275	13.25

(1) Source: COG, see Appendix A

(2) Rounded value

TASK <u>STUDY MEMO II-3</u> PHASE <u>I</u>	DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY
SUBJECT <u>WASTEWATER QUANTITIES &amp; CHARACTERISTICS</u>	FIRM <u>G&amp;H</u>

COMP BY REB DATE 4-18-82 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

TABLE 10  
SUMMARY-FORECAST OF ANNUAL AVERAGE  
WASTEWATER QUANTITIES - BLUE PLAINS SERVICE AREA

ITEM	1985	1990	1995	2000	2005
Estimated Sewered Pop.-1000 PERS.	1843.7	1940.8	2014.1	2069.0	2122.2
Wastewater Quantities					
Households (Domestic) - MGD	161.01	170.42	181.01	188.51	195.87
(Computed) - GCD	87	88	90	91	92
Employment - MGD	47.95	52.92	56.40	61.68	67.11
- 1000 PERSONS	1223.1	1320.0	1394.2	1488.9	1579.0
- GCD (Computed)	39	40	41	41	42
Visitors (D.C. Only) - MGD	4.97	6.18	7.81	10.86	13.25
Infiltration - MGD	51.80	53.00	54.05	54.92	55.78
Groundwater Pumpage - MGD (D.C. Only)	4.71	4.71	4.71	4.71	4.71
Water Distribution System Lost Water (D.C. Only) - MGD	41.88	31.88	31.88	31.88	31.88
Total Wastewater Quantities - MGD	312.32	319.11	335.86	351.76	368.60
- GCD	169	164	167	170	174
Totals - Rounded Off For Design - MGD	312	319	336	352	370

TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY REB DATE 4-10-81 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 1 OF 1

TABLE II

SUMMARY - FORECAST OF ANNUAL AVERAGE  
WASTEWATER QUANTITIES AND CHARACTERISTICS  
FOR THE BLUE PLAINS SERVICE AREA

ITEM	1985	1990	1995	2000	2005
Estimated Sewered Pop. - 1000 PERSONS	1843.7	1940.8	2014.1	2069.0	2122.1
<u>Wastewater Quantities - MGD</u>					
Virginia	23.80	27.43	32.10	35.86	39.42
Maryland (WSSC)	144.85	155.35	164.23	172.78	181.53
District of Columbia	143.67	136.33	139.53	143.12	147.65
Total - MGD (BPSA)	312.32	319.11	335.86	351.76	368.60
Totals Rounded Off For Design - MGD	312	319	336	352	370
<u>Wastewater Characteristics</u>					
Suspended Solids - PCD <sup>(1)</sup>	0.15	0.15	0.15	0.15	0.15
- 1000 LBS/DAY	460.9	485.2	503.5	517.3	530.5
- MG/L <sup>(2)</sup>	177	182	180	176	172
BOD <sub>5</sub> - PCD <sup>(1)</sup>	0.15	0.15	0.15	0.15	0.15
- 1000 LBS/DAY	460.9	485.2	503.5	517.3	530.5
- MG/L <sup>(2)</sup>	177	182	180	176	172
Total Nitrogen - PCD <sup>(1)</sup>	0.033	0.033	0.033	0.033	0.033
- 1000 LBS/DAY	60.8	64.0	66.5	68.3	70.0
- MG/L <sup>(2)</sup>	23	24	24	23	23
Total Phosphorus - PCD <sup>(1)</sup>	0.009	0.009	0.009	0.009	0.009
- 1000 LBS/DAY	16.6	17.5	18.1	18.6	19.1
- MG/L <sup>(2)</sup>	6.4	6.6	6.5	6.3	6.2

(1) PCD - POUNDS PER CAPITA PER DAY

(2) MG/L COMPUTED



TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY HEB DATE 4.10.84 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 2 OF 2

TABLE 15 (Cont'd)

ITEM	1985	1990	1995	2000	2005
<u>Wastewater Characteristics (continued)</u>					
<u>BOD<sub>5</sub></u>					
Annual Average - PCD	0.25	0.25	0.25	0.25	0.25
-1000 LBS/DAY	460.9	485.1	503.5	517.3	530.5
-MG/L	177	182	180	176	171
Maximum Month - RATIO TO AN. AVG.	1.34	1.34	1.34	1.34	1.34
-1000 LBS/DAY	617.6	650.2	674.7	693.1	710.9
3-Day Maximum - RATIO TO AN. AVG.	1.74	1.74	1.74	1.74	1.74
-1000 LBS/DAY	802.0	844.2	876.1	900.1	923.1
Maximum Day - RATIO TO AN. AVG.	2.00	2.00	2.00	2.00	2.00
-1000 LBS/DAY	921.8	970.4	1,017.0	1,034.6	1,061.0
<u>Total Nitrogen</u>					
Annual Average - PCD	0.033	0.033	0.033	0.033	0.033
-1000 LBS/DAY	60.8	64.0	66.5	68.3	70.0
-MG/L	23	24	24	23	23
Maximum Month - RATIO TO AN. AVG.	1.33	1.33	1.33	1.33	1.33
-1000 LBS/DAY	80.9	85.1	88.4	90.8	93.1
3-Day Maximum - RATIO TO AN. AVG.	1.53	1.53	1.53	1.53	1.53
-1000 LBS/DAY	93.0	97.9	101.7	104.5	107.1
Maximum Day - RATIO TO AN. AVG.	1.58	1.58	1.58	1.58	1.58
-1000 LBS/DAY	96.1	101.1	105.1	107.9	110.6
<u>Total Phosphorus</u>					
Annual Average - PCD	0.009	0.009	0.009	0.009	0.009
-1000 LBS/DAY	16.6	17.5	18.1	18.6	19.1
-MG/L	6.4	6.6	6.5	6.3	6.1
Maximum Month - RATIO TO AN. AVG.	1.40	1.40	1.40	1.40	1.40
-1000 LBS/DAY	23.2	24.5	25.3	26.0	26.7
3-Day Maximum - RATIO TO AN. AVG.	1.55	1.55	1.55	1.55	1.55
-1000 LBS/DAY	25.7	27.1	28.1	28.8	29.6
Maximum Day - RATIO TO AN. AVG.	1.78	1.78	1.78	1.78	1.78
-1000 LBS/DAY	29.5	31.1	32.2	33.1	34.0
<u>Wastewater Temperature</u>					
Minimum Day - °C	11.0	11.0	11.0	11.0	11.0
<u>Wastewater Alkalinity (CaCO<sub>3</sub>)</u>					
Average - MG/L	133	133	133	133	133
Min. Day - MG/L	50	50	50	50	50

REELEY  
AND  
JANSEN  
ENGINEERS

TASK STUDY MEMO E-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY \_\_\_\_\_ DATE \_\_\_\_\_ CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 1 OF 1

LIST OF FIGURES

FIGURE NO.

DESCRIPTION

- 1 Blue Plains and Adjacent Service Areas, Sewer Service Areas and Extent of Sanitary Sewered Areas (1005)
- 2 Blue Plains WWTP - Components of Flow
- 3 Blue Plains Service Area, Sewered Population Forecasts
- 4 Blue Plains WWTP - Record of Wastewater Temperature
- 5 Blue Plains WWTP - Record of Wastewater Alkalinity
- 6 Blue Plains WWTP - Record and Forecast of Annual Average Wastewater Quantities
- 7 Blue Plains WWTP - Record and Forecast of Annual Average Per Capita BOD<sub>5</sub> and Suspended Solids
- 8 Blue Plains WWTP - Record and Forecast of Annual Average Per Capita Total Nitrogen and Phosphorus
- 9 Blue Plains WWTP - Record and Forecast, Annual Average Suspended Solids.
- 10 Blue Plains WWTP - Record and Forecast, Annual Average BOD<sub>5</sub>
- 11 Blue Plains WWTP - Record and Forecast, Annual Average Total Nitrogen
- 12 Blue Plains WWTP - Record and Forecast, Annual Average Total Phosphorus
- 13 Blue Plains WWTP - Wastewater Flow Variations
- 14 Blue Plains WWTP - Suspended Solids Variations

(Continued)

TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY \_\_\_\_\_ DATE \_\_\_\_\_ CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 2 OF 2

LIST OF FIGURES

(continued)

<u>FIGURE NO.</u>	<u>DESCRIPTION</u>
15	Blue Plains WWTP - BOD <sub>5</sub> Variations
16	Blue Plains WWTP - Total Nitrogen Variations
17	Blue Plains WWTP - Total Phosphorus Variations
18	Blue Plains WWTP - Maximum Wastewater Flow Rates
19	Blue Plains WWTP - Peak Flow Rates Due to Storm Events Based on 3-650 Alternatives
20	Blue Plains WWTP - Duration of Peak 15-Minute Flow Rate Due to Storm Event
21	Blue Plains WWTP - Peak (15-Minute) Flow Rates (Combined Storm/Wastewater)

TASK STUDY MEMO II-3 PHASE I

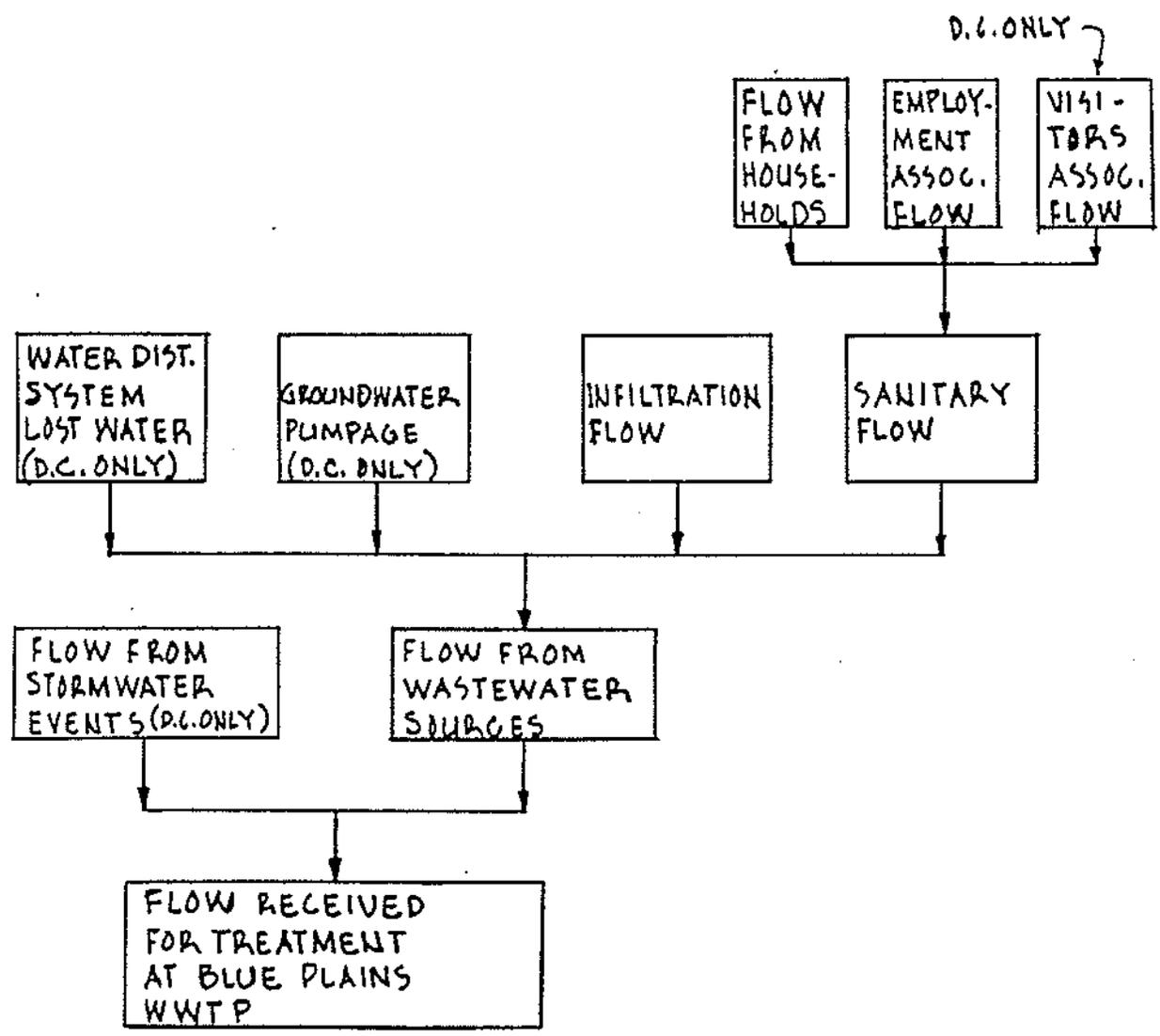
SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY REB DATE 4-18-81 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

FIGURE 2

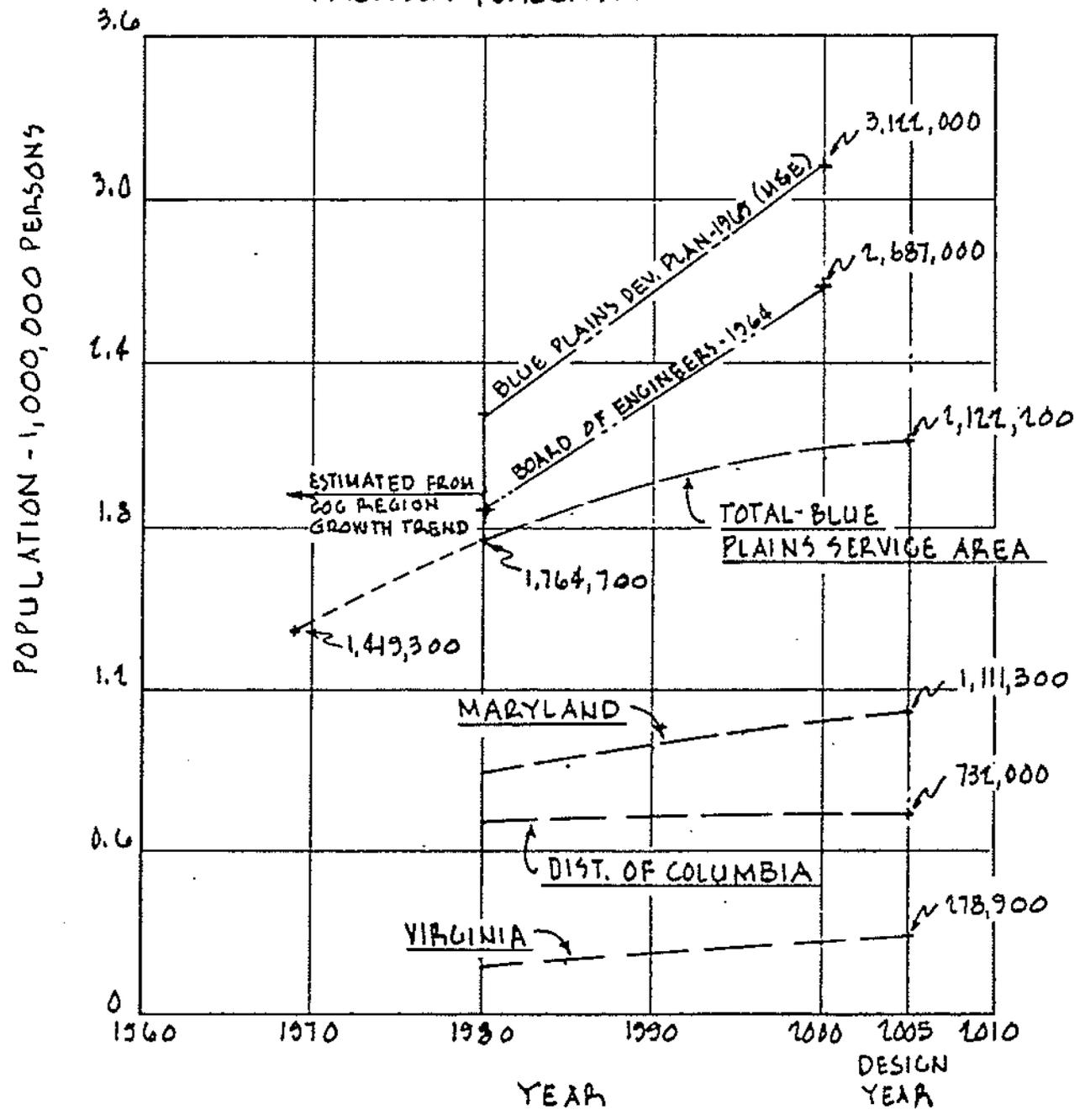


BLUE PLAINS WWTP  
COMPONENTS OF FLOW

LEGEND:

- — — — FEASIBILITY STUDY (SOURCE: LOG)
- - - - - PREVIOUS FORECASTS

FIGURE 3



BLUE PLAINS SERVICE AREA  
SEWERED POPULATION FORECASTS

TASK STUDY MEMO NO. II-3 PHASE I

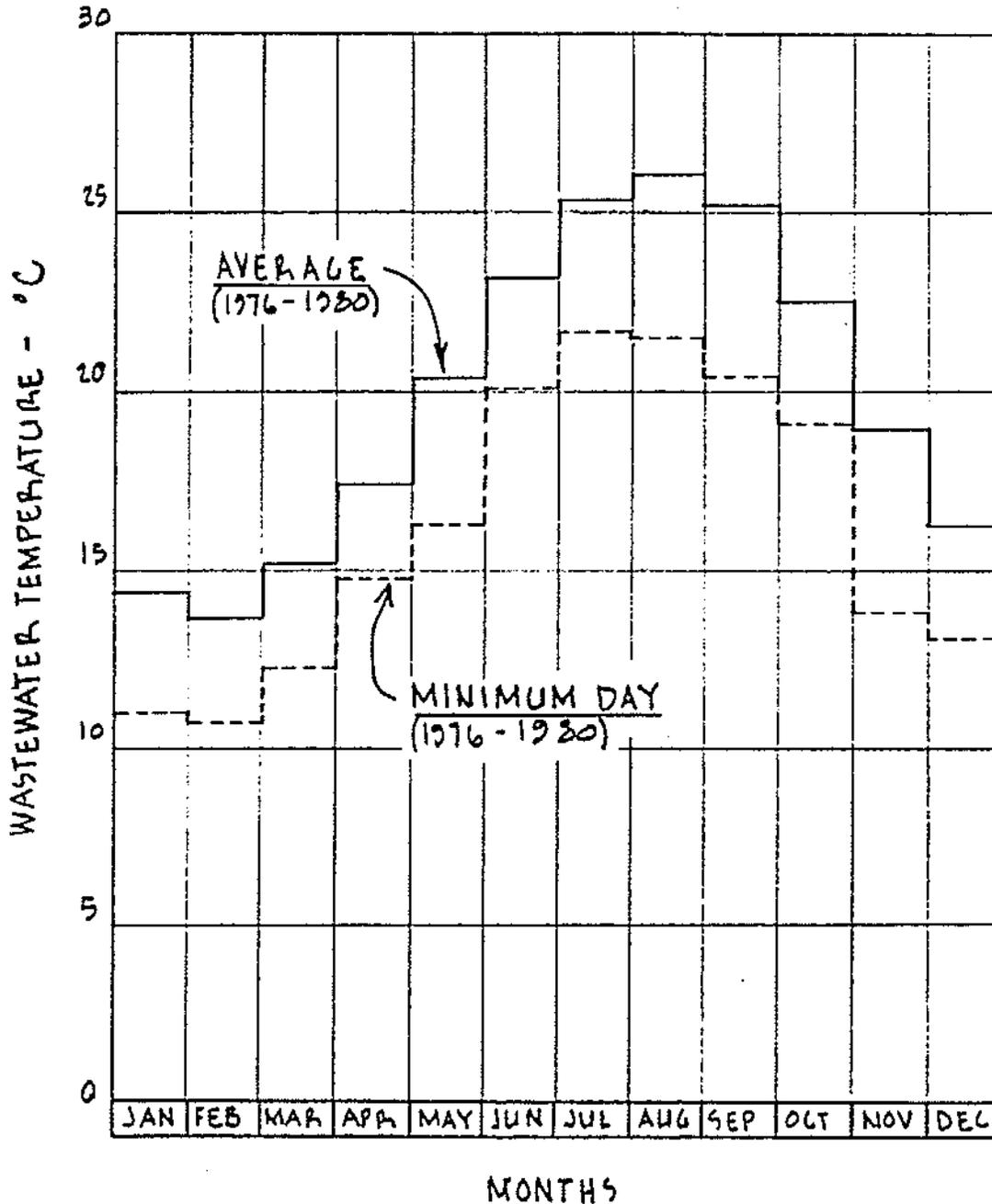
SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY REB DATE 4-10-81 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

FIGURE 4



BLUE PLAINS WWTP  
RECORD OF WASTEWATER TEMPERATURE

SOURCE: BPWWTP RECORDS

TASK STUDY MEMO II-3 PHASE I

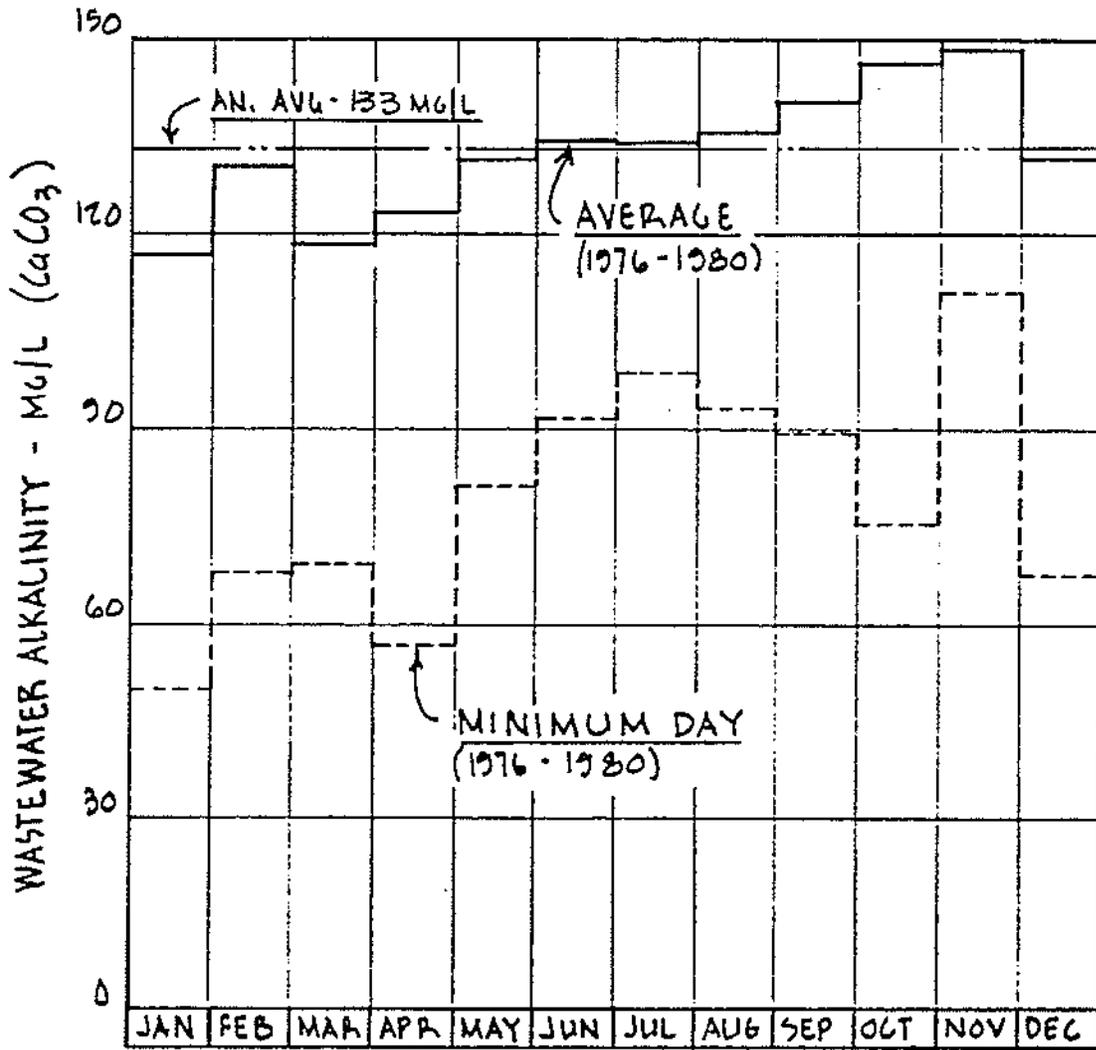
SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM GEH

COMP BY REB DATE 4.10.81 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

FIGURE 5



MONTHS

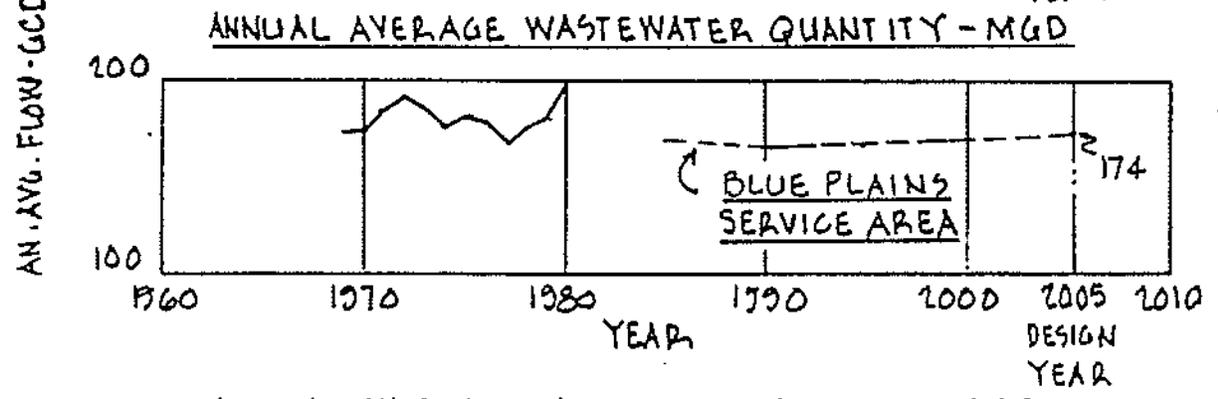
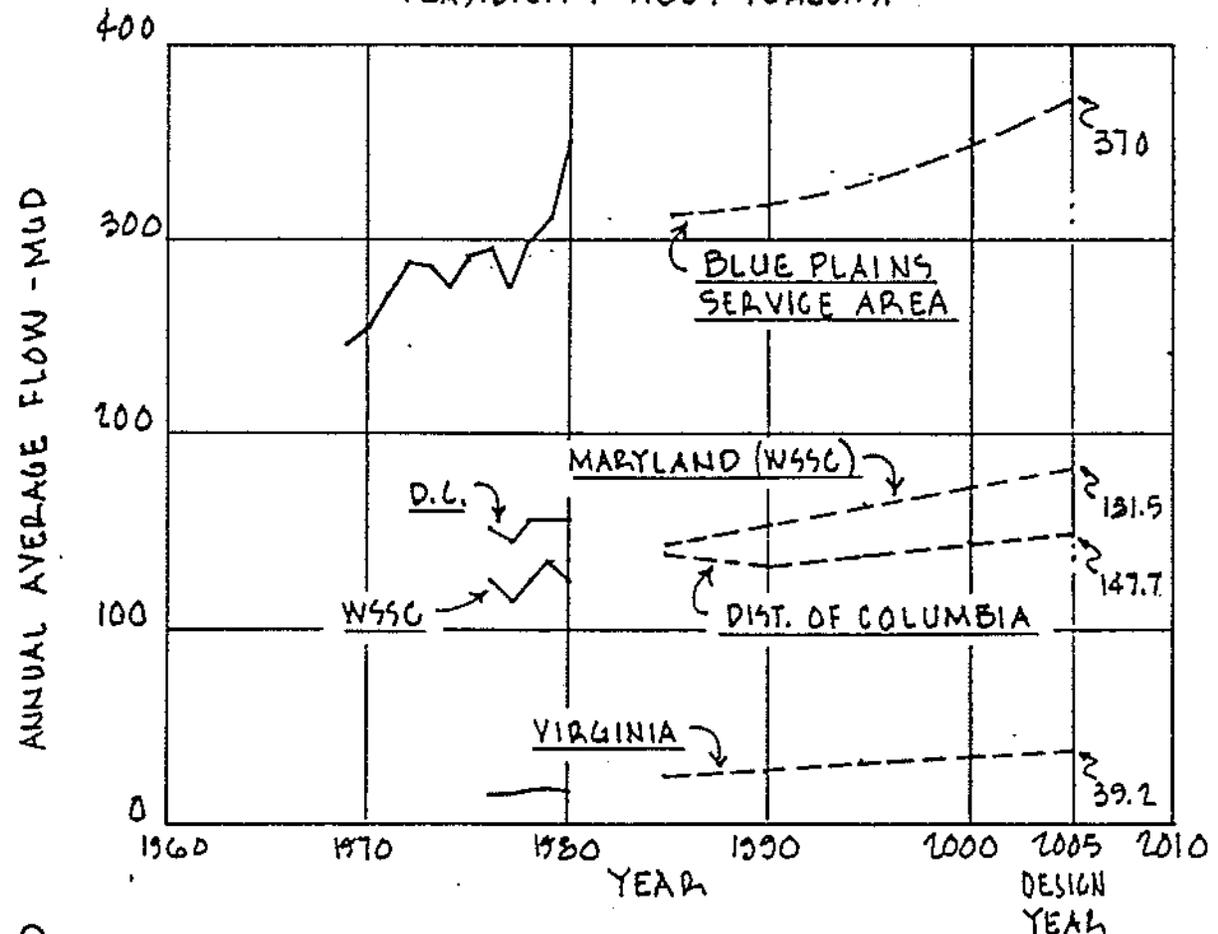
BLUE PLAINS WWTP  
RECORD OF WASTEWATER ALKALINITY

SOURCE: BPWWTP RECORDS

LEGEND:

- BLUE PLAINS WWTP RECORD
- - - - FEASIBILITY STUDY FORECAST

FIGURE 6



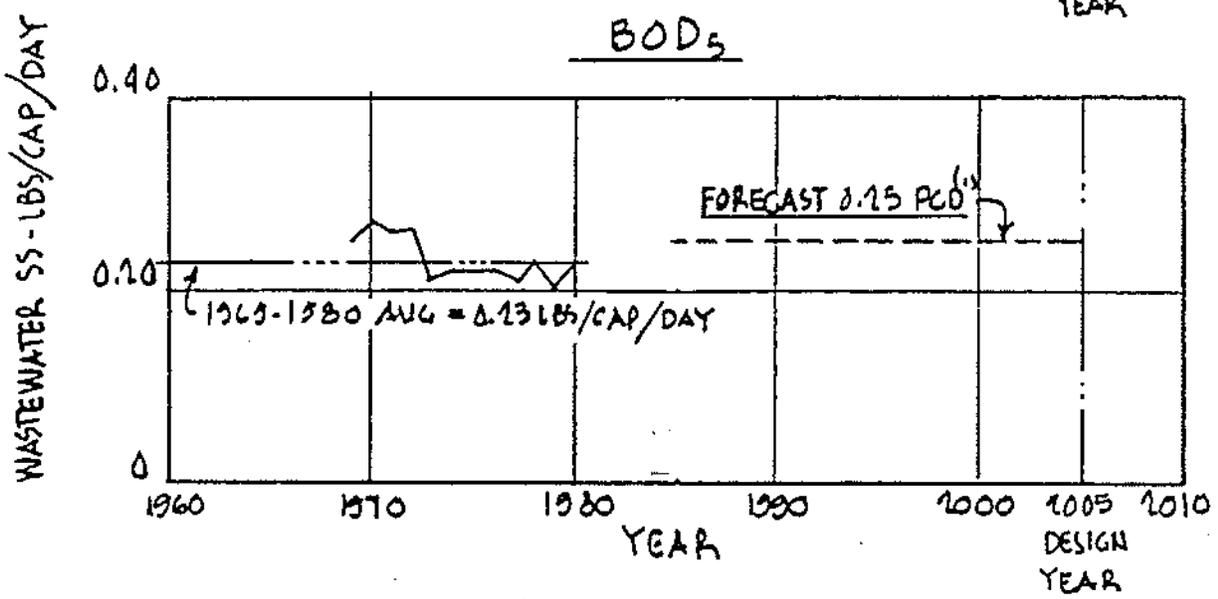
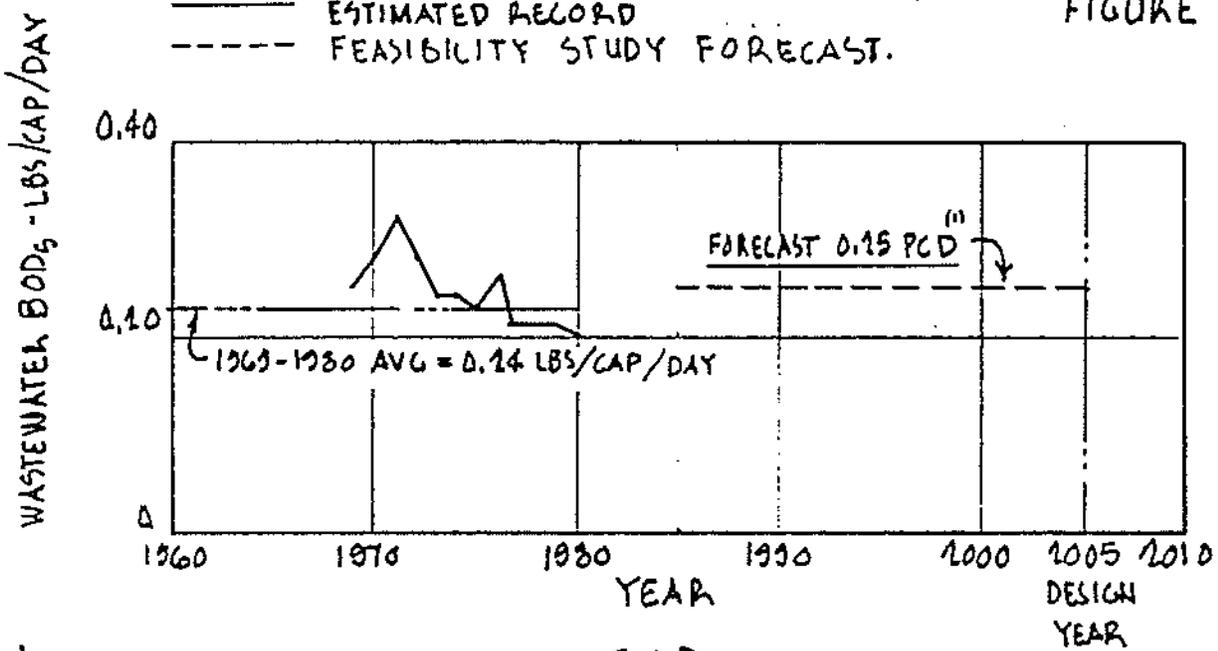
ANNUAL AVERAGE WASTEWATER QUANTITY - GCD

BLUE PLAINS WWTP RECORD AND FORECAST ANNUAL AVERAGE WASTEWATER QUANTITIES

LEGEND:

———— ESTIMATED RECORD  
----- FEASIBILITY STUDY FORECAST.

FIGURE 7



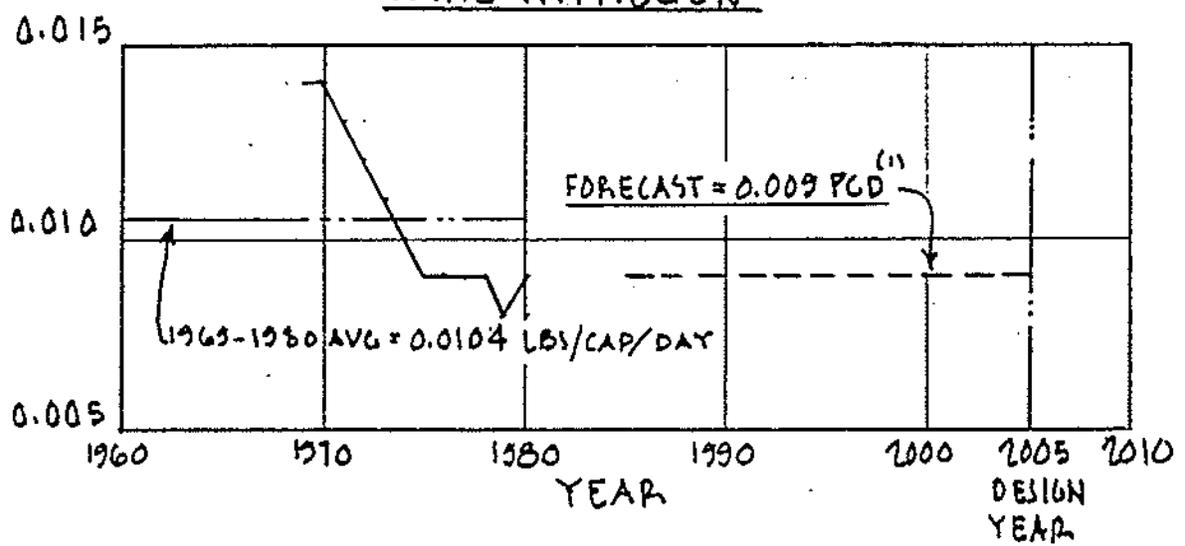
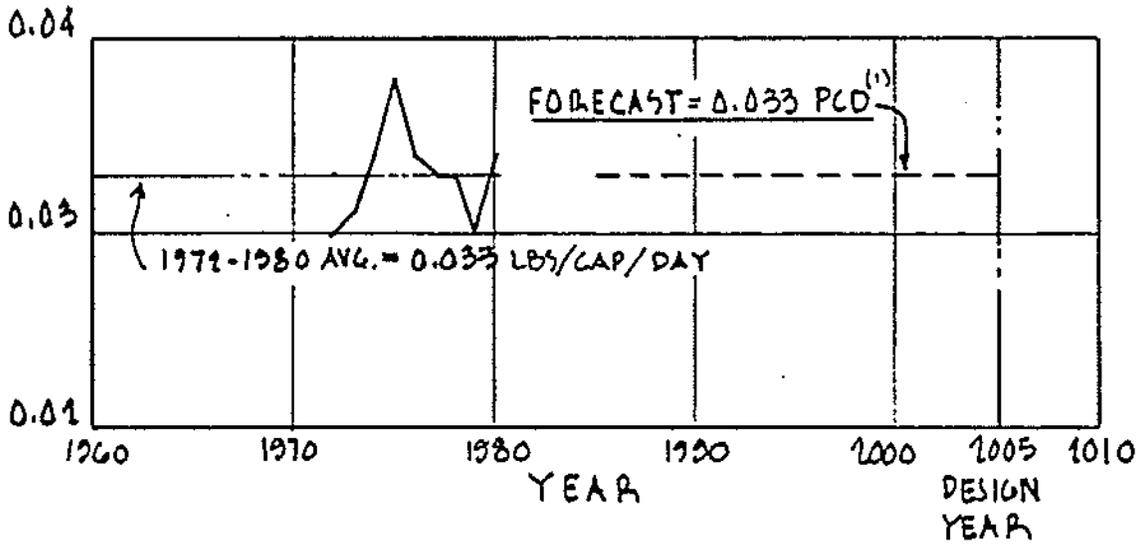
BLUE PLAINS WWTP  
ESTIMATED RECORD AND FORECAST  
ANNUAL AVERAGE PER CAPITA  
BOD<sub>5</sub> AND SUSPENDED SOLIDS

(1) PCD - POUNDS/CAPITA/DAY

LEGEND:

- ESTIMATED RECORD
- FEASIBILITY STUDY FORECAST

FIGURE B



BLUE PLAINS WWTP  
ESTIMATED RECORD AND FORECAST  
ANNUAL AVERAGE PER CAPITA  
TOTAL NITROGEN AND PHOSPHORUS

<sup>(1)</sup> PCD - POUNDS/CAPITA/DAY

REELEY  
AND  
ANSEN  
ENGINEERS

TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

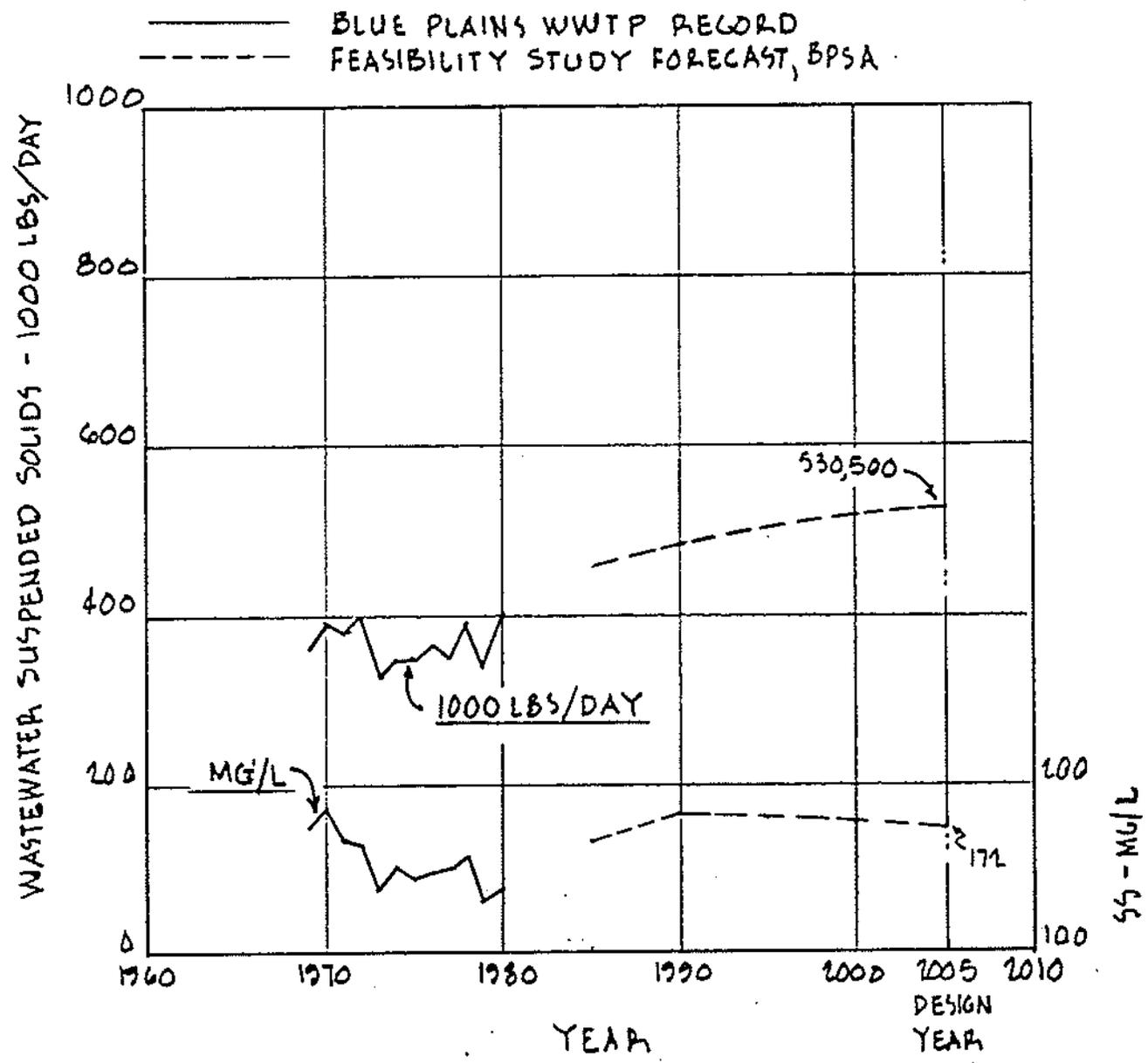
DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY REB DATE 4.10.81 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

LEGEND:

FIGURE 9



BLUE PLAINS WWTP  
RECORD AND FORECAST  
ANNUAL AVERAGE  
SUSPENDED SOLIDS

RECORD SOURCE: BLUE PLAINS WWTP

TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

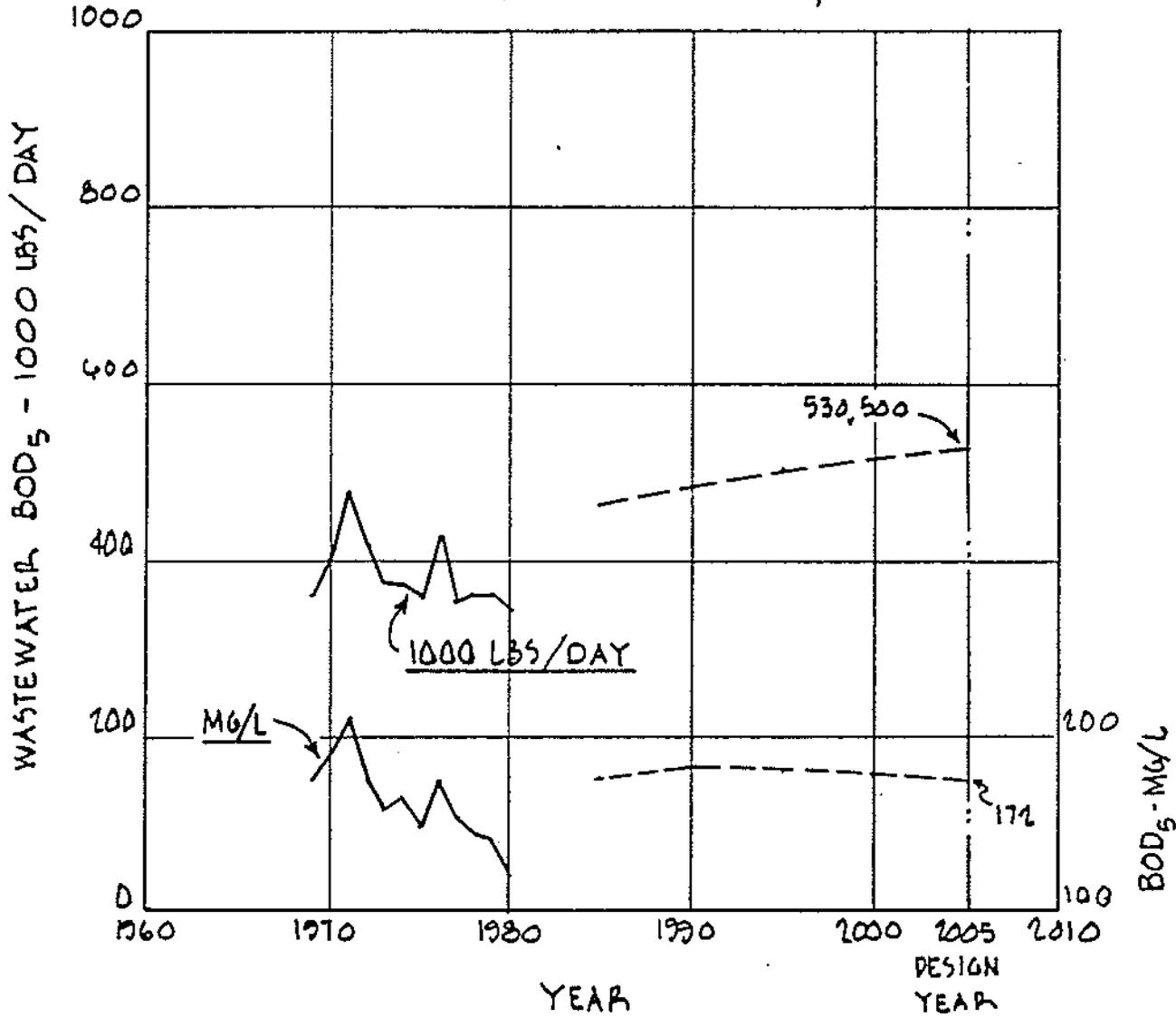
FIRM G&A

COMP BY REB DATE 4.10.81 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

LEGEND:

FIGURE 10

- BLUE PLAINS WWTP RECORD
- - - - FEASIBILITY STUDY FORECAST, BPSA



BLUE PLAINS WWTP  
RECORD AND FORECAST  
ANNUAL AVERAGE BOD<sub>5</sub>

RECORD SOURCE: BLUE PLAINS WWTP

TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

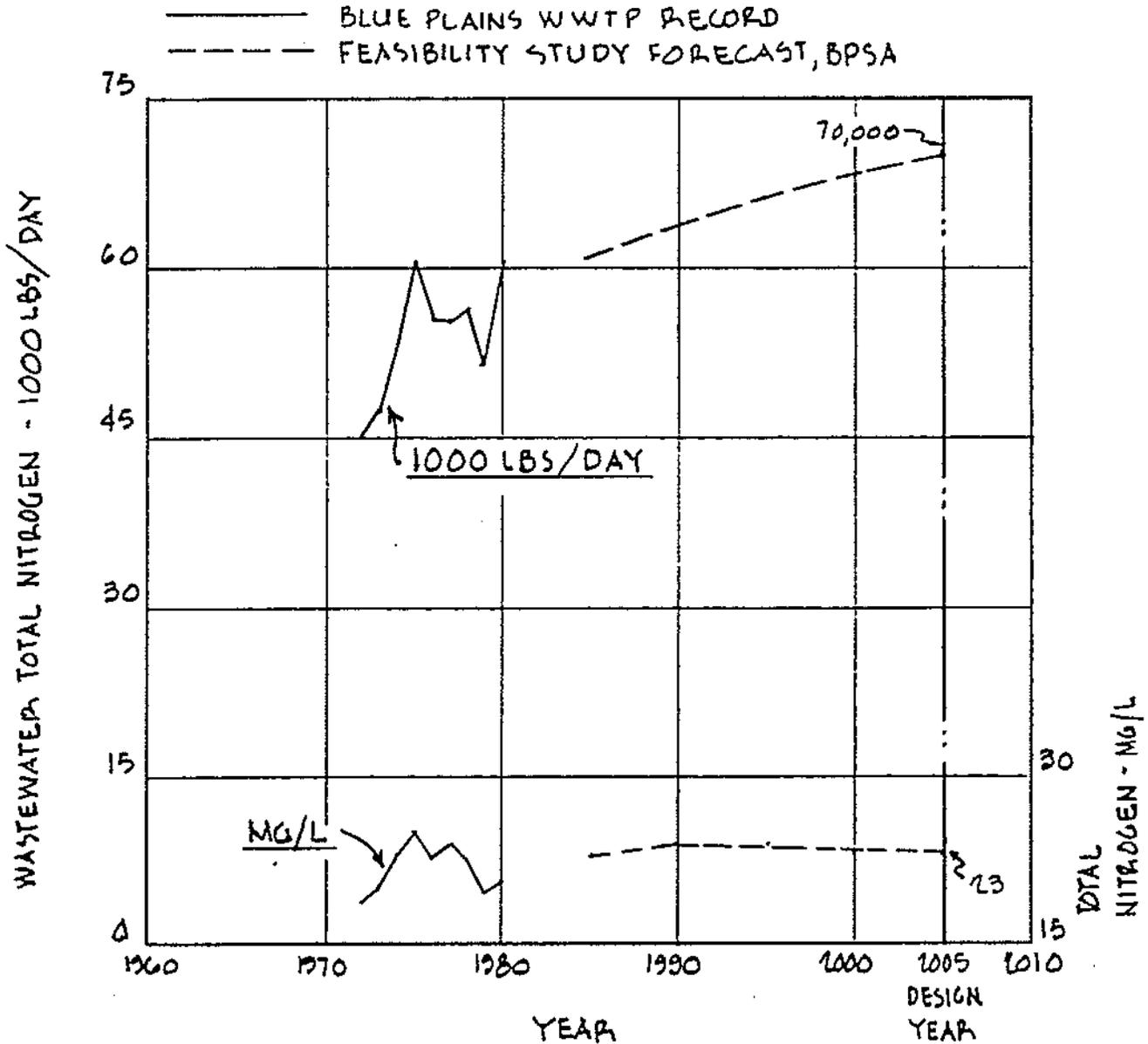
DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM OGH

COMP BY REB DATE 4.10.84 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

LEGEND:

FIGURE 11



BLUE PLAINS WWTP  
RECORD AND FORECAST  
ANNUAL AVERAGE  
TOTAL NITROGEN

RECORD SOURCE: BLUE PLAINS WWTP

LEELEY  
AND  
ANSEN  
ENGINEERS

TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

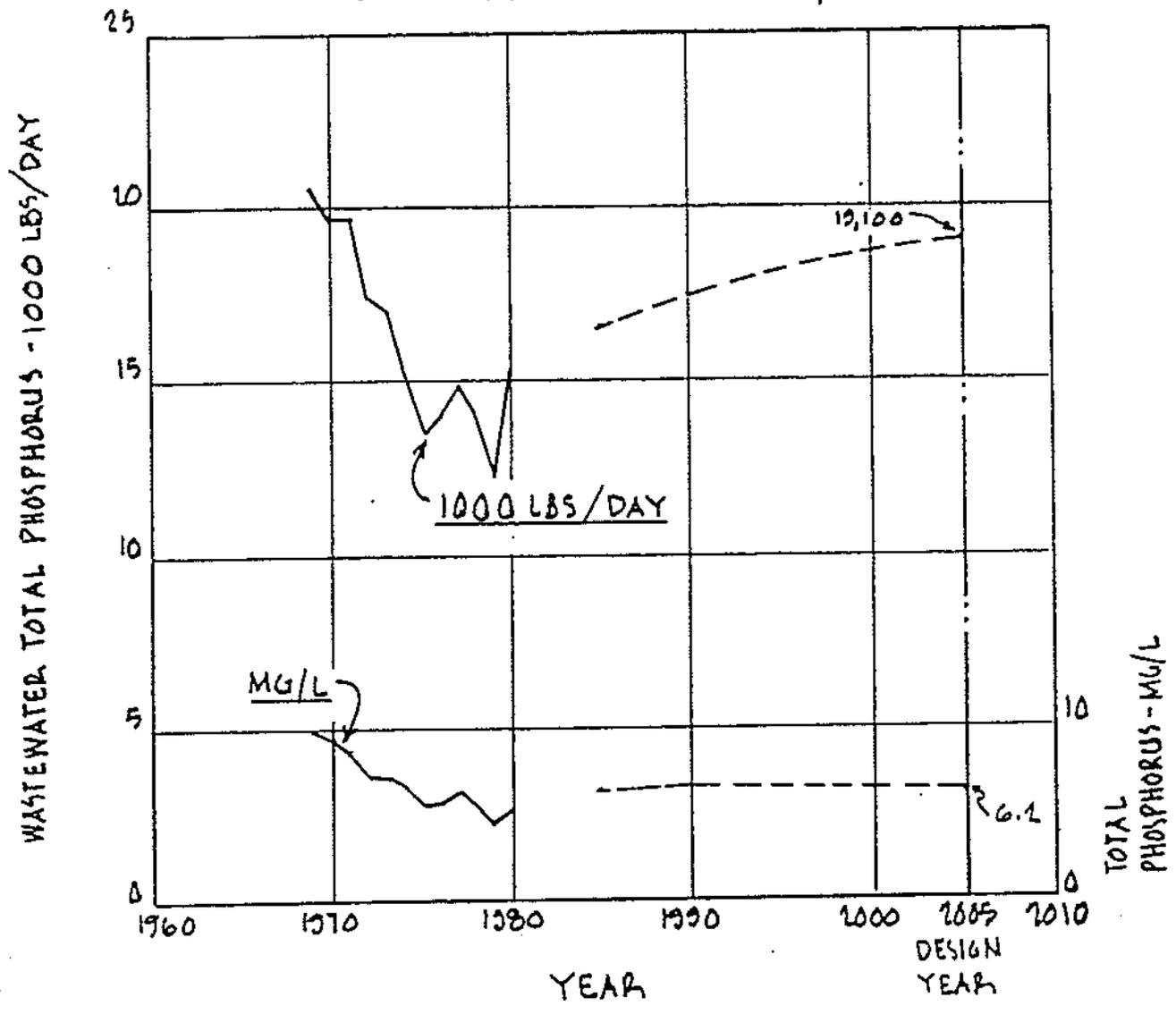
FIRM GGH

COMP BY HEB DATE 4.10.82 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

LEGEND:

FIGURE 12

— BLUE PLAINS WWTP RECORD  
- - - FEASIBILITY STUDY FORECAST, BPSA



BLUE PLAINS WWTP  
RECORD AND FORECAST  
ANNUAL AVERAGE  
TOTAL PHOSPHORUS

RECORD SOURCE: BLUE PLAINS WWTP

LEELEY  
AND  
ANSEN  
ENGINEERS

TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

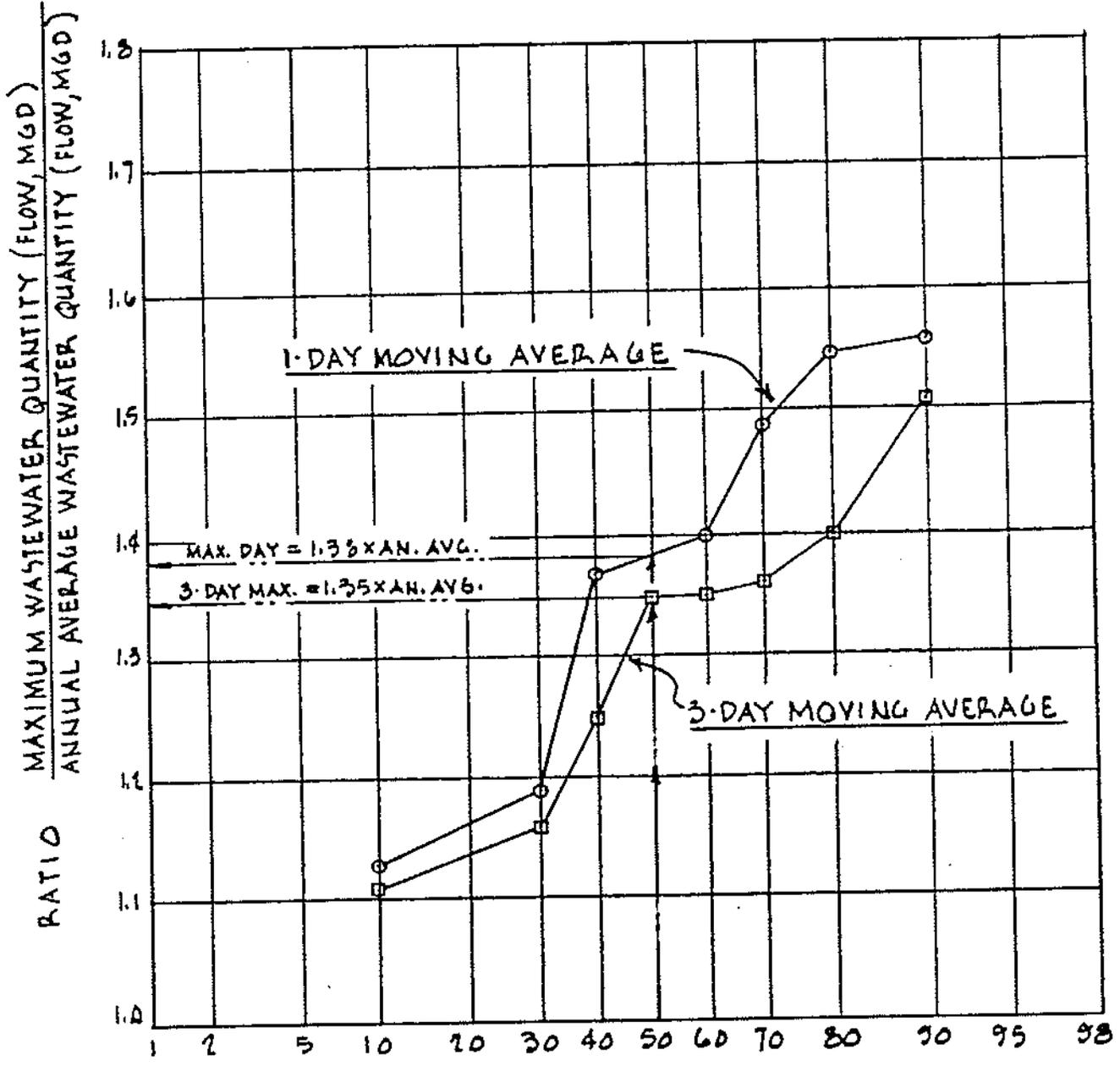
DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY REB DATE 4.10.84 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

BLUE PLAINS WWTP  
WASTEWATER FLOW VARIATIONS

FIGURE 13



OCCURANCE- PERCENT OF TIME RATIO OF MAXIMUM FLOW QUANTITY TO ANNUAL AVERAGE FLOW QUANTITY IS LESS THAN OR EQUAL TO INDICATED RATIO

\* RECORD SOURCE: BPWWTP (1971-1980 WASTEWATER DATA)

EELEY  
AND  
ANSEN  
ENGINEERS

TASK STUDY MEMO I-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

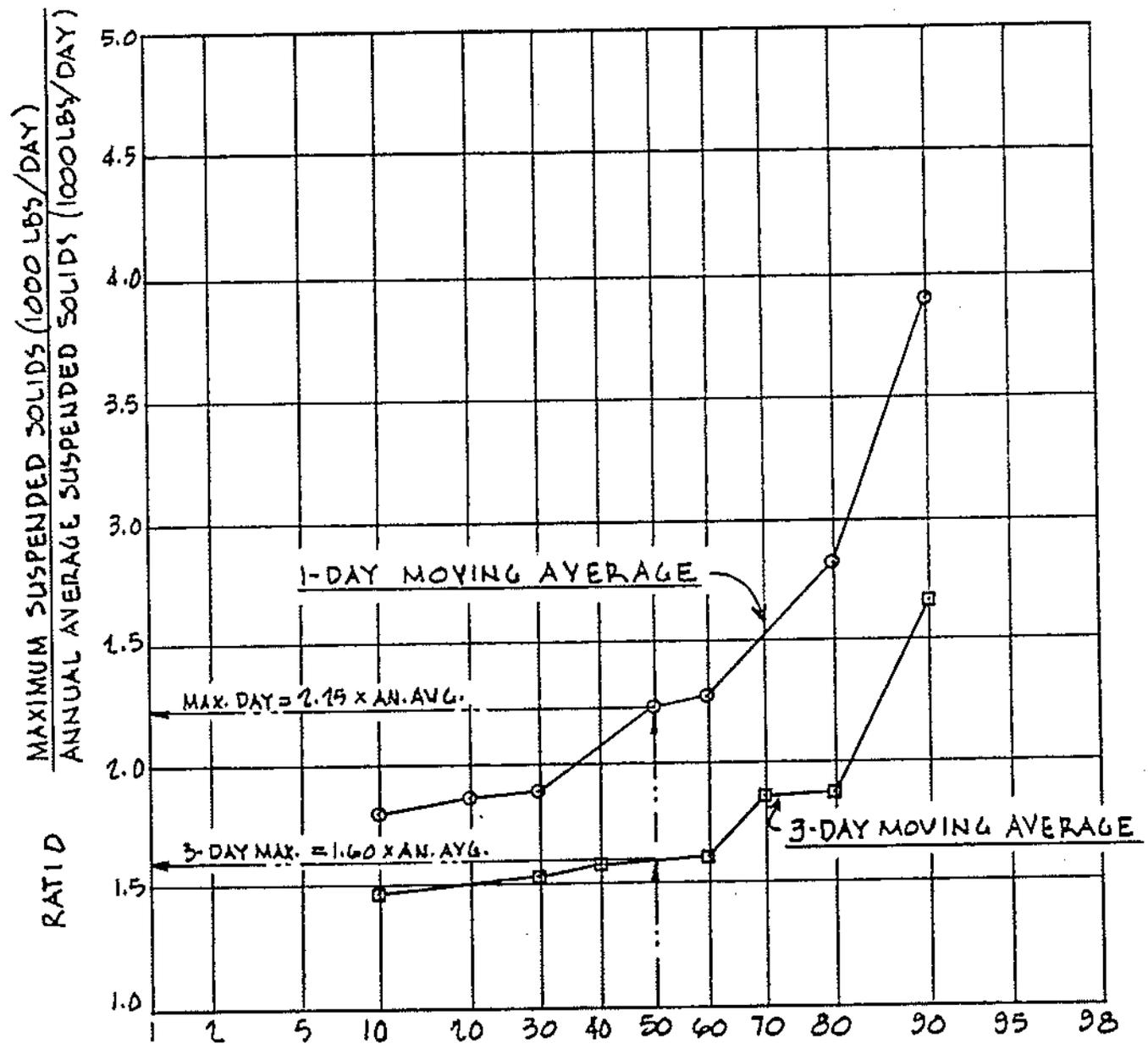
DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY RED DATE 4.10.82 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

BLUE PLAINS WWTP  
SUSPENDED SOLIDS VARIATIONS

FIGURE 14



OCOURANCE - PERCENT OF TIME RATIO OF MAXIMUM  
SUSPENDED SOLIDS QUANTITY TO ANNUAL  
AVERAGE SUSPENDED SOLIDS QUANTITY  
IS LESS THAN OR EQUAL TO INDICATED RATIO

RECORD SOURCE: BPWWTP (1971-1980 WASTEWATER DATA)

EILEY  
AND  
INSEN  
ENGINEERS

TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTE WATER QUANTITIES & CHARACTERISTICS

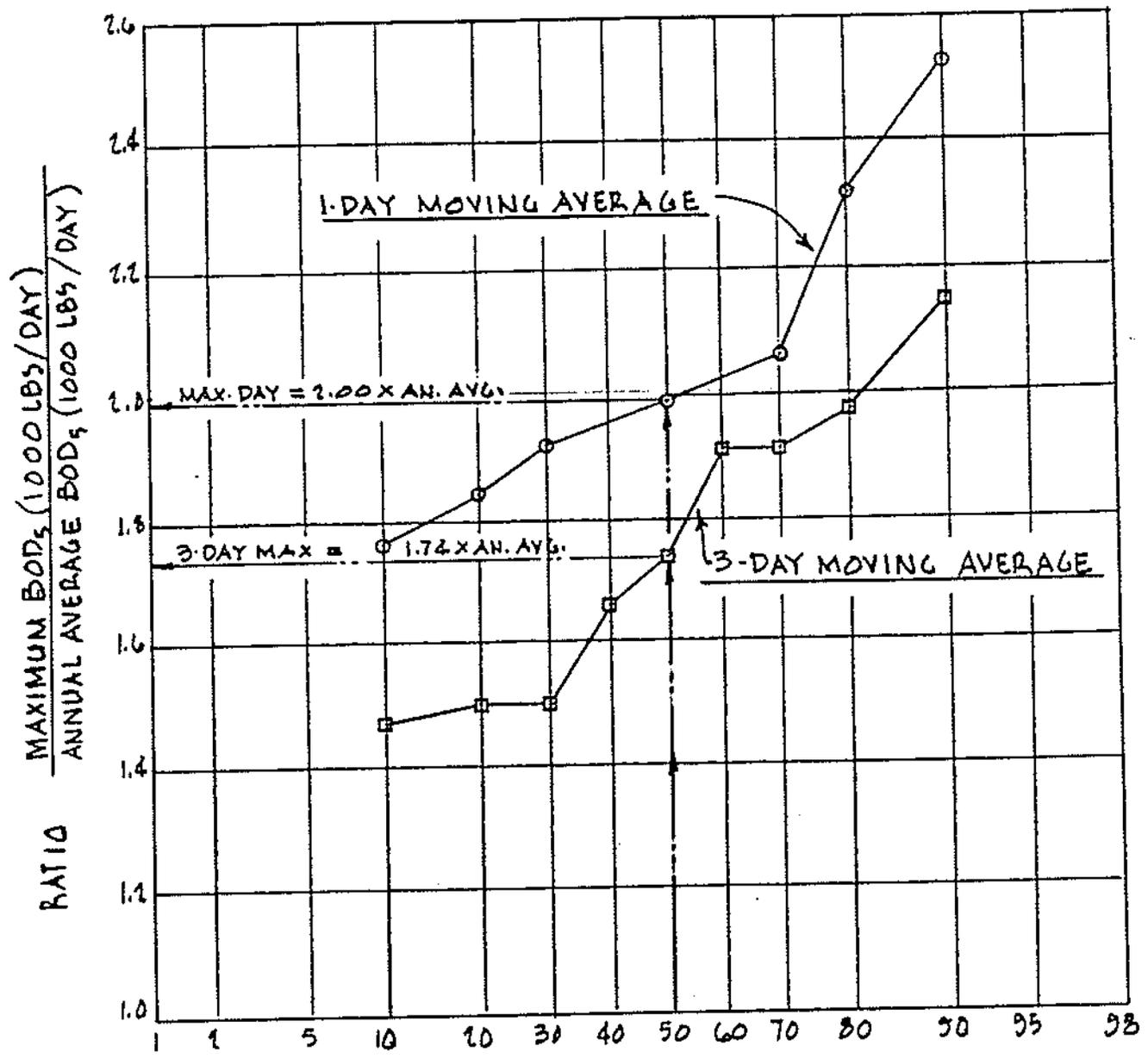
DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM GEH

COMP BY REB DATE 4.10.81 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

BLUE PLAINS WWTP  
BOD<sub>5</sub> VARIATIONS

FIGURE 15

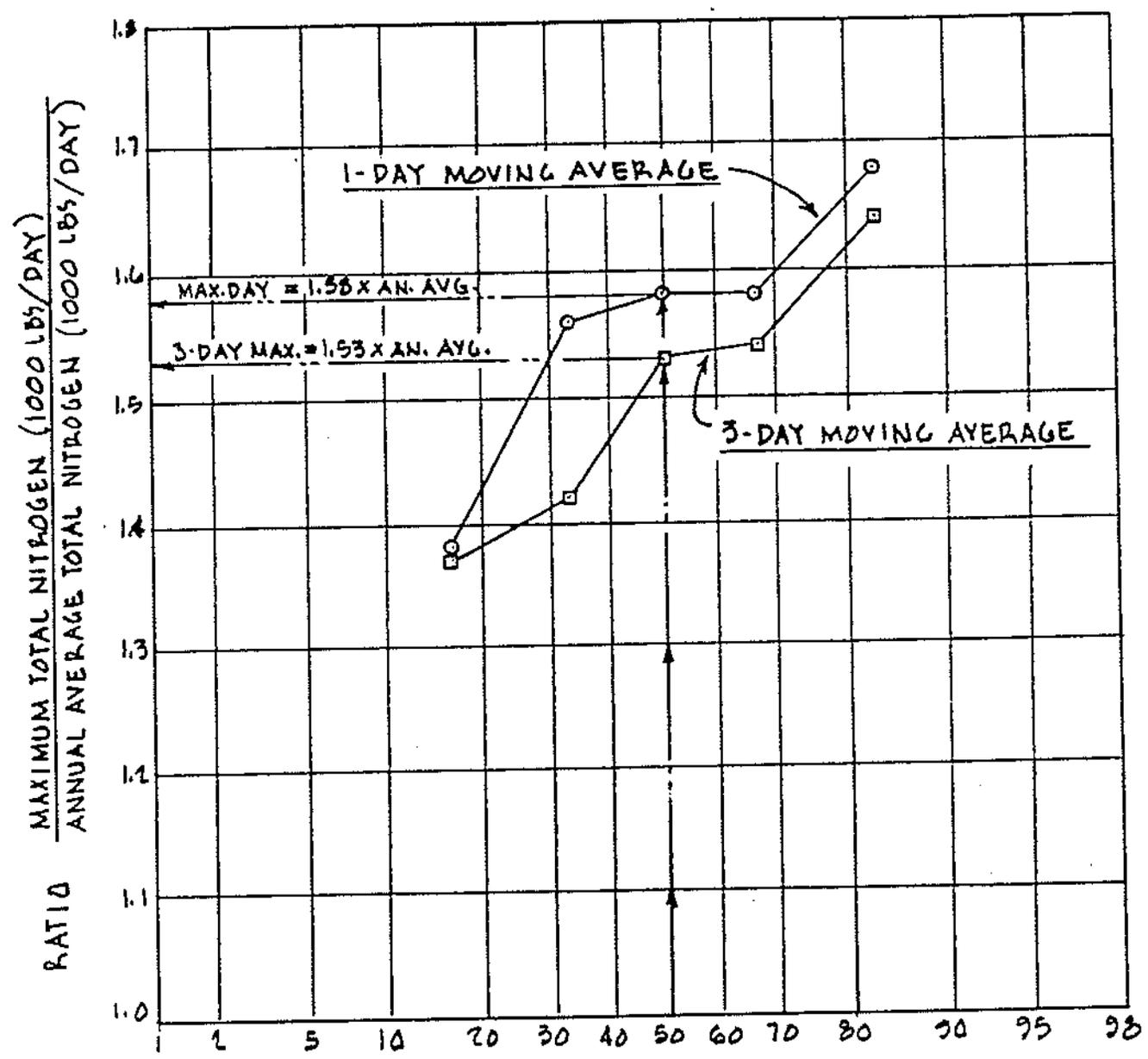


OCCURANCE - PERCENT OF TIME RATIO OF MAXIMUM BOD<sub>5</sub> QUANTITY TO ANNUAL AVERAGE BOD<sub>5</sub> QUANTITY IS LESS THAN OR EQUAL TO INDICATED RATIO

RECORD SOURCE: BPNWTP (1971-1980 WASTEWATER DATA)

BLUE PLAINS WWTP  
TOTAL NITROGEN VARIATIONS

FIGURE 16



OCCURANCE - PERCENT OF TIME RATIO OF MAXIMUM TOTAL NITROGEN QUANTITY TO ANNUAL AVERAGE TOTAL NITROGEN QUANTITY IS LESS THAN OR EQUAL TO INDICATED RATIO

RECORD SOURCE: BPWWTP (1976-1980 WASTEWATER DATA)

REELEY  
AND  
ANSEN  
ENGINEERS

TASK STUDY MEMO II-3 PHASE 1

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

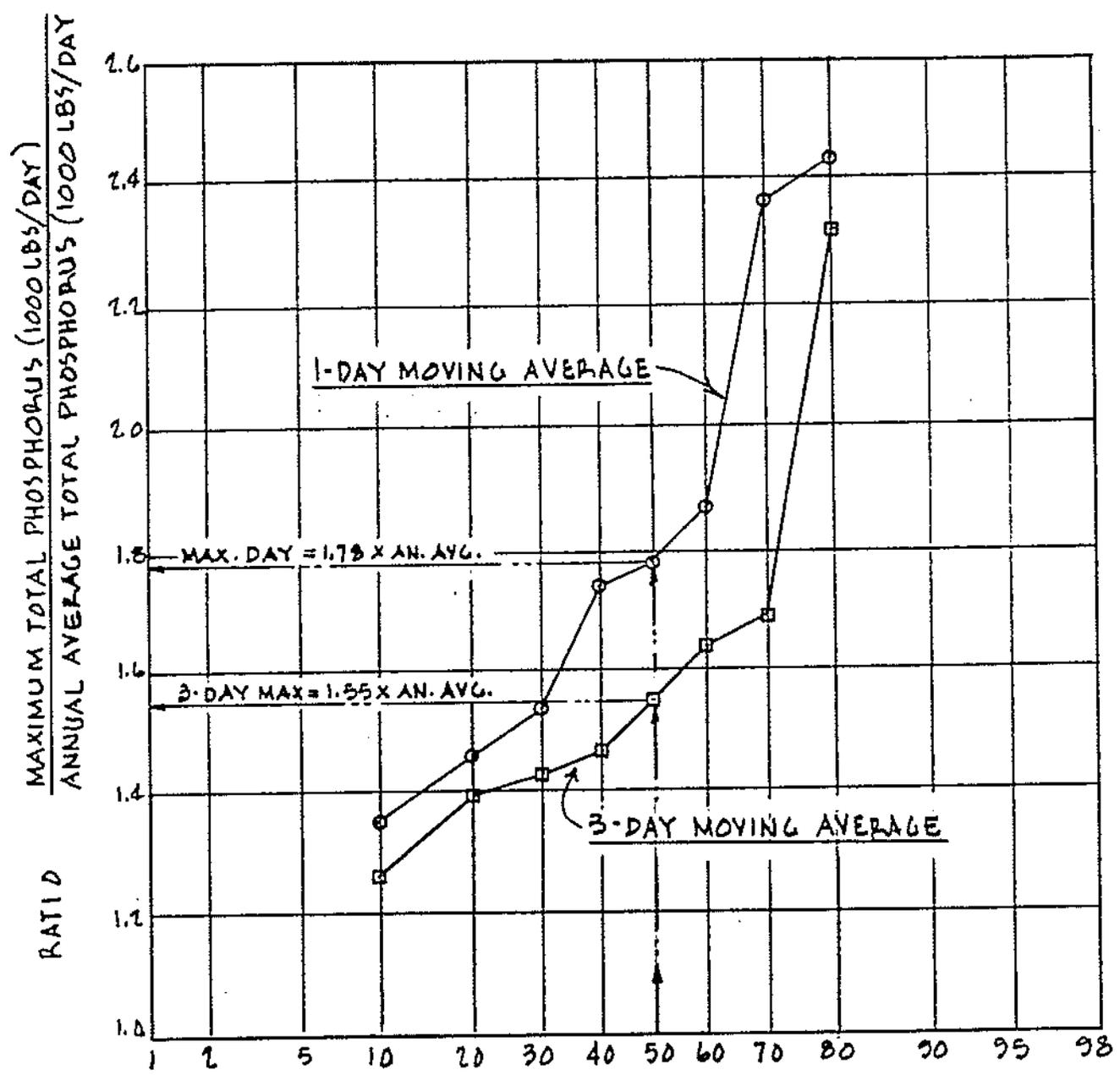
DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY REB DATE 4-10-82 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

BLUE PLAINS WWTP  
TOTAL PHOSPHORUS VARIATIONS

FIGURE 17



OCCURANCE - PERCENT OF TIME RATIO OF MAXIMUM TOTAL PHOSPHORUS QUANTITY TO ANNUAL AVERAGE TOTAL PHOSPHORUS QUANTITY IS LESS THAN OR EQUAL TO INDICATED RATIO

RECORD SOURCE: BP WWTP (1971-1980 WASTEWATER DATA)

EELEY  
AND  
INSEN  
ENGINEERS

TASK STUDY MEMO II-3 PHASE 1

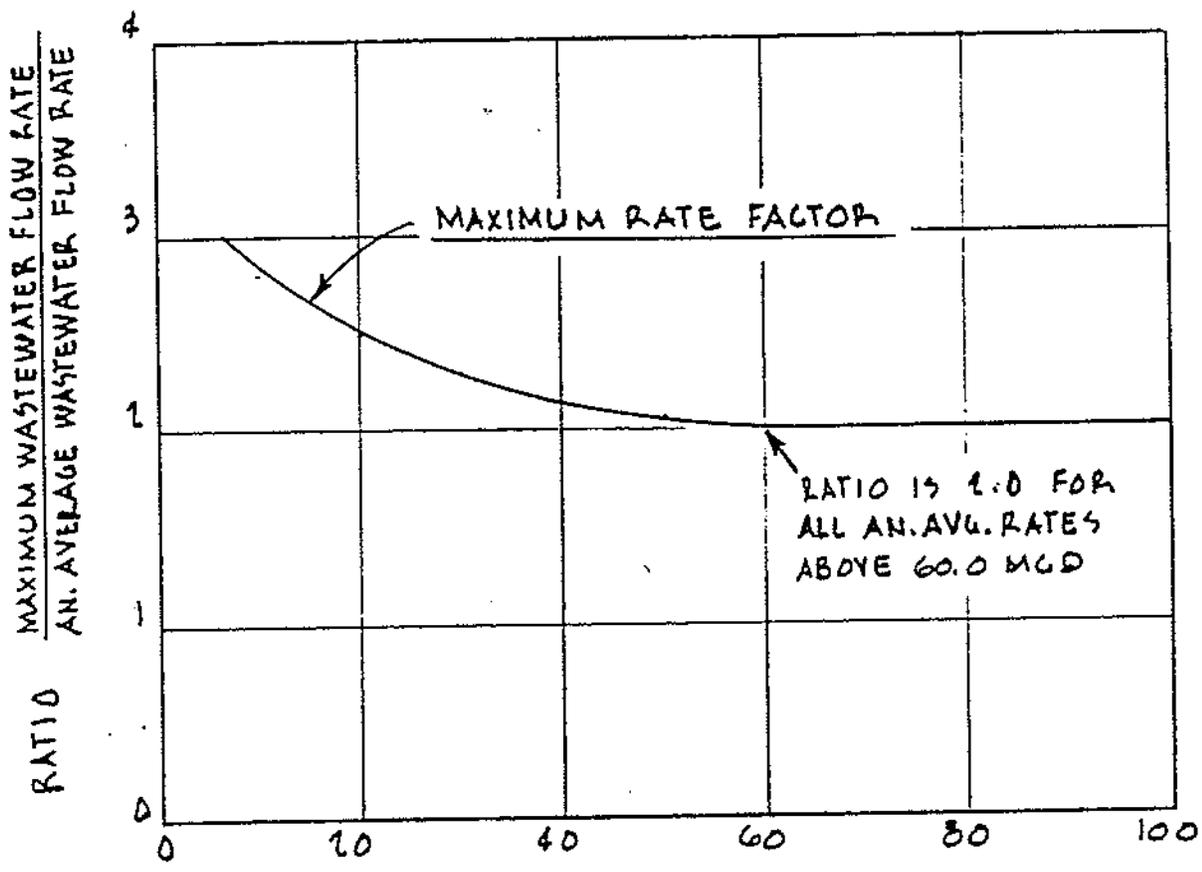
SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

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FIGURE 18



ANNUAL AVERAGE WASTEWATER FLOW RATE - MGD

BLUE PLAINS WWTP  
MAXIMUM WASTEWATER FLOW RATES  
(EXCLUSIVE OF STORMWATER FLOWS)

SOURCE: BOARD OF ENGINEERS (BOE)  
1957 REPORT ON IMPROVEMENTS TO SEWERAGE SYSTEM

TASK STUDY MEMO II-3 PHASE I

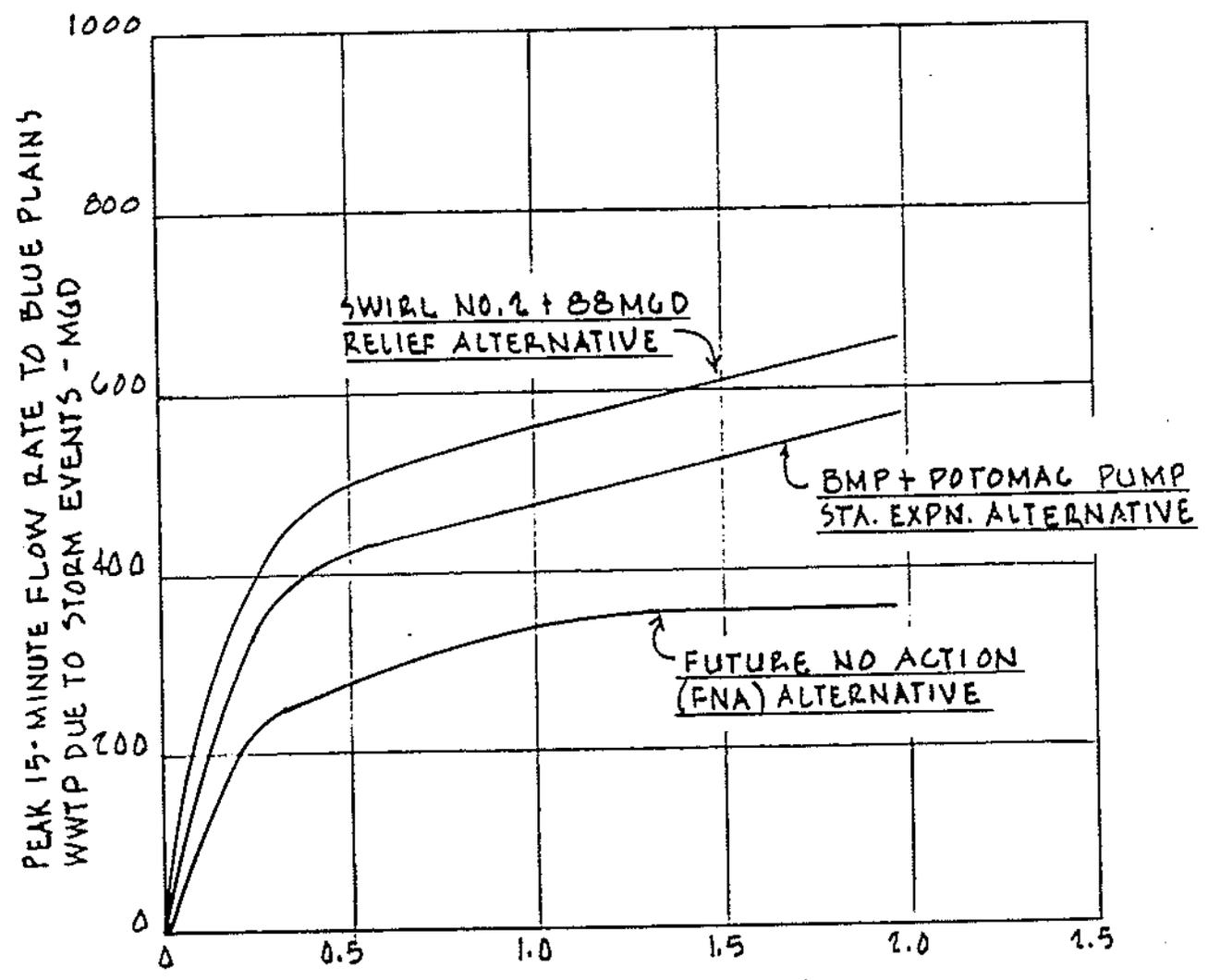
SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY REP DATE 4.10.81 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

FIGURE 19



MAXIMUM 60 MINUTE INTENSITY OF  
STORM EVENT - INS/HOUR

BLUE PLAINS WWTP  
PEAK FLOW RATES DUE TO  
STORM EVENTS BASED ON  
3-CSO ALTERNATIVES

SOURCE: O'BRIEN & GERE ENGINEERS, INC.  
COMBINED SEWER OVERFLOW STUDY

EELEY  
AND  
ANSEN  
ENGINEERS

TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

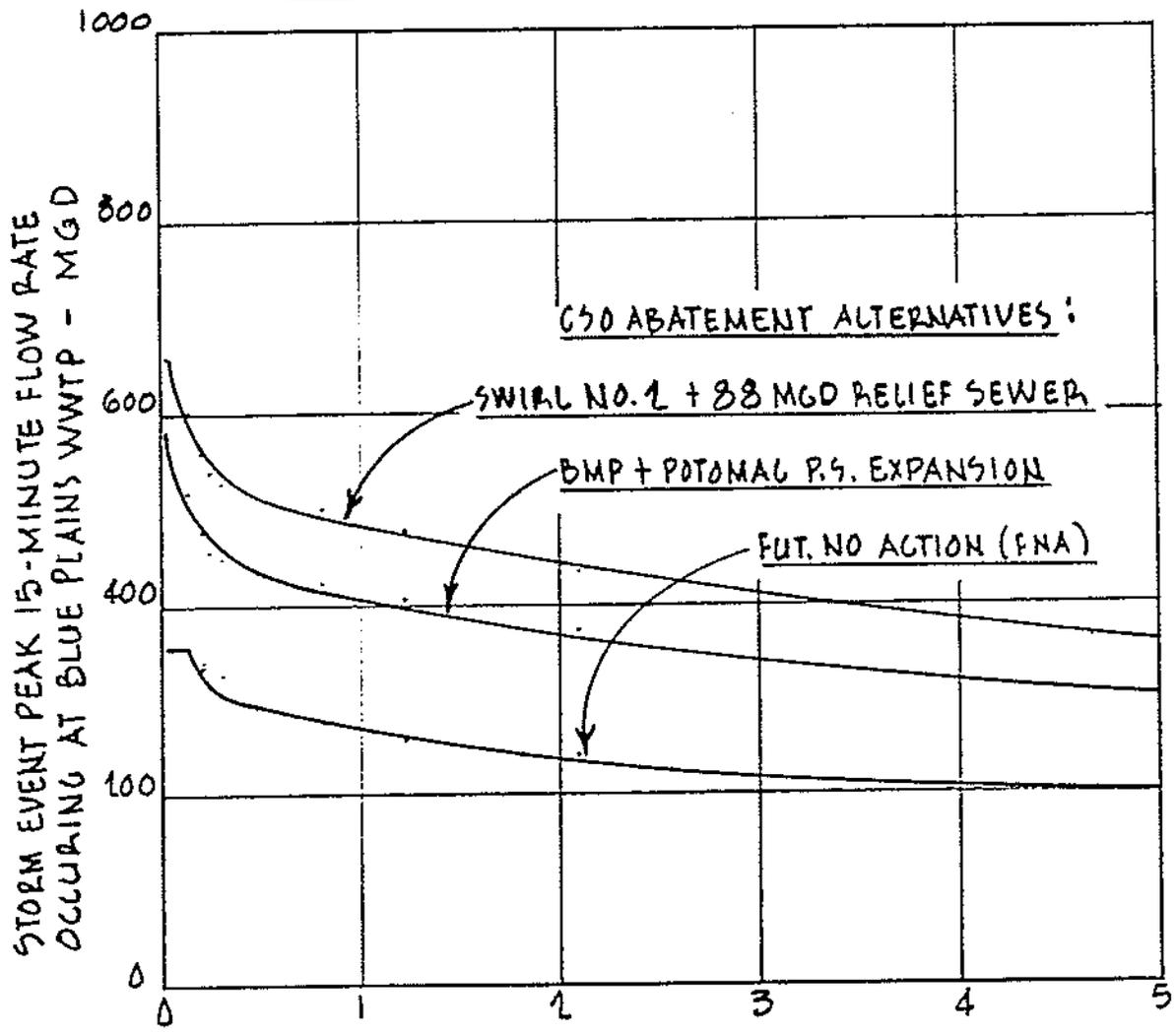
DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM G6H

COMP BY AEB DATE 4.10.81 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

BLUE PLAINS WWTP - DURATION OF  
PEAK 15-MINUTE FLOW RATE DUE  
TO STORM EVENT

FIGURE 20



NUMBER OF TOTAL HOURS DURING AVERAGE  
YEAR DURING WHICH PEAK FLOW RATE  
DUE TO STORM EVENT WILL OCCUR  
AT BLUE PLAINS WWTP UNDER VARIOUS  
CSO ABATEMENT ALTERNATIVES

SOURCE: D.C. COMBINED OVERFLOW STUDY

LEY  
P  
SEN  
EERS

TASK STUDY MEMO II-3

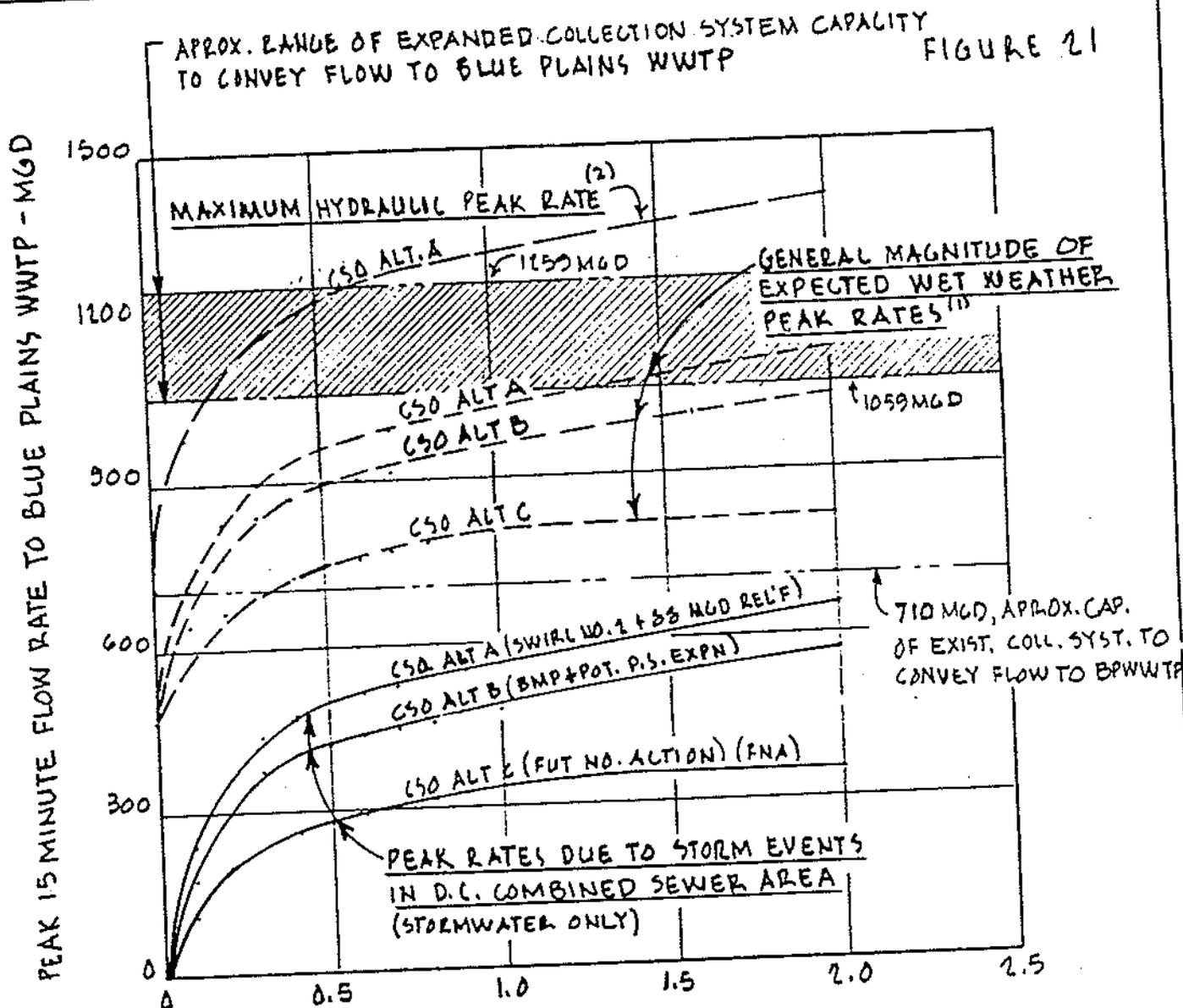
PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM GH

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MAXIMUM 60 MINUTE INTENSITY (I<sub>60</sub>)  
OF STORM EVENT - INS PER HOUR

BLUE PLAINS WWTP  
PEAK (15-MINUTE) FLOW RATES  
(COMBINED STORM/WASTEWATER)

(1) (STORM EVENT PEAK) + (1.26 X YR. 1005 AN. AVG. WASTEWATER FLOW, BPSA)

(2) (STORM EVENT PEAK) + (1.00 X YR. 1005 AN. AVG. WASTEWATER FLOW, BPSA)

GREELEY  
AND  
HANSEN  
ENGINEERS

TASK STUDY MEMO II-3 PHASE \_\_\_\_\_

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM \_\_\_\_\_

COMP BY \_\_\_\_\_ DATE \_\_\_\_\_ CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

APPENDIX A

CDG Documentation for Projection of Wastewater Flows  
Associated with Households, Employment and D.C. Visitors



metropolitan washington  
**COUNCIL OF GOVERNMENTS**

1875 Eye Street, N.W., Suite 200, Washington, D.C. 20006 223-6800

May 5, 1982

Mr. Clyde Wilber III  
Greeley and Hansen Engineers  
Soils Testing Building  
5000 Overlook Avenue, S.W.  
Washington, D.C. 20032

Dear Mr. Wilber:

Enclosed please find the final products required under COG W.A. 305-08-17, Schedule A, Item 7. These products include:

1. Documentation of Methodology Used for Projecting Base Annual Sanitary Wastewater Flows for the Blue Plains Feasibility Study - Phase I
2. Appendix A of the above referenced report which contains the following:
  - a. Table A - Round II "I-M" Estimated Employment Tributary to Blue Plains WWTP.
  - b. Table B - Round II "I-M" Estimated Employment Tributary to Blue Plains WWTP.
  - c. Table C - District of Columbia Visitor Projections and Annual Average Visitor Wastewater Flows.
  - d. Table D - Domestic and Sanitary Flows to Blue Plains by Jurisdiction and Basin.
  - e. Table E - Total Sanitary Flows to Blue Plains by Jurisdiction and Basin.
  - f. Table F - Employment Annual Average Wastewater for BPSA (1980-2005).
  - g. Table G - Domestic Annual Average Wastewater for BPSA (1980-2005).
  - h. Table H - Base Annual Average Wastewater for BPSA (1980-2005).

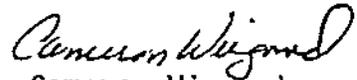
It is understood that these items will constitute the COG "data package" that is to be incorporated into the Study Memorandum concerning projected wastewater quantities at Blue Plains.

- more -

Mr. Clyde Wilber III  
May 5, 1982  
Page Two

With consideration to the above referenced transmittal, I believe that the submission of this material completes all requirements listed under Work Authorization 305-08-17, Schedule A, Item 7 and subsequent amendments and agreements. Please call me if you have any questions or comments.

Sincerely,

  
Cameron Wiegand  
Chief, Water Resources  
Management

Enclosure

pw/BT/CW

DOCUMENTATION OF METHODOLOGY USED FOR PROJECTING  
BASE ANNUAL SANITARY WASTEWATER FLOWS FOR  
THE BLUE PLAINS FEASIBILITY STUDY

PHASE I

Prepared for

Greeley and Hansen Engineers

by

Metropolitan Washington Council of Governments  
Department of Environmental Programs

May, 1982

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## DEMOGRAPHIC DATA BASES USED TO PROJECT BASE ANNUAL AVERAGE SANITARY WASTEWATER FLOWS

Intermediate COG Round II forecasts of households and employment and D.C. OPD projections of visitors were the demographic bases utilized for forecasting sanitary wastewater flows in the BPFs. In order to reach the BPFs planning horizon of 2005, the trend line between the 1995 and 2000 jurisdictional household and employment projection total was extended to the year 2005. Jurisdictional Round II projections of households and employment were disaggregated, as part of the Cooperative Forecasting Process, to 1353 separate COG Analysis Zones (CAZs) which, in composite, represent the entire metropolitan Washington area. To provide the appropriate inputs for projecting sanitary wastewater flows, the individual CAZ projections were aggregated and adjusted to represent the 430 separate SES sewersheds. The separate sewershed flow projections so derived were, in turn, reaggregated to provide separate sanitary flow projections for individual jurisdictions and for over 40 major drainage basins.

### Employment Demographic Projections

Employment generated sanitary wastewater flows were projected by using small area forecasts of employees as the demographic base. Round II employment projections by jurisdictions were disaggregated to the COG analysis zone (CAZ) level as part of the Cooperative Forecasting process. Employment projections reported on a CAZ basis were translated to a sewershed basis by an aggregation/disaggregation computer routine. This routine was developed to account for both geographical area and density of employment sites. Individual sewershed projections were then added together to develop projections by major service basins, these basin totals are shown in Table A. Employee tabulations shown in this Table represent projected sewer employment, i.e., only the employment sites in each major basin which are connected to sanitary sewers are reported. Employment projections and sewershed specific employment sewage generation factors are multiplied together to project employment sanitary wastewater flows. An explanation of how jurisdictional sewershed specific employment sewage generation factors were derived is presented in "Unit Flow Factors..."

### Household Demographic Projections

Domestic sanitary wastewater flow projections were developed by utilizing the household as the basic demographic projection unit. Upon consultation with appropriate staff representatives from the various jurisdictions, households, rather than population estimates were chosen as the basic and technically preferable demographic unit for projection of domestic sanitary wastewater flows for a number of reasons. First, and foremost, it was felt that the use of household inputs recognized that sewage flows produced by

- c. Single family household units on public water and sewer in each mini-basin were taken from the residential hookup data provided in FMO 55.
- d. The residential adc for the entire sewershed was tabulated by adding up the residential adc from each mini-basin making up the sewershed.
- e. Total household units within the sewershed were tabulated by adding up the single family and multi-family units from each mini-basin making up the sewershed.
- f. Total residential adc for the sewershed was divided by total households to develop an adc water use factor per household.

#### 4. Household Sewage Flow Generation

Household sewage flow generation factors were developed for each of the sewersheds by multiplying the assigned per capita water use factors by 0.9 to account for an estimated 10 percent of billed water use that is ultimately not converted into sanitary sewage flows. The 10 percent water loss factor was suggested by WSSC flow monitoring staff.(16)

#### 5. Employment Water Use

Water use per employee was estimated for groups of sewersheds common to WSSC flow monitoring points from the WSSC mini-basin billing records as follows:

- a. The adc shown for commercial property billing codes was aggregated with the industrial, institutional, and government codes to derive a total estimate of employment adc water use by each mini-basin. These estimates were then grouped into sewersheds.
- b. Sewershed employment adc data were aggregated to represent areas tributary to the same WSSC sewage flow monitoring point. M-NCPPC staff estimated that there were eight to ten monitoring points used in the county for this purpose.
- c. Total employment adc water use for the aggregated sewersheds was tabulated and divided by total employment within these same areas (as estimated from the COG Round II Forecasts) to develop a per employee adc factor for each aggregated sewershed area.

## 6. Employment Sewage Flow Generation

Sewage flow per employee was estimated for each grouping of sewersheds by multiplying the per employee adc by 0.9 to account for an estimated 10 percent of billed water use that is ultimately not converted into sanitary sewage flows. The 10 percent estimate was provided by WSSC flow monitoring staff.(17)

### District of Columbia

Each SES sewershed in the District utilized a separate household and employment generation factor to simulate average annual sanitary sewage flows from household and employment projections provided through COG's Cooperative Forecasting process. The sewershed factors were derived as follows:

#### 1. Sewershed Delineation

Sewersheds were delineated to represent entire sewer basins or aggregations of basins within the District as defined in the eight major Infiltration/ Inflow studies.

#### 2. Water Use Data

Unlike the other major Blue Plains user jurisdictions, water billing data used in the District of Columbia could not be accurately applied to develop per household and per employee estimates of sewershed water use. In the absence of these data, water use and sewage flow estimates from the District's various Infiltration/Inflow studies were used to develop per household and per employee sewage flow generation factors.(18,19,20,21, 22,23,24,25)

#### 3. Per Capita Water Use and Household Sewage Flow

a. The individual I/I reports contained estimates of per capita water use within each I/I study area based upon use of one or a combination of the following data sources:

- individual metered water consumption for small representative residential use areas;
- pitometer surveys conducted as part of the I/I Study;
- water pumpage records.

b. The individual I/I study areas also contained factors to apply to account for water loss and develop per capita sewage flow generation factors.

- c. The specific per capita sewage flow generation factors derived from the individual I/I studies were applied to the SES sewersheds.
- d. 1978 Round II estimates of population by sewershed were multiplied by the appropriate per capita unit flow factors and the resultant sanitary flow was recorded. This flow was, in turn, divided by the appropriate Round II household estimate and the resultant household sewage generation rate was recorded for each sewershed.

#### 4. Employment Water Use and Sewage Flow

- a. Water consumption per employee was measured as part of the Tiber Creek I/I study. Federal employment water consumption, based on meter readings for federal buildings, amounts to 53 gallons per employee day (gped). Commercial employment water consumption, as estimated from pitometer survey data, averaged 46 gped. These rates were based on a working year, i.e., days worked during the year, and were adjusted to reflect the entire 365-day physical year.
- b. A D.C. Department of Environmental Services' study assumed that 90 percent of employment water use results in sanitary sewage flow.(26)
- c. Application of the employee water use data and associated sewage flow factors to SES was done using a weighted average process as follows:
  - 1. For the Tiber Creek Area (and associated sewersheds), the Tiber Creek I/I study estimated that 55.8 percent of employment was commercial, 44.2 percent federal. This resulted in a weighted per employee sewage generation rate of 30 gped.
  - 2. For all sewersheds outside of the Tiber Creek area, COG estimated that 72 percent of the employment was commercial, 28 percent federal. This resulted in a weighted sewerage generation rate of 29 gped for those sewersheds.

#### 5. Visitor Water Use

Visitor water use rates were determined from the Tiber Creek Area I/I Study and from D.C. Department of Environmental Service (DES) guidance as follows:

- a. In order to distinguish between visitor types, OPD divided them into two groups: overnight and daily visitors. Overnight visitors were further subdivided into: overnight--friends,

### 3. Household Water Use

Department of Public Works computer printout UDIS-UDSPB 564 provided data on both single family and multi-family water use. Estimated domestic water use factors were developed as follows:

- a. Total water consumption in each Fairfax County sewershed by house type was divided by the number of connections of that type. Thus, a water use factor for each house type in each Fairfax County sewershed was developed.
- b. A combined weighted water consumption factor for all housing types reported on the printout was derived for each Fairfax County sewershed. That is, the combined total number of households reported for all types (single family, townhouse, mobile home and apartments) was divided into combined total domestic delivered water.
- c. These factors were then applied to SES sewersheds within the boundaries of the Fairfax County sewershed, i.e., if four SES sewersheds are contained entirely within one Fairfax County sewershed, then all four SES sewersheds are given the same household water consumption factor.

### 4. Household Sewage Generation

Unit flow factors for each SES sewershed were calculated by multiplying the per household consumption factor by 0.95 to account for an estimated five percent of the billed water that is not ultimately converted to sanitary sewage flows. The five percent water loss factor was suggested by the Fairfax County Department of Public Works.(29)

### 5. Employment Water Use

Data from the 1978 Industrial Wastes Survey (UDIS-USDP 0847) indicated, by Fairfax County sewershed, total water consumed by the employment sector. Estimated employment water use factors were derived as follows:

- a. Consumption from all "commercial users" was tabulated for each sewershed to derive a total estimate of employment consumption.
- b. The total employment water use was divided by the total employment within the Fairfax County sewershed (as taken from the COG Round II Cooperative Forecasts) to develop a per employee use factor for each Fairfax County sewershed.

- c. Fairfax County sewershed employment water use rates were disaggregated to SES sewersheds by the method described under households.

## 6. Sewage Flow Per Employee

Employee unit flow factors were estimated by multiplying average daily water consumption by 0.95 as in the household calculations.

### Arlington County

Each SES sewershed in the county utilized a separate household and employment sewage generation factor to simulate average annual sewage flows from household and employment projections provided through COG's Cooperative Forecasting Process. These sewershed factors were derived as follows:

#### 1. Sewershed Delineation

Arlington County Department of Public Works provided the COG staff with the sewershed delineation. Thus, Arlington County sewersheds and SES sewersheds are identical.

#### 2. Water Use Data

Data on water consumption for single family apartment and commercial users for the year 1978 was provided by an Arlington County Department of Public Works computer printout (Program ARL683).

#### 3. Household Water Use

Total water consumption by sewershed for both single family and apartments was provided in Program ARL683. Residential water consumption rates were developed as follows:

- a. Total single family and total apartment water consumption was tabulated by sewershed. Household (Round II) figures by sewersheds were reviewed by the Arlington County Planning Department during the 208 planning process.
- b. Single family and apartment water consumption was combined and divided by the total number of Round II estimated households for 1978 in each sewershed. The result obtained was an individual residential water use rate for each Arlington County sewershed.

#### 4. Household Sewage Generation

Household sewage generation factors were calculated by multiplying the household water use rates by 0.85 to account for billed water loss, which is not ultimately

converted into sanitary flow. The water loss figures were provided by Arlington County Department of Public Works. (30)

#### 5. Water Use Per Employee

Employee water use rates were determined in the same manner as the household use rates were. An individual employee user rate for each sewershed was derived by dividing the total billed commercial water by the number of employees.

#### 6. Sewage Flow Per Employee

Sewage generation rates per employee were obtained by multiplying the employee water consumption factors by a water loss factor of 0.85.

### Loudoun County

#### 1. Sewershed Delineation

Generally, sewersheds were delineated to conform to areas tributary to one or more Loudoun County sewage meters. The delineation of these sewersheds was reviewed by the Loudoun County Sanitation Authority during the 208 planning process.

#### 2. Water Use Rates

Since Loudoun County water billing information was not available in a form which is readily usable for this application, the Loudoun County Sanitation Authority and the City of Leesburg provided COG with water use rate estimates for both residential and commercial (employment) customers. Since the use rates are BPSA area-wide estimates, they are considered valid for each sewershed tributary to the Blue Plains WWTP.

#### 3. Sewage Generation Rates

The Loudoun County Sanitation Authority determined that five percent of delivered water was not ultimately collected by the sanitary sewer system. Thus, all user rates were multiplied by a factor of 0.95 to obtain the sewage generation rates. (31)

### BASE ANNUAL AVERAGE WASTEWATER FLOW PROJECTIONS

In general, the various categories of sanitary wastewater flows were projected by the multiplication of the appropriate demographic input forecast and the corresponding unit flow factor.

## Employment and Household Flows

As described previously, employment flows are developed on a sewershed level by utilizing a unique unit flow factor and the aggregated/disaggregated Round II employment for that particular sewershed. For reporting purposes, these sewershed employment flows have been aggregated to the major basin level and are presented in Table D. Household flows were developed in a similar manner and are also reported in Table D. Tables F and G present jurisdictional employment and household projected wastewater flows with allowances made for two available wastewater management options. The first of these options deals with the continued operation of the Seneca interim WWTP in Montgomery County. Flows are presented for both the condition of immediate shutdown of this facility and for its continued use to the planning horizon of 2005. The second option addresses the use of the Difficult Run pumpdown in Fairfax County. Use of this option would divert some flows from the Potomac Interceptor to the Accotink basin. This pump is scheduled to begin functional operation in 1985. Flows are presented for Fairfax County assuming two possibilities: no use of this option during the planning period, and use of this option according to the schedule set forth by Fairfax County. (32)

## Visitor Flows

Since there are a significant number of visitors who come to the District of Columbia each year, wastewater flows attributable to visitors were developed. Table C shows not only the resultant visitor sanitary wastewater flows, but the projection of visitation and the flow projection methodology, as well.

## Total Sanitary Flows

Table E represents total sanitary flows by jurisdiction on a major basin basis. This table was derived by adding the employment and household flows found in Table D. Table H portrays total sanitary wastewater flows by jurisdiction with consideration given to available wastewater management options.

## FOOTNOTES

1. A more detailed discussion of the Cooperative Forecasting process may be found in "Documentation of Population Projection and Disaggregation Methodology Used for the Blue Plains Feasibility Study - Phase I."
2. Metcalf & Eddy, Inc. - American Consulting Services/WSSC, "Anacostia - Beaverdam Sewerage System Infiltration/Inflow Analysis," 1975.
3. WSSC, "Parkway Sewerage System Infiltration/Inflow Analysis," 1978.
4. WSSC, "Oxon Run Sewerage System Infiltration/Inflow Analysis," 1976.
5. WSSC, "Western Branch Sewerage System Infiltration/Inflow Analysis," 1976.
6. Metcalf & Eddy - American Consulting Services/WSSC, "Piscataway - Broad Creek Sewerage System Infiltration/Inflow Analysis," 1975.
7. Personal communication - Mr. Bruce Downs, WSSC, November 1981.
8. Ibid.
9. Ibid.
10. Metcalf & Eddy, Inc. - American Consulting Services/WSSC, "Anacostia-Beaverdam Sewerage System Infiltration/Inflow Analysis," February 1975.
11. Metcalf & Eddy, Inc. - American Consulting Services/WSSC, "Montgomery County AWT Sewerage Systems Service Area Infiltration/Inflow Analysis," 1975.
12. WSSC, "Lower Rock Creek Sewerage System Infiltration/Inflow Analysis," 1977.
13. WSSC, "Lower Muddy Branch, Lower Watts Branch, Rock Run, Dulles Interceptor Sewerage System Infiltration/Inflow Analysis," 1977.
14. Montgomery County, "Comprehensive Ten-Year Water Supply and Sewerage Systems Plan FYs 1977-86," August 1976.
15. Personal communication - Mr. Bruce Downs, WSSC, November 1981.

FOOTNOTES (cont'd.)

16. Ibid.
17. Ibid.
18. Sterns and Wheeler, "Drainage Area No. 1 - Rock Creek," September 1976.
19. CH<sub>2</sub>M&Hill - Williams and Sheldia, "Drainage Area No. 2 - Anacostia Main Interceptor," October 1978.
20. Ecol Sciences, Inc., "Drainage Area No. 3 - Falls Branch, June," 1978.
21. Sterns and Wheeler, "Drainage Area No. 4 - Oxon Run and Outfalls," November 1978.
22. Corddy, Carpenter, Dietz and Zack, Drainage Area No. 5 - "Piney Branch," 1978.
23. Delon Hampton & Associates, "Drainage Area No. 6 - East Side Interceptor," 1978.
24. Hayes, Seay, Mattern & Mattern, "Drainage Area No. 7 - Northeast Boundry," September 1978.
25. Black and Veatch, "Drainage Area No. 8 - Tiber Creek - B Street and New Jersey Avenue," September 1978.
26. Personal communication, Mr. Abe Strayley, DES, January 1982.
27. Ibid.
28. Fairfax County Economic Development Authority, Sanitary Sewersheds Map, 1978.
29. Personal communication - Mr. Frank Howser, FCDPW, December 1981.
30. Personal communication - Mr. Ken Hook, ACDPW, October 1981.
31. Personal communication - Mr. Ken Shelton, LCSA, November 1981.
32. Fairfax County Office of Waste Management, "Wastewater Management Alternatives," February 1981.

APPENDIX A













GREELEY  
AND  
HANSEN  
ENGINEERS

TASK WA 305-08-17, SCHEDULE A, ITEMS 1-11, PHASE I

SUBJECT Rd II "I-M" ESTIMATED HOUSEHOLDS

TRIBUTARY TO BLUE PLAINS WATP

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM COS

COMP BY BDT

DATE \_\_\_\_\_ CKDBY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 1 OF 6

TABLE B

DRAINAGE BASIN

YEAR	JURISDICTION	ANA-COSTIN	NEVER-DANA-CREEK	BROAD-RUN	CADWIN-JOHN-CREEK	DIFFI-CULT-RUN	LITTLE-FALLS	MUDDY-DRAW	OXON-RUN	PINNACLE-RUN	ROCK-CREEK	ROCK-CREEK	SCOTT'S-RUN	SENEGON-ROCK	SUGAR-LAND-RUN	WANTS-DRAW	TOTAL
1980	District of Columbia	726,360				4990		19,225			14,164	107,811					272,000
	Montgomery County	63,970		21,427		13,643	261		29,773		436	67,704	1,153	17,454		4,210	192,274
	Prince Georges County	80,133	24,848														134,144
	Fairfax County			2,773						12,024			4,502		4,002		42,104
	Arlington County					10,773				5,105							5,105
	Loudoun County			9,055													9,055
TOTAL		270,501	24,248	11,768	21,427	18,013	261	40,928	17,129	14,000	115,915	1,153	4,572	17,454	4,002	6,210	654,682

GREELEY  
AND  
HANSEN  
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TASK WA 305-08-17, SCHEDULE A, ITEMS 1, PHASE I  
SUBJECT Rd II "Y-M" ESTIMATED HOUSEHOLDS  
TRIBUTARY TO BLUE PLAINS WWTTP

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BDT DATE CKD BY DATE SHEET 5 OF 6

TABLE B (CONT.)

YEAR	JURISDICTION	DRAINAGE BASIN													TOTAL		
		ANA-COSTA CREEK	BROAD RUN	CAGIN JOHN CREEK	DIFFI-COLT RUN	LITTLE FALLS	MUDDY BROOK	OXON RUN	PRINCE RUN	ROCK CREEK	ROCK RUN	SCOTT'S RUN	SENECA CREEK	SUGAR LAND RUN		WAITS BRANCH	
2000	District of Columbia	147,538			5989	29,826	17,176	112,431									299,000
	Montgomery County	86,039		24,519	15,626	463	982	86,231	1,835			35,266			9,143		262,017
	Prince George's County	88,769				34,438											155,679
	Fairfax County									15,750				7388		5,389	61,241
	Arlington County									5,313							5,313
Loudoun County																	25,740
TOTAL		317,806	30,472	31,985	26,519	26,472	21,615	463	57,264	21,063	181,665	1,835	35,266	7,388	9,143		809,020

GREELEY  
AND  
HANSEN  
ENGINEERS

TASK WA 305-08-17, SCHEDULE A, ITEMS, PHASE I  
SUBJECT RD II "I-M" ESTIMATED HOUSEHOLDS  
TRIBUTARY TO BLUE PLAINS WWTTP

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BDT DATE CKD BY DATE SHEET 6 OF 6

# TABLE B (CONT.)

YEAR	JURISDICTION	ANNA-COSTA CREEK	WHEELER DRY CREEK	BROAD RUN	CALVIN JOINT CREEK	DIFFERT CREEK	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PRINCE RUN	ROCK CREEK	ROCK RUN	SCOTT'S RUN	SENECA CREEK	SUGAR LAND RUN	WATTS BRANCH	TOTAL
2005	District of Columbia	101,784					6,049		24,159		17,327	113,681					383,000
	Montgomery County	40,343			27,303		15,907	511			1,084	88,858	1890	38,838		9530	274,264
	Prince George's County	4,023	32,228						37,908								161,159
	Fairfax County			4,803		28,603				17,065			55,866		8,277		66,334
	Arlington County									3,344							5,344
	Loudoun County			29,002													29,002
	TOTAL	366,184	32,228	35,805	27,303	28,603	21,956	571	59,067	27,409	202,594	1890	55,866	38,838	8,277	9530	839,103

TASK WA 305-08-17, SEMINAR A, ITEM 7 PHASE I

SUBJECT DISTRICT OF COLUMBIA VISITOR PROJECTIONS & ANNUAL AVERAGE VISITOR WASTEWATER FLOWS

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BDT DATE \_\_\_\_\_ CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 1 OF 1

TABLE C

VISITOR CATEGORY	1980		1985		1990		1995		2000		2005	
	Visitors/ YEAR x 1000	Flow MGD x 1000										
OVERNIGHT - Friends, Relatives & Treasure Flow = $\frac{\text{Visitors}}{365}$ x 1.034/1000 x 90 gpd	4,135	2,070	5,189	2,597	6,589	3,190	8,533	4,271	5,684	15,613	7,815	
OVERNIGHT - Business & Conventions Flow = $\frac{\text{Visitors}}{365}$ x 1.74/1000 x 90 gpd	2,622	1,746	3,209	2,136	3,957	2,636	4,921	3,276	4,099	7,747	5,158	
DAYTIME Flow = $\frac{\text{Visitors}}{365}$ x 1.56/1000 x 15 gpd	3,447	0,212	3,757	0,132	4,040	0,209	4,250	0,262	0,272	4,453	0,275	
TOTAL	10,204	4,028	12,155	4,865	14,588	6,103	17,704	7,809	10,055	27,813	13,248	

QUEELEY  
AND  
HANSEN  
ENGINEERS

TASK WA 305-08-17, SCHEME A, Item 7 -- PHASE I  
SUBJECT DOMESTIC AND EMPLOYMENT SANITARY  
FLUWS TO BLUE PLAINS BY TUBERATION & BASIN

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BMT DATE \_\_\_\_\_ CHK BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 1 OF 6

# TABLE D

YEAR	JURISDICTION	DRAINAGE BASIN														TOTAL	
		ANR-COSTA CREEK	DEVER DAM CREEK	BROAD RUN CREEK	CABIN JOHN CREEK	DIFFERENT CREEK	LITTLE FALLS	LUDDY CREEK	OYON RUN	PINNAC RUN	ROCK CREEK	ROCK RUN	SCOTT'S CREEK	SENECA CREEK	SUGAR LAKE RUN		WANTS DRAIN
1980	District of Columbia	33,517	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417
	Montgomery County	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241
	Prince Georges County	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417
	Fairfax County	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417
	Arlington County	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417
	Loudoun County	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417	5,241	17,417
	TOTAL	115,111	115,111	115,111	115,111	115,111	115,111	115,111	115,111	115,111	115,111	115,111	115,111	115,111	115,111	115,111	115,111

DOMESTIC  
(440)  
EMPLOYMENT



DREELEY  
AND  
HANSEN  
ENGINEERS

TASK <u>WA 305-08-17, Scheme A, Item 1</u>	PHASE <u>I</u>	DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY	
SUBJECT <u>DOMESTIC AND EMPLOYMENT SANITARY FLOODS TO BLUE PLAINS BY INTERSECTION &amp; BASIN</u>		FIRM <u>COF</u>	
COMP BY <u>BAT</u>	DATE _____	CKD BY _____	DATE _____
		SHEET <u>3</u>	OF <u>4</u>

TABLE D (CONT.)

YEAR	JURISDICTION	ANNA-COSTA CREEK	BEAVER DAM CREEK	BROAD RUN	CADIN JOHN CREEK	DUFFY CUL-T RUN	LITTLE FALLS	MOODY BROOK	OYON RUN	PRIMM RUN	INDIAN CREEK	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SOGAM LAND RUN	WANTS BRANCH	TOTAL
1990	District of Columbia	36.362					1.324		11.579		2.691	11.797						48.133
	Montgomery County	1.902			5.877		0.351		1.104		0.503	7.772			6.081		2.055	19.934
	Prince Georges County	16.011			2.147		2.428		0.551		0.116	17.360			0.497		0.118	52.126
	Fairfax County	29.571			2.147		1.001		7.041		0.039	7.641			20.112		0.118	118.160
	Spartanburg County	18.317					0.003		1.301									11.209
	Arhington County	6.194							1.301						1.012			10.539
	Loudoun County	2.157							2.924						0.440			11.249
	TOTAL								20.512						0.711			3.009
									0.711									0.711
									0.101									0.101
									0.448									4.668
									0.501									0.501
									3.816									170.390
									3.816									0.559
									0.513									170.390
									2.307									57.922
									0.513									57.922

DOMESTIC  
(CROD) (NEED)  
EMPLOYMENT

WHEELEY  
AND  
HANSEN  
ENGINEERS

TASK WA 305-08-17, Schedule A, Item 7 PHASE I  
SUBJECT DOMESTIC AND EMPLOYMENT SANITARY  
Flows to Blue Plains by Jurisdiction & Basin

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BAT DATE \_\_\_\_\_ CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 4 OF 6

TABLE D (CONT.)

YEAR	JURISDICTION	DRAINAGE BASIN													TOTAL				
		ANNA-COSTA	DEWEY DAM CREEK	BRAND RUII	CADIN JOHN CREEK	DIFFI-CULTY RUN	LITTLE FALLS	HUBBY BROOK	OXON RUN	PHANH RUN	TURNER	ROCK CREEK	ROCK RUN	SCOTTS RUN		SEEBEG CREEK	BOGARD LAND RUII	WANTS BRANCH	
1995	District of Columbia	37.197				1.383		15.711		2.816	11.936								70.069
	Montgomery County	10.213			7.157	0.352		1.410	0.510	7.717									212.262
	Prince Georges County	18.115			2.603	3.574	0.383		0.257	19.867	0.525								57.137
	Fairfax County	2.549			2.603	1.171	0.013	7.519	0.810	8.213	0.113								19.679
	Arlington County	18.715	6.101																32.495
	Lowdown County	2.352	2.425					2.018		1.115				1.059					11.089
	LOCALITY			1.031										0.526					11.343
	LOCALITY			0.213						0.584				0.526					4.512
	LOCALITY			5.456						0.911									0.911
	LOCALITY			0.771					0.101										0.101
TOTAL		71.197	6.101	6.487	7.157	6.305	4.977	22.210	10.566	3.057	34.966	6.325	1.059	6.387	2.803	1.351	1.351	181.011	
TOTAL		14.206	2.025	0.754	3.401	2.025	1.526	5.172	0.095	0.353	16.06	0.113	0.557	2.265	1.351	0.314	0.314	56.409	

DOMESTIC (M&D) EMPLOYMENT

GHEELEY  
AND  
HANSEN  
ENGINEERS

TASK WA 305-08-17, SCHEDULE A, ITEM 7.

PHASE I

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

SUBJECT DOMESTIC AND EMPLOYMENT SANITARY  
FLOWS TO BLUE PLAINS BY JURISDICTION & BASIN

COMP BY BAC DATE \_\_\_\_\_ CKDBY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 5 OF 6

FIRM COG

**TABLED (CONT.)**

YEAR	DRAINAGE BASIN														TOTAL		
2000	AVA-COSTA	DEVER DAM CREEK	BROAD RUN	CADIN JOHN CREEK	DIFFI-CULT RUN	LIME FALLS	HUBBY BROOK	OYON RUN	PRINCE RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCORES RUN	SENECA CREEK	SOGAR LAGOON	WANTS DRAG	TOTAL
District of Columbia	37.377				1.407		11.708		2.812	10.138							71.072
Montgomery County	10.375			7.337	0.310	1.444			0.528	2.891				7.676		2.152	20.600
Prince Georges County	19.249			1.171	3.151	0.840	7.870		0.310	19.112		0.112		3.358		0.311	60.161
Cavalry	2.311	0.472			1.119	0.097											33.691
Fairfax County		1.129			0.774		2.202		1.411				1.098		3.211		11.054
Arlington County					2.116				0.412				0.410		1.582		18.665
Cavalry Loudoun County		5.309							0.077								5.277
TOTAL	77.726	7.472	1.043	7.337	5.016	9.076	22.778	13.128	4.318	3.107	3.237	0.850	10.010	7.676	3.237	2.152	188.515
	11.513	4.463	1.071	4.124	2.491	1.574	3.019	3.019	0.107	0.551	1.115	0.113	0.610	3.153	1.583	0.319	61.675

DOMESTIC (M&D) EMPLOYMENT

GHEELEY AND HANSEN ENGINEERS

TASK WA 305-08-17, Schedule A Item 1, PHASE I

SUBJECT DOMESTIC AND EMPLOYMENT SANITARY

Flows to Blue Plains by Jurisdiction & Basin

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BST DATE \_\_\_\_\_ CKD BY \_\_\_\_\_ DATE \_\_\_\_\_

SHEET 6 OF 6

# TABLE D (CONT.)

YEAR	JURISDICTION	DRAINAGE BASIN													TOTAL			
		ANA-COSTA	DEVER DART CREEK	BROAD RUN	CAGIN JOHN CREEK	DIFF-COLT RUN	LIME FALLS	MUDDY BRANCH	OYON RUN	PUMMIT RUN	INDIAN	ROCK CREEK	ROCK RUN	SCOTTS RUN		SENECA CREEK	SUGAR LAKE RUN	WATTS BRANCH
2005	District of Columbia	31,375				1,421		15,107		2,727	16,363							72,072
	Montgomery County	10,201			7,583	0,369		7,177		0,545	8,018							20,937
	Prince Georges County	2,026			4,543	1,341		2,193		0,111	1,657							12,167
	Fairfax County	7,412						2,332										15,301
	Arlington County	6,401																17,090
	Loudoun County	2,401																15,301
TOTAL		70,474	2,050	12,227	7,583	7,310	23,300	17,111	13,111	7,004	10,014	6,351	11,338	1,317	3,111	1,311	145,071	

DOMESTIC (440)  
EMPLOYMENT (140)

GREELEY  
AND  
HANSEN  
ENGINEERS

TASK WA 305-08-17, Schedule A, Item 1, PHASE I  
SUBJECT TOTAL SANITARY FLOWS TO BLUE PLAINS BY JURISDICTION AND DRAINAGE BASIN

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM CGE

COMP BY BNT DATE \_\_\_\_\_ CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 1 OF 6

# TABLE E

YEAR	JURISDICTION	DRAINAGE BASIN													TOTAL*					
		ANA-COSTA CREEK	DEWEY DAM CREEK	BRAD RUN	CASHI JOHN CREEK	DIPPI CULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PANAMINT RUN	ROCK CREEK	ROCK CREEK RUN	SCOTT'S RUN	SENECA CREEK		SUGAR LAKE RUN	WANTS BRANCH			
1980	District of Columbia	13,819				1,361	15,125				2,805	20,837							88,278	
	Montgomery County	16,025			8,579	1,017	0,211			0,148	20,793	0,482	5,577				1,874		57,676	
	Prince George's County	21,682	7,064					8,102											37,857	
	Fairfax County			0,509						1,076					1,521				11,719	
	Arlington County									0,976									0,976	
	Loudoun County			2,537																2,537
	TOTAL	82,530	7,064	3,016	8,579	5,403	5,381	0,211	23,527	4,052	2,933	41,630	0,482	5,577	1,521		1,874		199,013	

\* Visitors' Flow Component = 4,028 mgd.



OREELEY  
AND  
HANSEN  
ENGINEERS

TASK WA 305-08-17, Schedule A, Item I, PHASE I  
SUBJECT TOTAL SANITARY FLOWS TO BLUE PLAINS BY  
JURISDICTION AND DRAINAGE BASIN

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM CGE

COMP BY BDT DATE CKD BY DATE SHEET 3 OF 6

TABLE E (cont.)

YEAR	JURISDICTION	AHA-COSTA	BEAVER DAM CREEK	BRAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIS RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENEG CREEK	SOGMA LAND RUN	WANTS BRANCH	TOTAL
1990	District of Columbia	16,264				1,739	15,976	3,199	21,569									94,950*
	Montgomery County	19,555		10,324		4,512	0,374	0,235	25,004	0,610		2,940					2,530	71,086
	Prince Georges County	24,592	8,232				8,444											41,768
	Fairfax County			0,881	7,423					3,771				1,462		2,221		15,158
	Arlington County									1,012								1,012
	Loudoun County			5,227														5,227
	TOTAL	59,411	8,232	6,108	10,324	7,423	6,251	0,374	24,910	1,983	3,434	46,575	0,610	1,462	6,940	2,221	2,530	229,501

\* Visitors' Flow Component = 6.183 mgd.

O'REELEY  
AND  
HANSEN  
ENGINEERS

TASK WA 305-08-17, SCHEDULE A, ITEM 7, ... PHASE I  
 SUBJECT TOTAL SANITARY FLOWS TO BLUE PLAINS BY  
JURISDICTION AND DRAINAGE BASIN

DISTRICT OF COLUMBIA  
 BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BNT DATE \_\_\_\_\_ CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 4 OF 6

TABLE E (CONT.)

YEAR	JURISDICTION	DRAINAGE BASIN													TOTAL				
		ANNA-COSTA	DEWEY DAM CREEK	BROAD RUN	CABIN JOHN CREEK	BIFPI-CULT RUN	LITTLE FALLS	MUDDY BROOK	OVON RUN	PRINCE RUN	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK		SOGONIA LAKE RUN	WATTS BRANCH		
1995	District of Columbia	17,136				1,715	16,121		3,326	21,703									98,140
	Montgomery County	20,754			10,942	4,318	0,424		0,274	26,632	0,658		10,154				2,663		77,911
	Prince Georges County	25,201	8,766				9,617												43,584
	Calverly Fairfax County		1,054									9,330		3,729		1,575		1,157	19,855
	Archeryton County													1,012					1,012
	Loudoun County			6,227															6,227
	County	73,391	2,766	7,201	10,912	6,463	0,426	26,112	1,741	3,600	48,525	0,658	1,585	10,154	1,157		2,663		245,229

\* Visitors' Flow Component = 7,809 mgd.

OREELEY  
AND  
HANSEN  
ENGINEERS

TASK WA 305-08-17, SCHEDULE A, ITEM 7, -- PHASE I  
SUBJECT TOTAL SANITARY FLOWS TO BLUE PLAINS BY JURISDICTION AND DRAINAGE BASIN

DISTRICT OF COLUMBIA  
BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BNT DATE \_\_\_\_\_ CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 5 OF 6

TABLE E (CONT.)

YEAR	JURISDICTION	DRAINAGE BASIN													TOTAL*											
		ANA-COSTA	BEVER DASH CREEK	BROAD RUN	CABIN JOHN CREEK	DEEP-CULT RUN	LITTLE FALLS	MUDDY BROOK	DIYON RUN	PHANTOM RUN	ROCK CREEK	ROCK RUN	SCOTT'S RUN	SENECA CREEK		SUGAR LAKE RUN	WAITS BRANCH									
2000	District of Columbia	18,152					1,767	16,354			3,370	22,029													101,727	
	Montgomery County	22,023			11,546		1,827	0,484			0,301	28,096						11,529							2,801	82,260
	Prince Georges County	25,739	10,939					10,072																		46,750
	Fairfax County			1,157		9,218																				20,912
	Arlington County													1,014												1,014
	Loudoun County			7,552																						7,552
	TOTAL	95,611	10,939	8,709	11,546	9,218	6,594	10,484	26,416	6,057	3,671	30,125	0,653					11,529						1,816	2,801	260,245

\* Visitors' Flow Component = 10,055 mgd.



TASK <u>WA 305-08-17, SCHEDULE A, ITEM 7</u> PHASE <u>I</u>	DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY
SUBJECT <u>EMPLOYMENT ANNUAL AVERAGE</u>	FIRM <u>COG</u>
<u>WASTEWATER FOR BPSA (1980-2005)</u>	

COMP BY B.D.T. DATE 3/5/82 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 1 OF 1

## TABLE F

JURISDICTION	1980	1985	1990	1995	2000	2005
DISTRICT OF COLUMBIA	19.760	19.514	19.934	20.262	20.600	20.937
Mont. Co. (Inc. Rockville)	13.470	15.510	18.160	19.674	21.599	23.469
ADJUSTED TOTAL ASSUMING USE OF SEWER STD	12.859	14.737	17.124	18.468	20.149	21.777
PRINCE GEORGES CO. TOTAL WSSC →	8.880	9.525	10.559	11.089	13.059	15.309
PRINCE GEORGES CO. (Inc. Aq. Co. Prince Georges)	2.310	3.041	3.710	4.613	5.374	6.132
ADJUSTED TOTAL ASSUMING USE OF PUMPHOUSE	2.310	2.582	2.791	3.169	3.230	3.812
LOUDOUN CO. TOTAL VA →	0.249	0.356	0.559	0.771	1.043	1.254
LOUDOUN CO. (Inc. VA)		3.397	4.169	5.384	6.417	7.384
TOTAL REGIONAL FLOWS - BLUE PLAINS SERVICE AREA	44.669	47.946	52.922	56.409	61.675	67.101
ADJUSTED BPSA TOTALS						
- IF SEWER IS USED	44.058	47.173	51.886	55.203	60.225	65.409
- IF PUMPHOUSE IS USED	44.669	47.487	52.003	54.965	59.531	64.781
- IF SEWER & PUMPHOUSE BOTH	44.058	46.714	50.967	53.759	58.081	63.089

TASK <u>W.A. 305-08-17, SCHEDULE A, Item 7</u> PHASE <u>I</u>	DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY
SUBJECT <u>DOMESTIC ANNUAL AVERAGE</u>	FIRM <u>COG</u>
<u>WASTEWATER FOR BPSA (1980-2005)</u>	

COMP BY B.D.T. DATE 3/5/82 CKD BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET 1 OF 1

## TABLE G

JURISDICTION	1980	1985	1990	1995	2000	2005
DISTRICT OF COLUMBIA	64.490	67.799	68.833	70.069	71.072	72.072
Mont. Co. (Inc. Rockville)	44.206	48.302	52.926	57.737	60.661	63.569
ADJUSTED TOTAL ASSUMING USE OF SENECA STP	42.703	46.383	50.546	54.529	57.721	59.871
PRINCE GEORGES	28.977	29.841	31.209	32.495	33.691	34.885
IF RC WSSC →		78.143	84.135	90.131	94.354	98.454
FAIRFAX Co. (Inc. Aq. Co. Falls)	10.385	11.604	12.760	15.254	16.582	18.012
ADJUSTED TOTAL ASSUMING USE OF PUMPKIN	10.385	9.863	9.609	10.498	10.066	11.112
LOUDOUN Co.	2.288	3.465	4.668	5.456	6.504	7.334
TOTAL VA →		15.069	17.428	20.710	23.086	25.346
TOTAL REGIONAL FLOWS - BLUE PLAINS SERVICE AREA	150.346	161.011	170.756	181.414	188.540	195.872
ADJUSTED BPSA TOTALS						
• IF SENECA IS USED	148.843	159.092	168.376	178.570	185.270	192.174
• IF PUMPKIN IS USED	150.346	159.270	167.605	176.658	182.024	188.972
• IF SENECA & PUMPKIN BOTH USED	148.843	157.351	165.225	173.814	178.754	185.274