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_5)

* Total Nitrogen (N)

* Total Phosphorus (P)

* Wastewater Temperature (Degrees C)

* Wastewater Alkalinity ($CaCO_3$)

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	Estimated Sewered Population - 1000 Persons					
	1980	1985	1990	1995	2000	2005
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	702.0	724.0	734.0	734.0	733.0	732.0
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:

Year	Estimated Tributary Population Blue Plains WWTP - 1000 Persons
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)

Item	Flow GCD	Pounds Per Capita Per Day SS	BOD_5	N(2)	P
Avgs. for 1969-1980	180	0.23	0.24	0.033	0.0104

(1) Based on estimated sewered 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:

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

(1) As $CaCO_3$

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:

Item	Blue Plains Service Area - Forecast of Annual Average Wastewater Quantities				
	1985	1990	1995	2000	2005
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)	41.88	31.88	31.88	31.88	31.88
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:

Item	Per Capita Quantities - PCD(1) SS	BOD_5	N	P
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_5 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_5 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_5, 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:

Blue Plains Service Area - Forecast of Annual Average Wastewater Quantities & Characteristics

Item	1985	1990	1995	2000	2005
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_5	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:

	Load Variations - Ratio to An. Avg. Characteristics - lbs/day Ratios				
Process Loading Condition	Flow MGD	SS	BOD_5	N	P
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:

	Peak 15-min Storm Event Flow Rate - MGD For Maximum 60-min Intensity - INS/HR			
CSO Abatement Project	0.50	1.00	1.50	2.00
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 x 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:

Year(2)	Dry Days Flow(1) - MGD		
	Avg.	Max.	Max/Avg.
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

(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.

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[1] Blue Plains Service Area

(Continued)

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TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTEWATER QUANTITIES AND CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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TABLE 1

BLUE PLAINS SERVICE AREA
ESTIMATED SEWERED POPULATION - 1000 PERSONS[1]

AREA	1980	1985	1990	1995	2000	2005
VIRGINIA						
1. Fairfax & Arlington Cos.	141.2	152.6	165.5	176.4	184.5	193.5
2. Loudoun Co.	30.9	41.2	56.5	64.8	76.3	85.4
Subtotal - Virginia	172.1	194.8	222.0	241.2	260.8	278.9
MARYLAND						
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	381.5	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
Total - Blue Plains Service Area	1764.7	1843.7	1940.8	2014.1	2069.0	2122.2

[1] SOURCE: COG
SM II-2, 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	1482.1	1513.5	1544.9	1576.3	1607.7	1639.1	1670.5	1701.9	1733.3	1764.7	-
Wastewater Quantity - MGD (BWT)[1]	246	255	272	288	285	277	291	294	277	300	311	351	-
- MGD (BWT ADJ.)[2]	-	-	-	-	-	-	-	-	-	-	-	296	-
- GCD (BWT)	173	176	184	190	185	176	181	179	166	176	179	199	180
Suspended Solids - MG/L[3]	176	185	168	166	138	151	145	148	152	157	131	138	-
- 1000 LBS/DAY	361	393	381	399	329	348	353	364	351	393	340	403	-
- PCD[4]	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_5 - MG/L	175	192	211	174	159	162	149	174	153	145	140	118	-
- 1000 LBS/DAY	360	408	478	419	377	374	361	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	-	-	-	13.3	13.9	23.1	25.0	22.7	24.0	22.5	19.8	20.7	-
- 1000 LBS/DAY	-	-	-	45.1	47.8	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 [5]
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	12.3	15.4	-
- 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	0.0104

(1) D.C. Bureau of Waste Treatment Reported Flow (BWT)
(2) D.C. BWT Adjusted MGD = (1.06 x BMS) - 273.43 (Started Nov. 1979, meters out of service)
(3) Concentrations Computed
(4) PCD - POUNDS PER CAPITA PER DAY (5) 9-YR AVG.

TABLE 3

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

AREA	WASTEWATER QUANTITIES - MGD				
	1976	1977	1978	1979	1980
Virginia Communities(2)	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(3)	0.39	0.39	0.41	0.48	0.35(4)
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

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

ITEM	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1. TEMPERATURE - °C												
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	22.2	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	18.5
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	25.9	21.0	17.2
5-YR AVG. TEMP - °C	14.3	13.7	15.2	17.5	20.4	23.2	25.4	26.0	25.2	22.5	19.0	16.3
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	25.9	22.0	19.2
2. ALKALINITY - MG/L												
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	139.9	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	135.7	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	130.5	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	141.4	139.6	167.0	138.9	148.4	154.7	160.1	156.2	147.4	-	159.9	167.0
1980 - AVG	111.7	138.3	111.6	111.2	116.1	121.4	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	123.0	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
5-YR. AVG. ALKAL - MG/L	117.2	130.3	113.4	123.1	131.7	134.7	134.5	135.9	140.2	146.5	143.7	131.5
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

GREELEY AND HANSEN 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 4.13.81 CKD BY _____ DATE _____ SHEET 1 OF 1

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	392.3	273.4	292.4	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	252.0	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	472.7	285.0	349.6	396.1
	AVG.		296.9			296.9			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	26.2
	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	309.0	1557.0	181.3	308.6	1,058.7	207.3	304.8	525.7
	1973	87.0	329.2	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	161.6	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	393.2	724.1	215.5	391.4	620.9	320.9	393.1	514.6
	1979	157.5	340.3	759.6	202.9	341.1	539.7	271.9	337.7	385.3
	1980	139.9	402.6	1131.6	203.1	401.3	748.1	203.1	399.5	503.9
	AVG.		364.5			364.3			363.4	

(Continued)

GREELEY AND HANSEN ENGINEERS

TASK STUDY MEMO II-3 PHASE

SUBJECT

TABLE 5 (cont'd)

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY LEB DATE 4.13.82 CKD BY DATE SHEET 2 OF 2

ITEM	YEAR	1-DAY MOVING AVERAGE			3-DAY MOVING AVERAGE			30-DAY MOVING AVERAGE		
		MIN.	AVG.	MAX	MIN.	AVG.	MAX.	MIN.	AVG.	MAX.
BOD_5 (1000 LB/D)	1972	184.0	418.9	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	696.7	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	602.7	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	165.5	352.9	618.3	207.1	352.3	671.7	264.7	349.2	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	637.4	187.5	361.9	691.3	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)	1971							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	74.3
	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	64.1
	1980	23.7	60.6	95.8	23.7	60.3	85.9	24.3	53.7	70.2
	AVG.		55.9			55.8			53.9	
TOTAL PHOSPHORUS (1000 LB/D)	1972	8.5	17.4	31.5	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	20.7
	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	7.4	14.0	24.9	4.4	14.0	21.7	11.7	14.0	15.8
	1977	7.7	14.9	22.9	10.8	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	7.7	15.4	43.3	7.9	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	132.6	212.8	86.4	131.0	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	142.3
	AVG.		132.0			131.5			131.9	

GREELEY AND HANSEN ENGINEERS

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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 6
SUMMARY - FORECAST OF ANNUAL AVERAGE WASTEWATER QUANTITIES - VIRGINIA (FAX, ARLN, LOU CO.)

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 (1)	0.38	0.76	1.06	1.40	1.73
Future Sewered Pop. - 1000 PERS.	22.7	49.5	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

GREELEY AND HANSEN ENGINEERS

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SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM GGH

COMP BY REB 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[1]	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

GREELEY AND HANSEN 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 _____

TABLE 8
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
Wastewater Quantities					
Households (Domestic) - MGD	67.80	68.83	70.07	71.07	72.07
- GCD	94	94	96	97	98
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 9) - MGD	4.97	6.18	7.81	10.06	13.15
Infiltration[1] - MGD	4.80	4.80	4.80	4.80	4.80
- GCD (Computed)	6	6	6	6	6
Groundwater Pumpage[1] - MGD	4.71	4.71	4.71	4.71	4.71
Water Distribution System Lost Water[1] - 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[2]	71	56	56	56	56
Total Wastewater Quantities - MGD	143.67	136.33	139.53	143.11	147.65
- GCD	198	186	190	195	201

[1] See Study Memo II-4, CSO and I/I Studies and Plans
[2] 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.[1]

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.	AN. AVG. FLOW MGD	
1980	4,135	11,329	2.03	90	1.070	2,611	7,183	2.70	90	1.746	3,447	9,444	1.50	15	0.211	4.03
1985	5189	14,216	2.03	90	1.597	3209	8,792	2.70	90	2.136	3757	10,293	1.50	15	0.231	4.97
1990	6589	18,052	2.03	90	3.298	3959	10,846	2.70	90	2.636	4040	11,068	1.50	15	0.249	6.18
1995	8533	23,378	2.03	90	4.271	4921	13,481	2.70	90	3.276	4150	11,644	1.50	15	0.261	7.81
2000	11,355	31,109	2.03	90	5.684	6157	16,868	2.70	90	4.099	4409	12,079	1.50	15	0.271	10.06
2005	15,613	42,775	2.03	90	7.815	7747	21,225	2.70	90	5.158	4453	12,200	1.50	15	0.275	13.25

(1) Source: COG, see Appendix A

(2) Rounded value

GREELEY AND HANSEN ENGINEERS

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SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY RED DATE 4.10.81 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	2112.1
Wastewater Quantities :					
Households (Domestic) - MGD	161.01	170.41	181.01	188.51	195.87
(Computed) - GCD	87	88	90	91	92
Employment - MGD	47.95	51.91	56.40	61.68	67.11
- 1000 PERSONS	1223.1	1320.0	1394.1	1488.9	1579.0
- GCD (Computed)	39	40	41	41	42
Visitors (D.C. Only) - MGD	4.97	6.18	7.81	10.06	13.15
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	318.11	335.86	351.76	368.60
- GCD	169	164	167	170	174
Totals - Rounded Off For Design - MGD	312	319	336	352	370

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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	2111.1
Wastewater Quantities - MGD					
Virginia	23.80	27.43	31.10	35.86	39.41
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	351	370
Wastewater Characteristics					
Suspended Solids - PCD[1]	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[2]	177	182	180	176	172
BOD_5 - PCD[1]	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[2]	177	182	180	176	172
Total Nitrogen - PCD[1]	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[2]	23	24	24	23	23
Total Phosphorus - PCD[1]	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[2]	6.4	6.6	6.5	6.3	6.2

(1) PCD - POUNDS PER CAPITA PER DAY
(2) MG/L COMPUTED

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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 4.10.81 CKD BY _____ DATE _____ SHEET 2 OF 2

TABLE 12 (Continued)

BLUE PLAINS WWTP - RECORD OF WASTEWATER LOADING VARIATIONS

ITEM	YEAR	1-DAY MOVING AVERAGE			3-DAY MOVING AVERAGE			30-DAY MOVING AVERAGE		
		AVG.	MAX.	MAX/AVG	AVG.	MAX.	MAX/AVG	AVG.	MAX.	MAX/AVG
TOTAL NITROGEN (1000 LBS/DAY)	1972							45.1	50.8	1.13
	1973							47.4	54.6	1.15
	1974							53.6	63.1	1.18
	1975							60.6	74.9	1.24
	1976	55.6	87.6	1.58	55.5	85.3	1.54	54.7	72.6	1.33
	1977	55.4	93.3	1.68	55.4	90.7	1.64	54.8	70.3	1.28
	1978	56.4	88.0	1.56	56.5	86.3	1.53	56.8	69.8	1.23
	1979	51.3	70.6	1.38	51.8	70.6	1.37	52.0	64.1	1.23
	1980	60.6	95.8	1.58	60.3	85.9	1.42	59.7	70.2	1.18
TOTAL PHOSPHORUS (1000 LBS/DAY)	1971	17.4	31.5	1.81	17.4	28.6	1.64	17.3	22.5	1.30
	1973	17.0	41.5	2.44	17.0	39.5	2.32	17.0	20.9	1.23
	1974	15.4	26.9	1.74	15.4	22.6	1.47	15.5	18.9	1.22
	1975	13.6	32.2	2.37	13.6	23.0	1.69	13.5	17.3	1.28
	1976	14.8	24.9	1.78	14.0	21.7	1.55	14.0	15.8	1.13
	1977	14.9	22.9	1.54	14.9	20.9	1.40	14.9	16.8	1.13
	1978	14.1	19.0	1.35	14.1	17.8	1.26	14.0	15.8	1.13
	1979	12.3	18.0	1.46	12.3	17.6	1.43	12.6	17.6	1.40
	1980	15.4	43.3	2.81	15.1	41.2	2.73	15.2	24.9	1.64

GREELEY AND HANSEN ENGINEERS

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 4-10-81 CKD BY _____ DATE _____ SHEET 2 OF 2

TABLE 15 (Cont'd)

ITEM	1985	1990	1995	2000	2005
Wastewater Characteristics (Continued)					
BOD_5					
Annual Average - PCD	0.15	0.15	0.15	0.15	0.15
- 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	693.2	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	1,007.0	1,034.6	1,061.0
Total Nitrogen					
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
Total Phosphorus					
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
Wastewater Temperature					
Minimum Day - °C	11.0	11.0	11.0	11.0	11.0
Wastewater Alkalinity ($CaCO_3$)					
Average - MG/L	133	133	133	133	133
Min. Day - MG/L	50	50	50	50	50

LIST OF FIGURES

(Continued)

LIST OF FIGURES

(Continued)

GREELEY AND HANSEN ENGINEERS

TASK STUDY MEMO II-3 PHASE I

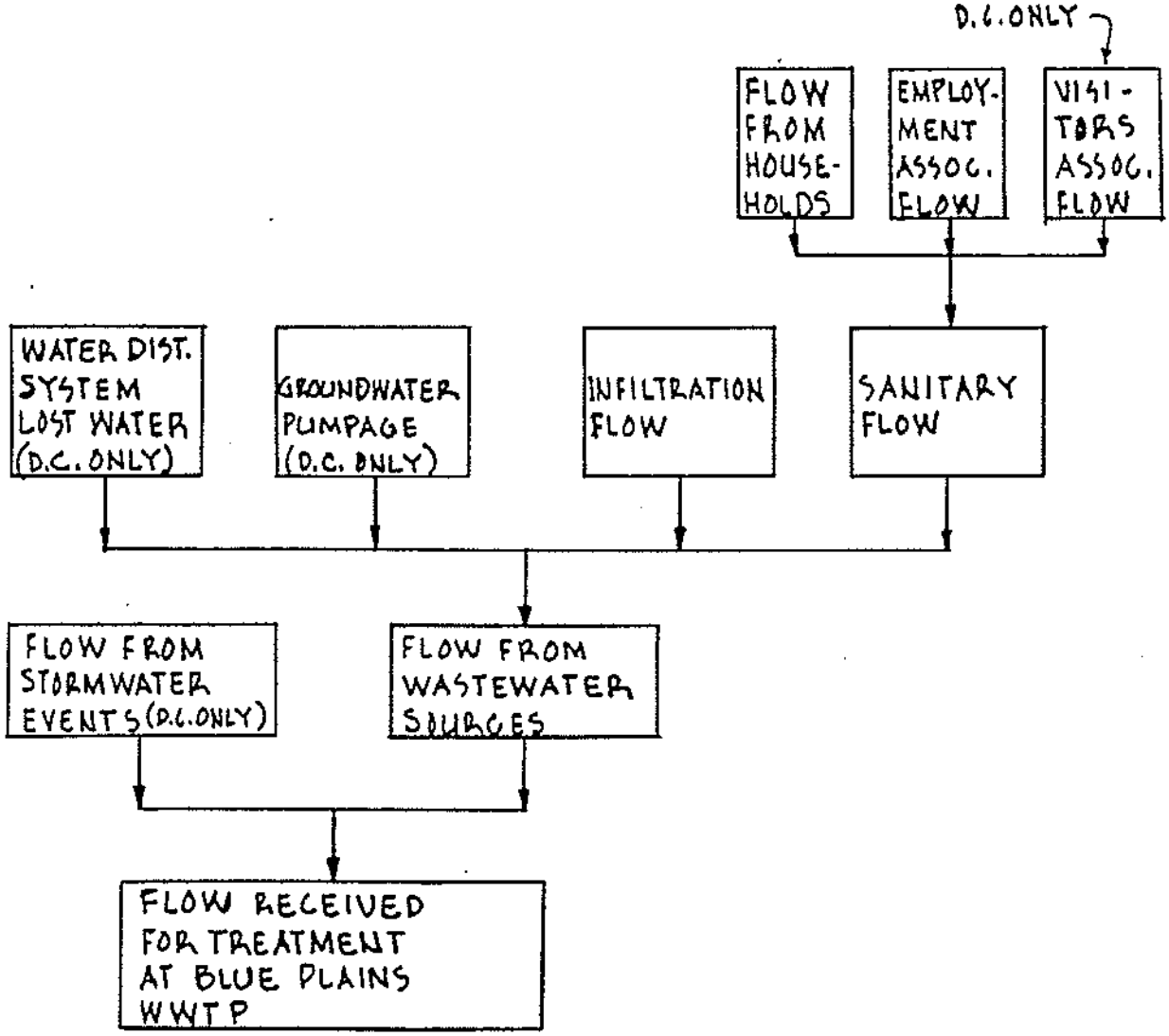
SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY REB DATE 4.10.81 CKD BY _____ DATE _____ SHEET _____ OF _____

FIGURE 2



BLUE PLAINS WWTP
COMPONENTS OF FLOW

REELEY AND HANSEN ENGINEERS

TASK STUDY MEMO II-3 PHASE 1

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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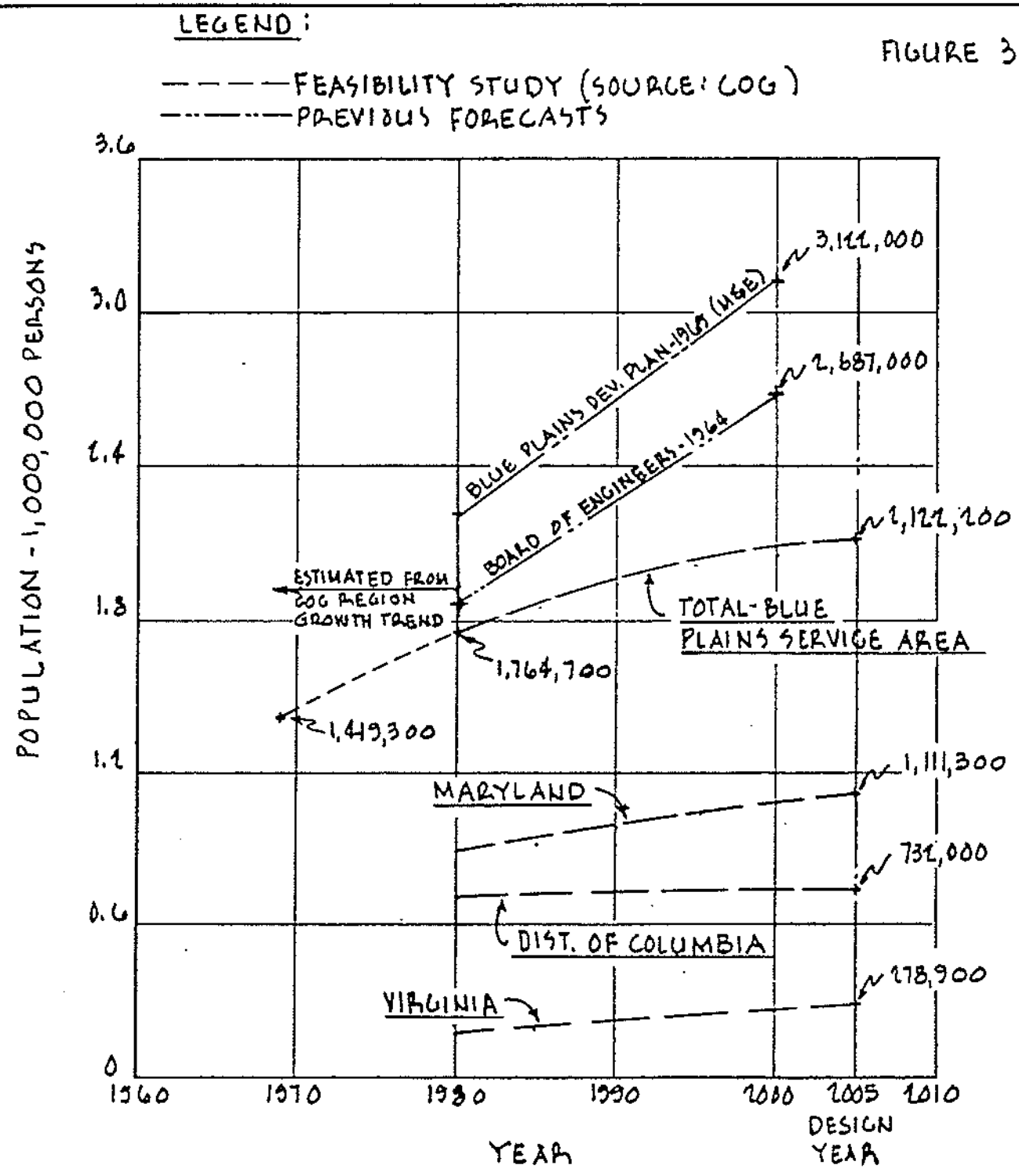
LEGEND:

FIGURE 3



BLUE PLAINS SERVICE AREA
SEWERED POPULATION FORECASTS

REELEY AND HANSEN GINEERS

TASK STUDY MEMO NO. II-3 PHASE 1

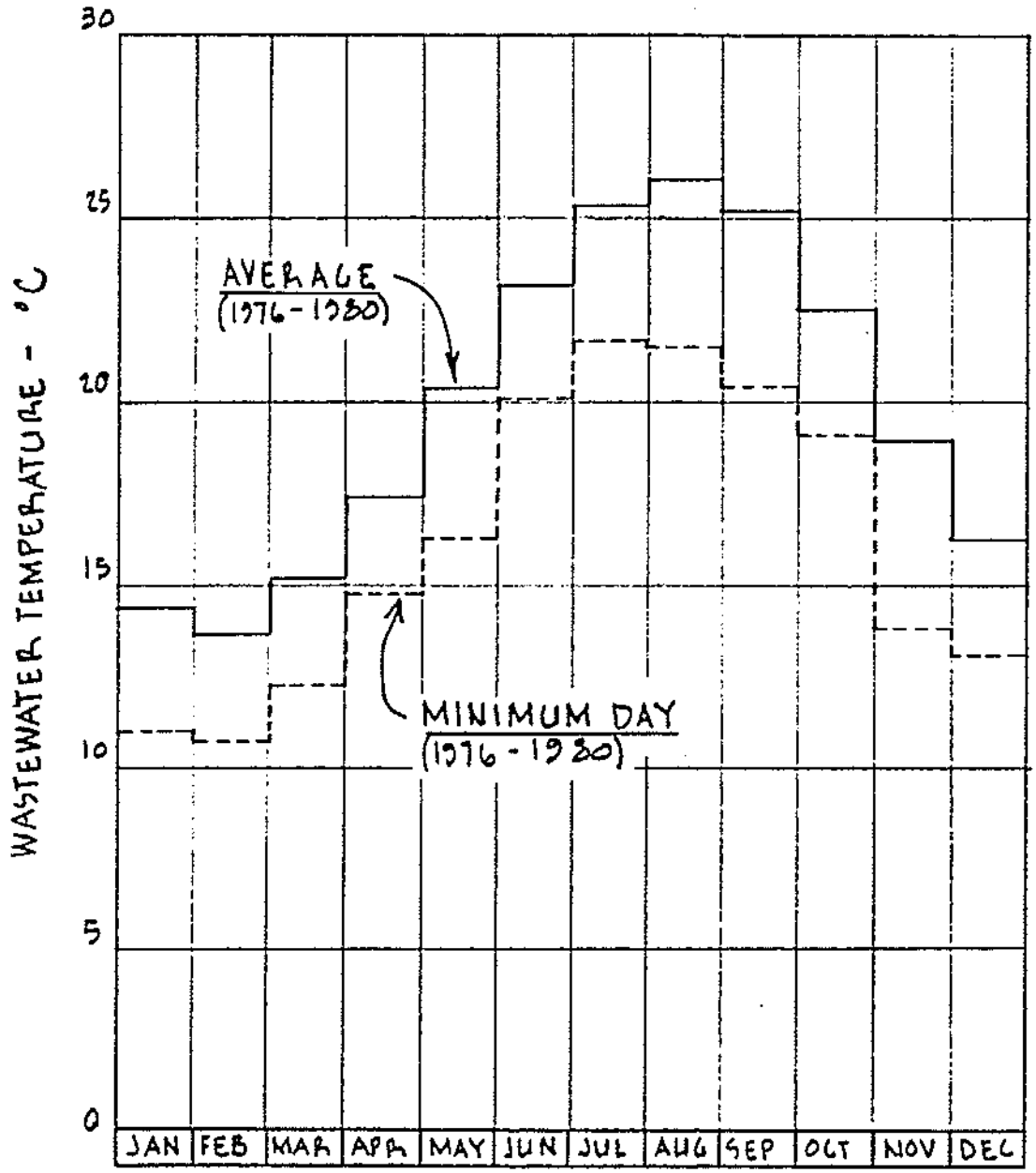
SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

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

GREELEY AND HANSEN ENGINEERS

TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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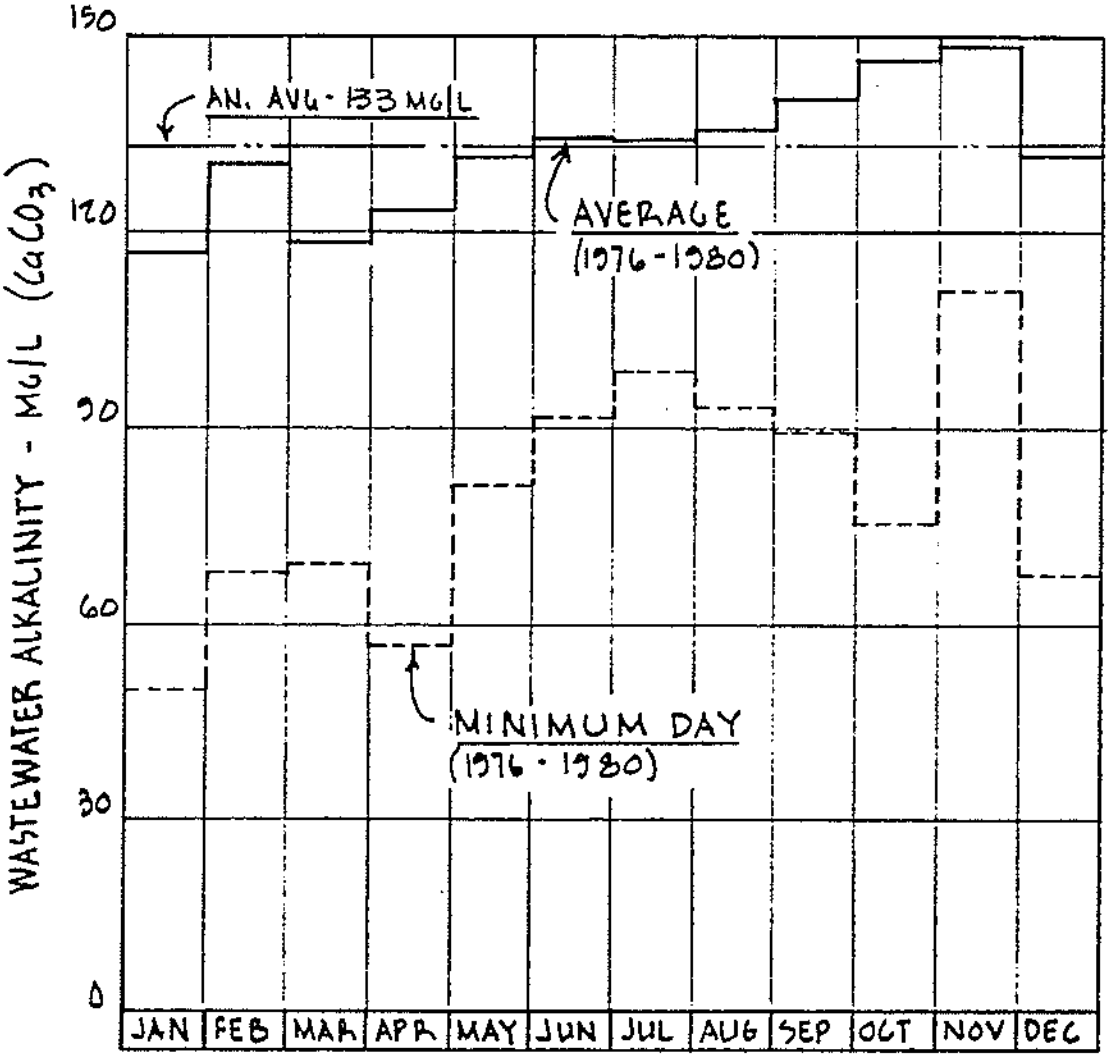
COMP BY REB DATE 4.10.81 CKD BY _____ DATE _____ SHEET _____ OF _____

FIGURE 5



BLUE PLAINS WWTP
RECORD OF WASTEWATER ALKALINITY

SOURCE: BPWWTP RECORDS

GREELEY AND HANSEN ENGINEERS

TASK STUDY MEMO I-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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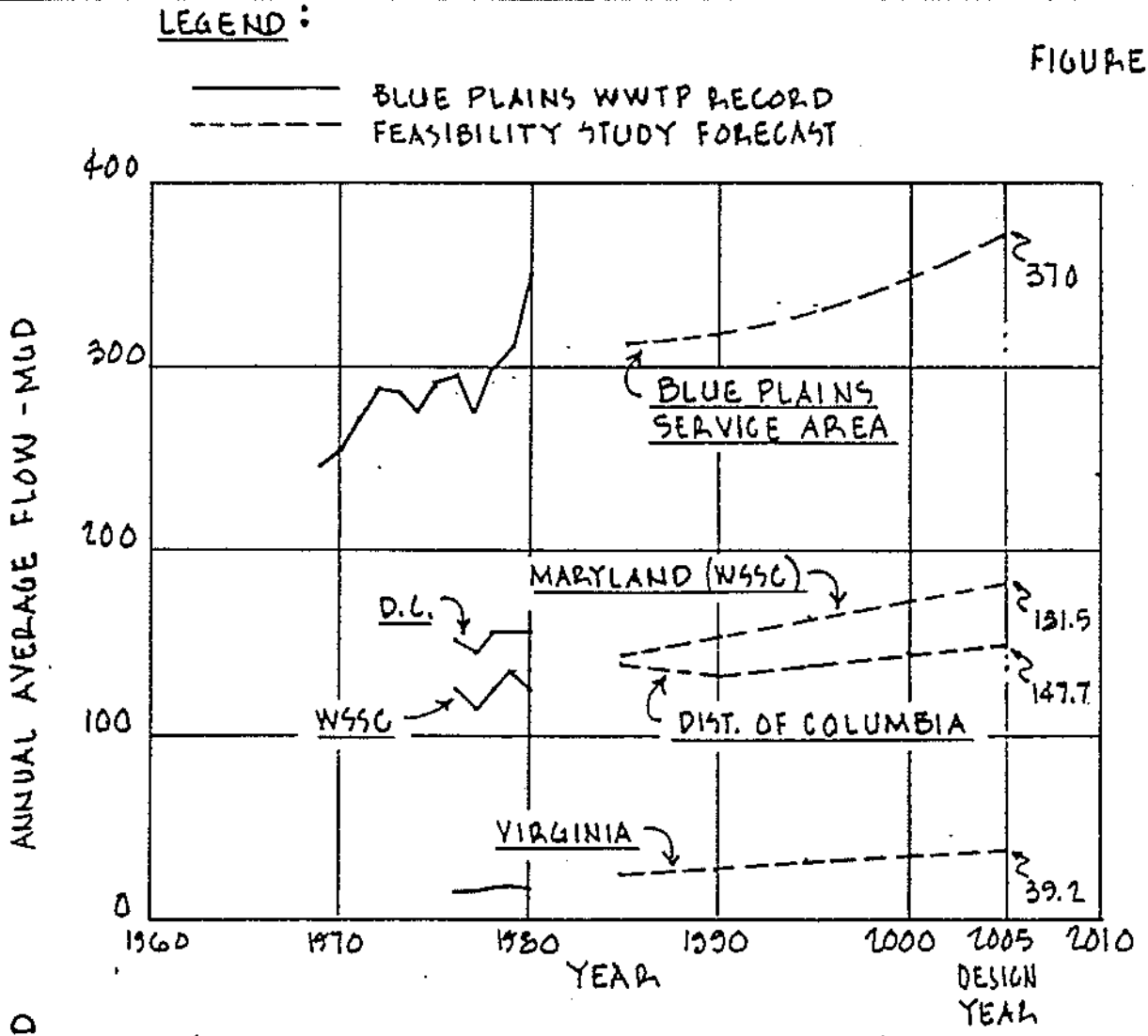
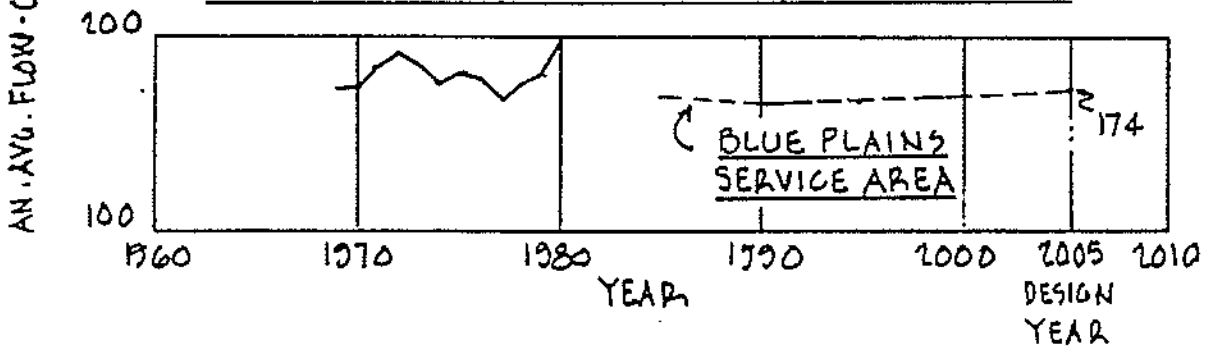
COMP BY REB DATE 4.10.82 CKD BY _____ DATE _____ SHEET _____ OF _____

FIGURE 6



ANNUAL AVERAGE WASTEWATER QUANTITY - MGD



ANNUAL AVERAGE WASTEWATER QUANTITY - GCD

BLUE PLAINS WWTP
RECORD AND FORECAST
ANNUAL AVERAGE
WASTEWATER QUANTITIES

GREELEY AND HANSEN ENGINEERS

TASK STUDY MEMO II-3 PHASE 1

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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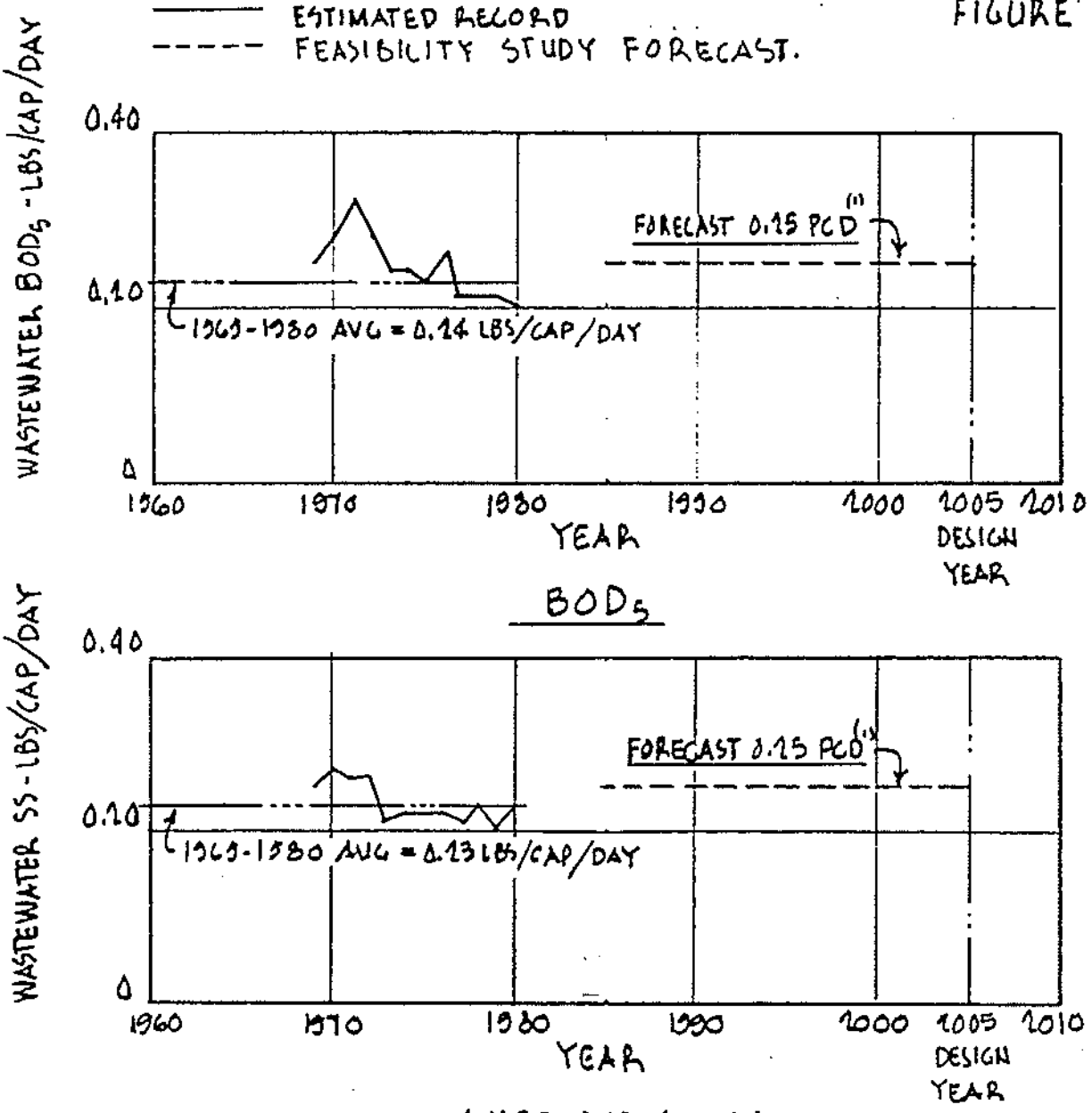
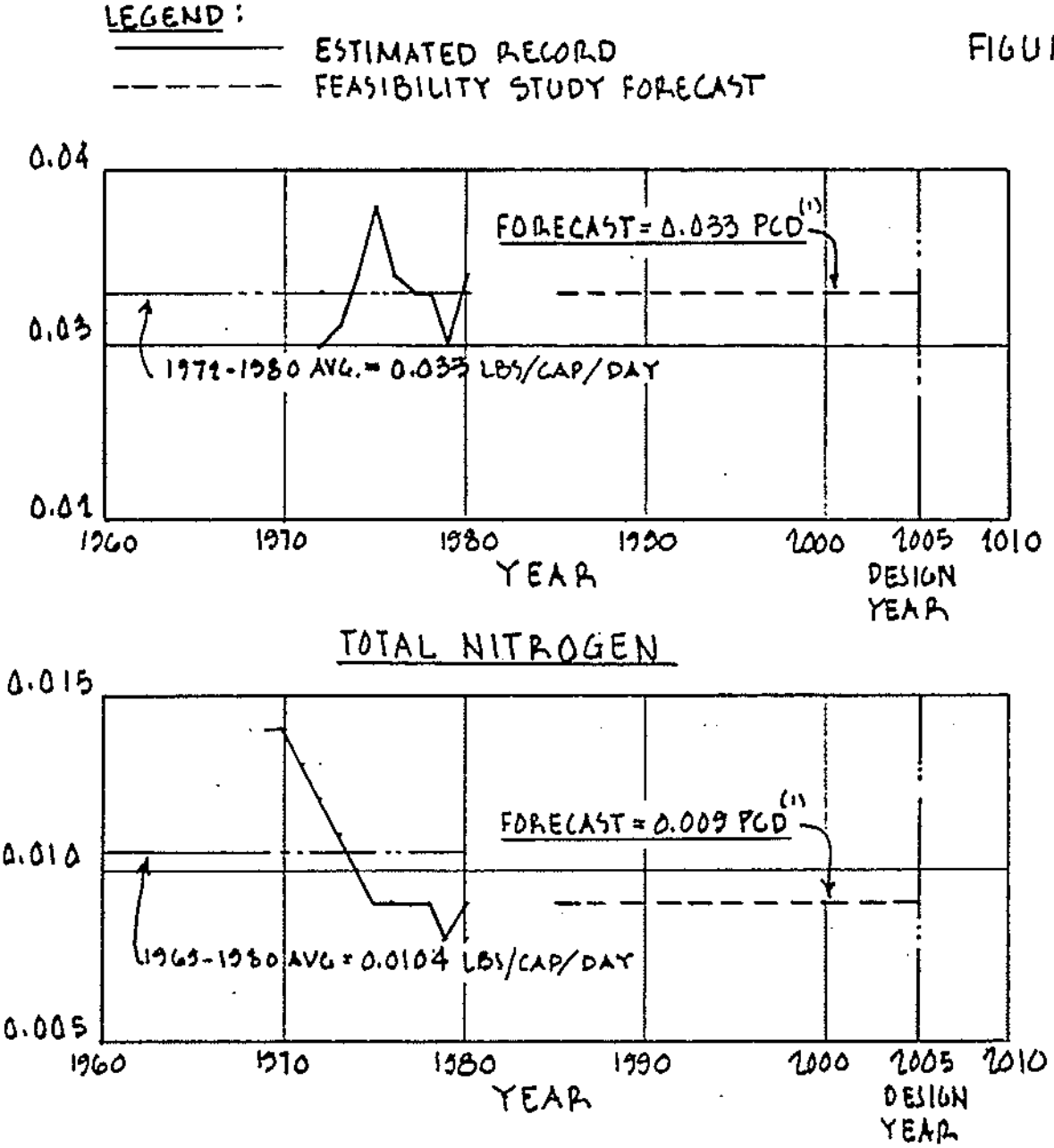
FIGURE 7



BLUE PLAINS WWTP
ESTIMATED RECORD AND FORECAST
ANNUAL AVERAGE PER CAPITA
BOD_5 AND SUSPENDED SOLIDS

(1) PCD - POUNDS/CAPITA/DAY

FIGURE B



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

(1) PCD - POUNDS/CAPITA/DAY

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TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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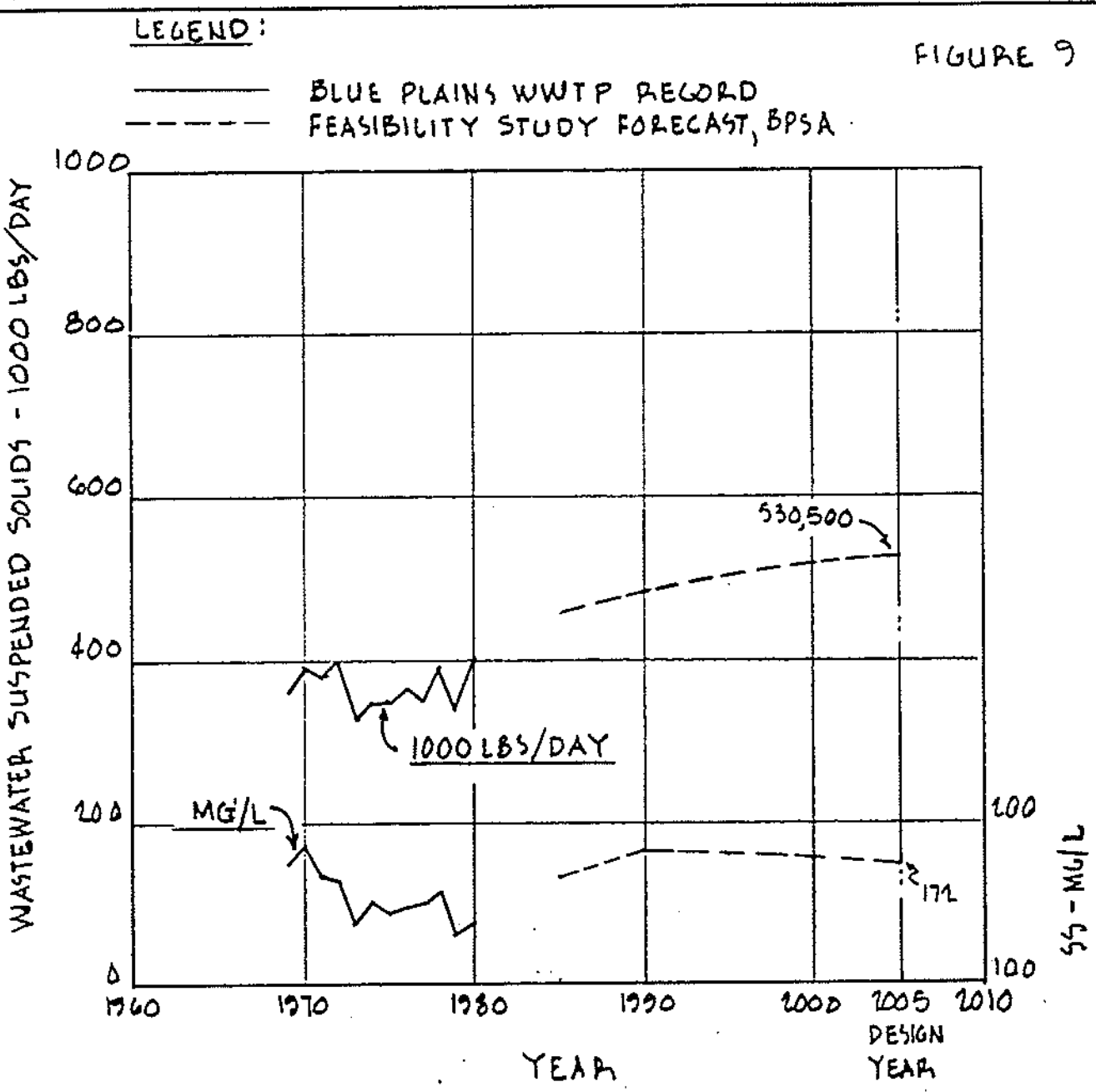
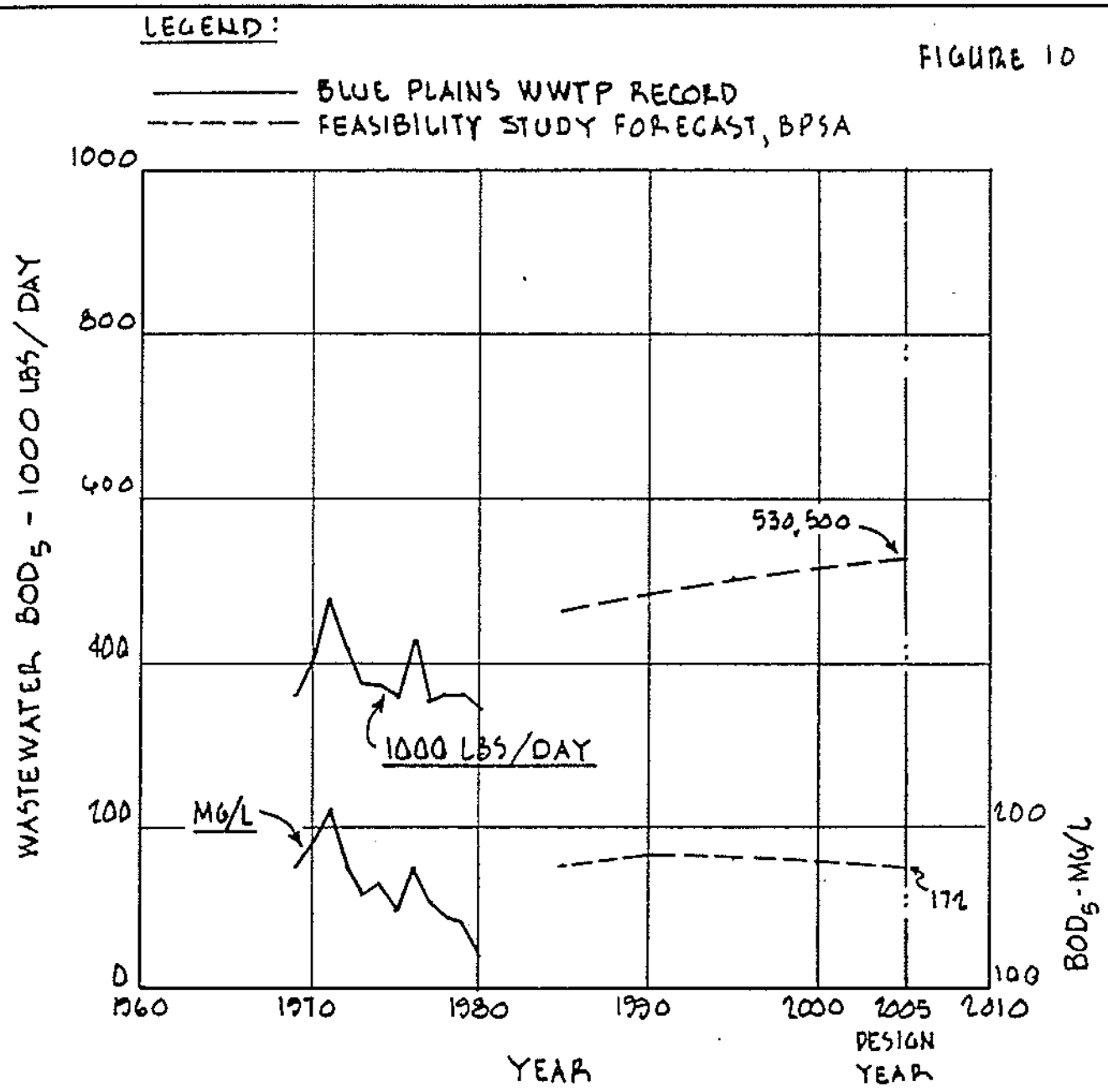
FIGURE 9



BLUE PLAINS WWTP
RECORD AND FORECAST
ANNUAL AVERAGE
SUSPENDED SOLIDS

RECORD SLUDGE: BLUE PLAINS WWTP

FIGURE 10

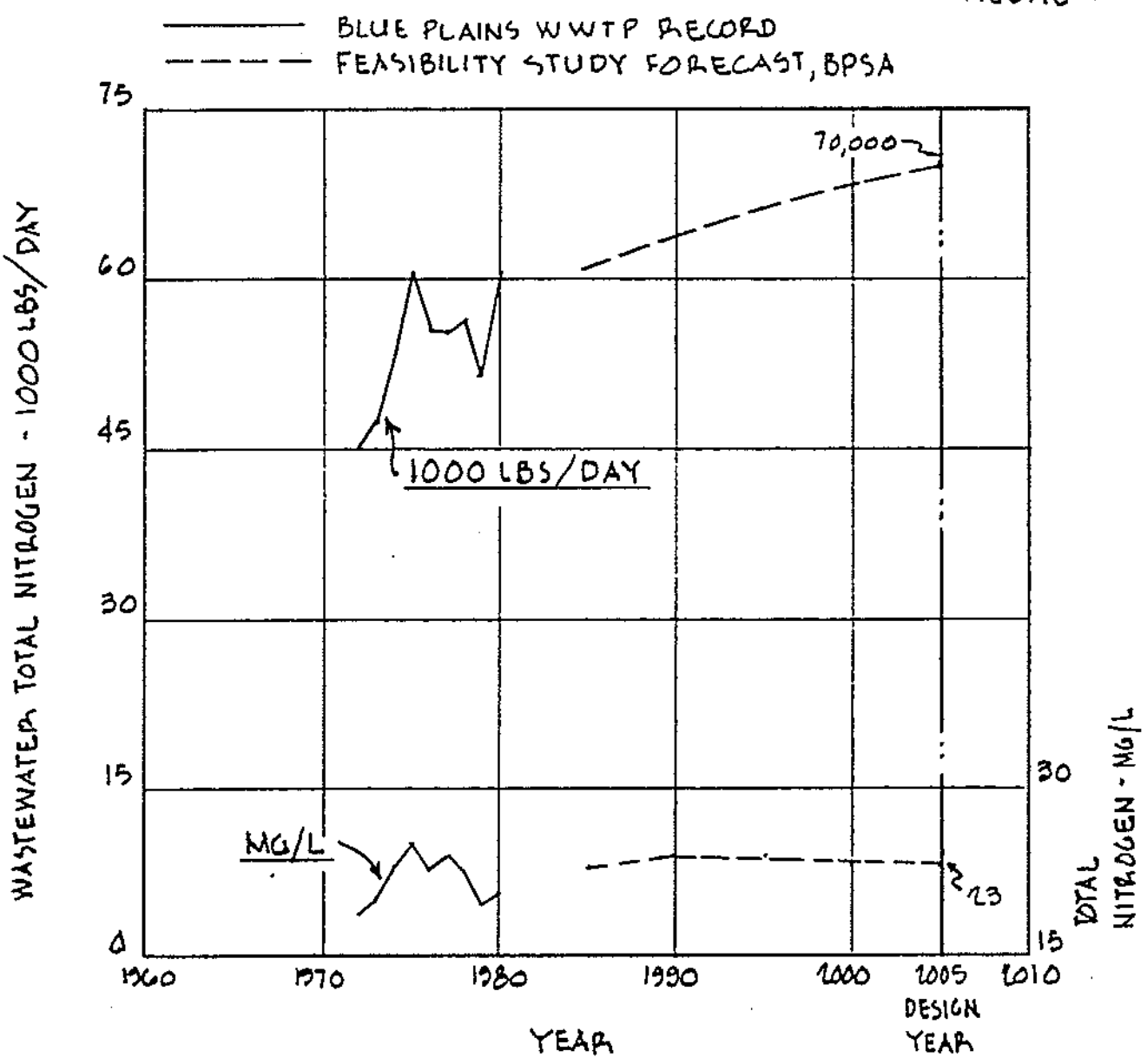


BLUE PLAINS WWTP
RECORD AND FORECAST
ANNUAL AVERAGE BOD_5

RECORD SOURCE: BLUE PLAINS WWTP

LEGEND:

FIGURE 11

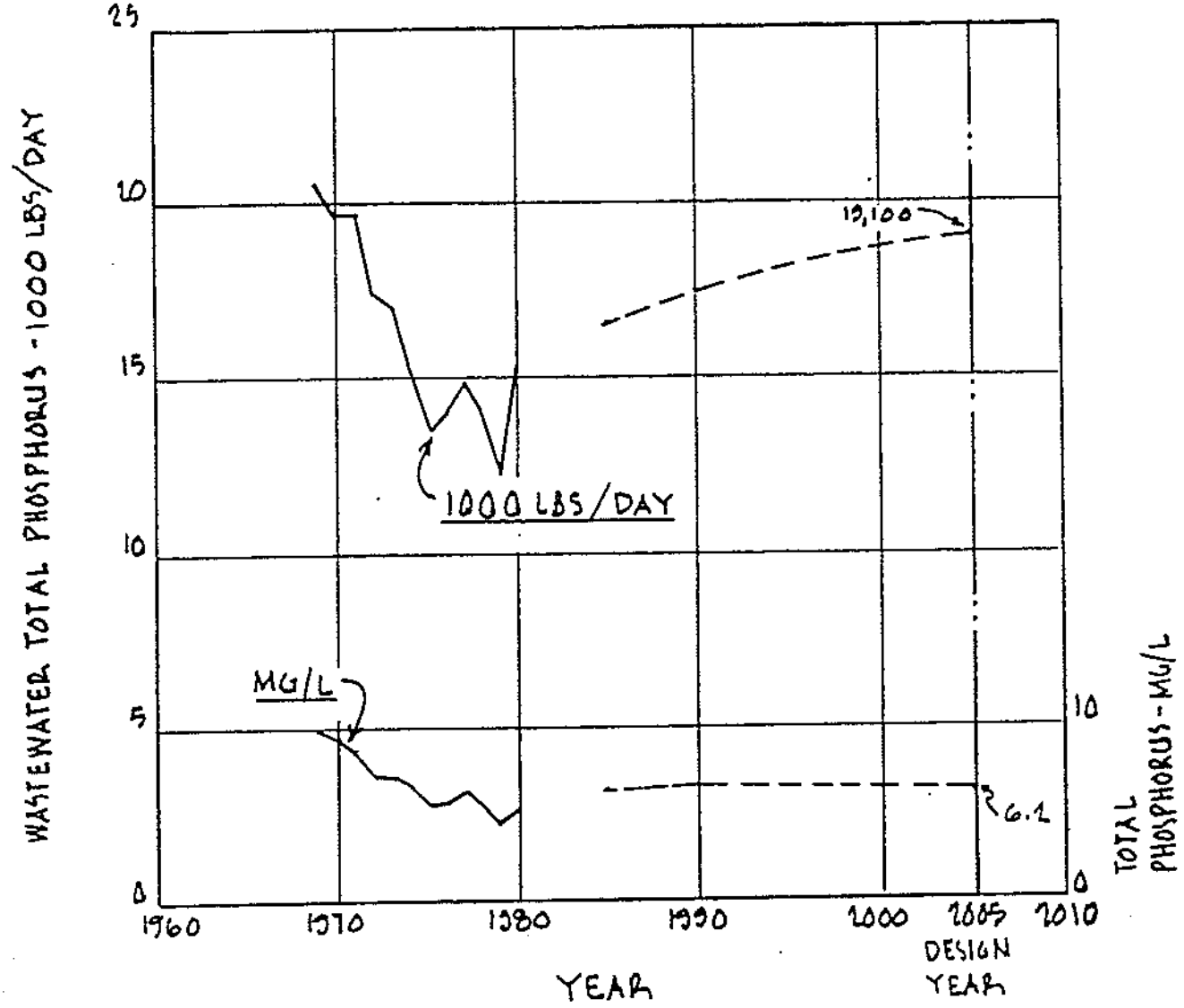


BLUE PLAINS WWTP
RECORD AND FORECAST
ANNUAL AVERAGE
TOTAL NITROGEN

RECORD SOURCE: BLUE PLAINS WWTP

LEGEND:

FIGURE 12



BLUE PLAINS WWTP
RECORD AND FORECAST
ANNUAL AVERAGE
TOTAL PHOSPHORUS

RECORD SOURCE: BLUE PLAINS WWTP

EELEY
AND
ANSEN
GINEERS

TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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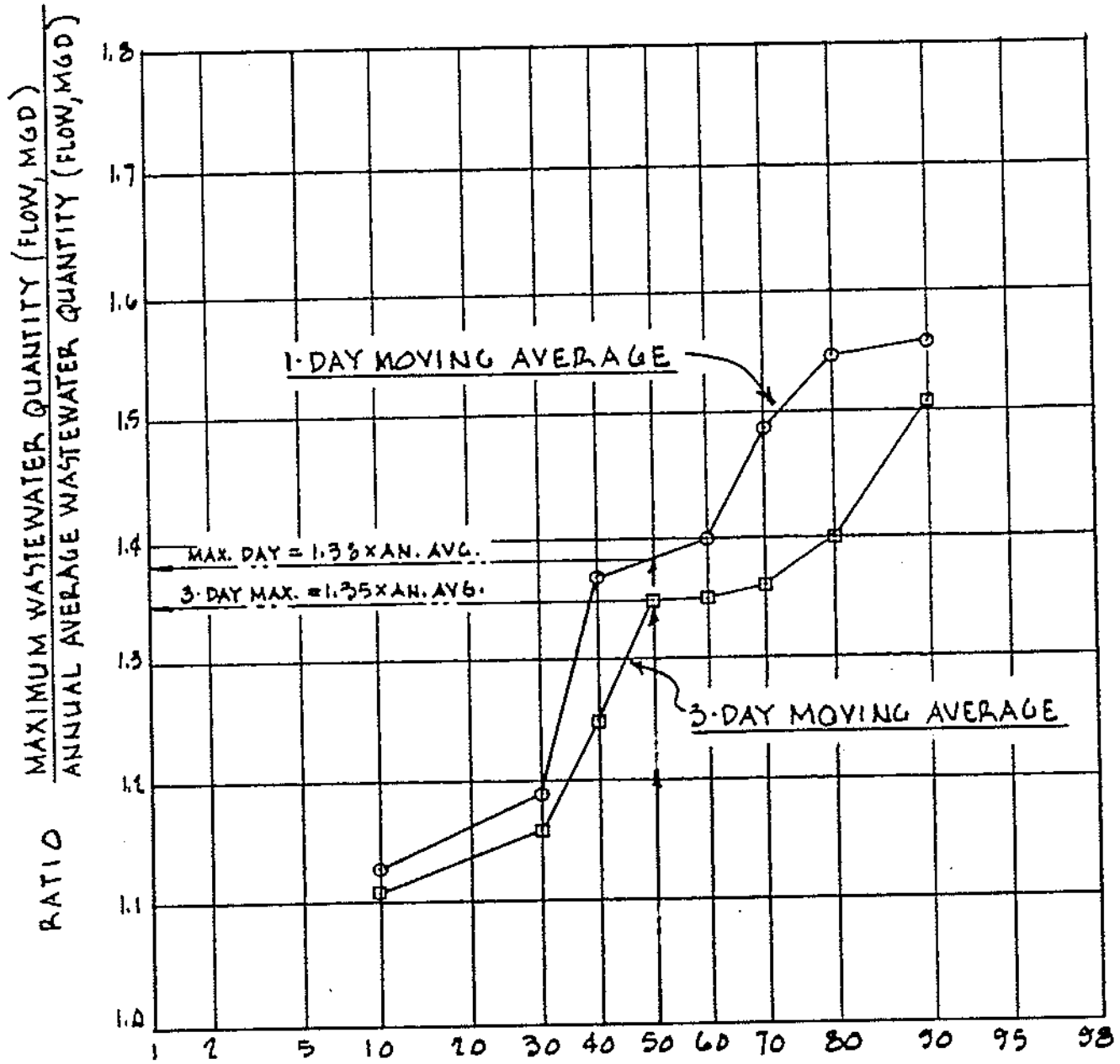
FIGURE 13

BLUE PLAINS WWTP
WASTEWATER FLOW VARIATIONS



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
GINEERS

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SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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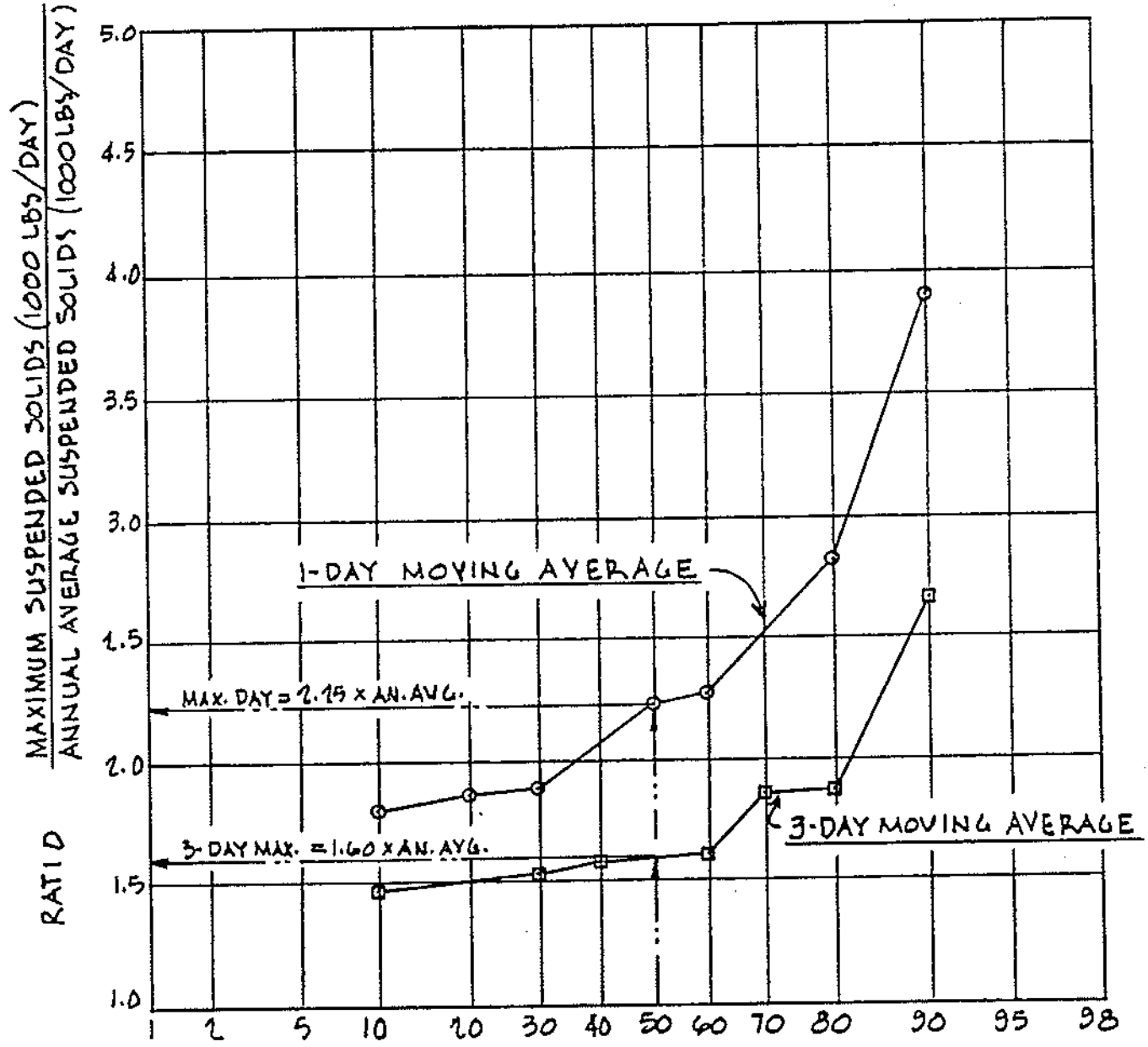
BLUE PLAINS WWTP
SUSPENDED SOLIDS VARIATIONS

FIGURE 14



OCCURANCE - 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)

EELEY
AND
NSEN
INEERS

TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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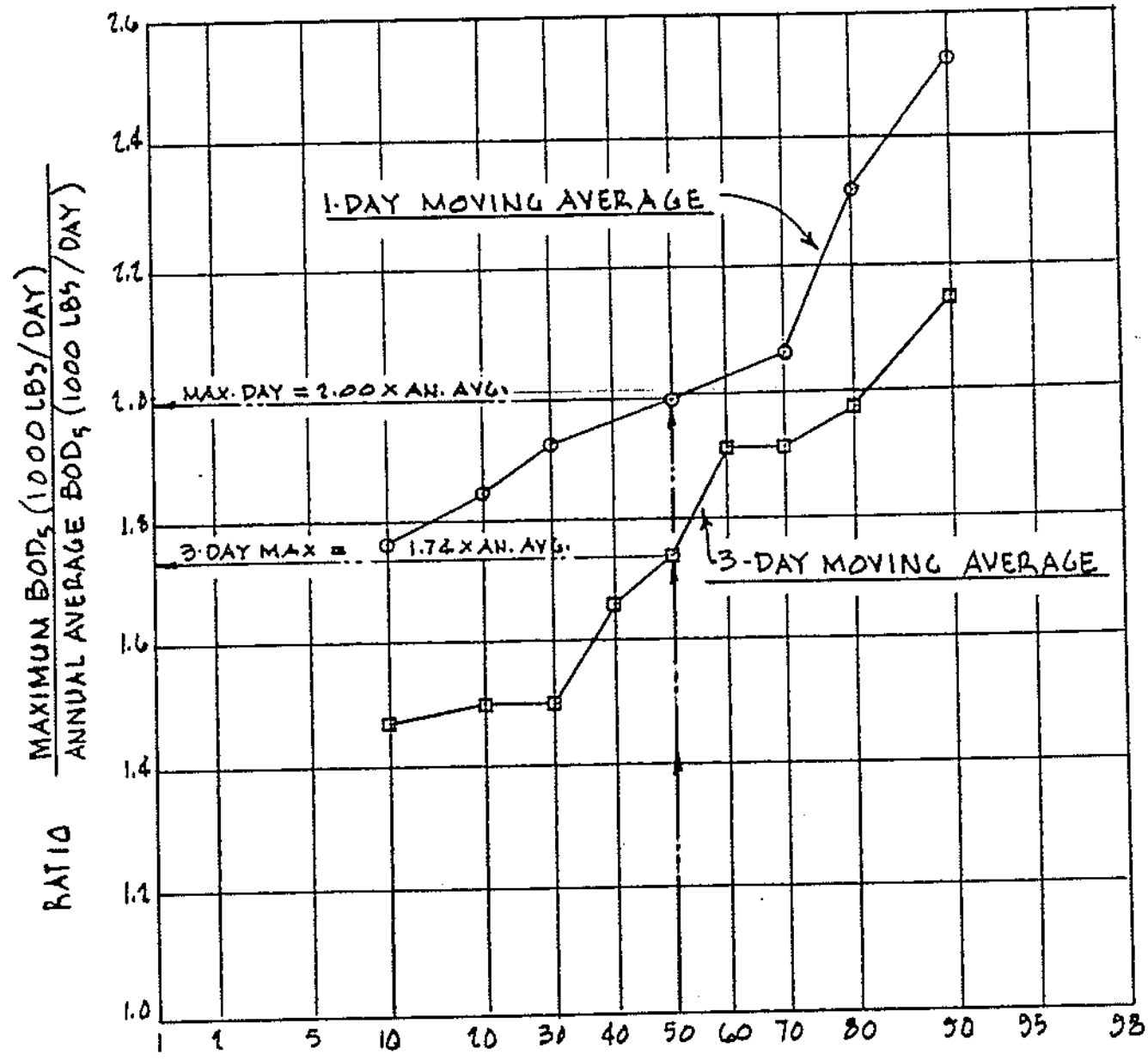
BLUE PLAINS WWTP BOD_5 VARIATIONS

FIGURE 15



OCCURANCE - PERCENT OF TIME RATIO OF MAXIMUM BOD_5 QUANTITY TO ANNUAL AVERAGE BOD_5 QUANTITY IS LESS THAN OR EQUAL TO INDICATED RATIO

RECORD SOURCE: BPNWTP (1972-1980 WASTEWATER DATA)

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DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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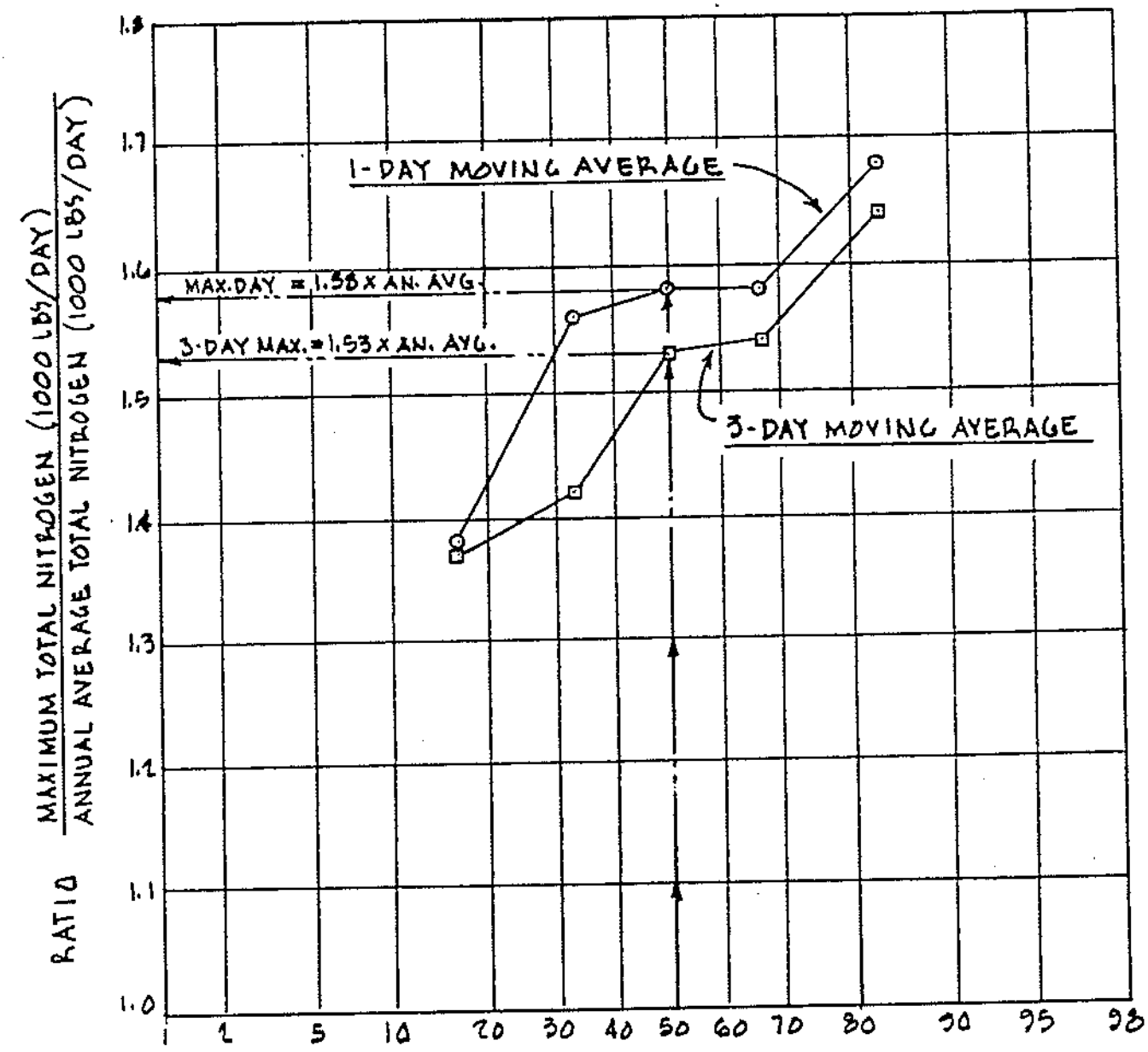
FIGURE 16

BLUE PLAINS WWTP
TOTAL NITROGEN VARIATIONS



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)

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SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

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BLUE PLAINS FEASIBILITY STUDY

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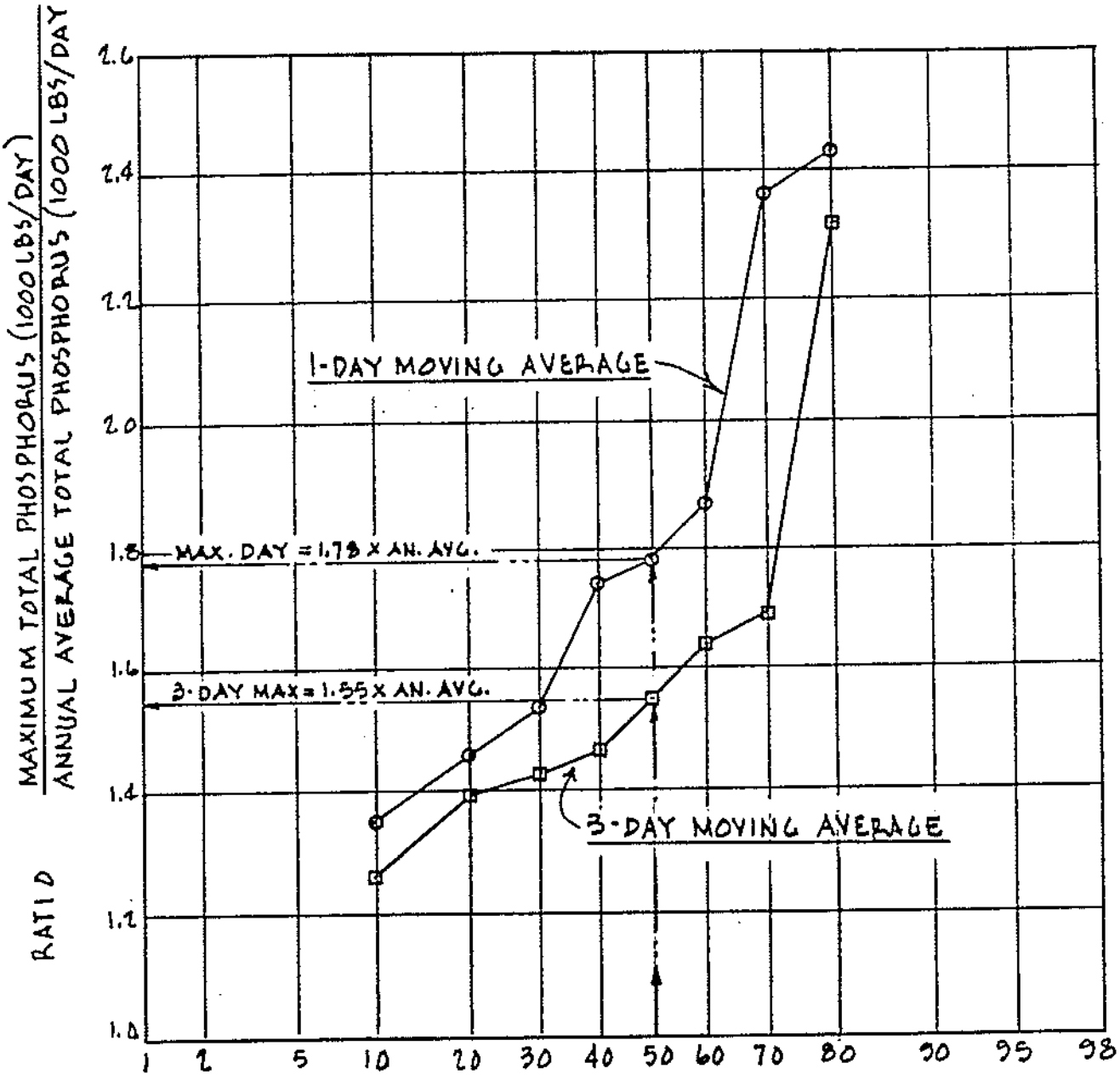
FIGURE 17

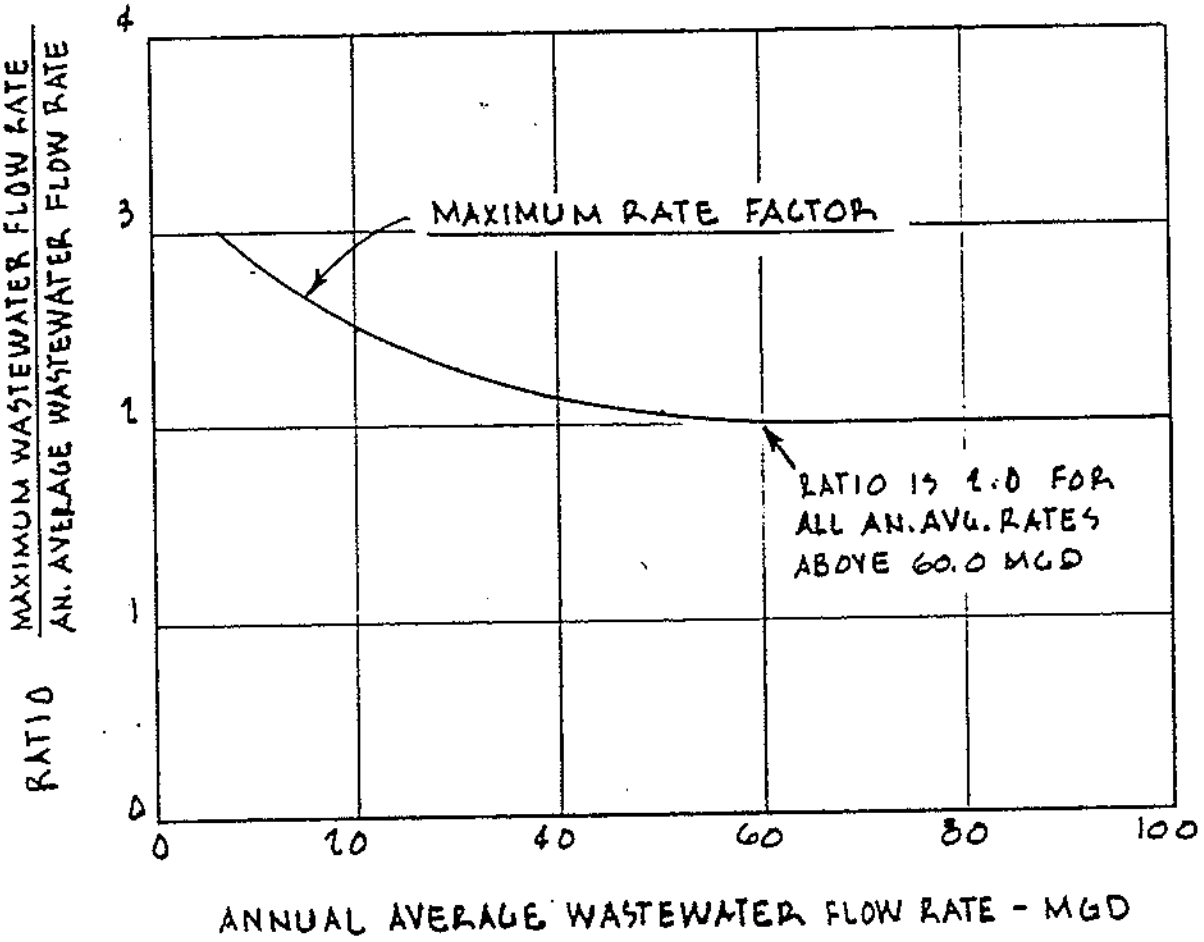
BLUE PLAINS WWTP
TOTAL PHOSPHORUS VARIATIONS



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: BPWWTP (1976-1980 WASTEWATER DATA)

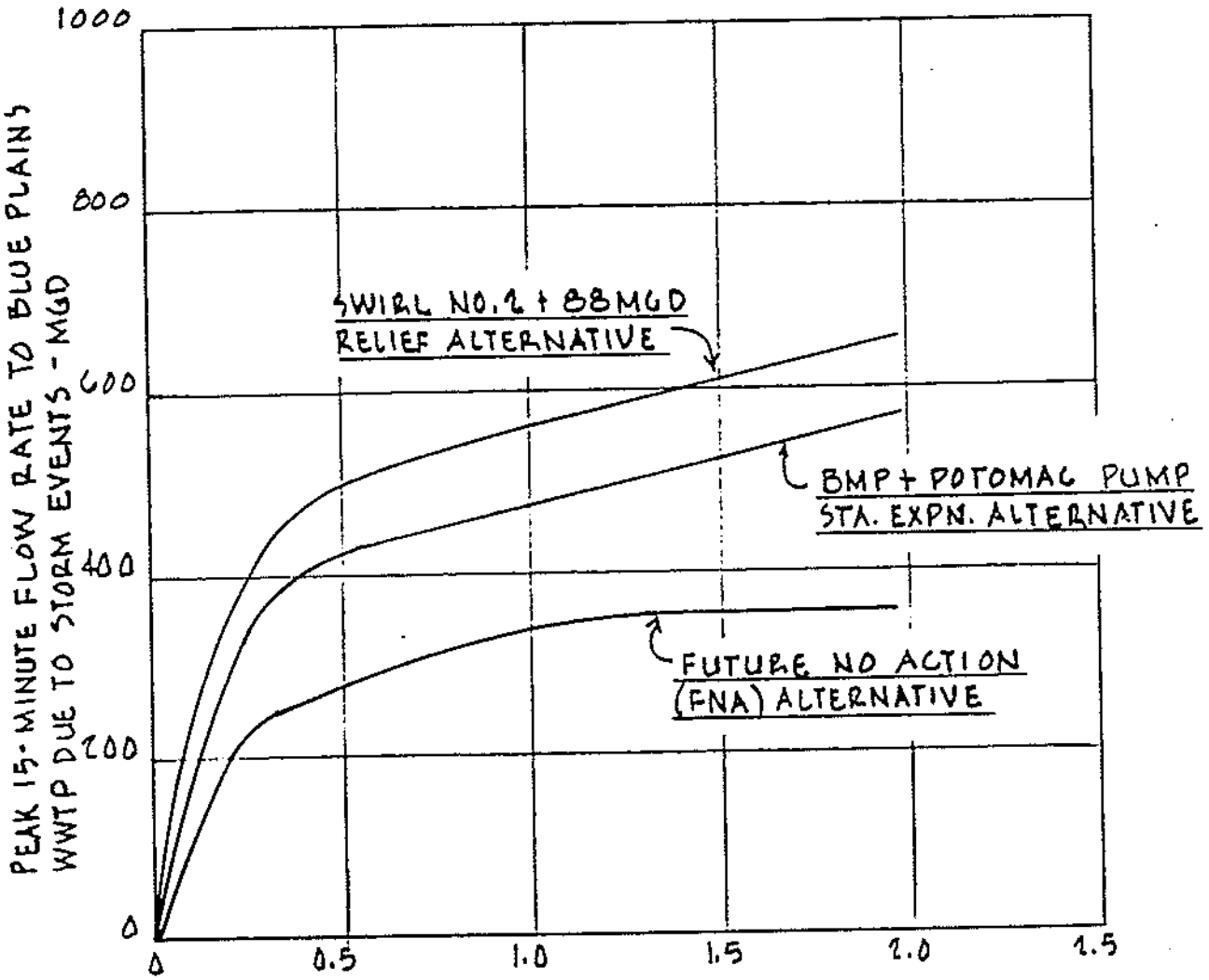
FIGURE 18



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

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

FIGURE 19

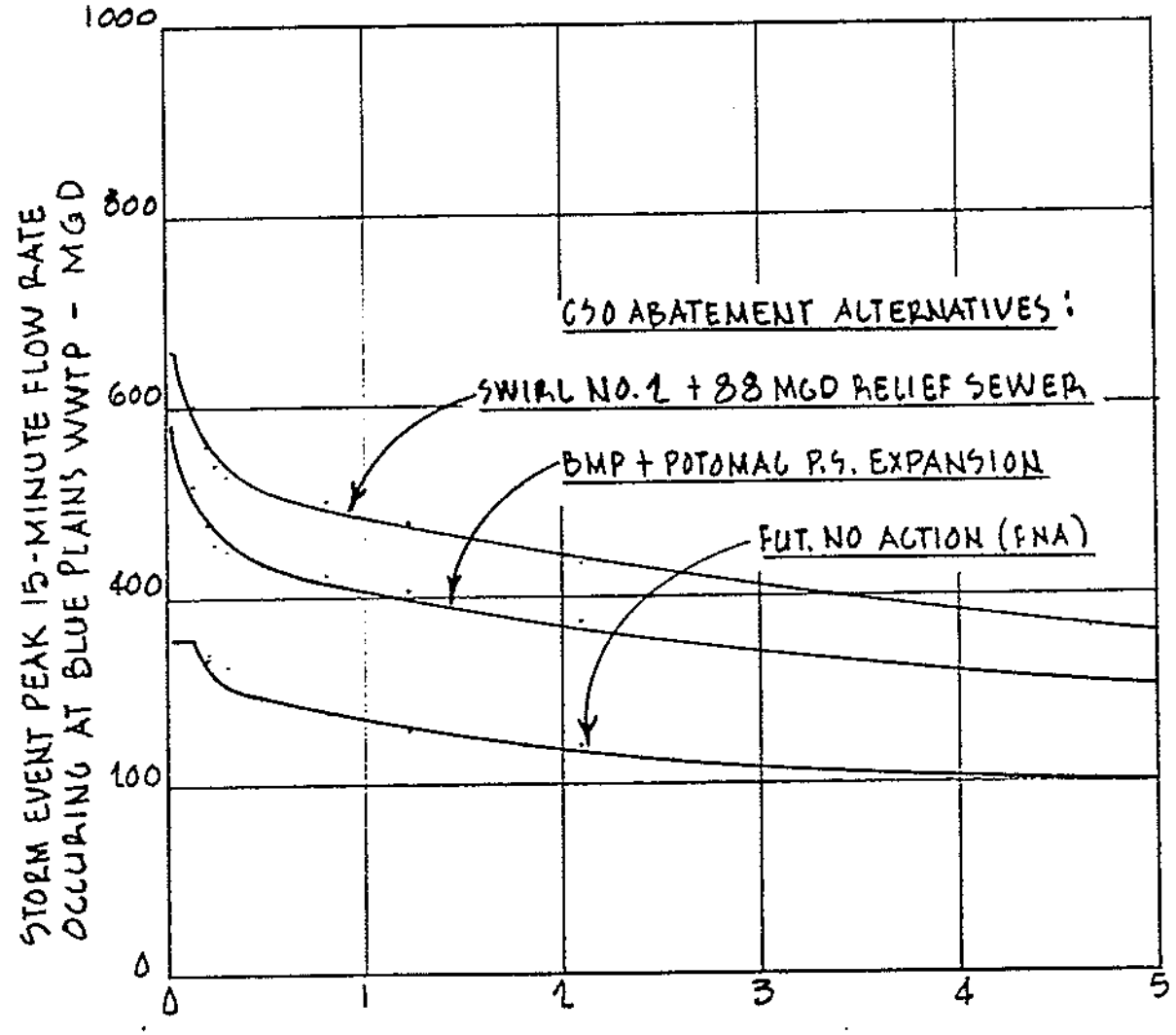


BLUE PLAINS WWTP
PEAK FLOW RATES DUE TO
STORM EVENTS BASED ON
3-CSO ALTERNATIVES

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

FIGURE 20

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



NUMBER OF TOTAL HOURS DURING AVERAGE YEAR DURING WHICH PEAK FLOW RATE DUE TO STORM EVENT WILL OCCUR AT BLUE PLAINS WWTP UNDER VARIOUS C50 ABATEMENT ALTERNATIVES

SOURCE: D.C. COMBINED OVERFLOW STUDY

TASK STUDY MEMO II-3 PHASE I

SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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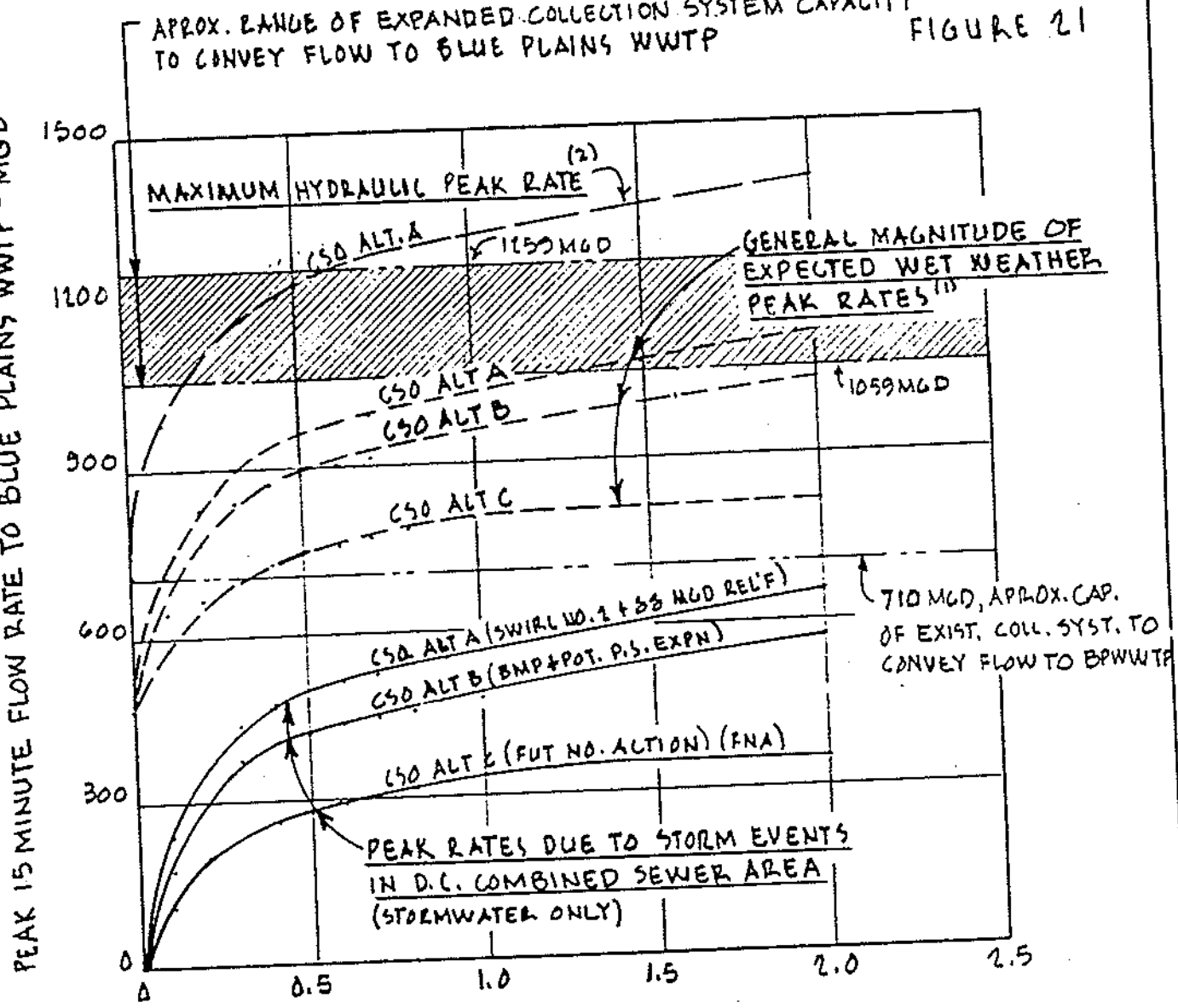
FIGURE 21



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) + (2.00 X YR. 1005 AN. AVG. WASTEWATER FLOW, BPSA)

APPENDIX A

COG 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 -

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

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 sewered 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 wastwater 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 sewersheds, 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 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 sewge 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. Sewersned 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 vaid 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, ail 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 Sewage 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 Sewage Systems Service Area Infiltration/Inflow Analysis," 1975.

12. WSSC, "Lower Rock Creek Sewage 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. CH2M&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, ITEM 5, PHASE I

SUBJECT R&T "I-M" ESTIMATED EMPLOYMENT TRIBUTARY TO BLUE PLAINS WWTP

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BST DATE CKD BY DATE SHEET 1 OF 6

TABLE A

YEAR 1980 JURISDICTION	DRAINAGE BASIN ANA-COSTIA	BEAVER DAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGAR LAND RUN	WATTS BRANCH	TOTAL
District of Columbia	320,776					11,501		11,342		16,579	283,784						644,000
Montgomery County	71,099			33,410		14,733	89			596	119,029	2,253		17,863		10,303	269,375
Prince George's County	106,075	24,430						29,251									161,756
Fairfax County			2,779		14,672				19,133				9829		2,269		48,682
Arlington County									2,521								2,521
Loudoun County			8655														8,655
TOTAL	497,950	24,430	11,434	33,410	14,672	26,234	89	40,593	21,654	17,193	401,813	2,253	9829	17,863	2,269	10,303	1,134,896

GHEELEY AND HANSEN ENGINEERS

TASK WA 305-08-17, SCHEDULE A, ITEM 5, PHASE I

SUBJECT RdII "I-M" ESTIMATED EMPLOYMENT TRIBUTARY TO BLUE PLAINS WWTP

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BDT DATE CKD BY DATE SHEET 2 OF 6

TABLE A (CONT.)

YEAR 1985 JURISDICTION	DRAINAGE BASIN																TOTAL
	ANACOSTIA	BEAVER DAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGAR LAND RUN	WATTS BRANCH	
District of Columbia	324,088					11,849		11,890		16,697	298,506						665,000
Montgomery County	78,165			37,295		16,911	101			722	175,968	2,276		22,549		12,226	306,213
Prince George's County	115,912	28,548						30,606									175,066
Fairfax County			4,023		20,654				21,171				12,905		3,063		61,816
Arlington County									2,705								2,705
Loudoun County			12,304														12,304
TOTAL	520,165	28,548	16,327	37,295	20,654	28,730	101	42,496	23,876	17,419	474,474	2,276	12,905	22,549	3,063	12,226	1,223,104

GREELEY AND HANSEN ENGINEERS

TASK WA 305-08-17, SCHEDULE A, ITEM 5, PHASE I

SUBJECT Rd II "I-M" ESTIMATED EMPLOYMENT TRIBUTARY TO BLUE PLAINS WWTP

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BDT DATE ____ CKD BY ____ DATE ____ SHEET 3 OF 6

TABLE A (CONT.)

YEAR 1990 JURISDICTION	DRAINAGE BASIN																TOTAL
	ANA-COSTIA	DEANER DAM CREEK	BEAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGAR LAND RUN	WATTS BRANCH	
District of Columbia	333,132					12,115		12,149		17,038	304,526						679,000
Montgomery County	88,463			111,242		18,733	100			842	153,623	2,298		30,072		15,094	348,717
Prince George's County	134,331	33,928						32,711									196,717
Fairfax County			5,202		24,287				22,665				15,729		3,802		73,675
Arlington County									2,650								2,650
Loudoun County			19,339														19,339
TOTAL	555,926	33,928	24,541	111,242	24,287	30,858	100	44,910	25,305	17,880	458,149	2,298	15,729	30,072	3,802	15,094	1,320,351

GILEELEY AND HANSEN ENGINEERS

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

SUBJECT RdII "I-M" ESTIMATED EMPLOYMENT TRIBUTARY TO BLUE PLAINS WWTP

DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BDT DATE CKD BY DATE SHEET 4 OF 6

TABLE A (CONT.)

YEAR 1995	DRAINAGE BASIN																
JURISDICTION	ANACOSTIA	BEAVER DAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGAR LAND RUN	WATTS BRANCH	TOTAL
District of Columbia	341,693					12,149		12,368		17,240	303,550						690,000
Montgomery County	92,358			45,718		29,270	100			853	164,638	2,247		34,623		16,726	379,583
Prince George's County	136,256	36,819						35,424									208,499
Fairfax County			6,481		31,409				24,455				18,827		4,607		86,779
Arlington County									2,477								2,677
Loudoun County			26,620														26,620
TOTAL	513,307	36,819	33,101	45,718	31,409	31,419	100	47,792	27,132	18,093	470,188	2,247	18,827	34,623	4,607	16,726	1,394,158

GREELEY AND HANSEN ENGINEERS

TASK WA 305-08-17, SCHEDULE A, ITEM 5, PHASE I

SUBJECT RDII "I-M" ESTIMATED EMPLOYMENT TRIBUTARY TO BLUE PLAINS WWTP

DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BDT DATE ____ CKD BY ____ DATE ____ SHEET 5 OF 6

TABLE A (CONT.)

YEAR 2000 JURISDICTION	DRAINAGE BASIN																TOTAL
	ANACOSTIA	BEAVER DAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGAR LAND RUN	WATTS BRANCH	
District of Columbia	358,592					12,444		12,818		17,839	309,357						702,000
Montgomery County	101,641			49,661		21,026	100			865	179,504	2,297		41,071		18,466	414,631
Prince George's County	139,683	57,003						37,565									234,251
Fairfax County			7,826		38,785				25,590				21,838		5,416		99,455
Arlington County									2,571								2,571
Loudoun County			35,930														35,930
TOTAL	560,866	57,003	43,756	49,661	38,785	33,470	100	50,383	28,161	18,704	488,861	2,297	21,838	41,071	5,416	18,466	1,488,838

GREELEY AND HANSEN ENGINEERS

TASK WA 305-08-17, SCHEDULE A, ITEM 5, PHASE I

SUBJECT Rd II "I-M" ESTIMATED EMPLOYMENT TRIBUTARY TO BLUE PLAINS WWTP

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BDT DATE ____ CKD BY ____ DATE ____ SHEET 6 OF 6

TABLE A (CONT.)

YEAR 2005 JURISDICTION	DRAINAGE BASIN																TOTAL
	ANACOSTIA	BEAVER DAM CREEK	BEAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGAR LAND RUN	WATTS BRANCH	
District of Columbia	352,143					12,739		13,268		18,438	35,112						712,000
Montgomery County	110,924			53,604		21,782	100			877	142,370	2,297		47,519		20,610	450,083
Prince George's County	142,922	77,187						39,716									259,325
Fairfax County			9171		45,161				24,707				24,849		6,225		112,113
Arlington County									2,438								2,438
Loudoun County			43,251														43,251
TOTAL	605,789	77,187	52,422	53,604	45,161	34,521	100	52,984	29,145	19,315	503,482	2,297	24,849	47,519	6,225	20,610	1,578,560

GREELEY AND HANSEN ENGINEERS

TASK WA 305-08:17, SCHEDULE A, ITEMS 5,... PHASE I

SUBJECT Rd II "I-M" ESTIMATED HOUSEHOLDS TRIBUTARY TO BLUE PLAINS WWTP

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BDT DATE ____ CKD BY ____ DATE ____ SHEET 1 OF 6

TABLE B

YEAR 1980	DRAINAGE BASIN																
JURISDICTION	ANACOSTIA	BEAVER DAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGAR LAND RUN	WATTS BRANCH	TOTAL
District of Columbia	176,350					4590		16,215		14,164	107,811						272,000
Montgomery County	63,978			21,427		13,643	261			436	67,704	1153		17,454		4218	192,274
Prince George's County	80,133	24,348						29,713									134,144
Fairfax County			2,713		18,713				12,024				4592		4,062		42,104
Arlington County									5105								5,105
Loudoun County			9,056														9,055
TOTAL	270,501	24,348	11,768	21,427	18,713	18,033	261	48,928	17,129	14,600	175,515	1,153	4,592	17,454	4,062	4,218	654,682

GREELEY AND HANSEN ENGINEERS

TASK WA 305-08-17, SCHEDULE A, ITEM 5; PHASE I

SUBJECT Rd II "I-M" ESTIMATED HOUSEHOLDS TRIBUTARY TO BLUE PLAINS WWTP

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BDT DATE CKD BY DATE SHEET 5 OF 6

TABLE B (CONT.)

YEAR 2000 JURISDICTION	DRAINAGE BASIN																TOTAL
	ANACOSTIA	BEAVERDAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGARLAND RUN	WATTS BRANCH	
District of Columbia	142,538					5,989		20,826		17,176	112,431						299,000
Montgomery County	86,031			26,519		15,626	463			982	86,231	1,835		35,206		9,143	262,047
Prince George's County	88,769	30,472						36,438									155,679
Fairfax County			6,242		26,472				15,750				5,389		7,388		61,241
Arlington County									5,313								5,313
Loudoun County			25,740														25,740
TOTAL	317,386	30,472	31,985	26,519	26,472	21,615	463	57,264	21,063	18,158	198,662	1835	5,389	35,206	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 WWTP

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY BDT DATE CKD BY DATE SHEET 6 OF 6

TABLE B (CONT.)

YEAR 2005	DRAINAGE BASIN																
JURISDICTION	ANACOSTIA	BEAVER DAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGAR LAND RUN	WATTS BRANCH	TOTAL
District of Columbia	104,784					6,049		21,159		12,327	113,681						383,000
Montgomery County	90,345			27,303		15,907	511			1,084	88,858	1090		38,838		9530	274,264
Prince George's County	91,023	32,228						37908									161,159
Fairfax County			4803		28,603				17,065				5586		8277		66,334
Arlington County									5,344								5,344
Loudoun County			29,002														29,002
TOTAL	326,152	32,228	35,805	27,303	28,603	21,956	511	59,067	22,409	18,411	202,539	1090	5586	38,838	8,277	9530	839,103

GREELEY AND HANSEN ENGINEERS

TASK WA 305-08-17, SCHEDULE 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 X1000	FLOW MGD	VISITORS/YEAR X1000	FLOW MGD	VISITORS/YEAR X1000	FLOW MGD	VISITORS/YEAR X1000	FLOW MGD	VISITORS/YEAR X1000	FLOW MGD	VISITORS/YEAR X1000	FLOW MGD
OVERNIGHT – FRIENDS, RELATIVES & PLEASURE FLOW = VISITORS/YR / 365 X 1.03 lb/cap/day X 90 gpcpd	4,135	2.070	5,189	0.597	6,589	3.290	8,533	4.271	11,355	5.684	15,613	7.815
OVERNIGHT – BUSINESS & CONVENTION FLOW = VISITORS/YR / 365 X 2.7 lb/cap/day X 90 gpcpd	2,622	1.746	3,209	2.136	3,959	2.636	4,921	3.276	6,157	4.099	7,747	5.158
DAYTIME FLOW = VISITORS/YR / 365 X 1.5 lb/cap/day X 15 gpcpd	3,447	0.212	3,757	0.232	4,040	0.249	4,250	0.262	4,409	0.272	4,453	0.275
TOTAL	10,204	4.028	12,155	4.965	14,588	6.103	17,704	7.809	21,921	10.055	27,813	13.248

GREELEY 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 BDT DATE ____ CKD BY ____ DATE ____ SHEET 1 OF 6

TABLE D

YEAR 1980 JURISDICTION	DRAINAGE BASIN: ANACOSTIA	BEAVER DAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SEVEN CREEK	SUGARLAND RUN	WATTS BRANCH	TOTAL
District of Columbia	33.516 / 10.303					1.931 / 0.333		11.931 / 1.311		2.315 / 0.490	13.516 / 7.243						64.490 / 19.760
Montgomery County	13.983 / 2.013			5.990 / 2.639		5.165 / 0.855	0.195 / 0.031			0.121 / 0.027	11.935 / 5.962	0.331 / 0.111		3.835 / 1.712		1.691 / 0.183	44.246 / 13.910
Prince George's County	17.417 / 5.241	5.133 / 1.936						6.189 / 1.695									28.471 / 8.872
Fairfax County			0.500 / 0.004		4.523 / 0.640				2.619 / 0.453				0.936 / 0.241		0.927 / 0.511		9.505 / 2.214
Arlington County									0.260 / 0.076								0.380 / 0.080
Loudoun County			2.288 / 0.241														2.288 / 0.241
TOTAL	64.916 / 18.591	5.133 / 1.936	2.788 / 0.259	5.990 / 2.639	4.523 / 0.640	7.096 / 1.195	0.195 / 0.036	18.120 / 3.041	2.879 / 0.529	2.436 / 0.517	25.451 / 13.111	0.331 / 0.111	0.936 / 0.241	3.835 / 1.712	0.927 / 0.511	1.691 / 0.183	150.316 / 44.669

DOMESTIC (MGD) / EMPLOYMENT (MGD)

GREELEY 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 BST DATE ____ CKD BY ____ DATE ____ SHEET 2 OF 6

TABLE D (CONT.)

YEAR 1985

JURISDICTION	DRAINAGE BASIN																TOTAL
	ANACOSTIA	BEAVER DAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PINEY RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SEVEN CREEK	SUGARLAND RUN	WATTS BRANCH	
District of Columbia	15.333 / 9.681					1.331 / 0.342		11.451 / 1.353		2.588 / 0.993	13.686 / 7.638						67.799 / 19.514
Montgomery County	15.020 / 5.331			6.628 / 3.005		3.319 / 0.991	0.372 / 0.013			0.167 / 0.037	15.168 / 6.731	0.114 / 0.112		1.807 / 0.161		1.810 / 0.318	48.303 / 15.510
Prince George's County	17.911 / 5.411	5.345 / 2.083						6.585 / 1.776									29.841 / 9.525
Fairfax County			0.690 / 0.012		5.201 / 1.265				2.932 / 0.507				1.000 / 0.310		1.077 / 0.795		10.704 / 2.959
Arlington County									0.900 / 0.101								0.900 / 0.104
Loudoun County			3.165 / 0.356														3.165 / 0.356
TOTAL	54.659 / 25.511	5.345 / 2.083	3.855 / 0.368	6.628 / 3.005	5.201 / 1.265	4.650 / 1.331	0.372 / 0.013	18.036 / 3.133	3.832 / 0.611	2.755 / 0.537	28.854 / 14.372	0.114 / 0.112	1.000 / 0.310	1.807 / 0.161	1.077 / 0.795	1.810 / 0.318	161.011 / 47.946

DOMESTIC (M&D) / (M&D) EMPLOYMENT

GREELEY 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 BAT DATE ____ CKD BY ____ DATE ____ SHEET 3 OF 6

TABLE D (CONT.)

YEAR 1990

DRAINAGE BASIN

JURISDICTION	ANACOSTIA	BEAVERDAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SEVEN CREEK	SOUTHWEST LAND RUN	WATTS BRANCH	TOTAL
District of Columbia	30.362 / 1.902					1.338 / 0.351		11.590 / 1.106		2.096 / 0.503	11.797 / 7.972						68.833 / 19.934
Montgomery County	16.098 / 5.453			6.877 / 5.147		5.438 / 1.021	0.531 / 0.013			0.196 / 0.039	13.366 / 7.611	0.997 / 0.113		6.087 / 3.956		2.055 / 0.775	53.926 / 18.460
Prince George's County	18.511 / 6.199	5.975 / 2.157						7.041 / 1.903									31.205 / 10.559
Fairfax County			0.843 / 0.019		3.793 / 1.630				2.929 / 0.542				1.912 / 0.440		1.343 / 0.931		11.249 / 3.009
Arlington County									0.911 / 0.101								0.911 / 0.101
Loudoun County			4.668 / 0.569														4.668 / 0.559
TOTAL	10.851 / 13.509	5.975 / 2.157	5.550 / 0.628	6.877 / 5.147	3.793 / 1.630	1.816 / 1.435	0.531 / 0.013	21.631 / 3.301	3.840 / 0.543	2.292 / 0.542	31.159 / 15.918	0.997 / 0.113	1.912 / 0.440	6.087 / 3.956	1.343 / 0.931	2.055 / 0.775	170.396 / 52.922

DOMESTIC (WW) / (WW) EMPLOYMENT

GREELEY 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 RST DATE ____ CKD BY ____ DATE ____ SHEET 4 OF 6

TABLE D (CONT.)

YEAR 1995

JURISDICTION	DRAINAGE BASIN: ANACOSTIA	DEVER DAN CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SEneca CREEK	SUGAR LAND RUN	WATTS BRANCH	TOTAL
District of Columbia	37.153 / 10.243					1.393 / 0.352		14.711 / 1.410		2.816 / 0.510	13.956 / 7.917						70.069 / 20.262
Montgomery County	18.115 / 3.549			7.159 / 2.603		3.511 / 1.171	0.583 / 0.013			0.233 / 0.010	18.503 / 8.213	0.525 / 0.113		6.889 / 3.362		4.393 / 0.341	57.737 / 19.674
Prince George's County	18.945 / 6.352	6.101 / 2.445						7.519 / 2.014									32.495 / 11.080
Fairfax County			1.031 / 0.013		6.305 / 2.015				3.115 / 0.581				1.059 / 0.524		2.803 / 1.351		11.313 / 4.512
Arlington County									0.911 / 0.101								0.911 / 0.101
Loudoun County			5.456 / 0.771														5.456 / 0.771
TOTAL	74.193 / 19.249	6.101 / 2.445	6.487 / 0.784	7.159 / 2.603	6.305 / 2.015	4.904 / 1.526	0.583 / 0.013	22.230 / 3.424	4.026 / 0.695	3.05 / 0.553	32.465 / 16.06	0.525 / 0.113	1.059 / 0.524	6.889 / 3.362	2.803 / 1.351	4.393 / 0.341	181.011 / 56.409

DOMESTIC (MGD) / (MGD) EMPLOYMENT

GREELEY 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	FIRM COG
	COMP BY BDT DATE ____ CKD BY ____ DATE ____	SHEET 5 OF 6

TABLE D (CONT.)

YEAR 2000

Each cell: Domestic (MGD) / Employment (MGD)

JURISDICTION	ANACOSTIA	BEAVER DAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGAR LAND RUN	WATTS BRANCH	TOTAL
District of Columbia	37.777 / 10.375					1.407 / 0.360		11.908 / 1.446		2.812 / 0.528	17.138 / 7.891						71.072 / 20.600
Montgomery County	17.241 / 32.13			7.375 / [illegible]		[illegible] / 1.212	0.440 / 0.044			0.210 / 0.011	19.112 / 2.901	0.540 / 0.113		7.676 / 3.458		2.152 / [illegible]	60.141 / 51.577
Prince George's County	19.365 / 6.391	6.476 / 1.463						7.870 / 2.202									33.691 / 11.059
Fairfax County			1.129 / 0.428		6.774 / 2.115				1.431 / 0.612				1.098 / 0.110		3.213 / 1.585		15.665 / 5.277
Arlington County									0.917 / 0.097								0.917 / 0.097
Loudoun County			6.509 / 1.043														6.509 / 1.043
TOTAL	76.333 / 11.513	6.976 / 4.463	7.638 / 1.071	7.375 / 9.174	6.774 / 2.115	5.016 / 1.572	0.440 / 0.044	19.778 / 3.648	2.348 / 0.709	3.102 / 0.569	36.25 / 10.792	0.540 / 0.113	1.098 / 0.110	7.676 / 3.458	3.213 / 1.583	2.152 / [illegible]	188.515 / 61.675

Key: DOMESTIC (MGD) / EMPLOYMENT (MGD)

GREELEY 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 BST DATE ____ CKD BY ____ DATE ____ SHEET 6 OF 6

TABLE D (CONT.)

YEAR 2005

JURISDICTION	DRAINAGE BASIN: ANACOSTIA	BEAVER DAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PUMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGAR LAND RUN	WATTS BRANCH	TOTAL
District of Columbia	38.375 / 10.838					1.421 / 0.369		15.107 / 1.471		2.922 / 0.545	16.303 / 8.018						72.072 / 20.937
Montgomery County	20.257 / 3.036			2.583 / 1.543		3.673 / 1.261	0.996 / 0.011			0.383 / 0.011	19.598 / 1.651	0.556 / 0.113		8.167 / 4.393		3.753 / 0.385	63.569 / 32.169
Prince George's County	11.442 / 2.401	6.850 / 2.527						8.153 / 2.312									34.645 / 15.359
Fairfax County			1.227 / 0.093		7.240 / 1.844				2.424 / 0.611				1.138 / 0.695		1.661 / 1.815		19.090 / 2.039
Arlington County									0.922 / 0.093								0.922 / 0.093
Loudoun County			7.334 / 1.254														7.334 / 1.254
TOTAL	78.474 / 19.75	6.850 / 6.569	8.561 / 1.287	2.583 / 1.543	7.240 / 3.847	5.094 / 1.63	0.996 / 0.011	23.300 / 3.813	3.346 / 0.733	3.153 / 0.556	36.001 / 11.673	0.556 / 0.113	1.138 / 0.695	8.167 / 4.393	3.661 / 1.813	3.753 / 0.385	195.872 / 67.101

DOMESTIC (MGD) / (MGD)
EMPLOYMENT

GREELEY 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 BAT DATE ____ CKD BY ____ DATE ____ SHEET 1 OF 6

TABLE E

YEAR 1980 JURISDICTION	DRAINAGE BASIN. ANACOSTIA	BEAVERDAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGAR LAND RUN	WATTS BRANCH	TOTAL
District of Columbia	13.819					1.364		15.425		2.805	20.837						88.278*
Montgomery County	16.025			8.579		1.017	0.211			0.118	20.793	0.482		5.547		1.874	57.676
Prince George's County	22.686	7.069						8.102									37.857
Fairfax County			0.509		5.403				1.076				1.210		1.521		11.719
Arlington County									0.976								0.976
Loudoun County			2.537														2.537
TOTAL	52.530	7.069	3.046	8.579	5.403	5.381	0.211	23.527	4.052	2.953	41.630	0.482	1.210	5.547	1.521	1.874	199.043

* Visitors' Flow Component = 1.028 mgd.

GREELEY 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 BAT DATE ____ CKD BY ____ DATE ____ SHEET 2 OF 6

TABLE E (CONT.)

YEAR 1985 JURISDICTION	DRAINAGE BASIN																TOTAL
	ANACOSTIA	DEVER DAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGAR LAND RUN	WATTS BRANCH	
District of Columbia	15.407					1.693		15.808		3.081	21.321						92.278*
Montgomery County	17.241			9.633		1.298	0.315			0.158	22.522	0.576		6.971		2.058	63.812
Prince George's County	23.577	7.428						8.361									39.366
Fairfax County			0.682		6.466				3.263				1.360		1.870		13.641
Arlington County									1.004								1.004
Loudoun County			3.821														3.821
TOTAL	56.225	7.428	4.503	9.633	6.466	5.991	0.315	24.169	4.267	3.239	43.843	0.576	1.360	6.971	1.870	2.058	213.922

* Visitors' Flow Component = 4.965 mgd.

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 COG

COMP BY BAT DATE CKD BY DATE SHEET 3 OF 6

TABLE E (CONT.)

YEAR 1990 JURISDICTION	DRAINAGE BASIN: ANA-COSTIA	BEAVER DAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGAR LAND RUN	WATTS BRANCH	TOTAL
District of Columbia	16.264					1.739		15.972		3.199	21.569						94.950 *
Montgomery County	18.555			10.324		4.512	0.374			0.235	25.004	0.610		8.940		2.530	71.086
Prince George's County	24.592	8.232						8.944									41.768
Fairfax County			0.881		7.423				3.471				1.462		2.221		15.458
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	24.916	4.483	3.434	46.573	0.610	1.462	8.940	2.221	2.530	229.501

* Visitors' Flow Component = 6.183 mgd.

GREELEY 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 BAT DATE ____ CKD BY ____ DATE ____ SHEET 4 OF 6

TABLE E (CONT.)

YEAR 1995 JURISDICTION	DRAINAGE BASIN: ANACOSTIA	DENVER DAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGAR LAND RUN	WATTS BRANCH	TOTAL
District of Columbia	17.432					1.715		16.121		3.326	21.703						98.140 *
Montgomery County	20.754			10.962		4.718	0.426			0.274	21.622	0.638		10.154		2.663	77.411
Prince George's County	25.201	8.766						9.617									43.584
Fairfax County			1.054		8.330				3.729				1.585		1.157		19.855
Arlington County									1.012								1.012
Loudoun County			6.227														6.227
TOTAL	73.391	8.766	7.281	10.962	8.330	6.463	0.426	25.738	4.741	3.600	43.325	0.638	1.585	10.154	1.157	2.663	245.229

* Visitors' Flow Component = 7.809 mgd.

GREELEY 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 BAT DATE CKD BY DATE SHEET 5 OF 6

TABLE E (CONT.)

YEAR 2000

JURISDICTION	DRAINAGE BASIN																
	ANACOSTIA	BEAVER DAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PINEY RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGAR LAND RUN	WATTS BRANCH	TOTAL
District of Columbia	18.152					1.767		16.354		3.370	22.929						101.727 *
Montgomery County	22.023			11.546		1.827	0.481			0.301	28.096	0.653		11.529		2.801	82.260
Prince George's County	25.739	10.939						10.072									46.750
Fairfax County			1.157		9.218				1.043				1.708		1.816		20.942
Arlington County									1.014								1.014
Loudoun County			7.552														7.552
TOTAL	65.914	10.939	8.709	11.546	9.218	6.594	0.481	26.426	6.057	3.671	50.125	0.653	1.708	11.529	1.816	2.801	260.245

* Visitors' Flow Component = 10.055 mgd.

GREELEY 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 BDT DATE ____ CKD BY ____ DATE ____ SHEET 6 OF 6

TABLE E (CONT.)

YEAR 2005 JURISDICTION	DRAINAGE BASIN: ANACOSTIA	BEAVERDAM CREEK	BROAD RUN	CABIN JOHN CREEK	DIFFICULT RUN	LITTLE FALLS	MUDDY BRANCH	OXON RUN	PIMMIT RUN	POTOMAC	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENECA CREEK	SUGARLAND RUN	WATTS BRANCH	TOTAL
District of Columbia	48.883					1.790		16.584		3.411	22.341						106.257*
Montgomery County	23.293			12.185		4.934	0.540			0.328	29.352	0.669		12.859		2.938	87.038
Prince George's County	26.248	13.417						10.529									50.194
Fairfax County			1.260		10.099				4.963				1.833		5.479		23.129
Arlington County									1.015								1.015
Loudoun County			8.588														8.588
TOTAL	98.424	13.417	9.848	12.125	10.099	6.724	0.540	27.113	5.978	3.739	51.693	0.669	1.833	12.859	5.479	2.938	276.221

* Visitors' Flow Component = 13.248 mgd.

GREELEY AND HANSEN ENGINEERS

TASK W.A. 305-08-17, SCHEDULE A, ITEM 7 PHASE I

SUBJECT EMPLOYMENT ANNUAL AVERAGE WASTEWATER FOR BPSA (1980-2005)

DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY

FIRM COG

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 SENECA STP	12.859	14.737	17.124	18.468	20.149	21.777
PRINCE GEORGES CO. TOTAL WSSC →	8.880	9.525 25.035	10.559 28.719	11.089 30.763	13.059 34.656	15.309 38.778
FAIRFAX CO. (INC. ARL. CO. FLOWS)	2.310	3.041	3.710	4.613	5.374	6.132
ADJUSTED TOTAL ASSUMING USE OF ALEXAN	2.310	2.582	2.791	3.169	3.230	3.812
LOUDOUN CO. TOTAL VA →	0.249	0.356 3.397	0.559 4.269	0.771 5.384	1.043 6.417	1.254 7.386
TOTAL REGIONAL FLOWS - BLUE PLAINS SERVICE AREA	44.669	47.946	52.922	56.409	61.675	67.101
ADJUSTED BPSA TOTALS						
- IF SENECA IS USED	44.058	47.173	51.886	55.203	60.225	65.409
- IF POTOMAC IS USED	44.669	47.487	52.003	54.965	59.531	64.781
- IF SENECA & ALEXANDRIA BOTH	44.058	46.714	50.967	53.759	58.081	63.089

GREELEY AND HANSEN ENGINEERS

TASK W.A. 305-08-17, Schedule A, Item 7 PHASE I

SUBJECT Domestic Annual Average Wastewater For BPSA (1980 - 2005)

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM COG

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
Total WSSC →		78.143	81.135	90.131	94.351	98.454
Fairfax Co. (Inc Arl. Co. Flows)	10.385	11.604	12.760	15.254	16.582	18.012
Adjusted Total Assuming Use of Pumpdown	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	17.426	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 Pumpdown is Used	150.346	159.270	167.605	176.658	182.024	188.972
- If Seneca & Pumpdown Both Used	148.843	157.351	165.225	173.814	178.754	185.274