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 Ouantities and Characteristics

Greeley and Hansen 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 (BOD₅)
 - * Total Nitrogen (N)
 - * Total Phosphorus (P)
 - * Wastewater Temperature (Degrees C)
 - * Wastewater Alkalinity (CaCO₃)

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:

- 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).

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, <u>Population and Land Use Blue</u>

 <u>Plains Service Area</u>
- 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, <u>Population</u> and <u>Land Use</u> - <u>Blue Plains Service Area</u>. Sewered population estimates are summarized in Table 1 and as follows:

	Est	imated Se	wered Por	ulation -	1000 Per	sons
<u>Area</u>	1980_		1990			2005
Virginia Maryland (WSSC) District of	172.1 890.6	194.8 924.9	222.0 984.8	241.2 1,038.9	260.8 1,075.2	278.9 1,111.3
Columbia	702.0	724.0	<u>734.0</u>	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 Ouantities 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 Ouantities and Characteristics(1)

		Flow	Pound	ds Per	Capita Pe	r Day
	<u>Item</u>	GCD	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

As shown in Table 2, flow meter problems developed at the Blue Plains WWTP in 1979 and quantities have since been estimated The District is engaged in based on pumping rates and times. 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

⁽²⁾ Avg. for 1972-1980

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

⁽¹⁾ As CaCO3

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

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

<u> Item</u>		Plains Se al Averag 1990			
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 - GCD	312.32 169	319.11 164	335.86 167	351.76 170	368.60 174
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:

				- PCD (1)
Item	<u> </u>	BOD5_	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

The recent record and forecast of per capita quantities are shown on Figure 7 for suspended solids and BOD5 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 BOD5 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.

⁽²⁾ For Year 2000

The recent record and forecasts of total annual average quantities of SS, BOD5, 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 Plai Forecast			
		ter Ouant			
<u>Item</u>	<u> 1985</u>	1990	<u>1995</u>	2000	<u>2005</u>
Wastewater Quantities - MGD	312	319	336	352	370
Wastewater Characteristics - 1000 LBS/Day					
Suspended Solids	460.9	485.2	503.5	517.3	530.5
BOD ₅	460.9	485.2	503.5		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. <u>Annual Average</u>, 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:

Process Loading Condition	_Load Flow _MGD	Variatio Character SS			
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				
CSO Abatement Project	0.50		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

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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. 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:

	Dry Days Flow(1) - MGD				
Year(2)	_ 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.

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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SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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TABLE NO.	DESCLIPTION
t	BPSA", Estimated Sowered Population - 1000 Persons
1	Blue Plains WWTP - Record of Annual Average Wastewater Quantities and Characteristics
3	Record of Annual Average Wastewater Quantifies from District of Columbia Department of Environmental Services for Principal Blue Plain's WWTP Users
4	Blue Plains WWTP-Record of Wastewater Temperature and Alkalinity
5	Blue Plains WXIP-Record of Wastewater Loading Variations
(p	Summary - Forecast of Annual Average Wastewater Quaulities - Virginia (Fax, Arlin, Lou. Cox)
7	Summary - Forecast of Annual Average Wastewater Quantities - Maryland (W550)
8	Summary - Forecast of Aunual Average Waslewater Quantities - District of Columbia
9	District of Columbia - Forecast of Annual Average Wastewater Quantities From Visitors to D.C.
10	Summory - Forecast of Annual Average Wastemater Quantities - Blue Plains Service Area
l)	Summary-Forecast of Annual Average Wastewster Quantities and Characteristics for the Blue Plains Service Area.
rL	Blue Plains WWTP - Record of Wastewater Loading

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SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
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TABLE NO.	DESCRIPTION
13	Blue Plains WWTP-Forecast of Wastewater Loading Variations
14	15-Minute Peak Flow Rates at Blue Plains WWTP Due to Storm Events Based on 3-650 Alternatives
15	Summary - Forecast of Wastewater Quantities and Characteristics for the Blue Plains Service Area

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TABLE 1

BLUE PLAINS SERVICE AREA ESTIMATED SEWERED POPULATION - 1000 PERSONS

CHIMATEV	JENGH	CD 1010	CALION	100076	CHJONJ	
AREA	1580	1985	1990	1995	1000	1005
<u>YIRGINIA</u>						
1. Fairfax & Arlington Cos.	141.2	152.4	165,5	176.4	184.5	193.5
1. Loudoun Co.	30.9	41.1	56.5	64.8	76.3	85.4
Subtotal - Virginia	112.1	194.5	212,0	241.2	160.3	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	313.3	381.5	384.6	386.7
Subtotal - Maryland	390.6	214.9	984.8	1038.9	1075.1	1111.3
b. District of Columbia	702.0	724.0	734.0	734.0	133.0	731.0
otal-Blue Plaius Service Area	1764.7	1843.7	1940.8	2014.1	2069.0	2122.2
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TABLE

STUDY MEMO **11-3** DISTRICT OF COLUMBIA SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS **BLUE PLAINS FEASIBILITY STUDY** FIRM 4.10.54 HEB DATE COMP BY. DATE SHEET OF 0.030 0.031 0.034 0.038 0.034 0.033 0.033 0.030 0.034 0.035 (6) |0.811|6.00.6|1000|2000|0.009|0.009|0.009|0.00|0.00| 10.27 | 226 | 2.26 | 0.21 | 0.22 | 0.22 | 0.22 | 0.23 | 0.23 | 0.23 | 0.23 1578 1575 1580 XVG. 131 138 340 403 Estimated Sewered Population - 1000's 11915-31481.1 | 1818 | 1840 | 1516.1 | 1000.1 | 1010.5 | 1010.1 | 1100.1 351 196 13.8 15.9 23.1 25.0 22.7 24.0 22.5 19.8 20.7 45.1 45.1 41.4 53.4 60.4 55.4 55.4 56.4 51.3 60.4 10.0 2.3 8.7 7.4 7.4 6.7 5.6 5.7 6.4 5.6 4.7 5.5 20.5 15.4 15.6 15.4 15.6 14.0 14.9 14.1 1.13 15.4 611 211 221 611 131 131 234 777 300 311 17c | 185 | 168 | 16c | 138 | 151 | 145 | 148 | 152 | 157 | 361 | 353 | 364 | 351 | 393 | BLUE PLAINS WWTP - RECORD OF ANNUAL AVERAGE | Tro||1911 | 1914 | 1915 | 1916 | 1916 | 1916 | 1917 WASTEWATER QUANTITIES AND CHARACTERISTICS 173 176 184 150 185 176 272 288 285 277

(1) D.C. Burcau of Waste Treatment Acported Flow (BWI)
(2) D.C. BWI Adjusted MCD = (1.06 x BMS) - 275.43 (Started Nov. 1919, meters out of service)
(4) Concentrations Computed PCD - POUNDS PER CAPITA PER DAY (9) 9.48 AVG

-1000 LBS/DAY Suspended Solids-MU/L(s)

0.15

PCD(4)

155

Wostewoter Quantity - MGD (BWT)" 246

TEM

- 6CD (BWT)

-1000 LBS/DAY - PCD 8005 - Mc/L

Total Nitrogen - MG/L

-1000 LBS/DAY

-1000 LBS/DAY - PCD Total Phosphorus - Mc/L

0.014 0.014 0.015

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SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS	DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY
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TABLE 3

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

	WASTEWATER QUANTITIES - MOD						
AREA	1976	1977	1978	1979	1980		
Virginia Communities	14.98	15,63	17,56	13.84	17.63		
Maryland (WSSC)	126.35	114.27	175.56	134.70	122.53		
District of Columbia	152.00	146.54	155.77	157.43	155.10		
Other®	8.39	0.35	0.41	0.48	d. 35		
Total	193.71	276.83	17.665	311.45	295.61		

- 1) From DES Billing Records
- 12) Includes Fairfax and Loudoun Counties and Town of Vienna
- (3) Includes Duller Airport, National Parks Service, U.S. Navy
- (4) 1980 Total for "Other" does not include U.S. Navy

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	Mata	NYC	FEB	MAF	ነ ልዖጹ	MAY	JUN	JUL	AUL	SEP	∞ 1	NOV	DEC	_
	I. TEMPERATURE - C		1					1						
	1976 - AVG	14.5		117.0	13.7	21.4	24.5	14.6	27.1	15.1	5 22.4	17.3	15.1	
	- MIN	13.1	1 -	15.4	16.3								13,1	
	· MAX	15.6	ŀ		21.3	1	27.3	17.6					16.8	
	1977 - AVG	13.4	13.3	1	1 '		23.3				22.3		1 1 1	
	XAM.	1		17.5	16.0						15.7			
	1978-840		1	13.6	1	14.0	74.7	25.2	25.7	17.1	75.5	12.0		
	-MIN		t .	12.2			23.5							
	- MAX			15,4	1 '	ž.	25.9	4	1 -		20.7			i
	1979-2006		4		17.0	140 /	27.1	11/1	12/7	124	7 44.4		17.4	
	-MIN	17.6	ר.מו	11.4	15.0	17.9	709	12 1	411.	20.5	•	1	16.1	ı
	- MAX	1	15.4	17.0	19.3	21.6	23.6	164	1/27	25.7		,	15.5	ļ
	1380 · AVG	14.7	140	14.7	17.3	73.1	77.7	15.5	210.3	21.1	22 9	12.4	•	١
	- MIN	12.7	12.0	12.8	14.8	17.7	20.1	21.7	75.3	24.1	20.0	17.4	14.9	I
	- MAX	16.4	15.3	16.0	18.7	23.4	25.0	27.2	27.6	27.7	29.9	21.0	n.1	
_			-	[-	<u>'</u>	1	1	1		1	1		+
i	5-YR AVG. TEMP C	14.3	13.7	15.2	17.5	204	23.1	25.4	16.0	15,1	22.5	19.0	16.3	Ì
	MIN - °C	10.7	10.7	11.1	14.8	16.4	20.2	21.7	21.4	20.5	10.1	13.9	13,1	l
ļ	MAX - °C	16.6	16.8	17.7	21.3	24.0	27.3	27.6	29.2	27.7	22.7	22.0	19.1	
	A Arterialisman					[]					[
	1. ALKALINITY - MG/L	ا م . ا						İ						
l	1076· AVG				113.1				-	-	1	1	140.8	
	-MIM -MAK				56.3				-	•	•	1	104.0	
ı	20/A · FC!				136.3				-		100.5	153.0	169.0	
I	- MIN	132.0	162 5	979	128.5	174.1	160.0	199.0	1016	176.7	162.5	147. 3	1157.0	ı
İ	-MAX	137.3	13/	158 %	1647	16.6.3	1744	1207	14.7	ודילפון	111.4	177.3	74.6	ļ
I	1378 · AVG	116.6	114.1	133.6	140.0	135.7	133.1	177.1	111 .7	144.3	170.0	175 4	121 A	l
l	-MIN	67.5	34.4	83.5	120.7	100.7	101.5	22.0	93.1	105.7	1451	1543	1767	l
l	-MAX	140.3	130.5	171.0	120.2	127.7	154.7	141.8	144.9	145.5	135.1	111.9	212.4	l
l	1979-AVG	111.9	117.6	109.2	111.1	179.0	127.0	132. 3	136.1	125.5	-	133 9	116.9	ĺ
l	-MIN	87.3	67.3	75.0	97.5	104A	24.6	116.8	106.5	32.2	_	111.3	67.3	
	-MAX	41.4	133.6	167.0	138.9	148.4	154.7	160.1	156.1	147.4	-	159.9		
	1980-AVG	111.3	135.3	11.6	111.1	115.1	121.4	131.7	134.6	132.5	133.5	143.0	121.1	
	-WIÑ	15.6	21.6	68.0	340	89.0	92.0	106.0	110.0	103.0	115.0	175.0	34.0	
	- MAX	134.0	49.5	144.0	132.0	146.0	165.0	ا ٥ . اما ا	182.0	156.0	161.0	172.0	162.0	
ļ	5-YR. AVG. ALKAL -MO/L	117 4 1	20.2	14	172 1	121	12/-	اء رور	125.6	184	11. *	مازا	151 -	r
l	MIN MG/L	117.2	L7.3	11 0. + 1 ₆ 4. A	56.3	21./	91 1	174.7	לולקו מב	140.2	70.7	147.7	ロハウ	
L		187.3	366	171.0	100.2	31.1	179.9	100.1	32.0	175.5	19.6	211.3	711 5	
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SUBJECT WASTEWATEL	QUANTITIES CHARACTERIS	1165

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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DATE 4-13-51	CKD BY	DATE	SHEET 1	0F	1

TABLE 5

BLUE PLAINS WATP - RECORD OF WASTEWATER LOADING VARIATIONS

		<u>,</u>			·						
		1. DAY MOVING			3-0	3-DAY MOVING AVERAGE			30-DAY MOVING AVERAGE		
ITEM	YELR	MIN.	AV4.	MAX.	MIN.	AVG.	MAX.	MIN.	AVG.	MAX.	
FLOW (MCD)	1972 1973 1974 1975 1970 1970 1979 1979	144.0 132.0 111.0 134.0 243.0 233.0 152.0 111.0 183.0	287.8 185.1 276.5 290.8 293.7 276.5 295.5 311.0 351.1	315.0 331.0 379.0 371.0 411.0 429.0 414.0 426.0 524.0	753.7 144.3 123.0 251.0 251.7 240.7 260.7 232.3 235.0	287.8 285.1 276.6 200.8 203.6 276.4 230.5 311.0	313.3 318.3 321.3 371.3 366.0 417.3 436.0 471.7	265.1 258.6 245.9 173.4 265.9 254.5 274.0 267.3 285.0	287.8 285.7 217.5 191.4 204.0 274.4 300.4 300.9 349.6	311.9 301.4 199.6 313.0 313.1 309.1 371.3 396.1	
TEMP (°C)	1976 1977 1978 1979 1980 AVC.	13.1 10.9 11.8 10.7 11.0	296.9 20.3 13.6 13.1 20.1 20.0	28.0 29.1 21.9 26.7 27.7	13.8 11.9 12.1 11.1 11.L	296.6 20.7 20.3 10.6 15.1 20.0	27.8 27.1 27.4 26.1 27.6	14.7 17.8 13.1 12.7 14.0	296.9 21.1 20.0 13.6 19.3 20.1 20.0	27.1 26.3 26.4 25.1 26.4	
5USP. SOLIDS (1000 LB/D)	1972 1973 1974 1976 1976 1979 1979 1980 AVG.	110.0 87.0 185.0 170.0 161.0 161.1 178.8 157.5 139.0	305.0 315.1 343.3 351.8 363.6 351.1 303.1 340.3 401.6 364.5	1557.0 679.0 789.0 640.0 650.9 878.8 724.1 755.6 1131.6	181.3 146.0 235.0 210.0 176.4 134.3 215.5 201.9 203.1	308.6 329.3 348.3 357.8 365.7 351.1 301.4 341.1 401.3 364.3	1,058.7 480.3 533.7 566.7 555.0 657.0 670.9 539.7 748.1	207.3 271.8 307.7 306.3 211.0 310.9 211.9 203.1	303.1	525.7 351.3 302.3 445.3 416.4 411.3 514.6 385.3 503.9	
									inc ed)		

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DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY

TABLE 5 (Coul'd) FIRM GOH

сомр ву 1	EB DA	TE 4-11-1			DATE		SHEET_	or			
		I-DAY MOVING AVERAGE				3·DAY MOVING AVERAGE			30-DAY MOUING AVERAGE		
LTEM	YEAR	MIN.	AVG.	MAX	MIN.		MAX.	MIN	AVG.	MAX.	
	 	1	7,400.	11-17-10-		1,7,001	14,20,	TO TACK	AVU.	MAX.	
BOD 5 (1000 LB/D)	1972	184.0	414.9	739.0	214.0	418.9	627.3	331.1	421.1	490.5	
(1000 - 10)	1274	122.0	374.4	735.0		4		1	373.7	429.7	
1	1275	123.0	361.9			1	550.3	337.0	373.3	411.1	
	1376	144.3	416.9	•	203.7	I	601.7	286.5	363.1	475.6	
	1517	163.5	352.9	863.4	,	417.5	843.0	317.5	434.0	539.8	
	1278	131.3	1	4		351.3	,	1647	349.2	440.1	
	1979	176.4	361.1	666.5			544.0	* ·	366.5	454.9	
	1 ' -	1	362.4	657.4		361.5	691.3	290.5	361.7	478.5	
	1980	124.6	344.1	870.4	139.9	341.3	736.0	157.2	341.7	458.1	
	AVG.		375.6			375,3			376.0		
TOTAL NITEOGEN	1971							35.3 38.8	45.1	50.8 54.6	
(1000 LE/D)	1974			j 				45.4	53.6	63.1	
1	1075			į]		54.7	60.6	74,5	
	1076	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	20.7	42.8	54.8	70.3	
	1978	32.4	56.4	38.0	40.0	56.5	36.3	45.7	56.8	63.8	
	1079	34.1	51.3	70.6	34.1	51.4	78.6	44.5	51.0	64.2	
	1080	23.7	60.6	35.8	13.7	60.3	85.9	24.3	50.7	70.2	
	AVG.		55.9		٠,٠١	55.8		54.7	53.9	10. L	
TOTAL	1972	3.5	17.4	31.5	10.1	17.4	126		17,5	21.5	
PHOSPHORUS	1073	6.8	17.0	41.5	10.6	17.0	39.5	14.8	17.0	20.7	
(000 LB/D)	1074	6.0	15.4	26.8	7,5	15.4	22.6	ا ما اا	15.5	13.9	
	1015	4.7	13.6	37.1	6.3	13.6	23.0	10.0	13.5	17.3	
	1976	7.4	14.0	24.9	4.4	14.0	21.7	ាក	14.0	15.8	
	1077	7.7	14.9	22.7	10.4	14.5	20.9	13.3	14.5	16.8	
	פרכו	9.5	14.1	15.0	9.0	14.1	17.8	12.5	14.0	15,8	
	1979	3.1	17.3	18.0	3.2	12.3	17.6	67	12.6	17.6	
	1980	1.7	15.4	43.3	2.9	15.1	42.2	5.4	15.1	24.9	
	AVG.		14.9			14.5		-	14.5		
ALKALINITY	1976	49.2	117.5	111.5	61.5	117.5	165.8	84.9	118.3	140.6	
(MG/L)	1017	24.6	149.1	198.8	104.7	149.3	186.8	113.1	145.9	171.7	
	1378	67.5	132.6	212.8	86.4	137.0	194.1	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	<u> </u>	1	131.5			131.9		

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SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS	DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY
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COMPBY REB DATE 4-10-31 CKD BY DATE SHEET 1 OF 1

TABLE 6 SUMMARY - FORECAST OF ANNUAL AVERAGE WASTEWATER QUANTITIES - YIRGINIA (FAX, ARCH, LOU CO)

1985	1990	1995	1000	2005
194.8	122.0	241.2	168.8	178.9
15.07	17.45	20.71	23.09 89	25.35
3.40 76.8 44	4.27 95.6 45	5,38 116,1 46	6,41 138.0 46	7.39 157.4 47
4.95 170. t 19 0.38 21.7	4.95 170.1 19 2.76 49.5	4.9.5 170.2 1.06 1.06 1.5	4.95 170.1 19 1.40 88.7	4.95 170.2 19 1.73 106.8
5.33	5.7.1	6.01	6.35	6.68
23.80 122	27.43. 124	32.10 133	35,86 137	39.41 14.1
	194.8 15.07 17 3.40 76.8 44 4.95 170.1 19 0.38 21.7 17 5.33	194.8 122.0 15.07 17.45 17 19 3.40 4.27 76.8 45 4.95 170.1 19 0.38 21.7 19 0.38 21.7 19 5.33 5.71 23.80 27.43	194.8 122.0 241.2 15.07 17.45 20.71 17 19 86 3.40 4.27 5.38 76.8 95.6 116.1 4.95 4.95 4.95 170.2 29 1.06 21.7 29 1.06 22.7 49.9 69.1 17 15 15 5.33 5.71 6.01	194.8 122.0 241.1 160.8 15.07 17.45 20.71 23.09 3.40 4.27 5.38 6.41 76.8 95.6 116.1 138.0 44 45 46 46 4.95 4.95 4.95 170.1 19 0.38 0.76 170.1 19 19 1.40 21.7 49.5 69.1 88.7 17 15 15 16 5.33 5.71 6.01 6.35

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

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TASK STUDY MENO H-3 PHASE I	
SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS	DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY
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COMP BY KEB	DATE 4-10-81	CKD BY	DATE	SHEET	OF	

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

,,				
1985	1990	1995	1000	1005
914.5	984.8	1038.9	1015.1	1111.3
78.14 84	84.14 85	90.13 81	94.35 88	98.45 88
75.04 481.3 51	28.71 545.4 53	30.76 588.1 51	34.66 648.9 53	38.78 700.4 55
41.04 390.0 40 0.63 34.3	41.04 890.6 46 1.45 94.1	41.04 830.6 46 7.10 143.3	41.04 890.6 46 1.73 184.6	41.04 850.6 46 3.16 110.7
41.67	41.49	43.14	43.77	44,30
144.85	155.35 158	164.13	171.73 161	181.53 163
	924.5 78.14 84 25.04 481.3 52 41.04 390.0 40 34.3 18 41.67	914.7 984.8 78.14 84.14 84 85 25.04 28.71 481.3 545.4 57 41.04 890.0 40 890.0 40 0.63 94.1 18 115 41.67 41.49	924.5 984.8 1038.9 78.14 84.14 90.13 84 85 87 25.04 28.71 30.76 481.3 545.4 588.1 51 53 51 41.04 890.6 890.6 46 0.63 1.45 2.20 34.3 94.1 148.3 18 15 15 41.67 41.49 43.14	914.7 984.8 1038.9 1015.1 78.14 84.14 90.13 94.35 88 25.04 28.71 30.76 34.66 48.9 52 53 41.04 \$90.6 \$90.6 \$90.6 \$90.6 46 46 46 46 60.63 94.1 145 2.10 1.73 94.1 18 15 15 15 15 15 15 15 15 15 15 15 15 15

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

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TASK STUDY MENO IL-3	PHASE
SUBJECT WASTEWATER QUANTITIES & CHARACTERIST	<u>()</u>

DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY

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COMPBYREB	DATE 4-18-84	CKD BY DATE	SHEET	OF

TABLE 8 SUMMARY - FORECAST OF ANNUAL AVERAGE WASTEWATER QUANTITIES - DISTRICT OF COLUMBIA

ITEM	1985	1990	1995	2000	1005
Estimated Sewered Pop-1000 PERSONS	714.0	734.0	734.0	733.0	731.0
Wastewater Quantities					
House holds (Domestic) - MGD - GCO	67.80 94	68.83 74	70.07	71.07 97	71.07
Employment - MCD - 1000 PERSONS - GCD (Computed)	19.51 665.0 19	19.93 679.0 29	20.26	20.60 702.0 19	20.94 712.0 29
Visitors (See Table &) - MGD	4.97	6.18	7.81	10.06	13.15
Infiltration - MGD - GCO (louputed)	4.80	4.80	4.80	4. 30	4.80
Groundwater Pumpage - MCO	4.71	ור. 4	4.71	4.71	4.71
Water Distribution System Lost Water MGD	41.38	31.88	31.38	31.88	31.88
Subtotal Intiltration + Groundwater Pumpage + Lost Water - MGD (Computed) - GCD(2)	51.39 71	41.39 56	41.39 56	41.39 56	41.39 56
Total Wastenater Quantities - MCD - GCD	143.67 158	136,33 186	139,53	143,11 195	147.65

¹¹⁾ See Study Memo II-4. CSO and I/I Studies and Plans
(12) General equivalent to GCD for Infiltration in Margland and Virginia

GREELEY AND Hansen Ngineers TASK STUDY MEMO I - 3 PHASE I

SUBJECT WASTEWATER QUANTITIES AND CHACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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COMPBY REB 4.10.82 DATE DATE SHEET OF MGD, AU AN. AVG TOTAL 0.00 13,15 4.03 4.91 1.8 AN. AVG. 0.111 0.149 0.171 0.131 0,175 0.161 FLOSE <u>8</u> ۷۱<u>۶</u>, DAYS GPD 7,123 2.70 30 1.744 3447 3444 1.50 15 21 | 0311 | 607'01 | 1516 | 751'2 2.636 4040 11,068 11.50 115 DISTRICT OF COLUMBIA - FORECAST OF ANNUAL AVERAGE WASTEWATER QUANTITIES FROM VISITORS TO D.C.(1) <u>₽</u> \overline{v} 5.158 4453 12,100 1.50 15 V19170 RS 3.276 4250 11,644 1.50 12,079 1.50 PER YR. PERDAY STAY VISITORS VISITORS PER DAYTIME 4.009 4409 AN. AVG 1 000 FLDVV MGD OVERNIGHT - BUSINESS 400 VISITORS VISITORS PER PER <u>.</u> |-<u>ව</u> 8,192 4.70 30 10,846 2.70 30 13,484 2.70 30 21,115 2.70 30 TABLE 9 16,868 2.70 PER YR. PER DAY STAY 3959 1.010 7,611 3109 12005 15,613 141,715 12.03 190 17.215 17.47 4.271 | 4921 5,654 6157 AN. AVE. 1000 14.216 2.03 30 12.597 3,198 " Source: COG, See Appendix A FLow Med 41X VIS. 11,323 2.03 90 13,578 20.03 30 MISTORS WISTORS PER PER 100 | 502 | 601,16 | 355,11 | 0001 18,051 (2.03 30 DAYS GPD OVERNICHT - SOCIAL PER YR. PER DAY (1) Rounded value 4,135 5189 5533 6589 1980 1385 1990 1995 YEAR

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SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS				B	DISTRICT OF COLUM LUE PLAINS FEASIBILIT	
COMPRY RED	DATE 4-18-82	CKUBA	D4TF			

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

			1	1	
TTEM	1585	1900	1995	1000	1005
Estimated Sewered Pop1000PERS.	1843.7	1940.8	2014.1	1069.0	2111.1
Wastewaler Quantities i					
Households (Domestic)-MGD (Computed)-GCD	161.01	170.41	181.01	133.51	195. 9 7 9.2
Employment - MGD - 1000 PERSONS - GCD (Computed)	41.95 1223.1 39	51.91 1310.0 40	56.40 1394.1 41	61.68 1488.9 41.	67.11° 1579.0 42
Visitors (Dic. Only) - Mad	4.97	6.13	7.81	10.06	13.15
lufillration - MGD	51.30	53.00	54.05	54,91	55.78
ariundwater Pumpage-MaD (Dic. Only)	4.71	4.71	4.71	4.71	4.71
Water Distribution System Lost Water (D.C. Only)-MGD	41.88	31.88	31.68	31.88	31,88
rotal Wastewater Quantities - MCD - GCD	311.31 160	315.17 164	335.86 167	351.76 170	363,60 174
Totals - Rounded Off For Design-Mad	311	319	336	351	370

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SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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COMPBY LEB DATE 410.81 CKDBY DATE SHEET 1 OF 1

TABLE !!

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

	,				
ITEM	1985 .	1990	1955	2000	1005
Estimated Sewered Pop 1000 PERSONS	1843.7	19408	2014.1	2069.0	2122.2
Wastewater Quantities - MCD					
Virginia Maryland (WSSC) District of Columbia	13.80 144.85 143.67	11.43 155.35 136.33	31.10 164.13 139.53	35.86 171.78 143.12	39.41 181.53 147.65
Total-MGD (BPSA)	311.32	315.11	335.84	351.76	368.60
Totals Rounded Off For Design-MGD	314	319	336	351	370
Wastewater Characteristics					
Suspended Solids - PCD(1) -1000 LBS/DAY -MG/L(2)	0.15 460.9 17.7	0.15 485.1 181	0.15 503.5 180	0.15 517.3 176	0.15 530.5 171
BODS - PGD ⁽¹⁾ - 1000 LBS/DAY - MG/L ^{D)}	0.15 460.9 177	0:15 485.1 182	0.15 503.5 180	0.15 517.3 176	0,25 530.5 172
Total Nitrogen - PCD(1) - 1000 LBS/DAY - MG/L(2)	0.033 60.5 13	0.033 64.0 14	0.033 66.5 24	0.033 68.3 13	0.033 70.0 23
Total Phosphorus - PCD ⁽¹⁾ -1000 LBS/DAY - MG/L (1)	0.009 16.6 6.4	0.003 17.5 6.6	0.009 18, 1. 6.5	0.009 13.6 6.3	0.009 1.01 2.0
1) PCD - POUNDS PER CAPITA PER DAY 1) MG/L COMPUTED					

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TASK STUDY MEMO I-3	PHASE [
SUBJECT WASTEWATER QUANTITIES & CHARACTERIST	165

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM GGH

DATE 4-18-84	CKD BY	DATE	SHEET L	of <u>1</u>

TABLE 12 (CINTINUES)

BLUE PLAINS WWTP - RECORD OF WASTEWATER LOADING YARIATIONS

		AYEL		T	AVE	Y MOVI	NG	30.D AVER	MY MO	ING
ITEM	YEAH	AVG.	MAX.	MX/AY6	AV4.	MAX.	MAX/AV6	AVG.	MAX.	MAX/AV4
TOTAL NITROGEN (1000 to y day)	1912 1913 1914 1975 1910 1917 1918 1980	55.4 55.4 56.4 51.3 68.6	87.4 93.3 88.0 70.6 95.8	1.58 1.63 1.56 1.38 1.58	55.5 55.4 56.5 51.4 60.3	85.3 90.7 86.3 70.4 85.5	1.54 1.64 1.53 1.37 1.42	45.1 47.4 53.6 60.0 54.7 54.8 56.8 57.7	50.8 54.6 63.1 74.5 71.6 71.3 64.1 70.1	1.13 1.15 1.13 1.24 1.33 1.23 1.23 1.18
TOTAL PHOSPHOLUS (1000BS/DAY)	1071 1073 1074 1076 1076 1077 1078 1079	17.4 17.0 15.4 13.0 14.8 14.9 14.1 15.4	31.5 41.5 76.5 37.1 74.7 77.7 19.0 18.0 43.3	1.37 2.44 1.74 7.37 1.78 1.54 1.35 1.46 2.51	17.4 17.0 15.4 13.0 14.0 14.0 14.1 12.3 15.1	28.6 39.5 71.6 13.0 21.7 20.9 17.8 17.6 41.1	1.64 2.32 1.47 1.69 1.55 1.40 1.16 1.43 1.78	17.3 17.0 15.5 13.5 14.0 14.0 17.6 15.1	17.5 18.9 17.3 15.8 15.8 15.8 17.6 24.9	1.30 1.13 1.12 1.13 1.13 1.13 1.40 1.64
								THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE P		

GREELEY AND Hansen Ingineers TASK STUDY MEMO II-3

SUBJECT WASTEWATER QUANTITIES &CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY HEB DATE 4-10-84 CKD BY DATE SHEET 7 OF 1

TABLE 15 (Cont'd)

·	TABLE 13	(CINTA)			
M371	1985	1990	1995	2000	2005
Wastewater Characteristics (Continu	(d)				
B005				<u> </u>	
Annual Average - PCD -1000 LBS/DAY -MG/L Moximum Month - RATIO TO AN.AVA1000 LBS/DAY 3 Day Maximum - RATIO TO AN.AUG1000 LBS/DAY	617.6 1.74 802.0	0.15 485.1 182 1.34 650.1 1.74 644.2	0.15 503.5 180 1.34 674.7 1.74 876.1	0.15 517.3 176 1.34 693.1 1.74 300.1	0.15 530.5 171 1.34 710.9 1.74 913.1
Maximum Day - RATIO TO ANIAVG.	2.00 921.8	2.00	1.00	2.00 1034.6	1,061.0
Total Nitrogen Annual Average - PCD -1000 LBS/DAY -MG/L Maximum blouth - RATIO TO AN. AVG1000 LBS/DAY 3. Day Maximum - RATIO TO AN. AVG1000 LBS/DAY Maximum Day-RATIO TO AN. AVG1000 LBS/DAY Total Phosphorus	8.033 60.8 23 1.33 80.9 1.53 93.0 1.58 94.1	0.033 64.0 24 1.33 35.1 1.53 97.9 1.58	0.033 66.5 24 1.33 88.4 1.53 101.7 1.58	0.033 68.3 1.33 90.8 1.53 104.5 1.58 101.9	0.033 70.0 23 1.33 93.1 1.53 107.1 1.58 110.6
Annual Average - PCD -1000 LBS/DAY - MG/L Maximum Mouth - RATIO TO M. AVG 1000 LBS/DAY 3-Day Maximum-RATIO TO AH. AVG.	0.009 16.6 6.4 1.40 73.1 1.55	0.00 0 17.5 6.6 1.40 24.5 1.55	0.009 18.1 6.5 1.40 25.3 1.55	0.009 18.6 6.3 1.40 16.0	0.009 19.1 6.1 1.40 26.7
-1000 LBS/DAY Maximum Day -RATIO TO AN, AVG1000 LBS/DAY	15.7 1.78 29.5	27.1 1.78 31.1	18.1. 1.73 32.1	28.8 1.78 33.1	19.6 178 34.0
Wastewater Temperature Minimum Day - °C Wastewater Alkalinity (CaCO3)	11-0	11.0	11.0	11.0	11.0
Average - Moll Min. Day - Ma/L	133 50	133 50	133 50	133 50	133 50

REELEY
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DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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COMP BY DATE CKD BY DATE SHEET OF

LIGT OF FIGURES

FIGURE	Ν٥.	DESCRIPTION
1		Blue Plains and Adjacent Service Areas, Sewer Service Areas and Extent of Sanitary Sewered Areas (2005)
1		Blue Plains WWTP - Components of Flow
3		Blue Plains Service Area, Sewered Population Forecasti
4		Blue Plains WWTP - Record of Wastewater Temperature
5		Blue Plaine WWTP-Record of Wallewater Alkalinity
Ġ		Blue Plains WWTP-Record and Forecast of Annual Average Wastewater Quantities
٦		Blue Plains WWTP - Record and Forecast of Annual Average Per Copita BODs and Suspended Solids
8		blue Plains WWTP-Record and Forecast of Annual Average Per Capita Total Nitrogen and Phosphorus
9		Blue Plains WWTP-Record and Forecost, Annual Average Suspended Solids.
10		Blue Plains WWTP - Record and Forecast, Annual Average BODs
11		Blue Plains WWTP-Record and Forceast, Annual Average Total Nitrogen
11		blue Plains WWIP-Record and Forecast, Annual Average Total Phosphorus
13		Blue Plains WWTP - Wastemater Flow Variations
14		Blue Plains WWTP - Suspended Solids Variations
		t_{i-1}

(Continued)

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SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY DATE CKD BY DATE SHEET CKD BY OF 1

LIST OF FIGURES

(Continued)

FIGURE No.	DEICRIPTION
15	Blue Plaius WWTP - BODS Variations
16	Blue Plain WWTP - Total Nitrogen Variations
17	Blue Plains WWTP- Total Phosphorus Variations
18	Blue Plains WWTP - Maximum Wastewater Flow Rates
19	Blue Plains WWTP - Peak Flow Rates Due to Storm Events Based on 3-650 Alternatives
10	Blue Plains WWTP - Duration of Peak 15-Minute Flow Rate Due to Storm Event
21	Blue Plains WWTP. Peak (15-Minute) Flow Rates (Combined Storm/Wastewater)

TASK STUDY MEMO 1-3 PHASE I GREELEY AND DISTRICT OF COLUMBIA SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS HANSEH **BLUE PLAINS FEASIBILITY STUDY** NGINEERS FIRM GGH COMPBY REB DATE 4-11-81 CKD BY_ DATE_ SHEET. FIGURE 1 D. C. ONLY -FLOW EMPLOY-VI51 -FROM TARS TIMBM HOUSE-A5506. A5506. FLOW HOLDS LELOW_ WATER DIST. SAUITARY SYSTEM GROUNDWATER INFILTRATION LOST WATER PUMPAGE FLOW FLOW (D.C. ONLY) (D.C. BULY) FLOW FROM FLOW FROM STORMWATER WASTEWATER EVENTS (P.C. ONLY) SIURCES FLOW RECEIVED FOR TREATMENT AT BLUE PLAINS WWTP

> BLUE PLAINS WWTP COMPONENTS OF FLOW

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_ phase <u>l</u> TASK STUDY WEND IN 3 SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA **BLUE PLAINS FEASIBILITY STUDY**

FIRM GUH

__ DATE 4.28 8 1 CKD BY__ COMP BY LEB SHEET LEGEND: FIGURE 3 ----FEASIBILITY STUDY (SOURCE: LOG) -PAEVIBUS FORECASTS 3.6 N 3.111,000 POPULATION - 1,000,000 PERSONS 3.0 , 2,687,000 1.4 N1,121,200 ESTIMATED FROM SOC PECION TOTAL- BLUE 1.3 GRAWTH TARKE PLAINS SERVICE AREA 1,764,700 ≥1,419,300 ١,١١١,٥٥٥ 1.1 MARYLAND , 732,000 0.6 DIST. OF COLUMBIA N 178,900 YIRGINIA -

BLUE PLAINS SERVICE AREA SEWERED POPULATION FORECASTS

YEAH

1930

1990

2000

1005 1010

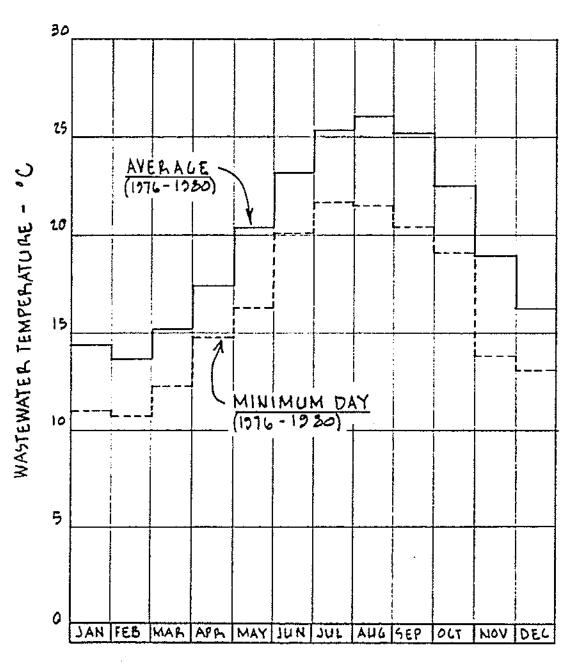
DESIGN

YEAR

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TASK STUDY N	KEMO NO. I	<i>.</i> გ	PHASE	<u> </u>	
SUBJECT WASTEN	LATER QUANTI	गाह्य ई ८म	ARACTERISTICS	BLUE	ISTRICT OF COLUMBIA PLAINS FEASIBILITY STUDY
	· · · · · · · · · · · · · · · · · · ·			FIRMG	6 H
SOURCE SEE	nor 4:60:81	AVA 50	0.75	CHEST	0.5

FIGURE 4



MONTHS

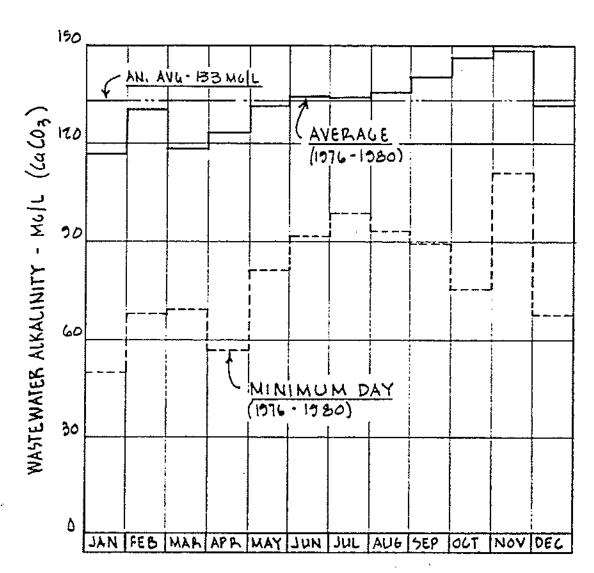
BLUE PLAINS WWTP RECORD OF WASTEWATER TEMPERATURE

SOULLE: SPWWTP MELONDS

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TASK STUDY MEMO I -3	PHASE		
SUBJECT WASTEWATER QUANTITIES & CHARACTE	ristics	DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY	
		FIRM G입H ·	
COMP BY REB DATE 4-10-81 CKD BY 1	DATE	SHEET OF	

FIGURE 5



MONTH5

BLUE PLAINS WWTP
RECORD OF WASTEWATER ALKALINITY

SHULLE: BPWWTP RECORDS

TASK STUDY MEM & T-3 PHASE I SUBJECT WASTEWATER QUANTITIES & CHALACTERISTICS				BLUE	DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY FIRM G名日			
COMP	_{by} Leb	DATE_44).41 CKD BY	DAT	ε	SHEET	OF	
	<u>L</u> I	EGEND:	,				£17.115.55	1.0
	400		BLUE PLA FEASIBILIT	•			FIGURE	9
- MCD	300				PLUE PLAI		370	
ANNUAL AVERAGE FLOW - MUD	200		٥.٤. ك	MARYLAN		¥	2131.5	
AUMUAL A	100	<u>w</u>	450 -x VI	RGINIA	DIST. OF C	OLUMBIA	>	
	8 <u> </u>	100	- lare	- 0	1000	1000	39.2 1005 2010	
	, 15 G	o Har		YEAR	1990	0	ESIGN	
g		ANNU AL A	NELAGE WA	STEWAT F	LA QUANT		real ID	
ე-	100							
AN JAVE. FLOW-GCD	100	_			BLUE PLA SERVICE A		₅	
	1760			YEAR	1790	ŗ	7005 2010 DESIGN YEAR	
		ANNUAL ,	AYELAGE WA	STEWATE	K QUANTI	<u> 14 - 600</u>)	
		<u>ĝ</u>	SLUE PLAIN NECORD AND NAUAL AV NASTEWATE	d fonec. Erage	<u>151</u>			

TASK STUDY WELLO II-3 BREELEY AND DISTRICT OF COLUMBIA SUBJECT WASTEWATEL QUANTITIES & CHARACTERISTICS HANSEN **BLUE PLAINS FEASIBILITY STUDY** GINEERS FIRM GEH COMPBY REB DATE 4-10-84 CKD BY LEGEND: FIGURE 7 ESTIMATED LECOLD WASTEWATEL BODS -LBS/KAP/DAY FEASIBILITY STUDY FORECAST. 0.40 FURELAST 0.15 PCD 4,10 1063-1080 AVG = 0.14 LBS/CAP/DAY ۵ 1970 1930 1990 2000 2005 2010 1560 YEAR DESIGN YEAR BOD5 WASTEWATER SS-LBS/CAP/DAY 0.40 FORECAST 0.15 PCD 0.10 1965-1580 AUG = 0.13 LBS/CAP/DAY 1960 1980 1000 1000 1005 1010 1010 YEAR DESIGN YEAR SUSPENDED SOLIDS BLUE PLAINS WWTP ESTIMATED RECORD AND FORECAST

ANNUAL AVERAGE PER CAPITA BOD AND SUSPENDED SOLIDS

MPCD - POUNDS/CAPITA/DAY

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TASK STUDY WENO T. 3 PHASE 1 DISTRICT OF COLUMBIA SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS BLUE PLAINS FEASIBILITY ST FIRM G&H	UDY
COMPBY FEB DATE 4-10-81 CKD BY DATE SHEET OF	
LEGEND: ESTIMATED RECORD FIGURE 8 FEASIBILITY STUDY FORECAST	— გ
0.04	
FORECAST = 0.033 PCD(1)	
0.03 / V 1972-1980 ANG. = 0.037 LBS/CAP/DAY	
0.01	
1960 1970 1980 1990 2000 2005 2010 YEAR YEAR	
TOTAL NITROGEN	
۵.015	
0.010 FORECAST = 0.009 PCD	u
1963-1980 AVG + 0.0104 LBS/CAP/DAY	
0.005	
1960 1970 1980 1990 2005 2010 YEAR DEILON	
TOTAL PHOSPHORUS	
TOTAL THOSE HOMAS	
BLUE PLAINS WWTP	

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

111 PCD - POUNOS/CAPITA/DAY

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AND
ANSEN
ANSEN GINEERS

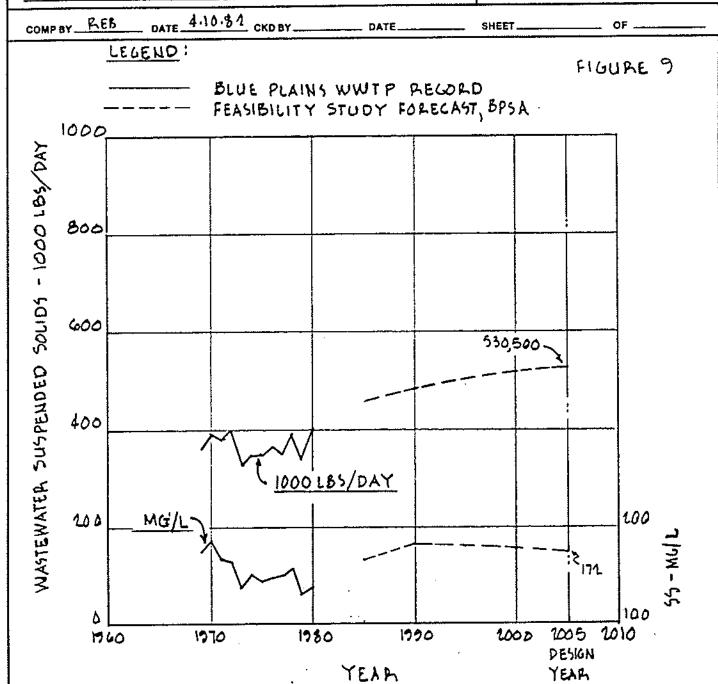
TASK STUDY MEMO II-3

PHASE I

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DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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DLUE PLAINS WWTP RECORD AND FORECAST ANNUAL AVERAGE SUSPENDED SOLIDS

RELIED SIDELE: BLUE PLAINS WWTP

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TASK STUDY MEMO IL-3 SUBJECT WASTEWATEL QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA BLUE PLAIN'S FEASIBILITY STUDY

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YEAR

COMP BY REB DATE 4.10.84 CKD BY_ SHEET LEGEND: FIGURE 10 - BLUE PLAINS WWTP RECOLD FEASIBILITY STUDY FORECAST, BPSA 1000 WASTEWATER BOD₅ - 1000 UB5/DAY 800 400 530,500. 400 1000 LBS/DAY 200 100 M6/L ک 171 D 1060 1990 2000 2005 2010 1270 1980 PESION YEAR

> BLUE PLAINS WWTP RECOLD AND FORECAST ANNUAL AVERAGE BODS

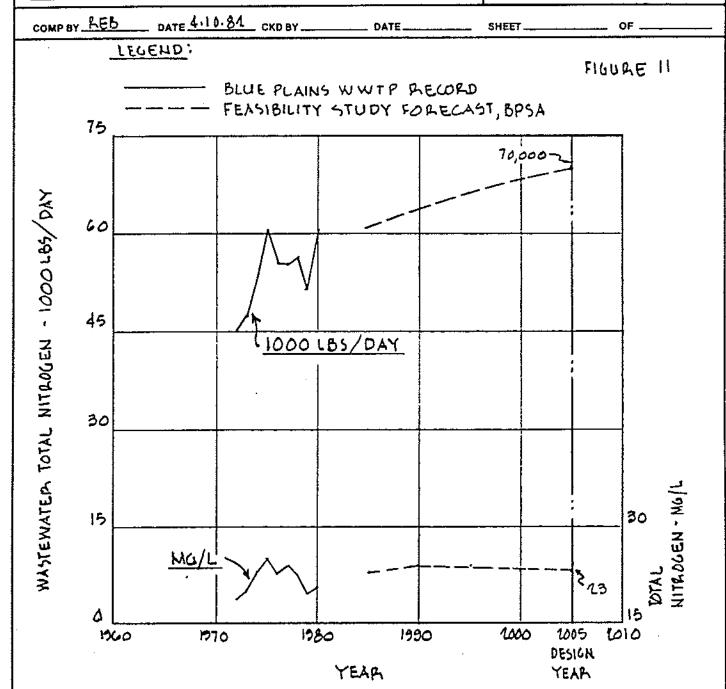
RELARD SOURCE ! BLUE PLAINS WWITP

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HANSEN EGINEERS	

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SUBJECT WASTEWATED QUANTITIES SCHARACTERISTICS	

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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BLUE PLAINS WWTP RECORD AND FORECAST ANNUAL AVERAGE TOTAL NITHOGEN

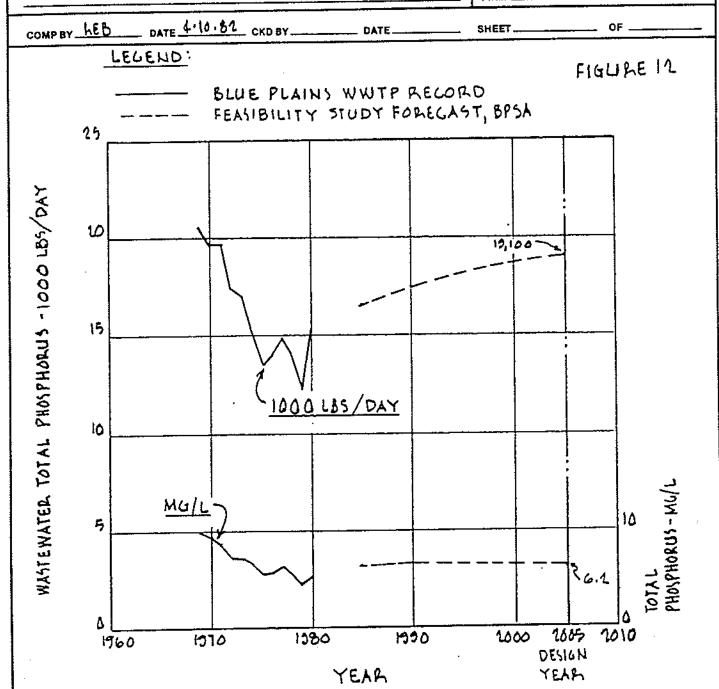
RECORD SOURCE ! BLUE PLAINS WITP

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BLUE PLAINS FEASIBILITY STUDY

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BLUE PLAINS WWTP RECORD AND FORECAST ANNUAL AVERAGE TOTAL PHOSPHORUS

RECORD SOURCE : BLUE PLAINS WINTP

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	WAST	'AWATER	CHITITIANG	& CHARACTERISTIC	5	

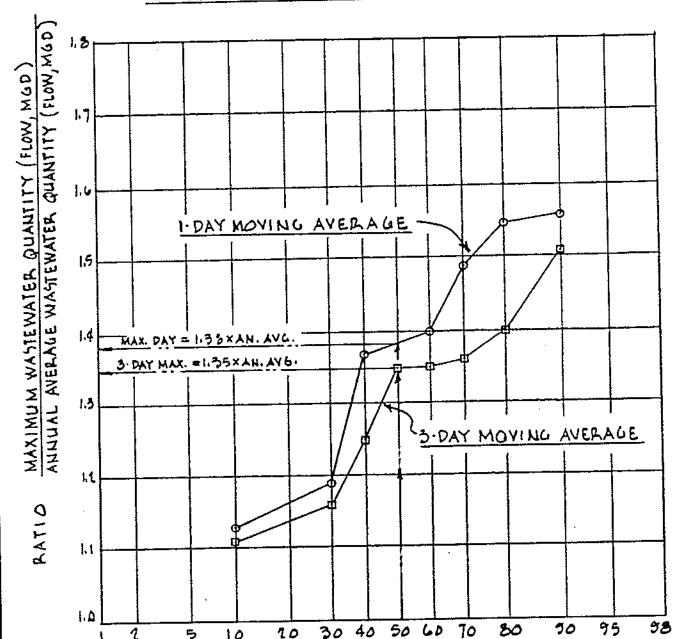
DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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COMP BY REB DATE 4-10.84 CKD BY DATE SHEET OF

BLUE PLAINS WWTP WASTEWATER FLOW VARIATIONS

FIGURE 13



OCCURANCE- PERCENT OF TIME RATIO OF MAXIMUM FLOW QUANTITY TO ANNUAL AVERAGE FLOW QUANTITY 19 LESS THAN OR EQUAL TO INDICATED RATIO

* RELORD SOURCE: BPWWTP (1971-1980 WASTEWATEL DATA)

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TASK STUDY MEMO L-3 PHASE I
SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

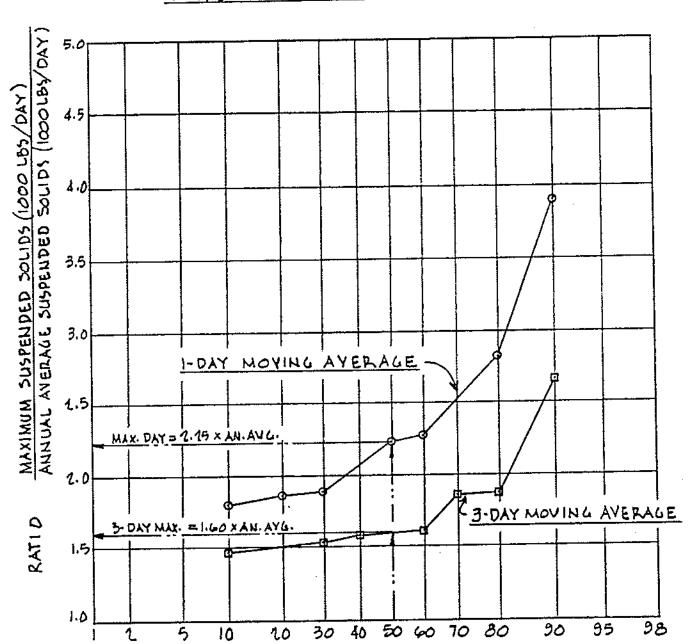
DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM G&H

COMP BY LED DATE 4.10.84 CKD BY DATE SHEET OF

BLUE PLAINS WWTP SUSPENDED SOLIDS VARIATIONS

FIGURE 14



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

RECORD SOURCE: BPWWTP (1974-1930 WASTERNATER DATA)

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SUBJECT WASTE WATER QUANTITIES & CHARACTERISTICS

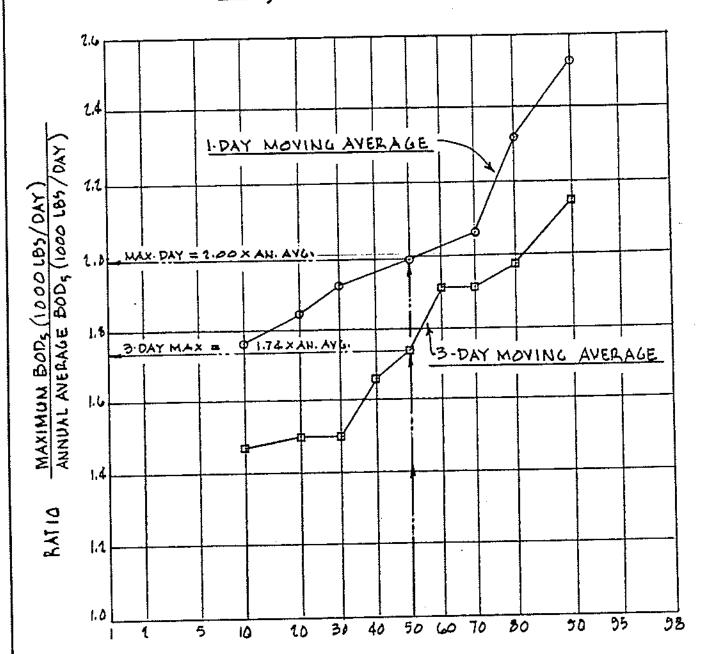
DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM GEH

COMP BY NES DATE 4.10.84 CKD BY DATE SHEET OF

BODS VARIATIONS

FIGURE 15



OCCURANCE - PERCENT OF TIME RATIO OF MAXIMUM BODS
QUANTITY TO ANNUAL AVERAGE BODS
QUANTITY 15 LESS THAN OR EQUAL TO
INDICATED RATIO

LELDED STURLE : BPNYSTP (19TE-1980 WASTEWATER DATA)

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AND
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GINEERS

TASK STUDY MENO II-3 PHASE I
SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

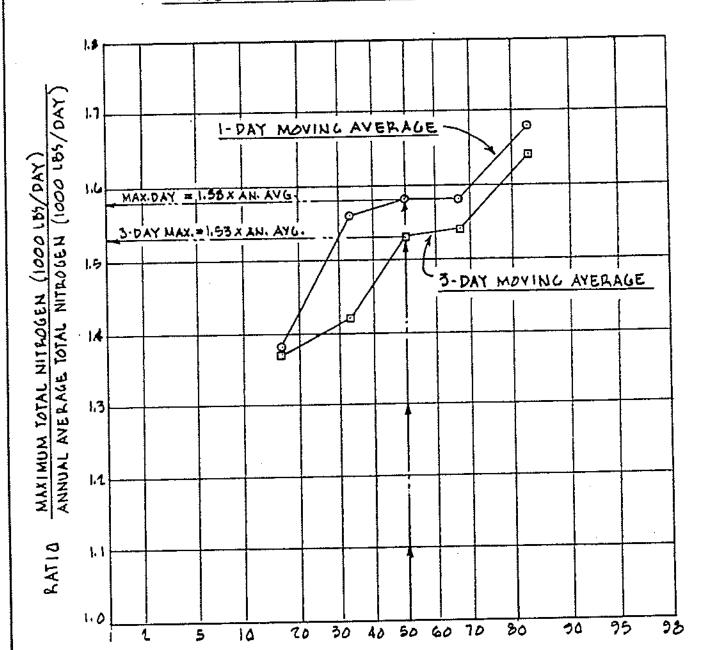
DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM GGH

COMP BY REB DATE 4-10-84 CKD BY DATE SHEET OF

BLUE PLAINS WWTP TOTAL NITROGEN VARIATIONS

FIGURE 16



OCCUPANCE - PERCENT OF TIME RATIO OF MAXIMUM TOTAL MITROGEN QUANTITY TO ANNUAL AYERAGE TOTAL MITROGEN QUANTITY IS LESS THAN DR EQUAL TO INDICATED PATIO

RECORD SOURCE! BPWWTP (MIG-1980 WASTEWATER DATA)

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AND
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GINEERS

TASK STUDY MEMO I. 3 PHASE I SUBJECT WASTEWATER QUANTITIES &CHARACTERISTICS

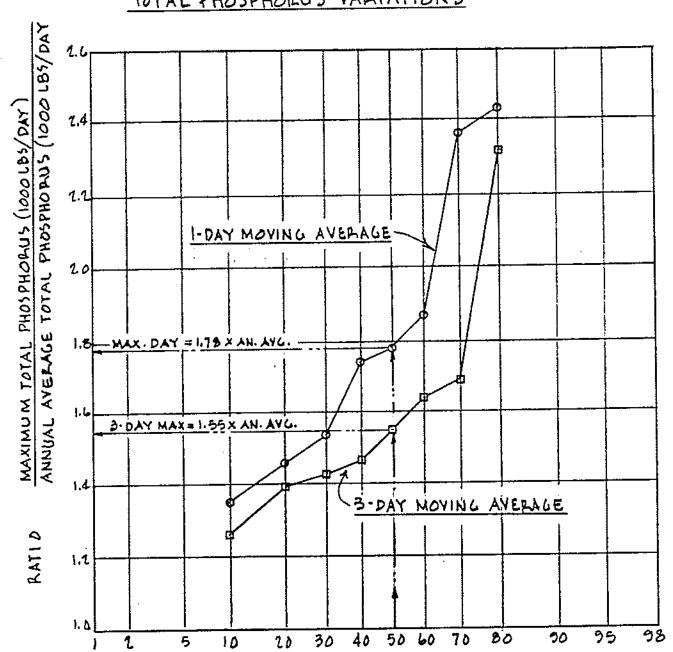
DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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COMPBY LEB DATE 410.81 CKD BY DATE SHEET OF

BLUE PLAINS WWTP TOTAL PHOSPHORUS VARIATIONS

FIGURE 17



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

LECORD SOURCE : BPWWTP (1974-1980 WASTEWATER DATA)

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SUBJECT WASTEWATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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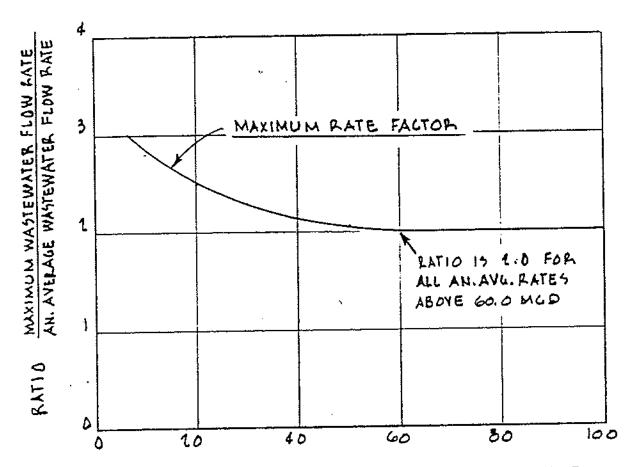
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FIGURE 18



ANNUAL AVERAGE WASTEWATER FLOW RATE - MGD

BLUE PLAINS WWTP

MAXIMUM WASTEWATER FLOW RATES

(EXCLUSIVE OF STORMWATER FLOWS)

Source: Board of Engineers (BOE)
1957 REPORT ON IMPROVEMENTS TO SEWERAGE SYSTEM

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AND
NSEN
NSEN INEERS

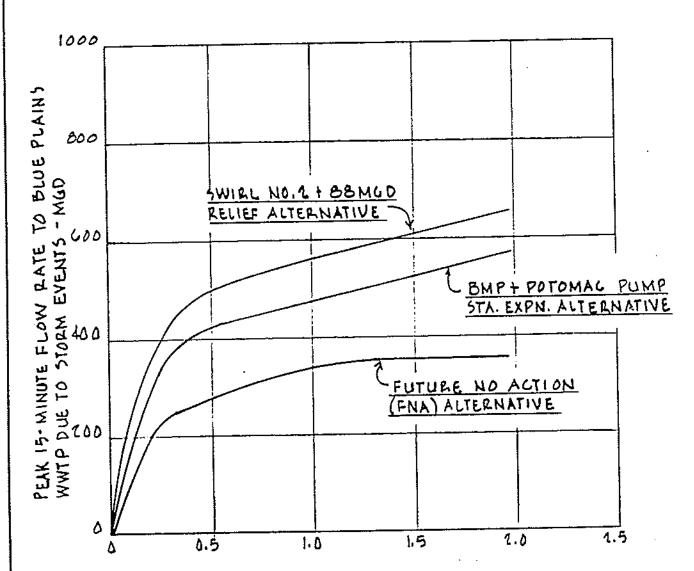
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SUBJECT WASTEMATER QUANTITIES & CHARACTERISTICS

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

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FIGURE 19



MAXIMUM GO MINUTE INTENSITY OF STOLM EYENT - INS/HOUR

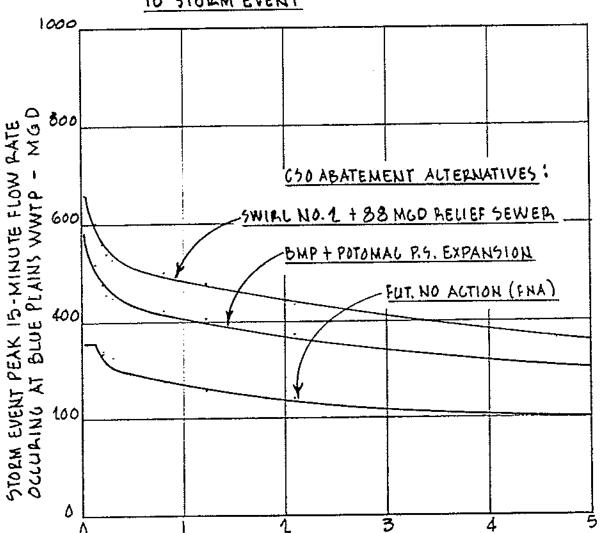
> PEAK FLOW RATES DUE TO STORM EVENTS BASED ON 3.050 ALTERNATIVES

SOURCE: O'BRIEN & GENE ENGINEERS, INC.
COMBINED SEWEL OVERFLOW STUDY

EELEY AND ANSEN LINEERS

TASK STUDY MEMO II-3 SUBJECT WASTEWATER QUANTITIES & CH	1	DISTRICT OF COLUMBIA BLUE PLAINS FEASIBILITY STUDY
COMPBY NEB DATE 4.10.81 CKDBY	DATE SI	HEET OF
BIDE DIAINS	NWTP-DURATION OF	FIGURE 20

BLUE PLAINS WWTP - DURATION OF PEAK 15-MINUTE FLOW PATE 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
CSO ABATEMENT ALTERNATIVES

STURLE: D.L. COMBINED OVERFLOW STUDY

<u></u>	. STU		MO I-3		PHAS	E_ <u>I</u>	DISTRICT OF COLUMBIA
'*	W	LSTEX	HIEL OULNI	ities & CHARA	CTERISTICS		BLUE PLAINS FEASIBILITY STUDY
Sui	BJEC1					 	FIRM GEH
-	OMP BY	SEB.	DATE 4.10.	<u>84</u> ckd by	DATE		SHEET OF
C	OMP BY		 			ALL 575	TEN CAPACITY
		ſ	- APROX. RAH TO CHUEY	ue of expan flow to bi	LUE PLAINS	NWTP	TEM CAPACITY FIGURE 21
	_		,0 0,,,,0				
	PLAINS WWTP - MGD	00			(2)		
	1		WYXIWAW	HYDRAULIC PI	 		THE OF
	¥	ر	a anno in	CO ALL A	(1150M60		EXPECTED WET WEATHER
	₹ 3 1	LOOK					PEAK RATES IN
	Z Z			11/1//////////////////////////////////		14.07/2	t1059MGD
			/	- 630 A	10	-,	מואקרטוי
	BLUE	900	1_/_			 	
	2		17				
	RATE.		- 		A (5WIRL WO. 1 t	A HUD!	TIO MCD, APRIOX. CAP.
	4	600	<i>i!' /</i>	150 ALT	A 13WIRL WO. 2 T	EXPH)	OF EXIST, COLL, SYST, TO CONVEY FLOW TO BOWWTO
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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:

- Documentation of Methodology Used for Projecting Base Annual Sanitary Wastewater Flows for the Blue Plains Feasibility Study - Phase I
- Appendix A of the above referenced report which contains the following:
 - Table A Round II "I-M" Estimated Employment Tributary to Blue Plains WWTP.
 - 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.
 - 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.

Mr. Clyde Wilber III May 5, 1982 Page Two

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

Sincerely,

Cameron Wiegand

Chief, Water Resources

Management

Enclosure

pw/BT/CW

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

PHASE I

Prepared for

Greeley and Hansen Engineers

by

Metropolitan Washington Council of Governments Department of Environmental Programs

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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 wastewaflows 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 sepa-Analysis Zones (CAZs) which, in composite, rate represent the entire metropolitan Washington area. To proappropriate inputs for projecting sanitary the 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 add 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 add 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 add 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 print-out 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. Sewershed Delineation

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

2. Water Use Rates

Since Loudoun County water billing information was not available in a form which is readily usable for this application, the Loudoun County Sanitation Authority and the City of Leesburg provided COG with water use rate estimates for both residential and commercial (employment) customers. Since the use rates are BPSA area-wide estimates, they are considered 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, all user rates were multiplied by a factor of 0.95 to obtain the sewage generation rates. (31)

BASE ANNUAL AVERAGE WASTEWATER FLOW PROJECTIONS

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

Employment and Household Flows

As described previously, employment flows are developed on a sewershed level by utilizing a unique unit flow factor and the aggregated/disaggregated Round II employment for that particular sewershed. For reporting purposes, these sewershed employment flows have been aggregated to the major basin level and are presented in Table D. Household flows were developed in a similar manner and are also reported in 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."
- Metcalf & Eddy, Inc. American Consulting Services/WSSC, "Anacostia - Beaverdam Sewage System Infiltration/Inflow Analysis," 1975.
- WSSC, "Parkway Sewerage System Infiltration/Inflow Analysis," 1978.
- WSSC, "Oxon Run Sewerage System Infiltration/Inflow Analysis," 1976.
- 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.
- 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

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BLUE PLAINS FEASIBILITY STUDY DISTRICT OF COLUMBIA

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Arlington									2,777								2,677
Loud oun County		2	029/92														26,620
Total	113,207 24,814 33,101 45,718 34,44 Ju. 4H	919	y lork	5,716	1,404	11,415	8	173411	1/26/2	6,043	881'02	1 1812	3961 3	4613	Login	221,41	אבי אולבין איניאן ניסאה בנחאה נושפון גבינ פפויסנה בנים ווינים וליבון מנינון מפון

GREELEY AND UAHSEN ENGINEERS

BLUE PLAINS FEASIBILITY STUDY DISTRICT OF COLUMBIA FIRM COG SHEET __ ENBLIECT RUIT -M" ESTIMBLED EMPLOYMENT TAGK WA 305:08-17, Suspute A, Trem S, PHASE I TRIBUTARY TO BLUE PLAIMS WINTP -- DATE ---- CKD BY ... COUP BY BOT DATE

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YEAR											2							Ŧ
2000							DRAINAGE	JA6	ų	BA	BASIN					_		
ANA- BENER DAMA JURISDICTION COSTO CREEK	ANA-	050/F		Ning?	BRMD CAGIN DIEPI-	LIME	LITTE AUDBY OYON	OYON	LITTLE AUDBY OYON PHANT		POTENA ROCK SCOTTS SEVEL SUGAR WATTS	Bock	Scorts	SENEC	SUGAR	WAITS		····
Distinct of	(3) (3) (3)				2					_		2	20%	2 3 3 3 3	Z GF		JAIOI , IOI AL	
Columbia						hanizi		12,078		17,839	72. 305 318,71						702,000	
Montgomery County	10,64			49,661		920'11	/8			285	1877 Jos'sul 578	1627		11011		18,46c	पाव ६३।	
Pince Aconge's Carothe	13,683 57,003	57,003						37,525							-		132 136	
Fairfax Countu			2826		38,785				25,590	_			2,638		3416		99 45	
Arlington									11.54					 	_		15.5	
Loud own Counts			3.4°														35930	
TOTAL	Stotet 51,003 43,756 49,661 38,785 33,470	5,00%	13,756	19761	39,785	0XAY8	8	187,82	1/11/62	4 toi8	18,80	1 162	h 8281	10)	91 916	1 331:6	858 BH1 19161 9165 12014 88812 2527 1888 40181 19162 18866	
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HANSEH EMDINEERS GREELEY

BLUE PLAINS FEASIBILITY STUDY DISTRICT OF COLUMBIA COF FIRM SUBJECT RATE "I-M" ESTUMATED EMPLOYMENT TASK WA 305.08-17 SHEDWIE A, TreMS, NIASE I TRIBUTARY TO BLUE PLAINS WINTP CKD BY COUP BY BOT DATE

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YEAR 2005	•					DŔ	Z Z Z	DRAINAGE		BA	BASIN						
JURISDICTION COSTO CORTE	אאט-	DANGE DANG CARLEX		CABIN	Brad Choim DEPL-	LITTE	LITTE HUDBY OYON FALLS BRAKL RUN		Phylip	Portew	PORK ROCK SCOTTS SENEC SUGAR WATES CAEEK RUN RUN CREEK RUN BRAVU	ROCK RUM	SCOTTS RUN	SENEG CREEK	SUGAR CALD RUN		warss Bilawu TOTAL
Ordrich of Columbia	352,4113					12,739		13,268		211 '912 91 h 81	2 H '9K		,				212,000
Hontgomery County	110,924			53,004		281,12	8			673	17 N.C.370 2297	1622		41,519		19410	45b, 083
Prince George's Caunty	19/11 711/21	נפויננ						316,85									254, 325
Fairfax County			unb		45,16/				10,707				14,845		522'9		112/113
Arlington County							_		865,2								86 672
Loud oun County			13,257														43,251
Toral	175'K 1415h 109'ES 22H'IS LOI'LL 6NL'509	7,167	274'1	Joy's	19154	t	8	186,22	29, H/S	5 5/6 3	00101 5227 HS 14 82 SOLWE 129 848 475 18 18 18 18 18 18 18 18 18 18 18 18 18	1,72,7	\$ 300 %	usu	5227	oria	095'8151

GREELEY ENGINEERS HAMSEN AND

BLUE PLAINS FEASIBILITY STUDY DISTRICT OF COLUMBIA FIRM COG T JSWII -SUBJECT Rd II "T-M" ESTUMPTED HOUSE HOUSE HOUSE TRIBUTARY TO BEVE PLAINS HINTP _ DATE_ TASK MA 305.08: 17, SCHEDING A, ITEMS, ... CKDBY COMP BY BAT DATE

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YEAR)							
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JURISDICTION COSTO CAREE	ANA- COSTIO	UENTER DAM CREEK		CABIN	BOND CAGIN DIFFI- RUH COCEK RUN	FALLS	MUDDY BRAK	Ser.	PMMFI	LITTLE MUDDY OXON PAMITY ROCK ROCK SCOTTS SENEG SUGMI WATTS FALLS BRAKE RUN RUN CREEK RUN RUN CREEK RUN	ROCK CREEK	ROCK RUN	SCOTTS RUN	SENEO CREEK	See See	WATTS BRANCI	WAITS TOTAL
District of Columbia	176,360					4390		19.215		HIM 107.BY	IVA, FOI						
Hortzomery	63,978			11017		ואנו											272,000
Pince Geomets							77			3	436 67,704 1153	133		FSh'LI		8127	Prz ,281
County	86/33	24,898	· -					29,713	_	_		 -	'				
Fairfax								-				1					[34, 14tt
County			2,773		18,713			<u></u>	12021				7654		4.00		
Arlington									+	T	+	+	-	+		+	45, 104
Rivay									\$105								V
County			9.056							 -	-	-	+	-	-		2,105
,	-		-	T	T	+	+	+	+	+	-	+		-	_		9,055
TOTAL	270,50 24,46	94,40	·	124/12	S 21,427 19, 7U 18,033	18,033	172	18,726,1	1 621/2	831/1 515 EX 1000/101 621/21 872/81 172	2,945 1,	153 4	592 17	t bsh	छत्रंत प्रश्ने निरम्पा पहले		187 759
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JIANSEN Engineers GREELEY

DISTRICT OF COLUMBIA FIRM COS Z 35VIId -SUBJECT PO I "T-M" ESTIMPTED HOUSEMYDS TRIBUTARY TO BEWE PLAINE WILLTP - DATE. TASK MA 305-08-11, SMEDULE A, ITEMS, CKD BY COMP BY BDT DATE

BLUE PLAINS FEASIBILITY STUDY

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2000				_	_	<u></u> _	× NAIN	DRAINAGE		BA	BASIN					,	
JURISDICTION COUNT CALLEY	ANA- COSTIA	OENFR Dam Callex		BRAD CAGIN DIFFI- RUL CAGEN RUN	CAGIN DIFFI- LOUN COLT CPEEK RUN		мирру Солчк	LIME AUDDY OYON FALLS BRANK RUN	Rung		POTEMY CREEK RUN RUN CREEK RUN	ROCK	SCOTTS RUN	ROCK ROCK SCOTTS SENECTOOON WAITS CREEK RUN RUN CREEK RUN BRAWU	Ser Aux Run		WAITS BRUWU, TOTAL
District of Columbia	Ms/SM					5489		778'07		יטנו'נו	11,176 111,431						269 000
Montgomery County	86,039			BS'M		15,616	\$			285	SEB'1 K2'78	1,835		35,206		9.H3	CHO'292 EN'S
Prince Beamels Countre	211 ⁶ 6 611 ⁸ 8	21.h'Œ						32,438									155 679
Fairfax County			2629		71,472				021,21				5,389		7388		142,10
Arlington									5,313								5,313
Loud oun County			25,740												(01/22
Total.	31,380 20,412 31,985 26,889 20,412 21,05	2140	286'10	W.519	ינה'יתו	sioin	46.3	paris	1 (20)2	BS/A	HICKS.	635	53.89	35,246	998.2	6/43	020'608 Enis 888'2 miss basis seal smin asiai eniz pries en

AND TASK WA AND INANSEN SUBJECT ENGINEERS

BLUE PLAINS FEASIBILITY STUDY DISTRICT OF COLUMBIA 9 FIRM COSE SHEET T asviid ---SUBJECT Pd II "T-M" ESTUMPTED HOUSEMULDS TRIBUTIARY TO BEWE PLAINS HINTP __ DAYE__ TASK WA 305-08-17, SMEDILE A, ITEMS, CKDBY COMP BY BOT DATE

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YEAR 2005			_			Ä,		DRAINAGE	- ك	BA	BASIN						
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District of Columbia	1 € 1,784					ью		85172		19751 125'0	113,681		•				38,000
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Pince Acomets County	977 X 178	22,228						32908									161,159
Fairfax Counly			€08}		28,603			_	17,045				2586		8,777		466,334
Arlington									इ.सम	· ,							5,344
Loud oun County			7,001										•		(-	10067
Tora.	812'18 31'91E	32,228		27,305	35,805 27,303 28,603 4,956	756 77	22/	73,067	7,409,1	8,411	571 39,047 12,409 18,411 LOS,559 1860 \$586 38,638 8,277	0.69	55B6 3	9x • 'a	3,277	otsb	834,103

GREGLEY And Uansen Engineers

A A, ITEM 7 PHASE I	SUBJECT DESTRUCT OF COLUMBIA PROJECTIONS & BLUE PLAINS FEASIBILITY STUDY	MANUAL AWAGGE VISITOR WASTEWATER FROMS FIRM COG	- CKD BY DATE SHEET
TASK WA 305-00-17, SCHEMME A, TTEM 7	DECT DISTRICT OF COLUMN	LAWAL AWORAGE VISITOR	COUP BY BOT DATE

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	ما	3	476	4.27	3,274	707.0	7.804
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	1985	Flew.	-dear	t's#1	7612	0,411	4.16
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	1480		4		71/27	0.211	4.028
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Ģ FIRM SHEET HASE BUBLECT DOWNESTIC AND EMPLOYMENT SAUITARY FINAS TO BLUE PLAINS BY TURESOKTUM & BYSIA DATE TASK WA 105-08-17, SCHENIKE A, ITEM L. CKD BY - DATE COMP BY ANT

BLUE PLAINS FEASIBILITY STUDY DISTRICT OF COLUMBIA

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		TOTAL	19.900	94.875 15,410	28.47¢	9.505	0.1.80	2,468 114.0	150,315	
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		SCOTTS SELVED SUGAR	·	3.63.5					3.11.	
	<u> </u>					9.93¢				
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ENGINEERS GREELEY HAHSEN AND

9 FIRM COST N SUBJECT DOMNESTIC AND EMPLOYMENT SAVITARY TASK WA 305-08-17, SCHEINE A TTEM J. PHASE I. FUNDS TO BLUE PLAINS BY JURISOKTIM & BASIN - DATE - CKD BY _ DATE__ COUPBY BLT

BLUE PLAINS FEASIBILITY STUDY DISTRICT OF COLUMBIA

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BLUE PLAINS FEASIBILITY STUDY DISTRICT OF COLUMBIA

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	-	ANA- OENER BA COSIIA CREUK, RU	31.375 10.504 2.5034 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623 1.623
	YEAR 2005	JURISDICTION COSTIN CREEK RUIT	Pushnet of Calverbia Hangomery County Frace George's County Artegon County Loudoun County

(CAND) (CALD) Charament .

GREELEY ENDINEERS HANSEH QNV

FIRM COSE SUBJECT TOTAL SAUTTARY FLOWS TO BLUE PLAINS BY T BHIASE T JURISAICTION AND DRAWAGE BASID TASK WA 305-08-17, SCHEDULA A. ITEM 7.

BLUE PLAINS FEASIBILITY STUDY DISTRICT OF COLUMBIA

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			*				<u>' </u>	. 	
		TOTAL	f83.278	57.676	39.857	મા:મા	0.976	2,537	199.043
		ROCK ROCK SCOTTS SENEC SUGME WATES TOTAL CAREEK RUN RUN CLEEK RUN BRUND		1.834					1687
		Sucha				1251			1251
		SENEC		5.543					5.547
		SCOTTS				1.210			012.1
	<u> </u>	POC K		0.482					0,211 23.52 2,952 2,953 41,630 0,482 1,212 5.547
	BASIN	ROCK	2.805 20.437	0,148 20,793 0.482					41,630
			2.80\$	0,148					2.953
	ų.	HITE MOOY OVON PHMIN				1.07	9440	ļ	250'\$
として	1A6	LITTE AUDON OVON	15,425		701'8				23.523
こと	DRAINAGE	NUDBY		0.211					0,211
		ume Faus	1.324	£10'}					1981
		PFF- COLT ROW				5,403			3.016 8.579 5.403 5.381
		BRAD CABINA JOHNA RUN CAEER		8.539		-			8.579
	_					0.509		£833	3.016
		USWER DAM CREEK			tso't				
		ANA- costa	13,819	250'7i	650't 35'17		1		82.530 P.019
	YEAR 1980	JURISDICTION COSTA CREEK	District of Columbia	Hantgomery County	Pince Beorge's	Fair fax Cocolu	Arlington	Loudoun	

1 Visitors! Flow Component = 4.028 mgd.

HANSEN Endiheers OREELEY

BLUE PLAINS FEASIBILITY STUDY DISTRICT OF COLUMBIA FIRM _COG SUBJECT TOTAL SANDARY FLOWS TO BLUE RAINS BY T BHASE T JURISDICTION AND DRAWAGE BASID TASK WA 305-08-17, SCHEOWER A, ITEM I, COMP BY BAT

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TABLE E (CONT.)

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× 1	L																
YEAR 1985		_		_	_		<u>∠</u> ≲.	DRAINAGE	_	BASIN	NS.			•			
JURISDICTION COSTA CAREK	AHA- COSNA	BENEK CAEEK	Blokb	BAND CAGIN DIFFI- SON COUT RUN CAGEK RUN	DIFFI- CULT RUN		LIME AUDOY FALLS DRAK	EV N	Phamin RUN	Portowe	POCK ROCK FOIDW CREEK RUM	ROCK	SCOTTS RUN	ROCK ROCK SCOTTS SENEC SUGAR CREEK RUP RUP CREEK RUN	SUGAR AND RUN	WAITS BRAWL	TOTAL
District of Columbia	15,403					1,493		15.1608		3,081 21,324	21, 324			,			92.278
Honlgomery Go <u>u</u> nly	192'61			867%		1,298 0.315	0.315			0.138	22.522 0.534	0,594		146.2		2.058	Z.088 63.812
Pince Buome's Caunty	23,577,428	7,428						8:3/1								,	39.36.6
Fairfax Govoly			0,682		774.7				3.263				1.310		0487		13.641
Arlington County				_					1,00,1		!						1.00:1
Loudoun County			3.821													_	158.5
1	21.22 7.424	52412	1.503	1843 1747 887% 605.	274.2	5,491	0.315	3150, 2 0181, 1991, 1981, 0,534, 1.300 6.91, 1.510 2,05K	£ 7Z'1	3.279	3.84¢ C	1.53.t	3.00	116.	0117	350'2	213.922
														•		•	

Wasters! Flour Component = 4.965 mgd.

OREGLEY AND HANSER ENGINEERS

BLUE PLAINS FEASIBILITY STUDY DISTRICT OF COLUMBIA FIRM COST SHEET_ SUBJECT TOTAL SANTARY FLOWS TO BLUE PLAINS BY TASK WA 205-08-17, SCHEDULE ALTIEM 7 ... PHINSE I JURISDICTION AND DRAWAGE BASID CKD BY_ DATE_ COMP BY BAT

TABLE E (CONT.)

YEAR						2	A A	DDAINIAGE	ſ	PACIN		•	-			i	
						5	- - -) ; ; 		5 _ }_	, - :) _						
JURISDICTION COSTA CREEK	ลฟุล- <i>co</i> รทก	GENER DAH CREEK		BOND CABIN SON CABER	DFP!- Count Run		FALLS BRAKE	OXer	PHMIT RUN	Potter	FOTOW CAPEK RUN RUN CAREK LALD	ROCK RUN	SCOTTS	SCOTTS SEHEC RUN CREEK	SOCAR LALD RUN	WATES BRAWU	TOTAL
District of Colymbia	16.204					f.739		21.6.51		3,199 21,569	21.549						4.950
Hailgomery	555'8			10.324		+EE'0 215'\$	146.0			017'0 190'57 552'0	75.00.2	017'0		0.₩o		08 \$'2	2,530 71.086
Prince Ocompe's County	21218 25517	2,232						£444			*		1	1			41,768
Fairfax Gozofi			lasro	-	7,123			-	3.471				7.71		2.22.1		15.458
Artımılun Cauntu								· · · ·	1.012								ر10.1
Loudoun County			5.227			-								<u> </u>	ľ		5.117
Total	58,411 8,732	2.732	6.108	10.334	3.433	1577	145.0	3.423 6.251 0.374 24.940 1.483		1.134 14.575 0.410 1.412 1.910 2.221 2.530		017	112	.910	1227	2	105.927
ं - - -	•	-		9								ĺ		ĺ			

* Visitors! Flow Component = 6.183 nyd.

ORECLEY
AND
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ENGINEERS

BLUE PLAINS FEASIBILITY STUDY DISTRICT OF COLUMBIA 502 FIRM | SHEET. SUBJECT TOTAL SANDARY FLOWS TO BLUE RAILYS BY TASK WA 205-08-17, SCHEDWE A TTEM 7 ... - PINSE I DAYE JURISDICTION AND DRAINAGE BASID _ CKD BY __ COMP BY BATE DATE

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TABLE E (CONT.)

						•											
YEAR 1995			٠	• • • • • • • • • • • • • • • • • • •		D. C.	NIA	DRAINAGE		BASIN	NIS		-	•	_		
JURISDICTION COSTA CARECT	ANA- COSUA	USWER DAN CREEK		BRAD CABIN COLT FOR CAREN ROW		ume	LIME AUDDY OYON			Potrave	POCK ROCK SCOTTS SENECT	RUH	POCK ROCK SCOTTS SENECT WORN CREEK RUH RON CREEK RUH	SEVE	SUCAR RUH	BOUND	TOTAL
District of	17.4%				-	1.745		121'9)		5,326 21,703	21.703						98.140
Harlgomery	156.05			176.01		4,718	0,426			0.174 21.622 0.658	22.83.25	0.459		+5/-0/		2,443	77.411
Pince George's	18.201 8.76	8.76.6						4.01.4									43.584
Fairfax			1,054		8.330				3.729				1,585		4'183		18.855
Arthoglan									1,012							-	1.012
Loudoun			6.127														6.127
TOTAL	13,341	13,341 8.11.		2)6'01	C.330	6,463	124.0	817.0 10.912 1.852 1.10 1.10 1.10 1.10 1.10 1.10 1.10 1.10	1,74.1	3,600	14.525	887.0	1.585	10.154 1.157 2.463	1.153	5,663	245.23d
Associated Company		1000		7.809 mad.							l	• 					

* Visitors' Flow Component = 7.809 mgd.

OREELEY AND Hansen Engineers

BLUE PLAINS FEASIBILITY STUDY DISTRICT OF COLUMBIA FIRM COG SHEET ... BUBBECT TOTAL SANTARY FLOWS TO BLUE PLAINS BY TASK WA 205-08-17, SCHEDWA A, ITEM I, PHASE I JURISDICTION AND DRAINAGE BASID _ CKD BY __ COMP BY BATE DATE.

TABLE E (CONT.)

						•	1	1	j	3		•						
YEAR						:				,				Ì				-
2000		_		_		<u>ක</u> ි -	Z- Z-	DRAINAGE		BASIN	Z.	•		_				
JURISDICTION COSTON CAREEK	AN(A- costia	BENER PAN GREEK	Brato Rox	BAND CABIN DIFFI- 1011H CULT RUH CREEK RUN	MFP!- CULT RUN	LIME FAUS	LIME AUDOY FALLS DRIVK	Prov	Phami	Mark	ROCK	ROCK RUN	Scoms	POTOM CAREK RUM RUN CAREK RUM	SVENA	WATS	TOTAL	
District of Columbia	18,152					1363		16.354		3,370 22.03	120.55						* 101.727	
Honlgomery County	£202?			11,546		1,82 ¥ 0.484	0.484			106.0	28.096 0.653	6,453		625'11		1.801	82,260	
Rince Ocompos Canaly	55.739 ps.939	£6'01						240'0									16.750	
Fairfax Counh			6511		9.2.9				1.013				8047		1.816		ረነነዓ፡ዕ፦	
Arlington Cavaly									+101								1.014	
Loudoun Caualy			1,552				,							:			7.552	
<u>J</u> oral	15,514 10,939		8.709	8.709 11.54 9.218 6.594 0.484 12.412 5.054 3.471 50.115 0.453 1.704 11.514 4.816 2.801	912'	.594 €	1.484	211-22	1500	1477	521.0	1 859"	30E.	1 615'	718		260.245	
* Visilors' Flow Component =	Compos	ent =	[10,055 mgd	ئۇ													

HANSEN Engineers GREELEY AND

505 FIRM ENDIFER TOTAL SANDARY FLOWS TO BLUE RAINS BY T SKING ---DATE_ JURISDICTION AND DRAWAGE BASIN TASK WA 205-08-17, SCHEDULE A, ITEM I. CKD BY DATE_ COMP BY BOT

BLUE PLAINS FEASIBILITY STUDY DISTRICT OF COLUMBIA

SHEET

TABLE E (COUT.)	DRAINAGE BASIN	ANA- BENER BEND CARDIN DIFFI- LITTLE AUDOY OYON PHMIT FORDIX ROCK SCOTTS SELECT SOUND LAND LAND CAREK RUN RUN CREEK RUN CREEK RUN TOTAL	1.790 1.561 3.111 22.341 1.06. 2.57	12,185 4,934 0,540 0.328 24,352 0,669 12.859 2.938 87,030	\$0.194 SD.194	951.29 5.434 5.434	51011	8.588	727.27 886.2 ptp. 2 728.21 883.1 823.1 823.0 63.148 35.78 83.7 883.1 833 12.887 874.1 878.8 614.81 144.8	imposent = 13.248 mgd.
		CABIN DIFFI- SOIIN COLT CAEEK RON			-			8.588	6.4 846 12,115 Boss 6,7	13.248 mgd.
	_	AHA- DENER DAN COSTIA CREEK	48.883	23,243	51,248 13,417				48.424 13.413	ouponent =
	YEAR 2005	JURISDICTION COSTA CAREK	District of Colympia		Pince George's Couply	Fair (ax Cognla	Artington Couply	Loudoun	Tora	* Visilors' Flow Component?

YANSOH CHA KARAH EREZHIDHE TASK W.A. 305-08-17, SCHEDING A TITEM 7 PHASE I SUBJECT EMBOYMENT ANNUAL AUERAGE WASTEWATER FOR BPSA (1980-2005)

DISTRICT OF COLUMBIA
BLUE PLAINS FEASIBILITY STUDY

FIRM COG

COMP BY B.O.T DATE 3/5/82 CKD BY DATE SHEET OF

			ABLE	F		
Supremail	1980	1985	1990	1995	2,000	7.005
DISTRICT OF COLUMBIA	19.760	19.514	19.934	20.262	20.600	20. 937
Mouss G. (Ire. Beknue)	13.470	15.510	18.160	4.674	21.599	23.469
Accounted Tark Attempte the OP SONECA STD	12.859	14.737	17.124	i 8, 468	20.149	21.777
PRINCE GEORGES TOTES	8.880	9. SZS 25.035	10.559 23.719	11.089 30.763	13.059 34.658	1 5.309 38 118
Clack As Co.	2.310	3.041	3.710	4.613	5.374	6.132
ACTUMENT ISTAL ACTUMENT USE OF ALLONS	2.310	2.582	2.79/	3.169	3. 230	3.812
Lousewa Coa TOTAL VA ->	o. 249	<i>0.356</i> 3.397	0, 559 4.169	0.77/ 5.384	1.043 6.417	1.254
TOTAL HOWAR FLOWS BLUE PLIMS SERVEB AREN	44.669	47.946	52.922	56.409	61.675	67.101
ADJUSTED BPSA TOTALS			-			
TE Severis Useo	44.058	47. 173	51,886	55. zo3	60.225	65.409
IP Pumptons	44.669	47.487	52.∞3	54.965	59. <i>531</i>	64.781
- IF SENICA ई निकन्द्राम्य दिन्त	44.058	46.714	50.967	53.759	58.081	63.089

GREELEY
AND
HANSEN
ENGINEERS

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

SUBJECT DOMESTIC ANNUAL AVERAGE BLUE PLAINS FEASIBILITY STUDY

WASTEWATER FOR BASA (1980 - 2005)

FIRM COG

COMP BY B.D.T. DATE 3/5/82 CKD BY. DATE. ABLE G 1995 1990 2005 1980 1985 2000 VIRISDICTION DISTRICT 68,833 67,799 64.490 70. 069 71.072 72.072 يم ن Columbia MONT. G. (JAC. 48.302 44.206 52,926 57. 137 60.661 63.569 Reknue) ACJUSTED TOTAL 54.529 46.383 50.546 Assuming the 57. 72 *l* 42.703 *5*9.871 OF SENECH STD Hence 29.841 28.977 32,495 GEORGES 31,209 33.*6*91 34.885 90.131 94.351 73.454 84.135 78.143 FAIRFAX CO. 11.604 12760 (Jac Ag. Co. Froms) *(୦*. 38*5* 15.254 16.582 18.012 ANDISTED TOTAL ASSUMING USE 9.863 9.409 10,498 11,112 10.066 10,385 OF Amoun Loubour 6.504 Ca. z.288 5.456 7. 334 3465 4.668 TOTAL 23,086 25.340 20.710 15.069 17.42 % VA ---TOTAL KEGINAL FLOWS 150.346 161.011 170.756 195.872 181.414 188.540 BULE PLANS SERVICE AZSA *Addusted* BPSA TOTAE 192.174 185,270 159.092 178.570 168.376 148.843 •IF SEVELAIS وعدلا 18B.972 182. 024 159.270 174.658 167,605 IF Pumpow 150.346 is Useo 185.274 178.754 165. 225 173, 814 IF SENECA ! 157.351 148.843 Aumopour Bon