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A NATIONAL SURVEY OF
MANPOWER UTILIZATION AND FUTURE NEEDS
OF CONSULTING ENGINEERING FIRMS ENGAGED
IN WATER POLLUTION CONTROL

by

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Professor of Civil and Environmental Engineering
Utah State University

and

Chairman, Manpower Needs Committee
American Association of Professors in Sanitary Engineering

in cooperation with the
Consulting Engineers Council
of the United States

and the

Office of Water Programs
Environmental Protection Agency

LOGAN, UTAH 84321

MARCH 1972

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CHAPTER I

INTRODUCTION

As part of the overall evaluation of manpower needs in the environmental field, a survey of architectural and engineering firms was jointly sponsored by the Consulting Engineers Council, the American Association of Professors in Sanitary Engineering and the Environmental Protection Agency. A questionnaire was mailed to 8,050 engineering and architectural firms that subscribe to the magazine Consulting Engineer. The firms were asked to indicate if they were involved in water pollution control work, and if they were, to complete a detailed questionnaire outlining the activities of the firm. A copy of the questionnaire is shown in Appendix F.

The 8,050 recipients of the questionnaire were thought to represent a significant proportion of the 10,614 engineering and architectural firms with four employees or more located throughout the USA (1). Firms not engaged in water pollution control work were not expected to return the questionnaire, although such a request was made. However, 640 firms returned the questionnaire indicating no activity, and 941 firms returned completed questionnaires indicating their degree of activity in water pollution control. Forty other partially completed questionnaires were returned that did not contain adequate data to be included in the final summary and analysis.

A return of over 1,600 questionnaires out of the total of 8,050 was a reasonable response from a mail survey requesting such detailed information, and considering the number of firms that were known to be engaged in unrelated activities, the response was exceptional. A further indication of the significant degree of response is indicated by the construction value of the wastewater treatment plants for which the firms had prime responsibility. Kollar and Youngwirth (2) have reported that the total construction put in place for water and wastewater treatment plants during 1970 was \$4.5 billion, and the construction value in 1970 for wastewater treatment plants handled by firms responding was \$4.5 billion (Table 1). The value reported by Kollar and Youngwirth includes expenditures actually invested for both water and wastewater treatment plants during 1970, and the survey value represents construction planned during 1970. Therefore, the two values are not directly related, but the comparison does indicate that a very significant proportion of the firms engaged in wastewater treatment design were involved in the survey response.

Two hundred and thirty-two firms with over 70 percent of the professional personnel involved in wastewater treatment plant design represented 24.6 percent of the total number of firms responding. When this total of 232 firms was compared with the various listings of engineering firms providing water pollution control consulting services, it is obvious that a significant sample of engineering firms principally engaged in water pollution control work was obtained. For example, there are only 223 "Consultant Members" of the Water Pollution Control Federation listed in the 1971 Yearbook of the Federation Journal, and Chemical Engineering lists 248 companies in an

Table 1

A Classification by EPA Region of the 941 Firms Reporting According to Number of Firms and Employees and Construction Value of Wastewater Treatment Plants for which Firms had Prime Responsibility.

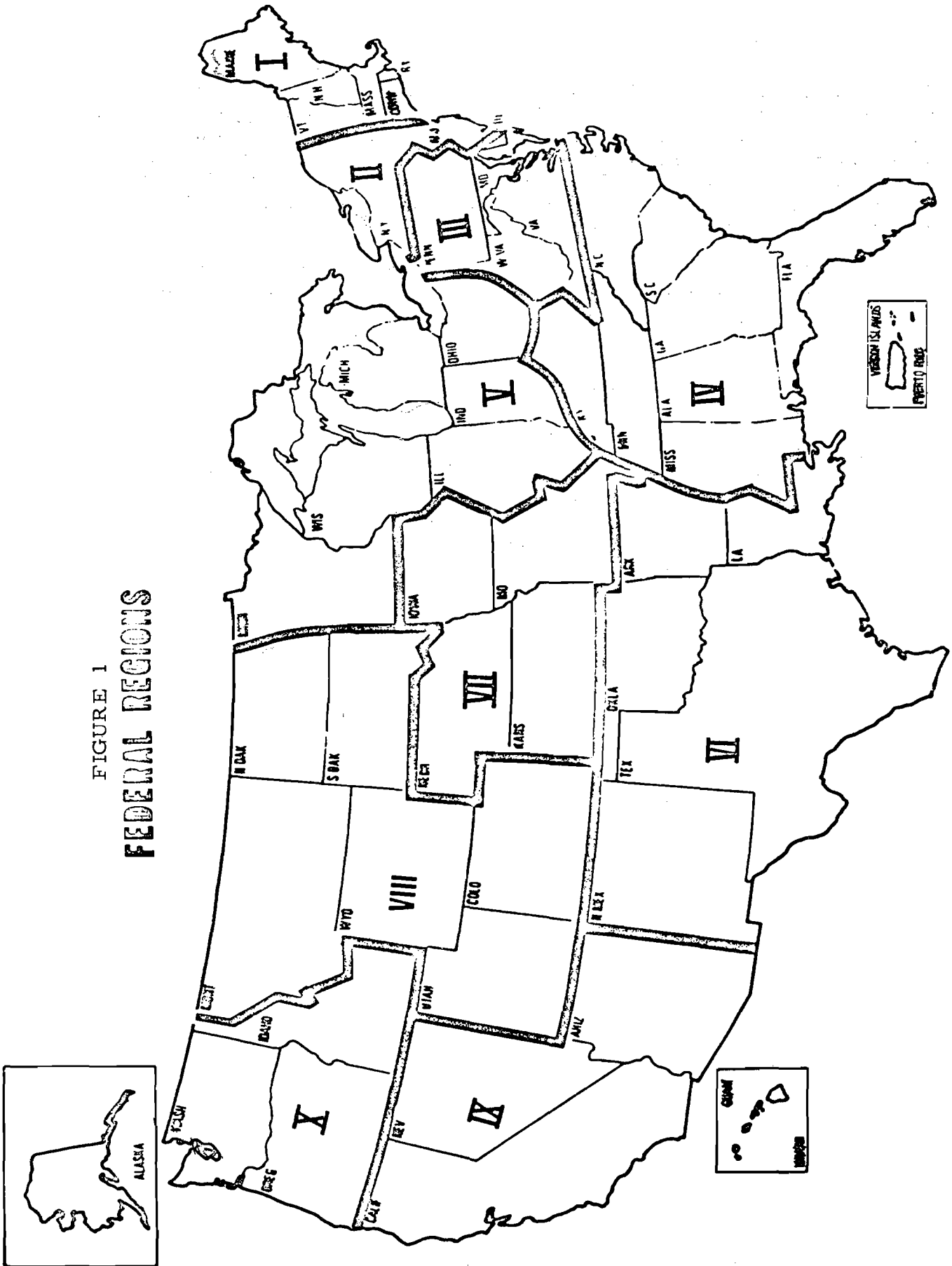
EPA Region	Firms		Employees (All Grades and Classifications)				Construction Value of Wastewater Treatment Plants for which Firms had Prime Responsibility			
			Full-Time		Part-Time		1970		1969	
	Number	% of Total	Number	% of Total	Number	% of Total	Dollars	% of Total	Dollars	% of Total
I	47	5.0	3,936	8.0	165	7.0	363,352,000	8.0	273,310,000	7.4
II	103	10.9	6,410	13.0	255	10.8	1,216,169,000	26.8	861,351,000	23.4
III	102	10.8	10,425	21.2	354	15.0	397,447,000	8.8	260,451,700	7.1
IV	142	15.1	3,892	7.9	301	12.8	316,517,000	7.0	192,253,000	5.2
V	189	20.1	4,992	10.2	366	15.5	1,014,879,152	22.4	583,644,500	15.8
VI	89	9.5	2,418	4.9	200	8.5	233,982,000	5.1	109,095,225	3.0
VII	60	6.4	6,916	14.1	182	7.7	336,986,000	7.4	276,245,500	7.5
VIII	37	3.9	570	1.2	125	5.3	27,680,000	0.6	34,720,000	0.9
IX	97	10.3	6,502	13.2	219	9.3	214,938,000	4.7	159,736,000	4.3
X	57	6.1	1,024	2.1	102	4.3	49,956,100	1.1	34,229,000	0.9
Unknown	18	1.9	2,065	4.2	88	3.8	365,841,533	8.1	904,763,887	24.5
Total	941	100.0	49,150	100.0	2,357	100.0	4,537,747,785	100.0	3,689,799,812	100.0

“Environmental Engineering Directory” as providing consulting engineering services. Approximately one-third of the firms listed in Chemical Engineering are equipment manufacturers. Although the above lists of firms providing consulting services in the water pollution control field are not complete, they do include the majority of the principal firms. Therefore, it is safe to assume that the survey response is representative of the consulting firms engaged in water pollution control activities.

Of the 941 questionnaires providing enough information to be included in the evaluation, many provided data only on selected sections of the questionnaire. Therefore, a comparison of the totals obtained from individual questions would be meaningless. Because of this inconsistency in reporting, the individual totals pertaining to each question are used as a basis for discussion and comparison rather than attempting to relate all responses to the total employees or total professional or technical staff.

All of the data are summarized for the 941 firms and discussed in the text and a similar summary of the data is presented in the Appendices showing the totals for the nation and the EPA Regions from which the reports were received. A map of the USA divided according to EPA Regions is shown in Figure 1. The response from each of the major sections of the questionnaire are discussed in individual chapters.

FIGURE I
FEDERAL REGIONS



CHAPTER II

SIZE AND REGIONAL DISTRIBUTION OF FIRMS REPORTING

Table 1 shows a classification by EPA Region of the 941 firms reporting according to the number of firms and employees and the construction value of the wastewater treatment plants for which the firms had prime responsibility. The number of firms reporting for each region was roughly in proportion to the population of the region. However, the average size of the firms as measured by the number of employees for each of the regions varied from 15 to 115 employees. When the size of the firms is expressed in terms of construction value of wastewater treatment plants for which the firm had prime responsibility, again, there is a wide variation between regions. The regional construction pattern differs from the variation shown by the average number of employees. This is not unexpected because of the variation in the percentage of the staff engaged in water pollution control activities. Many of the firms reporting had large numbers of employees but did only a limited amount of business relating to water pollution control.

One hundred and ninety-seven firms indicated that they did not have prime responsibility for wastewater treatment plants and seventy did not complete that section of the questionnaire, or there were 714 firms out of the total of 941 (76 percent) that indicated prime responsibility.

Appendix A (Tables A-1 through A-12) contains tables showing a detailed classification of the firms according to the ranges of percentage of the staff engaged in water pollution control activities, ranges of number of employees, and the construction value of wastewater treatment plants for which the firms had prime responsibility. Table A-1 reports the values for all 941 firms and the remaining tables show a similar classification according to the EPA Regions in which the firms are located.

Table 2 shows a classification of the 941 firms reporting according to the ranges of percentage of staff engaged in water pollution control and the construction value of wastewater treatment plants for which the firms had prime responsibility. In general, as the percentage of staff engaged in water pollution control increased, the average construction value of wastewater treatment plants for which the firm had prime responsibility increased.

The distribution of prime responsibility remained essentially the same from 1969 to 1970 with the exception being the firms with 20-29 percent of their staff engaged in water pollution control. During 1969 this group of firms had handled approximately 20 percent of the total construction value reported by the 941 firms. By 1970 the effort had been reduced to less than 10 percent of the total, and these firms experienced a 45 percent reduction in their previous share of the wastewater treatment plants. On a regional basis (Table 1) activity in wastewater treatment plant design increased from 1969 to 1970 for most of the 941 firms except in Region VIII where the firms experienced a 20 percent reduction in activity. The regional

Table 2

A Classification of the 941 Firms Reporting According to Ranges of Percentage of Staff Engaged in Water Pollution Control and Construction Value of Wastewater Treatment Plants for which Firms had Prime Responsibility.

Range of Percentage of Staff Engaged in Water Pollution Control	Firms		Construction Value of Wastewater Treatment Plants for which Firms had Prime Responsibility			
			1970		1969	
	Number	% of Total	Dollars	% of Total	Dollars	% of Total
0-9	68	7.2	69,044,100	1.5	50,550,000	1.4
10-19	154	16.4	401,768,000	8.9	229,683,533	6.2
20-29	127	13.5	403,714,152	8.9	730,824,000	19.8
30-39	78	8.3	446,170,000	9.8	345,679,000	9.4
40-49	35	3.7	61,647,000	1.4	57,525,000	1.6
50-59	111	11.8	269,801,000	6.0	81,853,000	2.2
60-69	26	2.8	314,270,000	6.9	179,240,000	4.9
70-79	42	4.5	559,180,000	12.3	414,357,000	11.2
80-89	43	4.5	1,000,555,000	22.0	884,885,000	24.0
90-100	147	15.6	884,873,533	19.5	629,730,054	17.0
Unclassified	110	11.7	126,725,000	2.8	85,473,225	2.3
Totals	941	100.0	4,537,747,785	100.0	3,689,799,812	100.0

distribution of the activity as measured by construction value remained essentially the same from 1969 to 1970.

The total numbers of employees, full- and part-time for all grades and classifications, for the 941 firms according to EPA Region are shown in Table 1. Approximately 11,000 architectural and engineering firms with four or more employees were reported in the 1967 Census (1) as employing approximately 218,000 people. Assuming that the total number of people employed by consulting firms has not varied significantly since the 1967 Census, the survey reported herein contacted approximately 23 percent of the consulting industry in terms of total manpower utilized by firms with four or more employees. Since these 11,000 firms employ over 92 percent of the total employed by the architectural and engineering firms, apparently greater than 20 percent of the total manpower in the industry was contacted by the survey.

Of the 941 firms engaged in water pollution control activities, seven did not report the number of employees and 134 firms had less than four employees. Therefore, 840 of the 941 firms (89 percent) returning the questionnaire had four or more employees. Apparently the firms returning the questionnaire represent many of the larger architectural and engineering firms. Seventy-nine of the 941 firms (8.4 percent) employed over 100 people, five firms had over 2,000 employees, and 314 firms had less than nine employees. The average size firm was 52 employees for this survey, and the national average in 1967 for firms with four or more employees was 21 employees.

Table 3 shows the total number of part- and full-time employees and the number of firms reporting employees in the various occupational classifications. The wide variation in the number of firms reporting employees in the various occupational categories indicates that a reasonably wide cross-section of the types of firms engaged in water pollution control activities were contacted.

Table 3
 Number of Part- and Full-time Employees and the Number of Firms Employing
 Personnel In The Various Occupational Categories For The
 941 Firms Reporting.

Professional and Technical Staff	Total # of Employees in Each Category Doing Water Pollution Work During October...				Number of Firms Re- porting Employees In Occup- ational Category
	1970		1971		
	Part- time	Full- time	Part- time	Full- time	
PROFESSIONAL STAFF	1,669	7,004	4,464	7,624	
Water Resources Planners	140	370	395	435	226
Civil/Sanitary Engineers	330	2,662	1,963	2,950	725
Civil/Structural Engrs.	159	837	178	857	438
Civil/Soils Engrs.	55	191	74	188	195
Mechanical Engineers	198	578	628	594	421
Electrical Engineers	260	446	443	465	334
Chemical Engineers	28	133	43	155	133
Architects	154	250	345	251	173
Geologists	26	73	31	78	88
Hydrologists	26	79	31	91	86
Biologists	13	17	16	29	38
Municipal Engrs./Planrs.	54	348	62	375	218
Economists	13	48	17	52	64
Landscape Architects	42	54	39	55	70
Surveyors	126	756	140	870	406
Systems Analysts	14	90	16	87	83
Chemists	31	72	43	92	90
TECHNICIANS	1,115	6,508	1,263	6,859	-
Draftsmen	566	3,390	630	3,461	798
Instrumentmen	89	581	106	604	348
Field Crew	273	1,128	318	1,172	421
Computer Programmers	41	147	43	162	162
Inspectors	146	1,262	166	1,460	444

CHAPTER III
TURNOVER OF PERSONNEL

Tables 4 and 5 show for professional and technical personnel in each occupational designation the number of part- and full-time openings unfilled for one month or more which were available for filling on June 30, 1971 by workers outside the establishments. A division of the totals reported for the 941 firms according to the EPA Region in which the firms are located is shown in Appendix B, Tables B-1 through B-12. The percentages of the total employment that the vacancies represent are based upon the numbers of people employed during October 1970. The highest number of full- and part-time vacancies occurred in the sanitary engineering classification, but in general there was little difference in the vacancies in terms of percentage of the total employed. There were very few part-time vacancies open for one month or more. Apparently there are many people seeking part-time employment or a second job in both the professional and technical categories.

Tables 4 and 5 also show the turnovers that occurred during the 1970 calendar year. The new hires were separated into two groups, one with less than three years of work experience and the other with over three years of work experience. Separations were classified according to reason as follows: (a) lack of work, (b) poor performance, and (c) other causes. The turnovers in terms of the percentage of the totals were calculated based upon the sums of the part- and full-time employees working during October 1970.

Civil/Sanitary Engineering positions represented the largest number of new hires in the professional category (Table 4). The greatest percentage increase in the total employed in a particular occupational category was recorded for chemical engineers with three or more years of experience. The number of new hires of chemical engineers with three or more years of experience represented 19.3 percent of the total employed in October 1970. The 19.3 percent new hires was twice the percentage of new hires for all categories. This increase in chemical engineers is probably attributable to the increase in industrial pollution control activities by the consulting firms where a greater knowledge of processes is desirable. An increase of 16.7 percent of the total for biologists indicates that the consulting firms are attempting to broaden their capabilities by providing an interdisciplinary approach to the solution of water pollution problems. A significant increase was also recorded by the municipal engineers/planners and chemists. Both increases are probably related to the increased activity in regional planning which requires a significant amount of water quality monitoring as well as planning.

During 1970, 3.1 percent of the total number of professionals employed were released because of a lack of work; however, there was a 17 percent increase in employment as measured by the new hires. Therefore, it appears that there was a net increase in professional employment in 1970. This is supported by the 8.9 percent increase in employment from October 1970 to October 1971 that is shown in Table 12. There was little difference in the

Table 4
 Vacant Positions and Turnover of Professional Personnel During 1970 According
 To Professional Classification for the 941 Firms Reporting.

Professional Staff	Professionals Employed During October 1970		Positions Vacant For One Month or More				Turnover in Personnel During 1970									
							New Hires				Separations					
	Part-Time	Full-Time	Num-ber	% of Total	Num-ber	% of Total	Exper. < 3 yrs.		Exper. > 3 yrs.		Lack of Work		Poor Perform.		Other Causes	
							Num-ber	% of Total	Num-ber	% of Total	Num-ber	% of Total	Num-ber	% of Total	Num-ber	% of Total
Water Resources Planners	140	370	3	2.1	22	6.0	30	5.9	32	6.3	4	0.8	2	0.4	18	3.5
Civil/Sanitary Engineers	330	2,662	17	5.2	169	6.4	288	9.6	330	11.0	45	1.5	46	1.5	204	6.8
Civil/Structural Engineers	159	837	3	1.9	25	3.0	64	6.4	146	14.7	58	5.8	20	2.0	59	5.9
Civil/Soils Engineers	55	191	3	5.5	14	7.3	27	11.0	14	5.7	9	3.7	3	1.2	16	6.5
Mechanical Engineers	198	578	6	3.0	26	4.5	48	6.2	25	3.2	49	6.3	29	3.7	40	5.2
Electrical Engineers	260	446	0	0	23	5.2	44	6.2	16	2.3	23	3.3	12	1.7	29	4.1
Chemical Engineers	28	133	0	0	11	8.3	13	8.1	31	19.3	8	5.0	3	1.9	7	4.4
Architects	154	250	0	0	3	1.2	24	5.9	41	10.2	21	5.2	4	1.0	27	6.7
Geologists	26	73	0	0	2	2.7	5	5.0	9	9.1	6	6.1	0	0	8	8.1
Hydrologists	26	79	0	0	3	3.8	7	6.7	9	8.6	4	3.8	0	0	2	1.9
Biologists	13	17	0	0	1	5.9	2	6.7	5	16.7	1	3.3	0	0	0	0
Municipal Engrs./Planners	54	348	0	0	17	4.9	18	5.2	60	17.2	12	3.5	8	2.3	20	5.8
Economists	13	48	0	0	2	4.2	4	6.6	4	6.6	3	4.9	0	0	3	4.9
Landscape Architects	42	54	0	0	1	1.9	3	3.1	7	7.3	2	2.1	0	0	6	6.3
Surveyors	126	756	0	0	33	4.4	63	7.1	90	10.2	24	2.7	27	3.1	29	3.3
Systems Analysts	14	90	0	0	4	4.4	6	5.8	8	7.7	0	0	0	0	0	0
Chemists	31	72	0	0	5	6.9	9	8.7	16	15.5	0	0	3	2.9	7	6.8
Totals	1,669	7,004	32	1.9	361	5.2	655	7.6	843	9.7	267	3.1	157	1.8	475	5.5

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Table 5
 Vacant Positions and Turnover of Technicians During 1970 According
 To Technical Classification for the 941 Firms Reporting.

Technicians	Technicians Employed During October 1970		Positions Vacant For One Month or More				Turnover in Personnel During 1970													
							Part-Time				Full-Time				New Hires					Separations
			Part-Time		Full-Time		Exper. < 3 yrs.		Exper. > 3 yrs.		Lack of Work		Poor Perform.		Other Causes					
	Part-Time	Full-Time	Num-ber	% of Total	Num-ber	% of Total	Num-ber	% of Total	Num-ber	% of Total	Num-ber	% of Total	Num-ber	% of Total	Num-ber	% of Total				
Draftsmen	566	3,390	25	4.4	170	5.0	482	12.2	535	13.5	338	8.5	167	4.2	418	10.6				
Instrumentmen	89	581	5	5.6	20	3.4	51	7.6	78	11.6	26	3.9	20	3.0	57	8.5				
Field Crew	273	1,128	28	10.3	43	3.8	504	36.0	83	5.9	87	6.2	61	4.4	347	24.8				
Computer Programmers	41	147	0	0	1	0.7	10	5.3	10	5.3	2	1.1	1	0.5	7	3.7				
Inspectors	146	1,262	9	6.2	33	2.6	150	10.7	237	16.8	96	6.8	34	2.4	135	9.6				
Totals	1,115	6,508	67	6.0	267	4.1	1,197	15.7	943	12.4	549	7.2	283	3.7	964	12.7				

percentages of each professional category that were separated for various reasons; however, the majority of the separations were attributable to "Other Causes" which probably represents the personnel that switched firms.

The technical personnel exhibited a less stable pattern than that shown for the professional category with the exception being the "Field Crew" personnel (Table 5). There was a significant increase (36 percent) in the number of new hires with less than three years of experience, and the number of separations attributable to "Other Causes" represented over 24 percent of the total employed as "Field Crew." This indicates that there is a significant interchange of personnel between various firms. The technical category personnel other than the field crew are approximately twice as mobile as the professional category when measured in terms of separation for "Other Causes."

CHAPTER IV

EMPLOYMENT DUTIES, RESPONSIBILITIES AND FUNCTIONS

The number of professional employees and the percentage of the total engaged in each occupational designation according to professional classification for the 941 firms reporting is shown in Table 6. A division of the totals reported for the 941 firms according to the EPA Region in which the firms are located is shown in Appendix C, Tables C-1 through C-12. All of the 941 firms did not show a division of effort in the various categories; therefore, the totals shown for each professional classification represents only the firms reporting, and these totals are less than the total employment reported for the 941 firms. However, the number of firms reporting represented approximately 75 percent of the total number employed during October 1971 and was adequate to give a very good indication as to how the work load is distributed at the "average" consulting engineering firm engaged in water pollution control activities.

Water resources planners, geologists, hydrologists, biologists and economists devoted a minimum of approximately 60 percent of their effort to water resources planning and preliminary engineering, and the engineers in general devoted over 70 percent of their effort to preliminary engineering and plans and specifications.

The percentage effort devoted to water resources planning varies from 0.7 percent for electrical engineers to 49.4 percent for water resources planners. Preliminary engineering effort varies from 13.8 percent for electrical engineers to 78.7 percent for economists and the effort in preparing plans and specifications varied from 1.9 to 68.8 for economists and electrical engineers, respectively. Construction administration occupied less than 10 percent of all professional employees except for the surveyors which devoted over 18 percent of their time. Surveyors also directed over 16 percent of their efforts to resident engineering activities. Less than 8 percent of the professional personnel are engaged in plant start up and monitoring of systems.

In general the survey of the distribution of effort did not produce any unexpected results, but the data do provide a good basis for estimating the distribution of the receipts for consulting services.

Table 7 shows the number of technicians employed and percentage of the total engaged in each occupational designation according to technical classification for the 941 firms reporting. As mentioned above for the professional employees, all 941 firms did not show a division of effort; however, the total number of technicians reported represents approximately 65 percent of the total number employed during October 1971.

Draftsmen devote the majority of their time to preparing plans and specifications, and the efforts of the instrumentmen and field crew are distributed essentially the same as that of the surveyors. Over 86 percent of the effort of the technical employees is devoted to preliminary engineering, plans and specifications, and resident engineering activities.

Table 6
 Number of Professional Employees and Percentage of the Total Engaged in Each Occupational Designation
 According to Professional Classification for the 941 Firms Reporting.

Professional Staff	Water Resources Planning		Preliminary Engineering		Plans and Specifications		Construction Administration		Resident Engineering		Plant Start Up & Consulting		Monitoring of Systems		Totals	
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total
Water Resources Planners	256.9	49.4	135.3	26.0	76.1	14.7	14.1	2.7	14.1	2.7	10.0	1.9	13.5	2.6	520.0	100
Civil/Sanitary Engineers	242.1	6.9	816.9	23.4	1,580.0	45.3	317.4	9.1	259.6	7.4	194.8	5.6	79.3	2.3	3,490.1	100
Civil/Structural Engineers	23.0	2.4	157.2	16.4	594.2	62.0	91.6	9.5	50.6	5.3	29.4	3.1	12.2	1.3	958.2	100
Civil/Soils Engineers	10.6	4.1	85.2	32.8	104.3	40.1	23.5	9.0	23.7	9.1	9.1	3.5	3.5	1.4	259.9	100
Mechanical Engineers	27.1	3.4	163.2	20.5	423.5	53.1	67.3	8.4	30.9	3.9	58.4	7.3	27.6	3.4	798.0	100
Electrical Engineers	4.0	0.7	71.0	13.8	354.6	68.8	41.5	8.0	8.2	1.6	20.4	4.0	16.0	3.1	515.7	100
Chemical Engineers	6.4	3.6	74.1	42.0	60.3	34.2	4.2	2.4	2.0	1.1	16.3	9.3	13.1	7.4	176.4	100
Architects	6.0	2.6	49.7	21.2	147.6	63.1	19.5	8.3	6.1	2.6	3.0	1.3	2.0	0.9	233.9	100
Geologists	16.6	18.4	34.9	38.8	18.6	20.7	2.1	2.3	2.6	2.9	9.1	10.1	6.1	6.8	90.0	100
Hydrologists	38.0	40.4	40.5	43.1	9.0	9.6	0.0	0.0	0.0	0.0	3.0	3.2	3.5	3.7	94.0	100
Biologists	7.0	25.0	9.0	32.1	2.0	7.1	0.0	0.0	1.0	3.6	1.0	3.6	8.0	28.6	28.0	100
Municipal Engrs./Planrs.	37.8	9.1	147.6	35.4	144.2	34.6	36.7	8.8	25.2	6.0	13.8	3.3	11.6	2.8	416.9	100
Economists	8.5	15.6	42.5	78.7	1.0	1.9	1.0	1.9	0.0	0.0	0.0	0.0	1.0	1.9	54.0	100
Landscape Architects	6.0	7.6	26.0	32.7	40.5	50.9	4.0	5.0	2.0	2.5	1.0	1.3	0.0	0.0	79.5	100
Surveyors	11.7	2.7	126.0	29.0	125.9	29.0	79.9	18.4	71.1	16.4	7.2	1.7	12.0	2.8	433.8	100
Systems Analysts	12.5	12.6	40.5	40.7	17.0	17.1	4.0	4.0	6.0	6.1	5.2	5.2	14.2	14.3	99.4	100
Chemists	9.8	8.9	37.7	34.3	7.6	6.9	1.0	0.9	1.0	0.9	8.7	7.9	44.2	40.2	110.0	100
Totals	724.1	8.7	2,057.3	24.6	3,706.5	44.3	707.8	8.5	504.1	6.0	390.5	4.7	267.9	3.2	8,358.2	100

Table 7

Number of Technicians Employed and Percentage of the Total Engaged in Each Occupational Designation According to Technical Classification for the 941 Firms Reporting.

Technicians	Water Resources Planning		Preliminary Engineering		Plans and Specifications		Construction Administration		Resident Engineering		Plant Start Up & Consulting		Monitoring of Systems		Totals	
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total
Draftsmen	93.3	3.3	370.3	12.9	2,284.6	79.8	64.2	2.2	18.2	0.6	16.7	0.6	16.0	0.6	2,863.3	100
Instrumentmen	4.5	1.3	86.5	25.3	143.2	41.9	38.9	11.4	51.3	15.0	10.1	3.0	7.2	2.1	341.7	100
Field Crew	11.0	1.7	154.3	23.1	253.7	38.0	122.8	18.4	76.2	11.4	28.5	4.3	20.8	3.1	667.3	100
Computer Programmers	5.9	4.8	48.9	39.9	39.5	32.2	6.0	4.9	7.0	5.7	4.0	3.3	11.2	9.2	122.5	100
Inspectors	5.0	0.4	136.5	11.0	13.0	1.0	177.5	14.3	826.6	66.4	53.5	4.3	32.1	2.6	1,244.2	100
Totals	119.7	2.3	796.5	15.2	2,734.0	52.2	409.4	7.8	979.3	18.7	112.8	2.1	87.3	1.7	5,239.0	100

CHAPTER V
LICENSED AND CERTIFIED PERSONNEL

The questionnaire requested that each firm indicate the number of professional and technical employees licensed to practice in accord with state laws. It was also requested that the number of engineers certified as a Diplomate by the American Academy of Environmental Engineers (AAEE) and the number of technicians holding a certificate from the Institute for Certification of Engineering Technicians be indicated. Tables 8 and 9 show the number and percentage of professional and technical staff licensed or certified according to professional and technical classification for 914 of the 941 firms reporting. A division of the totals reported for the 941 firms according to the EPA Region in which the firms are located is shown in Appendix C, Tables C-1 through C-12.

The percentages are based upon the sum of the part- and full-time employment during October 1971 and probably represent closely the percentage of the employees licensed or certified. For the entire survey approximately 54 percent of the professional employees were reported as licensed indicating that a substantial majority of the total number of employees that are eligible for licensing have complied with state laws (Table 8).

Over 90 percent of both the structural and soils engineers were licensed reflecting a necessity for licensing in these speciality areas. Surprisingly, a very significant proportion of all professionals were licensed to practice, and only the biologists, chemists, systems analysts, and economists showed less than 45 percent of the total as licensed. Although only approximately 15 percent of the total employed in these categories were licensed, this was higher than anticipated because the majority of the states do not have licenses available for these four professional groups.

The number of professional employees certified as a Diplomate in the American Academy of Environmental Engineers represented a very small percentage of the total number of practicing professionals. Certification by AAEE is limited by the Academy's definition of environmental engineering; however, there were very few Diplomates found among the categories specifically included in the definition. For example, Water Resources Planners and Sanitary Engineers are the major members of the AAEE and only three percent of the personnel in these two categories were certified as Diplomates of AAEE. Apparently, very little professional or economic advantage is afforded in consulting firms to Diplomates of AAEE.

Two percent of the professional staff were certified as engineering technicians. It would be expected that the majority of the professional personnel certified as engineering technicians would be employed in the categories that do not have a licensing law. However, this was not the case as 98 percent of the professionals certified as technicians were in categories having a licensing law available.

The number of technicians registered to practice according to state laws represented only 2.1 percent of the total number of technicians

Table 8
 Number and Percentage of Professional Staff Licensed or Certified According
 to Professional Classification for the 941 Firms Reporting.

Professional Staff	Professionals Employed Part & Full-Time During October 1971	Employees Licensed or Certified					
		Registered		Dip. AAEE		Cert. Eng. Tech.	
		Number	% of Total	Number	% of Total	Number	% of Total
Water Resources Planners	830	354	42.7	26	3.1	5	0.6
Civil/Sanitary Engineers	4,913	2,348	47.8	141	2.9	99	2.0
Civil/Structural Engineers	1,035	967	93.4	0	0	25	2.4
Civil/Soils Engineers	262	243	92.7	1	0.4	13	5.0
Mechanical Engineers	1,222	702	57.5	6	0.5	44	3.6
Electrical Engineers	908	477	52.5	4	0.4	19	2.1
Chemical Engineers	198	117	59.1	5	2.5	2	1.0
Architects	596	322	54.0	1	0.2	0	0
Geologists	109	52	47.7	1	0.9	1	0.9
Hydrologists	122	56	45.9	1	0.8	1	0.8
Biologists	45	8	17.8	0	0	0	0
Municipal Engrs./Planners	437	236	54.0	3	0.7	6	1.4
Economists	69	8	11.6	1	1.5	0	0
Landscape Architects	94	56	59.6	0	0	0	0
Surveyors	1,010	490	48.5	3	0.3	23	2.3
Systems Analysts	103	26	25.2	1	1.0	5	4.9
Chemists	135	22	16.3	0	0	0	0
Totals	12,088	6,484	53.6	194	1.6	243	2.0

Table 9
 Number and Percentage of the Technicians Licensed or Certified According to
 Technical Classification for the 941 Firms Reporting.

Technicians	Technicians Employed Part & Full-Time During October 1971	Employees Licensed or Certified					
		Registered		Dip. AAEE		Cert. Eng. Tech.	
		Number	% of Total	Number	% of Total	Number	% of Total
Draftsmen	4,091	88	2.2	1	0.02	409	10.0
Instrumentmen	710	11	1.6	0	0	48	6.8
Field Crew	1,490	14	0.9	0	0	24	1.6
Computer Programmers	250	20	9.8	3	1.5	12	5.9
Inspectors	1,626	34	2.1	0	0	68	4.2
Totals	8,122	167	2.1	4	0.05	561	6.9

employed. There were only four technicians certified as a Diplomate in AAEE, and three were listed as computer programmers.

Apparently licensing and certification has not gained much popularity among technicians, because only 6.9 percent of the total employed were certified. Draftsmen represented approximately 73 percent of the total number of technicians certified, and only 10 percent of the total number of draftsmen employed were certified. These statistics indicate that there is very little economic advantage associated with technician certification.

CHAPTER VI
HIGHEST DEGREE EARNED

Firms were requested to indicate the number of employees holding either an associate, baccalaureate, masters, or doctoral degree, and they were requested to count each employee only once and show only the highest degree earned. The results of the tabulation are shown in Tables 10 and 11 for the professional and technician staffs, respectively. A division of the totals reported for the 941 firms according to the EPA Region in which the firms are located is shown in Appendix D, Tables D-1 through D-12. Nine hundred and eighteen of the total 941 firms reported the number and level of academic degrees held by various employees. This is a very high percentage response although the 8,524 professional employees reported as holding some academic degree represents only 71 percent of the total part- and full-time employment during October 1971. It is doubtful that only 71 percent of the professional employees hold some type of academic degree. Probably there was a significant number of the firms that reported the number of degrees for the number of 1970 employees rather than 1971.

The number of degrees reported for the technicians represented only 9 percent of the total number of technicians employed, but the number of technicians expected to hold an academic degree is much lower than that expected for the professional staff. Therefore, it appears reasonable to assume that the response for the technical staff was equivalent to the professional response, but a majority of the technical staff do not hold an academic degree. Assuming that the percentage response for technicians holding academic degrees was equivalent to that for the professional staff (70.5 percent), it appears that less than 13 percent of all technicians hold an academic degree.

Only 4.5 percent of the professional staff listed the associate degree as the highest degree held, and only the surveyors differed significantly with the percentage for the overall survey. Almost 45 percent of the surveyors held an associate degree, 53 percent held a bachelors degree, and the remaining two percent held the masters degree. Seventy-two percent of the professional staff held a bachelors degree, 21 percent the masters and less than three percent held the doctorate.

Table 10
 Number and Percentage of the Professional Staff Holding Various Academic Degrees According to
 Professional Classification for the 941 Firms Reporting.

Professional Staff	Total Reported	Highest Degree Earned							
		Associate		B.S.		M.S.		Ph.D.	
		Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total
Water Resources Planners	465	14	3.0	265	57.0	165	35.5	21	4.5
Civil/Sanitary Engineers	3,194	95	3.0	2,225	69.6	795	24.9	79	2.5
Civil/Structural Engineers	1,258	29	2.3	936	74.4	268	21.3	25	2.0
Civil/Soils Engineers	341	21	6.1	180	52.8	120	35.2	20	5.9
Mechanical Engineers	888	42	4.7	743	83.7	92	10.4	11	1.2
Electrical Engineers	661	28	4.3	576	87.1	53	8.0	4	0.6
Chemical Engineers	108	3	1.4	134	64.4	49	23.6	22	10.6
Architects	369	28	7.6	308	83.4	32	8.7	1	0.3
Geologists	120	0	0	89	74.2	22	18.3	9	7.5
Hydrologists	106	2	1.9	57	53.8	41	38.7	6	5.6
Biologists	34	0	0	18	52.9	9	26.5	7	20.6
Municipal Engrs./Planners	337	12	3.5	256	76.0	66	19.6	3	0.9
Economists	54	0	0	31	57.4	15	27.8	8	14.8
Landscape Architects	86	8	9.3	67	77.9	11	12.8	0	0
Surveyors	210	94	44.7	111	52.9	4	1.9	1	0.5
Systems Analysts	87	1	1.1	56	64.4	22	25.3	8	9.2
Chemists	106	4	3.8	72	67.9	13	12.3	17	16.0
Totals	8,524	381	4.5	6,124	71.8	1,777	20.9	242	2.8

Table 11
 Number and Percentage of the Technicians Holding Various Academic Degrees According to
 Technical Classification for the 941 Firms Reporting.

Technicians	Total Reported	Highest Degree Earned							
		Associate		B.S.		M.S.		Ph.D.	
		Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total
Draftsmen	416	313	75.2	91	21.9	4	1.0	8	1.9
Instrumentmen	39	32	82.0	7	18.0	0	0	0	0
Field Crew	68	63	92.7	5	7.3	0	0	0	0
Computer Programmers	66	15	22.7	42	63.6	7	10.6	2	3.1
Inspectors	142	76	53.5	64	45.1	2	1.4	0	0
Totals	731	499	68.2	209	28.6	13	1.8	10	1.4

CHAPTER VII

PROJECTED MANPOWER REQUIREMENTS

Projected manpower requirements for 1972 and 1976 and the percentage increase over the numbers employed full-time during October 1970 is shown in Tables 12 and 13 for professional and technical employees, respectively. A division of the totals reported for the 941 firms according to the EPA Region in which the firms are located is shown in Appendix E, Tables E-1 through E-12. The projections were based upon two assumptions: first, that the expenditure for construction in water pollution control activities would remain essentially unchanged at an expenditure of approximately \$4 billion for government and \$1 billion for industry, and secondly, that the governmental expenditure would remain at \$4 billion dollars and industry would increase its activity to \$2 billion. Of the 941 firms returning the questionnaire, 801 firms projected their manpower requirements for the above described conditions.

Percentage increases are based upon full-time employment during October 1970 because the projections were to reflect the average total number of workers, and the full-time employment probably more closely approximates the full-time equivalent workers. Also it is very difficult to relate the percent of the total effort that is performed by the part-time employees, and it is probably better to omit the part-time effort than attempt to estimate the contribution.

It is also possible that relating the projected manpower to 1970 employment is not justified, because the projected figures were reported by 801 firms and the 1970 employment figures represent the totals for the 941 firms that reported. However, even though the projected figures are related to totals reported by 140 more firms than represented by the projections, the figures show a significant increase in employment over the next five years.

The most surprising result of the projected manpower requirements is the large increases in manpower that are expected even though the total expenditure for construction in water pollution control does not change between 1972 and 1976. For the 801 firms reporting, an increase from 8,693 to 11,832 professional employees, or a 36 percent increase, is expected between 1972 and 1976 without an increase in construction expenditure. An additional 29 percent increase in manpower is expected in 1972 if the construction expenditures for industrial pollution control are increased by a factor of two and the Federal contribution remains constant. The 1976 manpower needs are expected to increase by 41 percent if the industrial construction expenditures are increased by a factor of two. Apparently these percentage increases indicate that the majority of the firms are still hiring personnel to handle the present work load, and there will continue to be a large demand for professional and technical personnel.

A very substantial growth rate is anticipated for all categories of technical and professional employees in the consulting industry. All categories are expected to double in numbers by 1976 if the anticipated growth occurs,

Table 12
Professional Employment, Projected Manpower Requirements, and Percentage Increase
Over 1970 Totals for the 941 Firms Reporting.

Professional Staff	Professionals Employed Full-Time During October			Projected Manpower Requirements							
				At Present Levels of Fed. Aid				At 2 x Present Fed. Aid			
	1970	1971		1972		1976		1972		1976	
	Number	Number	% Increase	Number	% Increase	Number	% Increase	Number	% Increase	Number	% Increase
Water Resources Planners	370	435	17.6	457	23.5	566	53.0	619	67.3	980	164.9
Civil/Sanitary Engineers	2,662	2,950	10.8	3,259	22.4	4,248	59.6	4,222	58.6	6,161	131.4
Civil/Structural Engineers	837	857	2.4	1,036	23.8	1,410	68.5	1,277	52.6	1,871	123.5
Civil/Soils Engineers	191	188		302	58.1	417	118.3	394	106.3	541	183.3
Mechanical Engineers	578	594	2.8	778	34.6	1,096	89.6	986	70.6	1,486	157.1
Electrical Engineers	446	465	4.3	652	46.2	878	96.9	818	83.4	1,173	163.0
Chemical Engineers	133	155	16.5	209	57.1	393	195.5	305	129.3	621	366.9
Architects	250	251		290	16.0	377	50.8	355	42.0	467	86.8
Geologists	73	78	6.9	124	69.9	165	126.0	155	112.3	232	217.8
Hydrologists	79	91	15.2	129	63.3	215	172.2	174	120.3	309	291.1
Biologists	17	29	70.6	57	235.3	112	558.8	92	441.2	174	923.5
Municipal Engrs./Planners	348	375	7.8	384	10.3	548	57.5	527	51.4	774	122.4
Economists	48	52	8.3	63	31.3	100	108.3	89	85.4	146	204.2
Landscape Architects	54	55	-	91	68.5	119	120.4	112	107.4	154	185.2
Surveyors	756	870	15.1	652	-	838	10.9	810	7.1	1,139	50.7
Systems Analysts	90	87	-	99	10.0	158	75.6	133	47.8	227	152.2
Chemists	72	92	27.8	111	54.2	192	166.7	153	112.5	255	254.2
Totals	7,004	7,624	8.9	8,693	24.1	11,832	68.9	11,221	60.2	16,710	138.6

Table 13
 Technician Employment, Projected Manpower Requirements, and Percentage Increase Over 1970
 Totals for the 941 Firms Reporting.

Technicians	Technicians Employed Full-Time During October			Projected Manpower Requirements							
	1970		1971	At Present Levels of Fed. Aid				At 2 x Present Fed. Aid			
	Number	Number	% Increase	Number	% Increase	Number	% Increase	Number	% Increase	Number	% Increase
Draftsmen	3,390	3,461	2.1	3,504	3.4	4,839	42.7	4,530	33.6	6,650	96.2
Instrumentmen	581	604	4.0	665	14.5	930	60.1	873	50.3	1,195	105.7
Field Crew	1,128	1,172	3.9	1,078		1,564	38.7	1,565	38.7	2,273	101.5
Computer Programmers	147	162	10.2	237	61.2	315	114.3	291	98.0	426	189.8
Inspectors	1,262	1,460	15.7	1,555	23.2	2,124	68.3	2,209	75.0	3,180	152.0
Totals	6,508	6,859	5.4	7,039	8.2	9,772	50.2	9,468	45.5	15,724	141.6

and there is little doubt that growth in expenditures will at least match the \$4 billion for Federal assistance and the \$2 billion for industry in 1976. Even without an increase in industrial expenditures, all of the professional categories will experience approximately a 70 percent increase in manpower utilization by the consulting industry. The largest percentage increases are expected to occur in the number of biologists and chemical engineers employed by the consulting industry. The number of biologists employed by the 801 firms reporting is expected to increase from 17 full-time employees in October 1970 to over 170 in 1976, and the number of chemical engineers is expected to grow from 133 in 1970 to over 600 in 1976.

The total requirement for chemical and other types of engineers in the consulting industry is a small percentage of those currently employed throughout the country, and even with the projected needs this percentage will change very little. Therefore, the requirements of the consulting industry for chemical and other types of engineers can easily be met from the existing manpower pool. However, this is not the situation with sanitary and environmental engineers who are only available from a very limited source (3), and if a shortage in manpower develops in the consulting industry, it will likely occur in the sanitary and environmental engineering specialty area. In certain cases chemical engineers could be used as a substitute for the sanitary and environmental engineers provided additional training were obtained or the educational curriculum were modified.

Tables 12 and 13 showing the projected manpower requirements for 801 firms can be related to the universe of consulting firms engaged in water pollution control work by two methods, both of which will be presented below for comparison. The first approach will consist of assuming that the response of 981 firms out of the 8,050 represents the percentage of firms that are engaged in water pollution work. Thus, 12 percent of the 8,050 firms were engaged in water pollution work and it is assumed that the number engaged in water pollution control activities that did not report is insignificant. The second approach will be an attempt to verify the first approach, and it will consist of obtaining from the Bureau of the Census the number of firms reporting activities in water related activities for firms having four employees or more in the 1967 Census (1). Once the number of firms engaged in water activities in 1967 are known, it will be possible to determine what percentage of the total number of firms with four employees or more were engaged in water related activities.

Of the 981 firms returning the questionnaire indicating activity in water pollution control, 840 had four employees or more; therefore, only 10.4 percent of the 8,050 firms were engaged in water pollution control activities with four employees or more. In 1967 there were 10,614 architectural and engineering firms with four employees or more. Assuming that the percentage of the 10,614 firms engaged in water pollution control activities is the same as that found in the survey of the 8,050 firms, or 10.4 percent, there were 1,104 firms with four or more employees engaged in water pollution control work in 1967. Allowing for a growth of 10 percent between 1967 and 1970, there would be 1,214 firms engaged in water pollution control activities with four or more employees in 1970.

If it is assumed that the projected manpower requirements will increase in direct proportion to the number of firms practicing during 1970, the totals

shown in Tables 12 and 13 can be expanded to cover the entire field of water pollution control consulting activities. In brief, the totals can be multiplied by the ratio of the total number of firms to the number reporting projections, or 1214 divided by 713 which equals 1.7. The value of 713 firms with four employees or more was obtained by assuming that the percentage of the 801 firms reporting projected manpower needs with four or more employees was equal to the percentage of the 941 firms that had four employees or more, or 89 percent of the 801 firms had 4 employees or more. The results of multiplying the projected manpower requirements in Tables 12 and 13 by 1.7 are shown in Tables 14 and 15.

The results of the 1967 survey indicated that 1,200 firms were engaged in water related activities, and this total represented 11.4 percent of the 10,614 firms reporting receipts with four employees or more. This figure agrees well with the projections based upon the survey.

Table 14
 Projected Professional Manpower Requirements For The Consulting Industry
 According To Occupational Category.

Professional Staff	Projected Manpower Requirements			
	At Present Levels of Fed. Aid		At 2 x Present Fed. Aid	
	1972	1976	1972	1976
Water Resources Planners	777	962	1,052	1,666
Civil/Sanitary Engineers	5,540	7,222	7,177	10,474
Civil/Structural Engineers	1,761	2,397	2,171	3,181
Civil/Soils Engineers	513	709	670	920
Mechanical Engineers	1,323	1,863	1,676	2,526
Electrical Engineers	1,108	1,493	1,391	1,994
Chemical Engineers	355	668	519	1,056
Architects	493	641	604	794
Geologists	211	281	264	394
Hydrologists	219	366	296	525
Biologists	97	190	156	296
Municipal Engrs./Planners	653	932	896	1,316
Economists	107	170	151	248
Landscape Architects	155	202	190	323
Surveyors	1,108	1,425	1,377	1,936
Systems Analysts	168	269	226	386
Chemists	189	326	260	434
Totals	14,777	20,116	19,076	28,469

Table 15
 Projected Technician Manpower Requirements For The Consulting Industry
 According To Occupational Category.

Technicians	Projected Manpower Requirements			
	At Present Levels of Fed. Aid		At 2 x Present Fed. Aid	
	1972	1976	1972	1976
Draftsmen	5,957	8,226	7,701	11,305
Instrumentmen	1,130	1,581	1,484	2,032
Field Crew	1,833	2,659	2,660	3,864
Computer Programmers	403	536	495	724
Inspectors	2,644	3,611	3,755	5,406
Totals	11,967	16,613	16,095	23,331

CHAPTER VIII

MONITORING PROGRAMS

Each recipient of the questionnaire was asked to provide information for each occupational classification as to the number of permanent new employees that would be required to provide complete services if Federal monitoring of the industrial contribution to stream pollution were contracted to consulting firms. Five hundred and eighty-one firms out of the total of 941 firms (62 percent) reported the information summarized in Tables 16 and 17. A division of the totals reported according to the EPA Region in which the firms are located is shown in Appendix E, Tables E-1 through E-12.

Many of the smaller firms indicated that they would not be interested in participating even if the program were contracted, and probably many of the 360 firms that left the space blank were indicating a lack of interest in participating. Also, approximately 20 percent of the 941 firms reporting were electrical, mechanical, soils, or structural engineering firms and would be unable to provide such services. Therefore, the 62 percent overall response represents a much greater percentage of the total number of firms that are qualified to participate in a monitoring program. Excluding the 189 firms that indicated no prime responsibility for wastewater treatment plant design and construction (see page 3), the 581 firms responding represent approximately 77 percent of the total most likely qualified to participate in a monitoring program.

The percentage increase in manpower required for monitoring various numbers of stations are based upon the number of full-time employees during October 1971. Again, the full-time employment was selected as a base because information was requested for the number of permanent additions, and increases based on full-time employees are more meaningful because of the fluctuations in part-time employment and the difficulty in estimating the contribution of part-time employees to production.

Some increase in all occupational categories was indicated if monitoring was to be contracted, and the sanitary engineering, field crew, and inspectors represented the areas with the largest number of additions to the staff to perform the monitoring. Prior to the survey it was expected that the most significant increases in manpower requirements would occur in the technician category. However, in terms of numbers and percentage increase the requirements for professionals and technicians were approximately equivalent.

If each firm monitors 25 stations, approximately a 15 percent increase in the total number of employees in both the technical and professional categories would be required. If the firms that were uninterested or unable to participate (approximately 189 firms) in monitoring activities are excluded, the increase in employment for each firm indicating an interest in monitoring would be approximately 19 percent of the total.

Approximately a 50 percent increase in manpower (all classifications) would be required to double the number of stations monitored. Such an

Table 16
 Projected Professional Manpower Requirements and Percentage Increase Over 1971
 Full-Time Employment If Federal Monitoring of Industrial and Stream
 Pollution were Contracted to Private Firms.

Professional Staff	Professionals Employed Full-Time During October 1971	Projected Manpower Requirements If Federal Monitoring of Industrial & Stream Pollution were Contracted to Private Firms					
		25 Stations		50 Stations		100 Stations	
		Number	% Increase	Number	% Increase	Number	% Increase
Water Resources Planners	435	78	17.9	115	26.4	182	41.8
Civil/Sanitary Engineers	2,950	386	13.1	589	20.0	948	32.1
Civil/Structural Engineers	857	23	2.7	29	3.4	42	4.9
Civil/Soils Engineers	188	11	5.9	14	7.5	22	11.7
Mechanical Engineers	594	65	10.9	105	17.7	197	33.2
Electrical Engineers	465	39	8.4	60	12.9	97	20.9
Chemical Engineers	155	83	53.6	120	77.4	191	123.2
Architects	251	2	0.8	2	0.8	2	0.8
Geologists	78	10	12.8	17	21.8	30	38.5
Hydrologists	91	58	63.7	78	85.7	114	125.3
Biologists	29	88	303.5	139	479.3	217	748.3
Municipal Engrs./Planners	375	12	3.2	20	5.3	30	8.0
Economists	52	3	5.8	4	7.7	5	9.6
Landscape Architects	55	3	5.5	5	5.5	7	12.7
Surveyors	870	25	2.9	33	3.8	46	5.3
Systems Analysts	87	41	47.1	55	63.2	78	89.7
Chemists	92	277	301.1	428	465.2	682	741.3
Totals	7,624	1,204	15.8	1,813	23.8	2,890	37.9

Table 17
 Projected Technician Manpower Requirements and Percentage Increase Over 1971
 Full-Time Employment If Federal Monitoring of Industrial and Stream
 Pollution were Contracted to Private Firms.

Technicians	Technicians Employed Full-Time During October 1971	Projected Manpower Requirements If Federal Monitoring of Industrial & Stream Pollution were Contracted to Private Firms					
		25 Stations		50 Stations		100 Stations	
		Number	% Increase	Number	% Increase	Number	% Increase
Draftsmen	3,461	103	3.0	159	4.6	229	6.6
Instrumentmen	604	66	10.9	113	18.7	194	32.1
Field Crew	1,172	454	38.7	515	43.9	866	73.9
Computer Programmers	162	53	32.7	69	42.6	117	72.2
Inspectors	1,460	302	20.7	555	38.0	976	66.9
Totals	6,859	978	14.3	1,411	20.6	2,382	34.7

increase appears reasonable because a significant proportion of the initial investment is required in initiating the program, and the time required to double the sampling and analytical effort would be reduced significantly.

An estimate of the cost for a monitoring program is shown in Table 18. The cost figures used to calculate the values in Table 18 are based upon the assumption that a firm must receive approximately \$83,000 for each professional employee to remain in business. This figure includes the cost of all supporting personnel. The \$83,000 figure was calculated from data provided by the 1967 Census (1) by dividing the total receipts for all types of engineering firms by the total number of professional employees.

Table 18
Estimated Cost If Monitoring Is Contracted To Private Firms

Number of Stations per Firm	Total Number of Stations (Sta./Firm × 581 Firms)	Number of Professionals Required	Total Cost Per Year	Cost Per Station Per Year
25	14,525	1,204	\$ 99,932,000	\$6,880
50	29,050	1,813	\$150,479,000	\$5,180
100	58,100	2,890	\$239,870,000	\$4,130

CHAPTER IX
TRAINING NEEDS

The firms were asked to provide for each occupational classification the number of present employees that would require either short-term (two weeks) or more extended training within the next five years to remain current in present practices in water pollution control. Six hundred and one firms reported employees that would need training within the next five years. A summary of the response of the 601 firms is shown in Tables 19 and 20. A division of the totals reported according to the EPA Region in which the firms are located is shown in Appendix E, Tables E-1 through E-12. Whether or not the 340 firms not reporting were indicating their employees did not need training or they failed to report is unknown. Assuming that all of the personnel needing training were reported, the percentage of the total number of full- and part-time professionals employed during October 1971 needing training is significant. Over 18 percent of the total number of professionals will require short-term training and approximately 14 percent will enroll in extended programs.

A projection of the training needs for the consulting industry can be made in the same way as that used to project manpower needs. Based upon the projected total of 1,214 firms engaged in water pollution control, there would be 1,214/601 (2.0) times the number of personnel requiring training that are shown in Tables 18 or 19. On a national basis there would be approximately 4,500 professionals and 2,400 technicians employed in the consulting industry that would require short-term training over the next five years, and 3,300 professionals and 1,500 technicians would be expected to enroll in long-term programs. In all probability, the increases by occupational category will follow a similar pattern.

The above results indicate that a significant number of short-term programs will be needed to satisfy the need for refresher courses. The existing academic programs are probably adequate to provide the long-term programs (3), but a more concerted effort on a regional or state level will be required to satisfy the need for short-term programs. The consulting industry represents only a small percentage of the total number of people employed in the water pollution control field, and based upon the need for additional training in the consulting industry, it appears reasonable to assume that the total need for additional training will far exceed the totals projected for consulting. It is estimated that the training needs of consulting firms represents less than five percent of the total that have similar needs and are employed in the water pollution control field. Based upon the results of this study it would appear that a significant demand exists for well organized short-term continuing education courses.

Table 19
 Number and Percentage of the Professional Staff Expected to Require Advanced
 Training During the Next Five Years According to Professional Classification
 For the 941 Firms Reporting.

Professional Staff	Professionals Employed Part & Full-Time During October 1971	Employees Expected to Require Advanced Training During Next 5 Years			
		Short Term		Long Term	
		Number	% of Total	Number	% of Total
Water Resources Planners	830	169	20.4	117	14.1
Civil/Sanitary Engineers	4,913	925	18.8	678	13.8
Civil/Structural Engineers	1,035	220	21.3	183	17.7
Civil/Soils Engineers	262	65	24.8	50	19.1
Mechanical Engineers	1,222	185	15.1	165	13.5
Electrical Engineers	908	139	15.3	117	12.9
Chemical Engineers	198	98	49.5	68	34.3
Architects	596	81	13.6	17	2.9
Geologists	109	29	26.6	13	11.9
Hydrologists	122	39	32.0	32	26.2
Biologists	45	27	60.0	10	22.2
Municipal Engrs./Planners	437	89	20.4	71	16.3
Economists	69	10	14.5	6	8.7
Landscape Architects	94	5	5.3	5	5.3
Surveyors	1,010	63	6.2	49	4.9
Systems Analysts	103	38	36.9	26	25.2
Chemists	135	67	49.6	43	31.9
Totals	12,088	2,249	18.6	1,650	13.7

Table 20
 Number and Percentage of the Technicians Expected to Require Advanced
 Training During the Next Five Years According to Professional
 Classification for the 941 Firms Reporting.

Technicians	Technicians Employed Part & Full-Time During October 1971	Employees Expected to Require Advanced Training During Next 5 Years			
		Short Term		Long Term	
		Number	% of Total	Number	% of Total
Draftsmen	4,091	577	14.1	364	8.9
Instrumentmen	710	85	12.0	74	10.4
Field Crew	1,490	134	9.0	123	8.3
Computer Programmers	205	53	25.9	41	20.0
Inspectors	1,626	363	22.3	157	9.7
Totals	8,122	1,212	14.9	759	9.3

CHAPTER X
CONCLUSIONS

Based upon the compilation and analysis of the data obtained from the 941 firms returning a completed questionnaire indicating consulting activity in water pollution control, the following observations and conclusions are made.

1. A return of over 1,600 questionnaires out of the total of 8,050 was a reasonable response from a mail survey requesting such detailed information, and considering the number of firms that were known to be engaged in unrelated activities, the response was exceptional.
2. A comparison of the construction value of \$4.5 billion actually put in place during 1970 (both water and wastewater treatment plants) with the \$4.5 billion of water pollution control plants being designed by the 941 firms reporting detailed data shows that a significant response was obtained from the major firms.
3. A further indication of a high response from firms principally engaged in water pollution control activities is provided by the fact that there are only 223 "Consultant Members" of the Water Pollution Control Federation listed in 1971 Yearbook of the Federation, and 232 firms with over 70 percent of the professional personnel involved in wastewater treatment plant design represented 24.6 percent of the total number of firms responding.
4. The number of firms returning a completed questionnaire from each EPA Region was roughly in proportion to the population of the region.
5. The average size of the firms reporting as measured by the number of employees for each of the regions varied from 15 to 115 employees.
6. There were 714 firms out of the total of 941 reporting (76 percent) that indicated prime responsibility for the design and construction of wastewater treatment plants.
7. The construction value of wastewater treatment plants for which the 941 firms reporting had prime responsibility increased from \$3.7 billion in 1969 to \$4.5 billion in 1970.
8. In general, as the percentage of staff engaged in water pollution control increased, the average construction value of wastewater treatment plants for which the firms had prime responsibility increased.
9. Apparently the survey response represents a group of firms employing approximately 20 percent of the total manpower in the consulting industry employed by firms with four employees or more.
10. The average size firm was 52 employees for this survey, and the national average in 1967 for firms with four or more employees was 21 employees.
11. During June 1971 there were very few part-time vacancies open for one month or more. Apparently there are many people seeking part-time employment or a second job in both the professional and technical categories.

12. Chemical engineers and biologists showed the largest percentage increase in numbers of new hires being employed by consulting firms. However, the number of chemical engineers and biologists presently employed is very small although it is indicated that the use of these professionals is increasing.
13. During 1970, 3.1 percent of the total number of professionals employed were released for a lack of work; however, there was a 17 percent increase in employment as measured by the new hires.
14. Technicians are more mobile in terms of job switching than the professionals with the "Field Crew" representing the most significant increase (36 percent) in new hires. The number of separations attributable to "Other Causes" represented over 24 percent of the total employed as "Field Crew."
15. Water resources planners, geologists, hydrologists, biologists and economists devoted a minimum of approximately 60 percent of their effort to water resources planning and preliminary engineering, and the engineers in general devoted over 70 percent of their effort to preliminary engineering and plans and specifications.
16. Construction administration occupied less than 10 percent of all professional employees except for the surveyors who devoted over 18 percent of their time. Surveyors also directed over 16 percent of their efforts to resident engineering activities.
17. Over 86 percent of the effort of the technical employees is devoted to preliminary engineering, plans and specifications, and resident engineering activities.
18. Approximately 54 percent of the professional employees were reported as licensed indicating that a substantial majority of the total number of employees that are eligible for licensing have complied with state laws.
19. Only approximately 15 percent of the biologists, chemists, systems analysts, and economists were licensed; however, this was higher than anticipated because the majority of the states do not have licenses available for these four professional groups.
20. Only three percent of the personnel eligible for certification were Diplomates in the American Academy of Environmental Engineers.
21. Approximately seven percent of the total number of technicians were certified, and draftsmen represented 73 percent of this total. Only 10 percent of the total number of draftsmen were certified.
22. Apparently there is very little professional or economic advantage afforded in consulting firms to Diplomates of AAEE or to certified technicians.
23. Seventy-one percent of the total part- and full-time professional employment during October 1971 were reported as holding either an associate, baccalaureate, masters, or doctoral degree. It is doubtful that only 71 percent of the professional employees hold some type of academic degree. Probably there was a significant number of firms that reported the number of degrees for the number of 1970 employees rather than 1971.
24. Seventy-two percent of the professional staff held a bachelors degree, 21 percent the masters, and less than three percent held the doctorate.
25. Only 9 percent of the total number of technicians employed held some academic degree.

26. A 36 percent increase in professional employment is expected between 1972 and 1976 without an increase in construction expenditure. An additional 29 percent increase in manpower is expected in 1972 if the construction expenditures for industrial pollution control are increased by a factor of two and the Federal contribution remains constant.
27. The 1976 manpower needs are expected to increase by 41 percent if the industrial construction expenditures are increased by a factor of two.
28. Apparently the projected percentage increases in manpower needs indicate that the majority of the firms are still hiring personnel to handle the present work load, and there will continue to be a large demand for professional and technical personnel.
29. All occupational categories are expected to double in numbers by 1976 if the anticipated growth occurs, and there is little doubt that growth in expenditures will at least match the \$4 billion for Federal assistance and the \$2 billion for industry in 1976.
30. The largest percentage increases in manpower are expected to occur in the number of biologists and chemical engineers employed by consulting industry.
31. There were an estimated 1,214 consulting firms engaged in water pollution control activities with four employees or more in 1970.
32. It is estimated that the total number of professionals employed in the consulting industry will increase from a total of approximately 12,000 in 1970 to over 28,000 by 1976.
33. The number of technicians employed by consulting firms is expected to increase from approximately 10,200 in 1970 to over 23,000 in 1976.
34. The requirements for chemical and other types of engineers and professionals can in all probability be met by recruiting from the existing manpower pool. However, the need for sanitary and environmental engineers can be met only by drawing from a very limited source of supply.
35. If Federal monitoring of the industrial contribution to stream pollution were contracted to consulting firms, it would cost approximately \$6,880 per sampling station if each firm monitored 25 stations, \$5,180 per station if each firm monitored 50 stations, and \$4,130 per station if each firm monitored 100 stations.
36. The monitoring of 25 stations would result in approximately a 19 percent increase in the totals shown in Conclusions 32 and 33 for both technical and professional employees in the consulting industry. Approximately a 28 and 42 percent increase in manpower would occur if the number of stations were increased to 50 and 100 stations respectively.
37. On a national basis it is projected that approximately 4,500 professionals and 2,400 technicians employed in the consulting industry will require short-term training over the next five years to remain current, and 3,300 professionals and 1,500 technicians will be expected to enroll in long-term programs.
38. The consulting industry represents only a small percentage of the total number of people employed in the water pollution control field that will need additional training; therefore, a concerted effort should be made on a regional or state level to provide these

needs. If the present levels of Federal and State support for the long-term academic programs are not decreased, the need for long-term training can be met by the existing programs.

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APPENDIX A

Table A-1

A Classification of 941 Firms Engaged in Water Pollution Control Activities in the USA According to the Ranges of the Percentages of the Staff Engaged in Water Pollution Control, the Total Number of Employees, and the Construction Value of Wastewater Treatment Plants for which the Firm Had Prime Responsibility.

Number of Firms	Range of Percentage of Staff Engaged in Water Pollution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
19	0-9	0-9	23	2,300,000	1,210,000
7	0-9	10-19	1	237,100	130,000
8	0-9	20-29	42	3,050,000	1,280,000
7	0-9	30-39	48	3,420,000	1,170,000
5	0-9	40-49	22	250,000	120,000
3	0-9	50-59	3	1,100,000	900,000
1	0-9	70-79	12	1,100,000	2,800,000
1	0-9	80-89	3	0	0
7	0-9	100-199	27	5,687,000	2,490,000
2	0-9	200-299	2	0	250,000
2	0-9	400-499	53	0	0
3	0-9	500-599	20	11,400,000	7,200,000
1	0-9	600-699	0	0	0
1	0-9	2,000-2,999	18	20,500,000	18,000,000
1	0-9	4,000-4,999	0	20,000,000	15,000,000
Subtotal					
68			274	69,044,100	50,550,000
44	10-19	0-9	75	60,158,000	18,196,500
35	10-19	10-19	30	11,510,000	13,375,000
19	10-19	20-29	42	7,655,000	2,790,000
12	10-19	30-39	17	238,325,000	103,760,000
9	10-19	40-49	19	2,225,000	1,270,000
7	10-19	50-59	21	6,110,000	5,000,000
5	10-19	60-69	2	3,600,000	4,150,000
2	10-19	70-79	3	0	0
2	10-19	80-89	0	1,075,000	300,000
2	10-19	90-99	28	0	0
7	10-19	100-199	14	21,000,000	14,050,000
3	10-19	200-299	21	27,800,000	21,200,000
2	10-19	300-399	0	5,750,000	10,250,000
1	10-19	400-499	15	3,000,000	2,500,000
2	10-19	500-599	20	6,000,000	30,333,333
1	10-19	600-699	0	6,900,000	1,000,000
1	10-19	2,000-2,999	89	660,000	1,508,700
Subtotal					
154			396	405,768,000	229,683,533

Table A-1. Continued.

Number of Firms	Range of Percentage of Staff Engaged in Water Pollution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
43	20-29	0-9	81	5,470,000	7,559,000
36	20-29	10-19	64	13,586,152	22,702,000
18	20-29	29-29	22	71,628,000	6,460,000
8	20-29	30-39	12	15,650,000	6,375,000
5	20-29	40-49	45	4,450,000	2,000,000
2	20-29	50-59	7	6,000,000	4,000,000
1	20-29	60-69	2	25,000,000	4,000,000
1	20-29	70-79	10	100,000	200,000
1	20-29	90-99	0	4,800,000	3,300,000
9	20-29	100-199	17	161,480,000	36,228,000
1	20-29	300-399	0	20,000,000	18,000,000
1	20-29	400-499	10	550,000	550,000,000
1	20-29	700-799	0	75,000,000	70,000,000
Subtotal					
127			270	403,714,152	730,824,000
21	30-39	0-9	64	8,031,000	5,195,000
22	30-39	10-19	53	31,620,000	13,780,000
7	30-39	20-29	19	4,444,000	6,534,000
6	30-39	30-39	10	13,400,000	5,350,000
5	30-39	40-49	23	3,425,000	3,350,000
2	30-39	50-59	13	1,000,000	300,000
3	30-39	60-69	0	5,000,000	4,000,000
1	30-39	70-79	0	3,650,000	4,070,000
1	30-39	80-89	0	0	0
5	30-39	100-199	20	41,600,000	32,000,000
4	30-39	200-299	37	90,000,000	60,100,000
1	30-39	2,000-2,999	0	244,000,000	211,000,000
Subtotal					
78			239	446,170,000	345,679,000
15	40-49	0-9	15	10,080,000	5,555,000
6	40-49	10-19	7	3,017,000	1,730,000
5	40-49	20-29	5	11,100,000	8,250,000
3	40-49	30-39	1	7,300,000	3,800,000
2	40-49	40-49	8	2,350,000	5,790,000
2	40-49	50-59	0	5,800,000	1,200,000
1	40-49	60-69	7	2,000,000	1,200,000
1	40-49	100-199	2	20,000,000	30,000,000
Subtotal					
35			45	61,647,000	57,525,000

Table A-1. Continued.

Number of Firms	Range of Percentage of Staff Engaged in Water Pollution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
62	50-59	0-9	99	120,676,000	20,123,000
26	50-59	10-19	62	31,145,000	14,700,000
7	50-59	20-29	29	37,750,000	6,650,000
4	50-59	30-39	6	11,270,000	5,800,000
3	50-59	40-49	2	7,900,000	3,800,000
2	50-59	50-59	1	12,000,000	8,000,000
1	50-59	80-89	15	7,000,000	2,000,000
6	50-59	100-199	14	42,060,000	20,780,000
Subtotal					
111			228	269,801,000	81,853,000
1	60-69	0-9	1	90,000	30,000
6	60-69	10-19	12	8,580,000	5,610,000
3	60-69	20-29	7	8,000,000	6,500,000
3	60-69	30-39	10	3,000,000	1,300,000
3	60-69	40-49	48	12,600,000	6,000,000
1	60-69	50-59	3	5,600,000	4,100,000
2	60-69	60-69	2	13,500,000	17,100,000
2	60-69	70-79	2	20,000,000	13,000,000
1	60-69	80-89	10	150,000,000	60,000,000
3	60-69	100-199	39	39,900,000	29,600,000
1	60-69	500-599	3	53,000,000	36,000,000
Subtotal					
26			137	314,270,000	179,240,000
13	70-79	0-9	18	260,800,000	204,950,000
11	70-79	10-19	19	20,125,000	11,845,000
5	70-79	20-29	11	20,050,000	9,500,000
4	70-79	30-39	4	20,605,000	13,062,000
3	70-79	40-49	8	18,000,000	15,000,000
2	70-79	70-79	21	56,000,000	42,000,000
1	70-79	80-89	5	30,000,000	25,000,000
2	70-79	100-199	17	121,600,000	83,000,000
1	70-79	200-299	4	12,000,000	10,000,000
Subtotal					
42			107	559,180,000	414,357,000
12	80-89	0-9	22	13,960,000	7,375,000
11	80-89	10-19	15	21,400,000	10,700,000
5	80-89	20-29	16	11,020,000	4,390,000
7	80-89	30-39	13	11,960,000	10,025,000

Table A-1. Continued.

Number of Firms	Range of Percentage of Staff Engaged in Water Pollution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
3	80-89	40-49	48	36,500,000	33,000,000
2	80-89	100-199	5	25,715,000	23,395,000
2	80-89	200-299	7	620,000,000	548,000,000
1	80-89	3,000-3,999	5	260,000,000	248,000,000
Subtotal					
43			131	1,000,555,000	884,885,000
84	90-100	0-9	127	44,683,000	35,318,500
32	90-100	10-19	60	88,477,000	58,945,000
15	90-100	20-29	28	97,620,000	67,450,000
4	90-100	30-39	10	61,000,000	19,000,000
2	90-100	40-49	23	15,700,000	10,700,000
2	90-100	50-59	5	17,800,000	8,000,000
2	90-100	60-69	3	67,000,000	55,000,000
1	90-100	80-89	6	76,000,000	54,000,000
1	90-100	90-99	2	32,893,533	32,123,554
2	90-100	100-199	3	43,700,000	34,193,000
1	90-100	200-299	0	140,000,000	95,000,000
1	90-100	300-399	5	200,000,000	160,000,000
Subtotal					
147			272	884,873,533	629,730,054
110	Unclassified	9,128	258	126,725,000	85,473,225
Totals					
941		47,279	2,357	4,537,747,785	3,689,799,812

Table A-2
A Classification of 47 Firms Engaged in Water Pollution Control
Activities in EPA Region I According to the Ranges of the Per-
centages of the Staff Engaged in Water Pollution Control, the
Total Number of Employees, and the Construction Value of
Wastewater Treatment Plants for which the Firm had
Prime Responsibility.

Number of Firms	Range of Percentage of Staff Engaged in Water Pol- lution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
2	0-9	0-9	13	60,000	10,000
1	0-9	10-19	0	22,000	0
1	0-9	30-39	21	0	80,000
1	0-9	100-199	2	900,000	600,000
1	0-9	2,000-2,999	18	20,500,000	18,000,000
3	10-19	0-9	5	10,000	15,000
2	10-19	10-19	1	1,000,000	5,000,000
1	10-19	20-29	25	100,000	75,000
1	10-19	60-69	0	0	0
1	10-19	100-199	8	10,000,000	10,000,000
1	10-19	400-499	15	3,000,000	2,500,000
3	20-29	0-9	3	0	1,500,000
1	20-29	10-19	0	0	0
1	20-29	40-49	0	200,000	400,000
1	40-49	10-19	5	0	0
2	50-59	0-9	3	200,000	100,000
1	50-59	20-29	2	1,250,000	0
2	50-59	100-199	0	25,000,000	15,000,000
1	60-69	40-49	4	1,600,000	0
1	60-69	100-199	1	7,900,000	5,100,000
1	60-69	500-599	3	53,000,000	36,000,000
2	70-79	0-9	6	7,000,000	4,000,000
1	70-79	200-299	4	12,000,000	10,000,000
7	90-100	0-9	8	3,430,000	1,320,000
1	90-100	20-29	1	4,000,000	3,500,000
1	90-100	30-39	5	12,000,000	0
1	90-100	300-399	5	200,000,000	160,000,000
5	Unclassified	1	7	180,000	110,000
Totals 47		3,936	165	363,352,000	273,310,000

Table A-3
A Classification of 103 Firms Engaged in Water Pollution Control
Activities in EPA Region II According to the Ranges of the Per-
centages of the Staff Engaged in Water Pollution Control, the
Total Number of Employees, and the Construction Value of
Wastewater Treatment Plants for which the Firm had
Prime Responsibility.

Number of Firms	Range of Percentage of Staff Engaged in Water Pol- lution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
2	0-9	0-9	1	150,000	100,000
2	0-9	20-29	27	800,000	1,200,000
1	0-9	40-49	4	0	0
1	0-9	50-59	3	1,000,000	750,000
1	0-9	100-199	6	0	0
2	0-9	200-299	2	0	250,000
6	10-19	0-9	21	4,100,000	200,000
6	10-19	10-19	2	2,250,000	450,000
2	10-19	20-29	2	1,050,000	250,000
1	10-19	30-39	0	400,000	400,000
4	10-19	40-49	5	350,000	170,000
1	10-19	70-79	0	0	0
1	10-19	90-99	6	0	0
1	10-19	100-199	2	3,600,000	1,200,000
1	10-19	500-599	0	0	0
3	20-29	0-9	8	700,000	154,000
2	20-29	10-19	2	5,000,000	2,300,000
1	20-29	20-29	0	600,000	450,000
2	20-29	100-199	0	22,000,000	9,000,000
3	30-39	0-9	12	3,000,000	1,250,000
1	30-39	10-19	3	1,000,000	500,000
1	30-39	30-39	0	5,000,000	3,000,000
1	30-39	60-69	0	0	0
1	40-49	60-69	7	2,000,000	1,200,000
9	50-59	0-9	20	29,904,000	3,805,000
1	50-59	10-19	0	0	0
1	50-59	100-199	3	10,000,000	0
1	60-69	70-79	1	10,000,000	8,000,000
1	60-69	80-89	10	150,000,000	60,000,000

Table A-3. Continued.

Number of Firms	Range of Percentage of Staff Engaged in Water Pollution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
1	70-79	0-9	2	250,000,000	200,000,000
1	70-79	10-19	0	7,000,000	2,500,000
1	70-79	20-29	2	4,500,000	4,000,000
1	70-79	30-39	0	1,505,000	1,662,000
1	70-79	70-79	16	45,000,000	30,000,000
1	70-79	80-89	5	30,000,000	25,000,000
3	80-89	0-9	7	4,500,000	100,000
1	80-89	30-39	0	4,000,000	3,000,000
1	80-89	40-49	1	10,000,000	4,000,000
1	80-89	3,000-3,999	5	260,000,000	248,000,000
9	90-100	0-9	25	5,850,000	3,750,000
3	90-100	10-19	8	6,500,000	5,000,000
3	90-100	20-29	11	28,600,000	24,500,000
1	90-100	40-49	3	15,000,000	10,000,000
2	90-100	60-69	3	67,000,000	55,000,000
1	90-100	80-89	6	76,000,000	54,000,000
1	90-100	200-299	0	140,000,000	95,000,000
11	Unclassified	82	14	7,810,000	1,210,000
Totals 103		6,410	255	1,216,169,000	861,351,000

Table A-4
A Classification of 102 Firms Engaged in Water Pollution Control Activities in EPA Region III According to the Ranges of the Percentages of the Staff Engaged in Water Pollution Control, the Total Number of Employees, and the Construction Value of Wastewater Treatment Plants for which the Firm had Prime Responsibility.

Number of Firms	Range of Percentage of Staff Engaged in Water Pollution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
1	0-9	20-29	0	50,000	0
1	0-9	30-39	10	0	0
1	0-9	40-49	2	50,000	20,000
1	0-9	70-79	12	1,100,000	2,800,000
1	0-9	100-199	4	1,500,000	400,000
1	0-9	500-599	0	400,000	200,000
1	0-9	600-699	0	0	0
6	10-19	0-9	3	700,000	225,000
7	10-19	10-19	8	5,875,000	6,175,000
2	10-19	20-29	0	810,000	85,000
2	10-19	40-49	8	1,250,000	800,000
1	10-19	50-59	4	1,000,000	1,000,000
1	10-19	300-399	0	5,000,000	10,000,000
1	10-19	600-699	0	6,900,000	1,000,000
1	10-19	2,000-2,999	89	660,000	1,508,700
1	20-29	0-9	3	1,000,000	1,300,000
6	20-29	10-19	13	1,220,000	4,160,000
2	20-29	20-29	2	200,000	150,000
1	20-29	40-49	10	450,000	300,000
1	20-29	50-59	4	3,000,000	2,000,000
1	20-29	700-799	0	75,000,000	70,000,000
1	30-39	0-9	0	1,000,000	1,000,000
3	30-39	10-19	5	25,300,000	9,150,000
1	30-39	30-39	3	2,000,000	1,000,000
1	30-39	60-69	0	1,000,000	500,000
2	30-39	100-199	3	32,000,000	25,000,000
2	40-49	0-9	3	350,000	350,000
1	40-49	30-39	0	5,000,000	1,600,000
5	50-59	0-9	7	782,000	35,000
5	50-59	10-19	30	1,400,000	850,000
2	50-59	20-29	20	30,000,000	4,200,000

Table A-4. Continued.

Number of Firms	Range of Percentage of Staff Engaged in Water Pollution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
1	60-69	20-29	2	1,000,000	1,000,000
1	60-69	30-39	2	1,500,000	0
1	60-69	70-79	1	10,000,000	5,000,000
2	70-79	0-9	3	2,000,000	0
1	70-79	10-19	3	2,500,000	1,500,000
1	70-79	40-49	6	6,000,000	4,000,000
2	80-89	10-19	4	7,600,000	3,500,000
1	80-89	40-49	2	10,500,000	9,000,000
8	90-100	0-9	16	10,290,000	9,750,000
4	90-100	10-19	7	13,340,000	8,400,000
3	90-100	20-29	7	13,120,000	8,250,000
2	90-100	30-39	4	46,000,000	18,000,000
2	90-100	100-199	3	43,700,000	34,193,000
10	Unclassified	4,097	51	24,900,000	12,050,000
Totals					
102		10,425	354	397,447,000	260,451,700

Table A-5
A Classification of 142 Firms Engaged in Water Pollution Control Activities in EPA Region IV According to the Ranges of the Percentages of the Staff Engaged in Water Pollution Control, the Total Number of Employees, and the Construction Value of Wastewater Treatment Plants for which the Firm had Prime Responsibility.

Number of Firms	Range of Percentage of Staff Engaged in Water Pollution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
2	0-9	0-9	1	10,000	50,000
1	0-9	10-19	0	125,000	100,000
1	0-9	500-599	20	6,000,000	5,000,000
10	10-19	0-9	15	53,365,000	16,595,000
5	10-19	10-19	5	1,680,000	930,000
3	10-19	20-29	4	1,750,000	600,000
2	10-19	30-39	4	1,000,000	100,000
1	10-19	50-59	2	2,000,000	2,000,000
1	10-19	100-199	0	900,000	350,000
12	20-29	0-9	36	1,120,000	1,220,000
3	20-29	10-19	6	1,700,000	1,900,000
1	20-29	20-29	1	750,000	500,000
2	20-29	30-39	5	1,000,000	1,500,000
1	20-29	40-49	3	2,300,000	200,000
2	20-29	100-199	2	10,400,000	4,000,000
2	30-39	0-9	2	0	0
4	30-39	10-19	4	490,000	225,000
1	30-39	20-29	8	500,000	500,000
1	30-39	30-39	2	1,000,000	500,000
1	30-39	100-199	6	2,000,000	4,000,000
3	30-39	200-299	15	20,000,000	18,100,000
6	40-49	0-9	3	5,130,000	3,945,000
1	40-49	10-19	0	1,247,000	400,000
2	40-49	30-39	1	2,300,000	2,200,000
1	40-49	50-59	0	800,000	1,200,000
1	40-49	100-199	2	20,000,000	30,000,000
8	50-59	0-9	12	71,145,000	738,000
4	50-59	10-19	3	12,195,000	4,750,000
2	50-59	40-49	1	5,600,000	3,300,000
1	50-59	100-199	0	5,000,000	4,000,000

Table A-5. Continued.

Number of Firms	Range of Percentage of Staff Engaged in Water Pol- lution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
1	60-69	10-19	1	5,000,000	3,000,000
1	60-69	40-49	4	3,000,000	1,000,000
1	60-69	50-59	3	5,600,000	4,100,000
2	70-79	0-9	0	150,000	0
1	70-79	10-19	2	300,000	70,000
1	70-79	40-49	0	2,000,000	3,000,000
2	80-89	0-9	3	6,010,000	6,000,000
1	80-89	10-19	0	500,000	500,000
4	80-89	30-39	11	2,710,000	2,200,000
1	80-89	40-49	45	16,000,000	20,000,000
1	80-89	100-199	2	2,500,000	2,500,000
16	90-100	0-9	26	5,325,000	7,515,000
6	90-100	10-19	14	10,360,000	9,000,000
3	90-100	20-29	3	19,000,000	14,000,000
1	90-100	30-39	1	3,000,000	1,000,000
15	Unclassified	91	23	3,555,000	9,465,000
Totals 142		3,892	301	316,517,000	192,253,000

Table A-6
A Classification of 189 Firms Engaged in Water Pollution Control
Activities in EPA Region V According to the Ranges of the Per-
centages of the Staff Engaged in Water Pollution Control, the
Total Number of Employees, and the Construction Value of
Wastewater Treatment Plants for which the Firm had
Prime Responsibility.

Number of Firms	Range of Percentage of Staff Engaged in Water Pol- lution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
1	0-9	0-9	1	0	0
2	0-9	20-29	6	200,000	80,000
3	0-9	30-39	9	220,000	90,000
2	0-9	40-49	5	200,000	100,000
1	0-9	50-59	0	100,000	150,000
1	0-9	400-499	0	0	0
9	10-19	0-9	11	1,258,000	1,011,500
9	10-19	10-19	9	480,000	580,000
4	10-19	20-29	3	1,380,000	480,000
4	10-19	30-39	8	236,525,000	101,280,000
1	10-19	40-49	5	250,000	200,000
1	10-19	70-79	3	0	0
1	10-19	90-99	22	0	0
3	10-19	100-199	4	3,500,000	500,000
1	10-19	200-299	0	16,200,000	13,000,000
8	20-29	0-9	7	590,000	325,000
9	20-29	10-19	19	2,656,152	11,242,000
4	20-29	20-29	8	61,250,000	600,000
1	20-29	30-39	0	9,500,000	0
1	20-29	50-59	3	3,000,000	2,000,000
2	20-29	100-199	6	75,000,000	13,000,000
3	30-39	0-9	2	540,000	250,000
3	30-39	10-19	12	600,000	325,000
2	30-39	20-29	2	1,150,000	1,000,000
1	30-39	30-39	4	500,000	250,000
3	30-39	40-49	12	325,000	1,950,000
1	30-39	50-59	3	1,000,000	300,000
1	40-49	0-9	2	0	0
2	40-49	10-19	2	1,020,000	540,000
3	40-49	20-29	2	6,500,000	1,250,000

Table A-6. Continued.

Number of Firms	Range of Percentage of Staff Engaged in Water Pollution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
13	50-59	0-9	17	9,750,000	7,120,000
7	50-59	10-19	11	9,500,000	4,650,000
4	50-59	20-29	7	6,500,000	2,450,000
1	50-59	50-59	0	6,000,000	1,000,000
1	50-59	80-89	15	77,000,000	2,000,000
1	60-69	0-9	1	90,000	30,000
2	60-69	10-19	5	930,000	460,000
2	60-69	20-29	5	7,000,000	5,500,000
1	60-69	60-69	2	500,000	100,000
1	60-69	100-199	15	10,000,000	4,500,000
4	70-79	0-9	5	1,100,000	600,000
1	70-79	10-19	1	2,500,000	1,000,000
3	70-79	20-29	9	13,550,000	4,000,000
1	70-79	30-39	2	10,000,000	4,000,000
4	80-89	0-9	6	2,800,000	850,000
4	80-89	10-19	8	2,400,000	100,000
4	80-89	20-29	15	6,280,000	2,330,000
1	80-89	30-39	0	250,000	125,000
1	80-89	200-299	2	360,000,000	300,000,000
12	90-100	0-9	7	6,380,000	4,940,000
8	90-100	10-19	22	30,885,000	18,155,000
3	90-100	20-29	4	19,000,000	8,000,000
1	90-100	50-59	2	10,000,000	8,000,000
22	Unclassified	444	35	68,520,000	53,231,000
Totals 189		4,992	366	1,014,879,152	583,644,500

Table A-7
A Classification of 89 Firms Engaged in Water Pollution Control Activities in EPA Region VI According to the Ranges of the Percentages of the Staff Engaged in Water Pollution Control, the Total Number of Employees, and the Construction Value of Wastewater Treatment Plants for which the Firm had Prime Responsibility.

Number of Firms	Range of Percentage of Staff Engaged in Water Pollution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
2	0-9	0-9	2	50,000	0
2	0-9	10-19	1	20,000	0
1	0-9	50-59	0	0	0
2	10-19	10-19	5	90,000	140,000
1	10-19	20-29	0	75,000	200,000
3	10-19	30-39	1	190,000	230,000
1	10-19	50-59	6	0	0
2	10-19	60-69	0	3,500,000	3,000,000
2	10-19	200-299	21	11,600,000	8,200,000
5	20-29	0-9	5	300,000	250,000
3	20-29	10-19	5	1,100,000	600,000
1	20-29	20-29	0	250,000	100,000
1	20-29	40-49	30	500,000	100,000
1	20-29	60-69	2	25,000,000	4,000,000
2	20-29	100-199	9	49,080,000	5,728,000
1	30-39	0-9	3	0	0
3	30-39	10-19	1	600,000	1,500,000
1	30-39	20-29	7	1,000,000	1,500,000
2	30-39	30-39	1	4,900,000	600,000
2	30-39	40-49	11	3,100,000	1,400,000
1	30-39	200-299	22	70,000,000	42,000,000
1	40-49	0-9	0	4,000,000	1,000,000
1	40-49	10-19	0	50,000	150,000
8	50-59	0-9	14	1,975,000	645,000
5	50-59	10-19	10	6,500,000	3,750,000
3	50-59	30-39	1	9,770,000	4,300,000
1	50-59	50-59	1	6,000,000	7,000,000
1	50-59	100-199	3	1,130,000	450,000
1	70-79	0-9	1	50,000	100,000
2	70-79	10-19	5	1,200,000	1,450,000

Table A-7. Continued.

Number of Firms	Range of Percentage of Staff Engaged in Water Pol- lution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
3	80-89	10-19	3	10,000,000	6,500,000
1	80-89	30-39	2	5,000,000	4,700,000
8	90-100	0-9	9	2,690,000	1,970,000
6	90-100	10-19	3	12,342,000	6,190,000
9	Unclassified	79	16	1,920,000	1,342,225
Totals 89		2,418	200	233,982,000	109,095,225

Table A-8

A Classification of 60 Firms Engaged in Water Pollution Control Activities in EPA Region VII According to the Ranges of the Percentages of the Staff Engaged in Water Pollution Control, the Total Number of Employees, and the Construction Value of Wastewater Treatment Plants for which the Firm had Prime Responsibility.

Number of Firms	Range of Percentage of Staff Engaged in Water Pollution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
1	0-9	10-19	0	20,000	0
2	0-9	100-199	5	1,787,000	1,490,000
1	10-19	0-9	4	25,000	0
1	10-19	20-29	1	40,000	50,000
2	10-19	30-39	4	210,000	1,750,000
2	10-19	50-59	6	3,110,000	2,000,000
1	10-19	60-69	2	0	0
1	10-19	80-89	0	1,000,000	300,000
2	20-29	0-9	6	600,000	260,000
2	20-29	10-19	6	300,000	200,000
3	20-29	20-29	5	500,000	500,000
3	20-29	30-39	6	4,750,000	3,975,000
1	20-29	90-99	0	4,800,000	3,300,000
1	20-29	100-199	0	5,000,000	4,500,000
1	20-29	300-399	0	20,000,000	18,000,000
1	30-39	0-9	1	0	0
1	30-39	10-19	4	50,000	20,000
2	30-39	20-29	2	1,044,000	2,534,000
1	30-39	60-69	0	4,000,000	3,500,000
1	30-39	2,000-2,999	0	244,000,000	211,000,000
1	40-49	50-59	0	5,000,000	0
5	50-59	0-9	3	2,050,000	1,780,000
2	60-69	10-19	6	2,350,000	1,950,000
1	60-69	40-49	40	8,000,000	5,000,000
1	70-79	10-19	2	2,500,000	2,000,000
1	70-79	30-39	0	8,500,000	7,000,000
1	80-89	0-9	2	0	0
4	90-100	0-9	6	210,000	546,500
1	90-100	10-19	1	750,000	700,000
13	Unclassified	4,156	70	16,390,000	3,890,000
Totals 60		6,916	182	336,986,000	276,245,500

Table A-9
A Classification of 37 Firms Engaged in Water Pollution Control
Activities in EPA Region VIII According to the Ranges of the Per-
centages of the Staff Engaged in Water Pollution Control, the
Total Number of Employees, and the Construction Value of
Wastewater Treatment Plants for which the Firm had
Prime Responsibility.

Number of Firms	Range of Percentage of Staff Engaged in Water Pol- lution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
1	0-9	0-9	0	0	0
1	0-9	40-49	11	0	0
1	10-19	0-9	3	400,000	100,000
1	10-19	20-29	4	600,000	500,000
1	10-19	60-69	0	100,000	1,150,000
1	20-29	0-9	3	100,000	50,000
3	20-29	10-19	7	300,000	150,000
1	20-29	30-39	0	0	0
1	30-39	0-9	35	1,200,000	600,000
4	30-39	10-19	17	3,280,000	1,860,000
1	40-49	10-19	0	700,000	640,000
1	40-49	20-29	1	600,000	3,000,000
1	50-59	0-9	5	750,000	1,500,000
1	50-59	10-19	8	350,000	500,000
1	50-59	30-39	5	1,500,000	1,500,000
1	60-69	10-19	0	300,000	200,000
1	60-69	60-69	0	13,000,000	17,000,000
1	70-79	0-9	1	500,000	250,000
1	70-79	30-39	2	600,000	400,000
1	80-89	0-9	2	0	0
4	90-100	0-9	13	1,350,000	1,120,000
1	90-100	20-29	0	1,900,000	2,200,000
7	Unclassified	33	8	150,000	2,000,000
Totals 37		570	125	27,680,000	34,720,000

Table A-10
A Classification of 97 Firms Engaged in Water Pollution Control
Activities in EPA Region IX According to the Ranges of the Per-
centages of the Staff Engaged in Water Pollution Control, the
Total Number of Employees, and the Construction Value of
Wastewater Treatment Plants for which the Firm had
Prime Responsibility.

Number of Firms	Range of Percentage of Staff Engaged in Water Pol- lution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
5	0-9	0-9	4	2,030,000	1,050,000
1	0-9	10-19	0	50,000	0
2	0-9	20-29	3	0	0
2	0-9	30-39	8	3,200,000	1,000,000
1	0-9	80-89	3	0	0
1	0-9	100-199	10	1,500,000	0
1	0-9	400-499	53	0	0
1	0-9	500-599	0	5,000,000	2,900,000
1	0-9	4,000-4,999	0	20,000,000	15,000,000
4	10-19	0-9	5	200,000	50,000
4	10-19	10-19	0	135,000	100,000
4	10-19	20-29	3	1,850,000	550,000
1	10-19	40-49	0	160,000	100,000
2	10-19	50-59	3	0	0
1	10-19	80-89	0	75,000	0
1	10-19	300-399	0	750,000	250,000
6	20-29	0-9	9	1,060,000	2,500,000
2	20-29	10-19	1	260,000	150,000
3	20-29	20-29	1	428,000	160,000
3	30-39	0-9	7	2,000,000	1,500,000
2	30-39	10-19	3	0	0
1	30-39	50-59	10	0	0
1	30-39	70-79	0	3,650,000	4,070,000
1	30-39	80-89	0	0	0
2	30-39	100-199	11	7,600,000	3,000,000
4	40-49	0-9	5	450,000	160,000
6	50-59	0-9	4	3,000,000	2,470,000
3	50-59	10-19	0	1,200,000	200,000
1	50-59	100-199	8	930,000	1,330,000

Table A-10. Continued.

Number of Firms	Range of Percentage of Staff Engaged in Water Pollution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
2	70-79	10-19	5	2,850,000	2,150,000
1	70-79	20-29	0	2,000,000	1,500,000
1	70-79	100-199	15	101,600,000	83,000,000
1	80-89	100-199	3	23,215,000	20,895,000
10	90-100	0-9	11	4,600,000	450,000
3	90-100	10-19	5	11,500,000	8,000,000
1	90-100	20-29	2	12,000,000	7,000,000
11	Unclassified	56	27	1,645,000	1,101,000
Totals 97		6,502	219	214,938,000	159,736,000

Table A-11
A Classification of 57 Firms Engaged in Water Pollution Control
Activities in EPA Region X According to the Ranges of the Per-
centages of the Staff Engaged in Water Pollution Control, the
Total Number of Employees, and the Construction Value of
Wastewater Treatment Plants for which the Firm had
Prime Responsibility.

Number of Firms	Range of Percentage of Staff Engaged in Water Pol- lution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
3	0-9	0-9	1	0	0
1	0-9	10-19	0	100	30,000
1	0-9	20-29	6	2,000,000	0
1	0-9	100-199	0	0	0
4	10-19	0-9	8	100,000	0
1	10-19	40-49	1	215,000	0
1	20-29	0-9	0	0	0
4	20-29	10-19	3	1,050,000	2,000,000
3	20-29	20-29	5	7,650,000	4,000,000
1	20-29	30-39	1	400,000	900,000
1	20-29	40-49	2	1,000,000	1,000,000
5	30-39	0-9	1	291,000	595,000
1	30-39	10-19	4	300,000	200,000
1	30-39	20-29	0	750,000	1,000,000
1	40-49	0-9	2	150,000	100,000
1	40-49	20-29	2	4,000,000	4,000,000
1	40-49	40-49	5	350,000	1,200,000
5	50-59	0-9	14	1,120,000	1,930,000
1	50-59	40-49	1	2,300,000	500,000
2	60-69	30-39	8	1,500,000	1,300,000
2	70-79	10-19	1	1,275,000	1,175,000
1	70-79	40-49	2	10,000,000	8,000,000
1	80-89	0-9	2	650,000	425,000
1	80-89	10-19	0	900,000	100,000

Table A-11. Continued.

Number of Firms	Range of Percentage of Staff Engaged in Water Pollution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
4	90-100	0-9	3	1,000,000	500,000
1	90-100	10-19	0	2,800,000	3,500,000
1	90-100	40-49	20	700,000	700,000
1	90-100	50-59	3	7,800,000	0
6	Unclassified	88	7	1,655,000	1,074,000
Totals					
57		1,024	102	49,956,100	34,229,000

Table A-12
A Classification of 18 Firms Engaged in Water Pollution Control Activities in which the EPA Region was Unknown According to the Ranges of the Percentages of the Staff Engaged in Water Pollution Control, the Total Number of Employees, and the Construction Value of Wastewater Treatment Plants for which the Firm had Prime Responsibility.

Number of Firms	Range of Percentage of Staff Engaged in Water Pollution Control	Ranges and Total Number of Employees (All Grades and Classifications)		Construction Value of Wastewater Treatment Plants for which Firms Had Prime Responsibility	
		Full-Time	Part-Time	1970	1969
1	0-9	0-9	0	0	0
1	10-19	100-199	0	3,000,000	2,000,000
1	10-19	500-599	20	6,000,000	30,333,333
1	20-29	0-9	1	0	0
1	20-29	10-19	2	0	0
1	20-29	70-79	10	100,000	200,000
1	20-29	400-499	10	550,000	550,000,000
1	30-39	0-9	1	0	0
1	40-49	40-49	3	2,000,000	4,590,000
1	60-69	100-199	23	22,000,000	20,000,000
1	70-79	70-79	5	11,000,000	12,000,000
1	70-79	100-199	2	20,000,000	0
1	80-89	20-29	1	4,740,000	2,060,000
1	80-89	200-299	5	260,000,000	248,000,000
2	90-100	0-9	3	3,558,000	3,457,000
1	90-100	90-99	2	32,893,533	32,123,554
1	Unclassified	1	0	0	0
Totals					
18		2,065	88	365,841,533	904,763,887

APPENDIX B

Table B-1

Numbers of Employees, Positions and Turnovers in Each Occupational Category for 941 Consulting Engineering Firms Engaged in Water Pollution Control in the USA.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	A				B						
	Total #of Employees in Each Category Doing Water Pollution Work During October ...				Positions (if any) vacant for one month or more		Turnover in Personnel During Past 12 months				
	1970		1971				New Hires		Separations		
	Part Time	Full Time	Part Time	Full Time	Part Time	Full Time	3 yrs. or less exp.	3 yrs. or more exp.	Due to Lack of Work	Due to Poor Performance	Other Cause
PROFESSIONAL STAFF	1668.9	7003.4	4452.7	7622.6	32.0	361.0	655.0	843.0	267.0	157.0	475.0
Water Resources Planners	140.0	370.0	395.0	434.5	3.0	22.0	30.0	32.0	4.0	2.0	18.0
Civil/Sanitary Engineers	330.3	2662.3	1962.5	2950.4	17.0	169.0	288.0	230.0	45.0	46.0	204.0
Civil/Structural Engrs.	158.6	836.6	177.8	856.7	3.0	25.0	64.0	146.0	56.0	20.0	59.0
Civil/Soils Engrs.	55.3	190.6	73.5	188.2	3.0	14.0	27.0	14.0	9.0	3.0	16.0
Mechanical Engineers	192.0	577.9	628.0	593.9	6.0	26.0	48.0	25.0	49.0	23.0	40.0
Electrical Engineers	260.0	446.3	443.0	464.7	.0	23.0	44.0	16.0	23.0	12.0	29.0
Chemical Engineers	29.0	133.0	43.0	155.0	.0	11.0	13.0	31.0	8.0	7.0	7.0
Architects	154.0	250.0	345.0	251.0	.0	3.0	24.0	41.0	21.0	4.0	27.0
Geologists	26.0	73.0	31.0	78.0	.0	2.0	5.0	9.0	6.0	.0	3.0
Hydrologists	26.0	79.0	31.0	91.0	.0	3.0	7.0	9.0	4.0	.0	2.0
Biologists	13.0	17.0	16.0	29.0	.0	1.0	2.0	5.0	1.0	.0	.0
Municipal Engrs./Planrs.	54.0	347.6	62.0	374.7	.0	17.0	18.0	60.0	12.0	8.0	20.0
Economists	13.0	48.0	17.0	52.0	.0	2.0	4.0	4.0	3.0	.0	3.0
Landscape Architects	42.0	54.0	39.0	55.0	.0	1.0	3.0	7.0	2.0	.0	6.0
Surveyors	125.6	756.0	139.8	869.5	.0	33.0	63.0	90.0	24.0	27.0	29.0
Systems Analysts	14.0	90.0	16.0	87.0	.0	4.0	6.0	8.0	.0	.0	.0
Chemists	31.0	72.0	43.0	92.0	.0	5.0	9.0	16.0	.0	3.0	7.0
TECHNICIANS	1114.6	5507.3	1262.3	6359.1	66.5	257.0	1197.0	943.0	548.5	287.0	964.0
Draftsmen	565.5	3390.1	629.6	3461.2	25.0	170.0	482.0	535.0	338.0	167.0	418.0
Instrumentmen	89.1	531.0	105.8	604.0	5.0	20.0	51.0	78.0	26.0	20.0	57.0
Field Crew	273.0	1127.6	318.0	1172.2	27.5	43.0	504.0	83.0	97.0	61.0	397.0
Computer Programmers	41.0	147.0	43.0	162.0	.0	1.0	10.0	10.0	2.0	1.0	7.0
Inspectors	146.0	1261.6	166.0	1459.7	9.0	33.0	150.0	237.0	95.5	34.0	135.0
	2783.5	13510.7	5725.0	14481.7	98.5	628.0	1852.0	1796.0	915.5	440.0	1439.0

Table B-2
 Numbers of Employees, Positions and Turnovers in Each Occupational Category for 47 Consulting
 Engineering Firms Engaged in Water Pollution Control in EPA Region I.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	A				B						
	Total # of Employees in Each Category Doing Water Pollution Work During October . . .				Positions (if any) vacant for one month or more		Turnover in Personnel During Past 12 months				
	1970		1971		Part Time	Full Time	New Hires		Separations		
	Part Time	Full Time	Part Time	Full Time			3 yrs or less exp.	3 yrs. or more exp.	Due to Lack of Work	Due to Poor Performance	Other Cause
PROFESSIONAL STAFF	168.0	772.0	173.0	889.0	3.0	10.0	58.0	104.0	21.0	12.0	48.0
Water Resources Planners	15.0	53.0	14.0	66.0	.0	1.0	1.0	5.0	.0	.0	4.0
Civil/Sanitary Engrs.	20.0	370.0	20.0	415.0	.0	6.0	34.0	37.0	7.0	3.0	22.0
Civil/Structural Engrs.	29.0	67.0	26.0	78.0	3.0	1.0	8.0	15.0	4.0	2.0	2.0
Civil/Soils Engrs.	8.0	17.0	8.0	18.0	.0	.0	2.0	1.0	.0	.0	1.0
Mechanical Engineers	23.0	53.0	30.0	78.0	.0	.0	5.0	15.0	1.0	2.0	5.0
Electrical Engineers	13.0	36.0	12.0	41.0	.0	.0	3.0	5.0	1.0	1.0	2.0
Chemical Engineers	4.0	11.0	3.0	13.0	.0	.0	.0	2.0	.0	.0	.0
Architects	5.0	20.0	4.0	22.0	.0	.0	.0	4.0	.0	.0	2.0
Geologists	4.0	7.0	5.0	7.0	.0	.0	.0	.0	1.0	.0	1.0
Hydrologists	3.0	5.0	3.0	6.0	.0	.0	.0	1.0	.0	.0	.0
Biologists	2.0	4.0	2.0	3.0	.0	.0	.0	.0	.0	.0	.0
Municipal Engrs./Planrs.	11.0	45.0	11.0	55.0	.0	2.0	1.0	11.0	3.0	3.0	1.0
Economists	1.0	4.0	2.0	4.0	.0	.0	.0	.0	.0	.0	.0
Landscape Architects	14.0	17.0	16.0	15.0	.0	.0	2.0	2.0	.0	.0	4.0
Surveyors	10.0	39.0	11.0	51.0	.0	.0	.0	5.0	4.0	.0	1.0
Systems Analysts	5.0	8.0	5.0	10.0	.0	.0	.0	.0	.0	.0	.0
Chemists	1.0	6.0	1.0	7.0	.0	.0	2.0	1.0	.0	1.0	3.0
TECHNICIANS	79.0	559.0	89.0	630.0	.0	20.0	86.0	108.0	42.0	25.0	90.0
Draftsmen	44.0	285.0	46.0	342.0	.0	11.0	51.0	66.0	15.0	15.0	63.0
Instrumentmen	5.0	45.0	7.0	48.0	.0	2.0	8.0	2.0	.0	1.0	6.0
Field Crew	15.0	57.0	16.0	54.0	.0	4.0	13.0	3.0	4.0	1.0	7.0
Computer Programmers	9.0	13.0	10.0	16.0	.0	.0	2.0	2.0	.0	1.0	1.0
Inspectors	4.0	159.0	10.0	170.0	.0	3.0	12.0	35.0	23.0	7.0	13.0
	247.0	1331.0	262.0	1519.0	3.0	30.0	144.0	212.0	63.0	37.0	138.0

Table B-3

Numbers of Employees, Positions and Turnovers in Each Occupational Category for 103 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region II.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	A				B						
	Total # of Employees in Each Category Doing Water Pollution Work During October ...				Positions (if any) vacant for one month or more		Turnover in Personnel During Past 12 months				
	1970		1971				New Hires		Separations		
	Part Time	Full Time	Part Time	Full Time	Part Time	Full Time	3 yrs or less exp.	3 yrs. or more exp.	Due to Lack of Work	Due to Poor Performance	Other Cause
PROFESSIONAL STAFF	248.4	752.2	538.2	801.9	7.0	40.0	85.0	122.0	28.0	26.0	65.0
Water Resources Planners	70.0	26.0	312.0	31.0	2.0	4.0	1.0	07.0	1.0	1.0	2.0
Civil/Sanitary Engineers	50.1	339.1	51.3	378.2	4.0	24.0	47.0	49.0	9.0	11.0	32.0
Civil/Structural Engrs.	26.1	89.1	37.3	83.2	.0	1.0	8.0	13.0	3.0	5.0	10.0
Civil/Soils Engrs.	5.1	23.1	11.3	22.2	1.0	3.0	2.0	1.0	.0	.0	1.0
Mechanical Engineers	38.0	55.2	44.0	52.4	.0	2.0	7.0	19.0	4.0	6.0	8.0
Electrical Engineers	24.0	53.1	29.0	50.2	.0	2.0	7.0	11.0	2.0	1.0	6.0
Chemical Engineers	1.0	19.0	11.0	12.0	.0	1.0	.0	4.0	.0	1.0	1.0
Architects	4.0	19.0	7.0	19.0	.0	1.0	.0	.0	.0	.0	.0
Geologists	2.0	9.0	2.0	8.0	.0	.0	.0	1.0	2.0	.0	1.0
Hydrologists	1.0	5.0	4.0	8.0	.0	.0	1.0	2.0	1.0	.0	.0
Biologists	2.0	.0	3.0	.0	.0	.0	.0	.0	.0	.0	.0
Municipal Engrs./Planrs.	6.0	21.1	4.0	24.2	.0	.0	.0	3.0	1.0	.0	.0
Economists	1.0	1.0	2.0	1.0	.0	.0	.0	.0	.0	.0	.0
Landscape Architects	1.0	1.0	.0	1.0	.0	.0	.0	.0	.0	.0	.0
Surveyors	12.1	72.5	10.3	83.5	.0	1.0	6.0	10.0	5.0	1.0	3.0
Systems Analysts	1.0	9.0	2.0	13.0	.0	1.0	3.0	1.0	.0	.0	.0
Chemists	6.0	10.0	8.0	15.0	.0	.0	3.0	1.0	.0	.0	1.0
TECHNICIANS	142.1	723.3	216.3	823.6	3.0	19.0	108.0	140.0	32.0	36.0	77.0
Draftsmen	87.0	421.1	141.0	466.2	2.0	13.0	55.0	76.0	21.0	26.0	38.0
Instrumentmen	10.1	60.5	11.3	66.5	.0	1.0	7.0	8.0	1.0	1.0	10.0
Field Crew	16.0	85.1	30.0	75.2	.0	.0	18.0	8.0	2.0	3.0	8.0
Computer Programmers	3.0	12.0	4.0	14.0	.0	.0	.0	1.0	.0	.0	2.0
Inspectors	26.0	144.6	30.0	201.7	1.0	5.0	28.0	47.0	8.0	6.0	19.0
	390.5	1475.5	754.5	1625.5	10.0	59.0	193.0	262.0	60.0	62.0	142.0

Table B-4

Numbers of Employees, Positions and Turnovers in Each Occupational Category for 102 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region III.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	A				B						
	Total #of Employees in Each Category Doing Water Pollution Work During October . . .				Positions (if any) vacant for one month or more		Turnover in Personnel During Past 12 months				
	1970		1971				New Hires		Separations		
	Part Time	Full Time	Part Time	Full Time	Part Time	Full Time	3 yrs or less exp.	3 yrs. or more exp.	Due to Lack of Work	Due to Poor Performance	Other Cause
PROFESSIONAL STAFF	237.0	859.0	2159.0	837.0	3.0	40.0	34.0	103.0	21.0	18.0	37.0
Water Resources Planners	12.0	41.0	11.0	46.0	.0	2.0	.0	4.0	2.0	.0	.0
Civil/Sanitary Engineers	110.0	239.0	1610.0	306.0	.0	17.0	15.0	43.0	2.0	5.0	21.0
Civil/Structural Engrs.	9.0	104.0	15.0	39.0	.0	1.0	5.0	11.0	12.0	1.0	6.0
Civil/Soils Engrs.	7.0	27.0	10.0	14.0	.0	.0	.0	.0	.0	.0	.0
Mechanical Engineers	22.0	97.0	420.0	79.0	3.0	6.0	1.0	8.0	1.0	3.0	5.0
Electrical Engineers	22.0	53.0	22.0	55.0	.0	7.0	4.0	7.0	.0	3.0	3.0
Chemical Engineers	3.0	26.0	5.0	31.0	.0	.0	1.0	6.0	.0	.0	.0
Architects	6.0	28.0	9.0	26.0	.0	1.0	1.0	2.0	2.0	2.0	1.0
Geologists	7.0	10.0	8.0	12.0	.0	.0	1.0	1.0	1.0	.0	1.0
Hydrologists	3.0	8.0	5.0	12.0	.0	1.0	1.0	1.0	.0	.0	.0
Biologists	4.0	4.0	5.0	4.0	.0	.0	1.0	1.0	1.0	.0	.0
Municipal Engrs./Planrs.	2.0	31.0	2.0	34.0	.0	.0	1.0	4.0	.0	.0	.0
Economists	2.0	5.0	3.0	6.0	.0	.0	.0	1.0	.0	.0	.0
Landscape Architects	10.0	9.0	8.0	11.0	.0	1.0	1.0	3.0	.0	.0	.0
Surveyors	6.0	37.0	9.0	39.0	.0	4.0	1.0	8.0	.0	3.0	.0
Systems Analysts	3.0	26.0	4.0	8.0	.0	.0	.0	1.0	.0	.0	.0
Chemists	2.0	14.0	13.0	15.0	.0	.0	.0	2.0	.0	1.0	.0
TECHNICIANS	99.5	1120.5	111.0	1037.5	1.5	44.0	143.0	123.0	58.0	27.0	113.0
Draftsmen	62.0	694.5	74.0	564.5	.0	29.0	62.0	54.0	55.0	18.0	37.0
Instrumentmen	5.5	77.0	7.0	76.0	.0	2.0	2.0	10.0	.0	.0	5.0
Field Crew	19.0	156.0	20.0	141.0	1.5	11.0	44.0	10.0	2.0	8.0	32.0
Computer Programmers	3.0	17.0	2.0	20.0	.0	.0	2.0	4.0	.0	.0	1.0
Inspectors	10.0	175.0	8.0	236.0	.0	2.0	33.0	45.0	1.0	1.0	39.0
	336.5	1979.5	2270.0	1874.5	4.5	84.0	177.0	226.0	79.0	45.0	150.0

Table B-5
 Numbers of Employees, Positions and Turnovers in Each Occupational Category for 142 Consulting
 Engineering Firms Engaged in Water Pollution Control in EPA Region IV.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	A				B						
	Total # of Employees in Each Category Doing Water Pollution Work During October ...				Positions (if any) vacant for one month or more		Turnover in Personnel During Past 12 months				
	1970		1971				New Hires		Separations		
	Part Time	Full Time	Part Time	Full Time	Part Time	Full Time	3 yrs or less exp.	3 yrs. or more exp.	Due to Lack of Work	Due to Poor Performance	Other Cause
PROFESSIONAL STAFF	184.0	846.7	193.0	907.7	1.0	60.0	77.0	112.0	17.0	17.0	46.0
Water Resources Planners	8.0	29.0	10.0	35.0	.0	3.0	2.0	5.0	.0	.0	.0
Civil/Sanitary Engineers	34.0	303.0	42.0	343.0	1.0	26.0	33.0	37.0	2.0	1.0	20.0
Civil/Structural Engrs.	13.0	111.0	24.0	118.0	.0	5.0	5.0	10.0	1.0	1.0	6.0
Civil/Soils Engrs.	7.0	21.0	5.0	19.0	.0	1.0	4.0	2.0	3.0	1.0	3.0
Mechanical Engineers	35.0	53.2	50.0	52.2	.0	5.0	8.0	8.0	.0	1.0	.0
Electrical Engineers	12.0	63.5	22.0	75.5	.0	5.0	8.0	8.0	2.0	.0	3.0
Chemical Engineers	1.0	7.0	.0	9.0	.0	.0	.0	1.0	.0	.0	.0
Architects	39.0	43.0	8.0	38.0	.0	1.0	6.0	5.0	3.0	1.0	5.0
Geologists	1.0	4.0	2.0	4.0	.0	.0	.0	1.0	1.0	.0	.0
Hydrologists	1.0	3.0	2.0	5.0	.0	.0	.0	.0	.0	.0	.0
Biologists	1.0	.0	1.0	1.0	.0	.0	.0	2.0	.0	.0	.0
Municipal Engrs./Planrs.	5.0	24.0	7.0	25.0	.0	2.0	4.0	6.0	3.0	1.0	2.0
Economists	2.0	3.0	1.0	4.0	.0	.0	1.0	1.0	1.0	.0	.0
Landscape Architects	1.0	6.0	2.0	7.0	.0	.0	.0	2.0	.0	.0	.0
Surveyors	12.0	162.0	16.0	155.0	.0	12.0	4.0	20.0	1.0	11.0	6.0
Systems Analysts	.0	6.0	.0	7.0	.0	.0	.0	1.0	.0	.0	.0
Chemists	1.0	8.0	1.0	10.0	.0	.0	1.0	2.0	.0	.0	1.0
TECHNICIANS	109.0	929.0	135.0	991.0	15.0	51.0	259.0	133.0	62.0	53.0	245.0
Draftsmen	61.0	447.0	67.0	480.0	7.0	31.0	63.0	68.0	31.0	25.0	73.0
Instrumentmen	7.0	98.0	10.0	94.0	.0	6.0	9.0	19.0	5.0	6.0	17.0
Field Crew	23.0	215.0	37.0	233.0	8.0	7.0	175.0	18.0	17.0	17.0	148.0
Computer Programmers	1.0	19.0	1.0	22.0	.0	.0	1.0	1.0	.0	.0	1.0
Inspectors	17.0	160.0	20.0	162.0	.0	7.0	11.0	27.0	9.0	5.0	6.0
	293.0	1775.7	328.0	1898.7	16.0	111.0	336.0	245.0	79.0	70.0	291.0

Table B-6

Numbers of Employees, Positions and Turnovers in Each Occupational Category for 189 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region V.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	A				B						
	Total # of Employees in Each Category Doing Water Pollution Work During October . . .				Positions (if any) vacant for one month or more		Turnover in Personnel During Past 12 months				
	1970		1971				New Hires		Separations		
	Part Time	Full Time	Part Time	Full Time	Part Time	Full Time	3 yrs or less exp.	3 yrs. or more exp.	Due to Lack of Work	Due to Poor Performance	Other Cause
PROFESSIONAL STAFF	250.0	1132.5	278.0	1295.0	4.0	53.0	123.0	126.0	46.0	21.0	86.0
Water Resources Planners	6.0	49.0	8.0	48.0	.0	2.0	.0	1.0	.0	1.0	5.0
Civil/Sanitary Engineers	40.5	443.2	50.5	500.7	2.0	30.0	55.0	51.0	7.0	11.0	31.0
Civil/Structural Engrs.	32.0	127.0	34.0	133.0	.0	2.0	6.0	20.0	7.0	2.0	11.0
Civil/Soils Engrs.	8.0	33.0	8.0	35.5	.0	1.0	9.0	2.0	1.0	.0	6.0
Mechanical Engineers	37.0	97.2	40.0	108.2	2.0	3.0	5.0	15.0	8.0	2.0	4.0
Electrical Engineers	31.0	52.0	26.0	55.0	.0	1.0	4.0	2.0	6.0	.0	4.0
Chemical Engineers	9.0	27.0	11.0	27.0	.0	3.0	2.0	2.0	3.0	1.0	2.0
Architects	31.0	46.0	40.0	47.0	.0	.0	6.0	9.0	9.0	.0	8.0
Geologists	4.0	5.0	4.0	3.0	.0	.0	1.0	1.0	.0	.0	1.0
Hydrologists	3.0	14.0	3.0	8.0	.0	2.0	.0	.0	2.0	.0	1.0
Biologists	.0	4.0	2.0	4.0	.0	.0	.0	.0	.0	.0	.0
Municipal Engrs./Planrs.	12.0	64.0	15.0	60.0	.0	4.0	1.0	12.0	1.0	1.0	6.0
Economists	2.0	7.0	1.0	6.0	.0	.0	.0	.0	1.0	.0	1.0
Landscape Architects	8.0	6.0	5.0	5.0	.0	.0	.0	.0	.0	.0	2.0
Surveyors	22.5	141.0	21.5	231.5	.0	3.0	32.0	9.0	1.0	3.0	3.0
Systems Analysts	.0	10.0	1.0	15.0	.0	1.0	.0	.0	.0	.0	.0
Chemists	4.0	7.0	8.0	8.0	.0	1.0	2.0	1.0	.0	.0	1.0
TECHNICIANS	262.0	1107.5	268.0	1130.5	18.0	55.0	207.0	102.0	101.0	46.0	123.0
Draftsmen	132.5	494.0	126.5	476.0	5.0	36.0	67.0	60.0	71.0	22.0	41.0
Instrumentmen	17.5	114.0	22.5	107.0	2.0	4.0	8.0	6.0	3.0	4.0	3.0
Field Crew	75.0	213.0	79.0	236.0	8.0	9.0	101.0	11.0	12.0	13.0	51.0
Computer Programmers	9.0	15.5	10.0	15.5	.0	.0	1.0	.0	1.0	.0	.0
Inspectors	28.0	271.0	30.0	296.0	3.0	6.0	30.0	25.0	14.0	7.0	28.0
	512.0	2240.0	546.0	2425.5	22.0	108.0	330.0	228.0	147.0	67.0	209.0

Table B-7

Numbers of Employees, Positions and Turnovers in Each Occupational Category for 89 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region VI.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	A				B						
	Total # of Employees in Each Category Doing Water Pollution Work During October . . .				Positions (if any) vacant for one month or more		Turnover in Personnel During Past 12 months				
	1970		1971				New Hires		Separations		
	Part Time	Full Time	Part Time	Full Time	Part Time	Full Time	3 yrs. or less exp.	3 yrs. or more exp.	Due to Lack of Work	Due to Poor Performance	Other Cause
PROFESSIONAL STAFF	156.0	528.0	172.0	575.0	7.0	41.0	105.0	109.0	72.0	30.0	92.0
Water Resources Planners	5.0	31.0	14.0	30.0	.0	2.0	2.0	.0	.0	.0	3.0
Civil/Sanitary Engineers	25.0	168.0	31.0	175.0	4.0	21.0	16.0	19.0	2.0	.0	11.0
Civil/Structural Engrs.	9.0	43.0	8.0	54.0	.0	5.0	7.0	46.0	9.0	4.0	6.0
Civil/Soils Engrs.	4.0	7.0	8.0	6.0	.0	2.0	3.0	1.0	.0	.0	2.0
Mechanical Engineers	16.0	36.0	10.0	43.0	.0	2.0	3.0	15.0	12.0	1.0	5.0
Electrical Engineers	11.0	30.5	8.0	32.0	.0	2.0	4.0	9.0	2.0	.0	3.0
Chemical Engineers	5.0	11.0	3.0	15.0	.0	2.0	.0	5.0	3.0	.0	.0
Architects	1.0	9.0	1.0	8.0	.0	.0	2.0	2.0	.0	.0	2.0
Geologists	4.0	.0	4.0	.0	.0	.0	.0	.0	.0	.0	.0
Hydrologists	4.0	8.0	4.0	10.0	.0	.0	2.0	.0	.0	.0	.0
Biologists	.0	1.0	.0	1.0	.0	.0	.0	.0	.0	.0	.0
Municipal Engrs./Planrs.	6.0	51.0	6.0	55.0	.0	4.0	1.0	15.0	.0	2.0	2.0
Economists	1.0	2.0	2.0	3.0	.0	1.0	1.0	1.0	.0	.0	1.0
Landscape Architects	.0	1.0	.0	.0	.0	.0	.0	.0	1.0	.0	.0
Surveyors	32.0	61.0	33.0	50.0	.0	9.0	2.0	19.0	2.0	1.0	8.0
Systems Analysts	2.0	6.0	3.0	5.0	.0	.0	1.0	2.0	.0	.0	.0
Chemists	3.0	2.0	3.0	5.0	.0	1.0	.0	1.0	.0	.0	.0
TECHNICIANS	128.0	467.5	138.0	492.0	4.0	51.0	44.0	135.0	31.0	8.0	43.0
Draftsmen	57.0	291.0	64.0	317.0	4.0	23.0	50.0	73.0	49.0	20.0	52.0
Instrumentmen	24.0	49.0	25.0	59.0	1.0	4.0	4.0	15.0	4.0	4.0	4.0
Field Crew	54.0	92.0	61.0	102.0	.0	9.0	43.0	10.0	6.0	4.0	27.0
Computer Programmers	5.0	17.0	5.0	17.0	.0	1.0	2.0	.0	.0	.0	1.0
Inspectors	15.0	79.0	17.0	80.0	2.0	4.0	6.0	11.0	13.0	2.0	9.0
	284.0	995.5	310.0	1067.0	11.0	92.0	149.0	244.0	103.0	38.0	135.0

Table B-8

Numbers of Employees, Positions and Turnovers in Each Occupational Category for 60 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region VII.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	A				B						
	Total # of Employees in Each Category Doing Water Pollution Work During October . . .				Positions (if any) vacant for one month or more		Turnover in Personnel During Past 12 months				
	1970		1971				New Hires		Separations		
	Part Time	Full Time	Part Time	Full Time	Part Time	Full Time	3 yrs or less exp.	3 yrs. or more exp.	Due to Lack of Work	Due to Poor Performance	Other Cause
PROFESSIONAL STAFF	104.0	642.0	469.0	656.0	2.0	73.0	61.0	85.0	9.0	11.0	22.0
Water Resources Planners	5.0	31.0	4.0	32.0	.0	1.0	1.0	1.0	.0	.0	.0
Civil/Sanitary Engineers	10.2	235.0	108.2	251.0	2.0	15.0	32.0	13.0	1.0	3.0	15.0
Civil/Structural Engrs.	10.5	93.0	9.5	98.0	.0	5.0	8.0	6.0	2.0	2.0	3.0
Civil/Soils Engrs.	4.2	17.0	4.2	14.0	.0	1.0	.0	1.0	.0	1.0	.0
Mechanical Engineers	6.6	43.0	7.0	37.0	.0	4.0	5.0	.0	.0	1.0	.0
Electrical Engineers	123.0	45.0	308.0	40.0	.0	3.0	2.0	56.0	.0	1.0	2.0
Chemical Engineers	1.0	7.0	2.0	12.0	.0	2.0	2.0	.0	.0	.0	.0
Architects	1.0	37.0	2.0	38.0	.0	.0	.0	2.0	3.0	.0	.0
Geologists	.0	5.0	.0	6.0	.0	.0	.0	1.0	.0	.0	.0
Hydrologists	3.0	5.0	3.0	5.0	.0	.0	.0	.0	.0	.0	.0
Biologists	2.0	.0	1.0	.0	.0	.0	.0	.0	.0	.0	.0
Municipal Engrs./Planrs.	2.0	31.0	3.0	29.0	.0	.0	2.0	2.0	1.0	1.0	1.0
Economists	2.0	9.0	2.0	7.0	.0	.0	.0	.0	.0	.0	.0
Landscape Architects	1.0	7.0	1.0	6.0	.0	.0	.0	.0	.0	.0	.0
Surveyors	11.0	71.0	12.0	76.0	.0	1.0	9.0	3.0	2.0	2.0	1.0
Systems Analysts	.0	5.0	.0	4.0	.0	1.0	.0	1.0	.0	.0	.0
Chemists	2.0	1.0	2.0	1.0	.0	.0	.0	.0	.0	.0	.0
TECHNICIANS	83.0	452.0	72.0	431.0	.0	12.0	60.0	32.0	10.0	16.0	58.0
Draftsmen	44.0	186.0	35.0	177.0	.0	9.0	12.0	27.0	4.0	6.0	29.0
Instrumentmen	6.0	55.0	7.0	51.0	.0	.0	6.0	4.0	1.0	3.0	2.0
Field Crew	19.0	102.0	17.0	102.0	.0	3.0	26.0	4.0	2.0	4.0	25.0
Computer Programmers	5.0	15.0	4.0	13.0	.0	.0	2.0	.0	.0	.0	.0
Inspectors	9.0	88.0	9.0	88.0	.0	.0	7.0	4.0	3.0	3.0	2.0
	267.0	1094.0	541.0	1087.0	2.0	45.0	121.0	118.0	19.0	27.0	80.0

Table B-9

Numbers of Employees, Positions and Turnovers in Each Occupational Category for 37 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region VIII.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	A				B							
	Total # of Employees in Each Category Doing Water Pollution Work During October . . .				Positions (if any) vacant for one month or more		Turnover in Personnel During Past 12 months					
	1970		1971				New Hires		Separations			
	Part Time	Full Time	Part Time	Full Time	Part Time	Full Time	3 yrs or less exp.	3 yrs. or more exp.	Due to Lack of Work	Due to Poor Performance	Other Cause	
PROFESSIONAL STAFF	49.0	151.0	67.0	167.0	3.0	6.0	18.0	16.0	15.0	2.0	8.0	
Water Resources Planners	8.0	11.0	10.0	15.0	1.0	1.0	3.0	1.0	.0	.0	.0	
Civil/Sanitary Engineers	12.0	56.0	19.0	62.0	2.0	4.0	8.0	8.0	5.0	1.0	4.0	
Civil/Structural Engrs.	7.0	16.0	4.0	15.0	.0	.0	1.0	3.0	4.0	.0	1.0	
Civil/Soils Engrs.	.0	6.0	1.0	7.0	.0	.0	.0	1.0	.0	.0	1.0	
Mechanical Engineers	1.0	13.0	3.0	12.0	.0	.0	1.0	.0	2.0	.0	.0	
Electrical Engineers	1.0	6.0	1.0	9.0	.0	.0	2.0	.0	1.0	.0	.0	
Chemical Engineers	1.0	1.0	4.0	1.0	.0	.0	.0	.0	.0	.0	.0	
Architects	7.0	1.0	6.0	2.0	.0	.0	.0	.0	1.0	1.0	.0	
Geologists	.0	3.0	.0	4.0	.0	.0	.0	.0	.0	.0	.0	
Hydrologists	4.0	5.0	4.0	3.0	.0	.0	.0	.0	1.0	.0	.0	
Biologists	.0	1.0	.0	1.0	.0	.0	.0	.0	.0	.0	.0	
Municipal Engrs./Planrs.	3.0	10.0	3.0	10.0	.0	.0	1.0	.0	.0	.0	1.0	
Economists	1.0	.0	3.0	.0	.0	.0	.0	.0	.0	.0	.0	
Landscape Architects	.0	1.0	.0	2.0	.0	.0	.0	.0	.0	.0	.0	
Surveyors	7.0	18.0	8.0	20.0	.0	1.0	2.0	3.0	1.0	.0	1.0	
Systems Analysts	1.0	.0	1.0	.0	.0	.0	.0	.0	.0	.0	.0	
Chemists	.0	3.0	.0	3.0	.0	.0	.0	.0	.0	.0	.0	
TECHNICIANS	35.0	123.5	42.0	152.5	1.0	4.0	26.0	10.0	10.5	5.0	14.0	
Draftsmen	12.0	39.0	16.0	47.0	1.0	2.0	13.0	5.0	3.0	3.0	2.0	
Instrumentmen	3.0	13.0	5.0	21.0	.0	.0	2.0	2.0	.0	.0	1.0	
Field Crew	12.0	35.0	12.0	46.0	.0	.0	10.0	2.0	5.0	1.0	10.0	
Computer Programmers	.0	7.5	2.0	9.5	.0	.0	.0	1.0	.0	.0	.0	
Inspectors	8.0	29.0	7.0	29.0	.0	2.0	1.0	.0	2.5	1.0	1.0	
	84.0	274.5	109.0	319.5	4.0	10.0	44.0	26.0	25.5	7.0	22.0	

Table B-10

Numbers of Employees, Positions and Turnovers in Each Occupational Category for 97 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region IX.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	A				B						
	Total # of Employees in Each Category Doing Water Pollution Work During October . . .				Positions (if any) vacant for one month or more		Turnover in Personnel During Past 12 months				
	1970		1971				New Hires		Separations		
	Part Time	Full Time	Part Time	Full Time	Part Time	Full Time	3 yrs or less exp.	3 yrs. or more exp.	Due to Lack of Work	Due to Poor Performance	Other Cause
PROFESSIONAL STAFF	125.0	634.0	351.0	768.0	3.0	45.0	67.0	131.0	24.0	29.0	50.0
Water Resources Planners	5.0	48.5	7.0	54.5	.0	5.0	.0	7.0	1.0	.0	4.0
Civil/Sanitary Engineers	14.0	186.0	15.0	227.5	1.0	15.0	18.0	36.0	.0	5.0	17.0
Civil/Structural Engrs.	3.0	81.5	8.0	91.5	.0	3.0	11.0	11.0	4.0	2.0	3.0
Civil/Soils Engrs.	6.0	20.5	7.0	29.5	1.0	5.0	5.0	2.0	2.0	1.0	2.0
Mechanical Engineers	10.0	48.0	12.0	60.0	1.0	2.0	5.0	29.0	9.0	9.0	7.0
Electrical Engineers	8.0	30.0	8.0	33.0	.0	1.0	3.0	7.0	3.0	5.0	2.0
Chemical Engineers	1.0	9.0	3.0	20.0	.0	2.0	5.0	7.0	.0	.0	.0
Architects	52.0	20.0	262.0	27.0	.0	.0	3.0	5.0	2.0	.0	3.0
Geologists	2.0	25.0	5.0	29.0	.0	2.0	2.0	3.0	1.0	.0	3.0
Hydrologists	2.0	19.0	1.0	25.0	.0	.0	3.0	4.0	.0	.0	1.0
Biologists	1.0	2.0	1.0	12.0	.0	1.0	1.0	2.0	.0	.0	.0
Municipal Engrs./Planrs.	4.0	43.0	5.0	44.5	.0	3.0	4.0	2.0	.0	.0	5.0
Economists	.0	12.0	1.0	13.0	.0	1.0	.0	1.0	.0	.0	1.0
Landscape Architects	1.0	4.0	1.0	5.0	.0	.0	.0	.0	1.0	.0	.0
Surveyors	4.0	60.5	8.0	63.5	.0	.0	3.0	7.0	1.0	5.0	2.0
Systems Analysts	1.0	12.0	.0	15.0	.0	1.0	2.0	1.0	.0	.0	.0
Chemists	5.0	13.0	7.0	18.0	.0	3.0	.0	5.0	.0	1.0	.0
TECHNICIANS	61.0	429.0	61.0	512.0	10.0	13.0	74.0	76.0	54.0	30.0	59.0
Draftsmen	34.0	235.5	36.0	272.5	2.0	9.0	30.0	51.0	30.0	21.0	33.0
Instrumentmen	7.0	37.5	6.0	41.5	1.0	1.0	2.0	11.0	3.0	1.0	9.0
Field Crew	7.0	87.0	10.0	101.0	4.0	.0	34.0	3.0	11.0	8.0	14.0
Computer Programmers	1.0	16.0	1.0	18.0	.0	.0	.0	.0	1.0	.0	.0
Inspectors	12.0	53.0	8.0	79.0	3.0	3.0	8.0	11.0	9.0	.0	3.0
	186.0	1053.0	412.0	1280.0	13.0	58.0	141.0	207.0	78.0	59.0	109.0

Table B-11

Numbers of Employees, Positions and Turnovers in Each Occupational Category for 57 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region X.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	A				B						
	Total # of Employees in Each Category Doing Water Pollution Work During October . . .				Positions (if any) vacant for one month or more		Turnover in Personnel During Past 12 months				
	1970		1971				New Hires		Separations		
	Part Time	Full Time	Part Time	Full Time	Part Time	Full Time	3 yrs or less exp.	3 yrs. or more exp.	Due to Lack of Work	Due to Poor Performance	Other Cause
PROFESSIONAL STAFF	78.5	279.5	77.5	317.0	1.0	13.0	24.0	45.0	39.0	5.0	27.0
Water Resources Planners	4.0	9.0	4.0	15.0	.0	.0	.0	.0	.0	.0	.0
Civil/Sanitary Engineers	12.5	98.5	13.5	109.0	1.0	5.0	10.0	14.0	9.0	3.0	6.0
Civil/Structural Engrs.	12.0	34.0	10.0	37.0	.0	2.0	1.0	6.0	7.0	1.0	5.0
Civil/Soils Engrs.	3.0	6.0	5.0	5.0	.0	.0	.0	1.0	2.0	.0	.0
Mechanical Engineers	11.0	27.0	11.0	30.0	.0	1.0	3.0	7.0	6.0	2.0	2.0
Electrical Engineers	8.0	26.0	6.0	26.0	.0	1.0	.0	3.0	2.0	.0	.0
Chemical Engineers	2.0	6.0	1.0	5.0	.0	1.0	2.0	1.0	2.0	.0	2.0
Architects	5.0	8.0	4.0	8.0	.0	.0	.0	4.0	1.0	.0	6.0
Geologists	1.0	1.0	.0	1.0	.0	.0	.0	.0	.0	.0	.0
Hydrologists	2.0	1.0	2.0	1.0	.0	.0	.0	.0	.0	.0	.0
Biologists	1.0	1.0	1.0	2.0	.0	.0	.0	.0	.0	.0	.0
Municipal Engrs./Planrs.	3.0	23.0	6.0	33.0	.0	1.0	3.0	4.0	3.0	.0	2.0
Economists	1.0	1.0	.0	1.0	.0	.0	.0	.0	.0	.0	.0
Landscape Architects	3.0	2.0	3.0	2.0	.0	.0	.0	.0	.0	.0	.0
Surveyors	9.0	34.0	11.0	38.0	.0	2.0	5.0	4.0	7.0	.0	4.0
Systems Analysts	1.0	.0	.0	1.0	.0	.0	.0	.0	.0	.0	.0
Chemists	.0	2.0	.0	3.0	.0	.0	.0	1.0	.0	.0	.0
TECHNICIANS	77.0	255.5	80.0	255.0	11.0	8.0	51.0	34.0	72.0	9.0	39.0
Draftsmen	31.0	105.0	24.0	112.0	4.0	7.0	20.0	16.0	29.0	6.0	17.0
Instrumentmen	3.0	36.0	5.0	33.0	1.0	.0	2.0	1.0	9.0	.0	.0
Field Crew	30.0	58.5	33.0	56.0	6.0	.0	24.0	8.0	25.0	1.0	15.0
Computer Programmers	4.0	7.0	4.0	8.0	.0	.0	.0	.0	.0	.0	1.0
Inspectors	9.0	49.0	14.0	46.0	.0	1.0	5.0	9.0	9.0	2.0	6.0
	155.5	535.0	157.5	572.0	12.0	21.0	75.0	79.0	111.0	15.0	56.0

Table B-12.

Numbers of Employees, Positions and Turnovers in Each Occupational Category for 18 Consulting Engineering Firms Engaged in Water Pollution Control Not Classified by EPA Region.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	A				B						
	Total # of Employees in Each Category Doing Water Pollution Work During October . . .				Positions (if any) vacant for one month or more		Turnover in Personnel During Past 12 months				
	1970		1971				New Hires		Separations		
	Part Time	Full Time	Part Time	Full Time	Part Time	Full Time	3 yrs or less exp.	3 yrs. or more exp.	Due to Lack of Work	Due to Poor Performance	Other Cause
PROFESSIONAL STAFF	17.0	457.0	19.0	492.0	1.0	10.0	64.0	53.0	16.0	7.0	43.0
Water Resources Planners	1.0	41.5	1.0	61.0	.0	.0	20.0	.0	.0	.0	.0
Civil/Sanitary Engineers	2.0	174.5	2.0	183.0	.0	6.0	19.0	23.0	1.0	3.0	25.0
Civil/Structural Engrs.	2.0	71.0	2.0	60.0	.0	.0	3.0	5.0	3.0	.0	6.0
Civil/Soils Engrs.	3.0	13.0	6.0	18.0	1.0	1.0	1.0	2.0	1.0	.0	.0
Mechanical Engineers	1.0	45.2	1.0	42.0	.0	1.0	3.0	8.0	3.0	2.0	4.0
Electrical Engineers	1.0	51.2	1.0	48.0	.0	1.0	7.0	9.0	4.0	1.0	4.0
Chemical Engineers	.0	9.0	.0	10.0	.0	.0	1.0	2.0	.0	1.0	2.0
Architects	3.0	19.0	2.0	16.0	.0	.0	6.0	7.0	.0	.0	.0
Geologists	1.0	4.0	1.0	4.0	.0	.0	1.0	1.0	.0	.0	1.0
Hydrologists	.0	6.0	.0	8.0	.0	.0	.0	1.0	.0	.0	.0
Biologists	.0	.0	.0	1.0	.0	.0	.0	.0	.0	.0	.0
Municipal Engrs./Planrs.	.0	4.5	.0	5.0	.0	1.0	.0	1.0	.0	.0	.0
Economists	.0	4.0	.0	7.0	.0	.0	2.0	.0	1.0	.0	.0
Landscape Architects	3.0	.0	3.0	1.0	.0	.0	.0	.0	.0	.0	.0
Surveyors	.0	10.0	.0	12.0	.0	.0	.0	2.0	.0	.0	.0
Systems Analysts	.0	8.0	.0	9.0	.0	.0	.0	1.0	.0	.0	.0
Chemists	.0	6.0	.0	7.0	.0	.0	1.0	1.0	.0	.0	1.0
TECHNICIANS	11.0	280.0	16.0	321.0	.0	.0	78.0	76.0	35.0	6.0	54.0
Draftsmen	1.0	192.0	.0	207.0	.0	.0	52.0	46.0	30.0	5.0	33.0
Instrumentmen	.0	6.0	.0	7.0	.0	.0	1.0	.0	.0	.0	.0
Field Crew	2.0	21.0	3.0	26.0	.0	.0	16.0	6.0	1.0	1.0	10.0
Computer Programmers	.0	8.0	.0	9.0	.0	.0	.0	1.0	.0	.0	.0
Inspectors	8.0	53.0	13.0	72.0	.0	.0	9.0	23.0	4.0	.0	11.0
	28.0	747.0	35.0	813.0	1.0	10.0	142.0	139.0	51.0	13.0	97.0

APPENDIX C

Table C-1

Numbers of Employees in Each Occupational Category Engaged in Various Employment Duties, Responsibilities and Functions for 941 Consulting Engineering Firms Engaged in Water Pollution Control in the USA.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	C						
	EMPLOYMENT DUTIES, RESPONSIBILITIES AND FUNCTIONS						
	Water Resources Planning	Preliminary Engr. (Feasibility Economic Process, etc.)	Plans and Specifications	Construction Administration	Resident Engineering	Plant Start up and Consulting	Monitoring of Systems
PROFESSIONAL STAFF	7 24 .1	2 05 7.3	3 7 06.5	7 0 7.8	5 0 4.1	3 9 0.5	2 6 7.9
Water Resources Planners	2 56 .9	1 3 5.3	7 6.1	1 4.1	1 4.1	1 0.0	1 3.5
Civil/Sanitary Engineers	2 42 .1	8 1 6.9	1 5 80.0	3 1 7.4	2 5 9.6	1 9 4.8	7 9.3
Civil/Structural Engrs.	2 3 .0	1 5 7.2	5 9 4.2	9 1.6	5 0.6	2 9.4	1 2.2
Civil/Soils Engrs.	1 0 .6	8 5.2	1 0 4.3	2 3.5	2 3.7	9.1	3.5
Mechanical Engineers	2 7 .1	1 6 3.2	4 2 3.5	6 7.3	3 0.9	5 8.4	2 7.6
Electrical Engineers	4 .0	7 1.0	3 5 4.6	4 1.5	8 .2	2 0.4	1 6.0
Chemical Engineers	6 .4	7 4.1	6 0.3	4 .2	2 .0	1 6.3	1 3.1
Architects	6 .0	4 8.7	1 4 7.6	1 9.5	6 .1	3 .0	2 .0
Geologists	1 6 .6	3 4.9	1 8.6	2 .1	2 .6	9.1	6 .1
Hydrologists	3 8 .0	4 0.5	9 .0	.0	.0	3 .0	3 .5
Biologists	7 .0	9 .0	2 .0	.0	1 .0	1 .0	8 .0
Municipal Engrs./Planrs.	3 7 .8	1 4 7.6	1 4 4.2	3 6.7	2 5.2	1 3.8	1 1.6
Economists	8 .5	4 2.5	1 .0	1 .0	.0	.0	1 .0
Landscape Architects	6 .0	2 6.0	4 0.5	4 .0	2 .0	1 .0	.0
Surveyors	1 1 .7	1 2 6.0	1 2 5.9	7 9.9	7 1.1	7.2	1 2.0
Systems Analysts	1 2 .5	4 0.5	1 7.0	4 .0	6 .0	5.2	1 4.2
Chemists	9 .8	3 7.7	7 .6	1 .0	1 .0	8.7	4 4.2
TECHNICIANS	1 1 9.8	7 9 6.5	2 7 3 4.1	4 0 9.5	9 7 9.4	1 1 2.8	8 7.3
Draftsmen	9 3.3	3 7 0.3	2 2 8 4.6	6 4.2	1 8.2	1 6.7	1 6.0
Instrumentmen	4 .5	8 6.5	1 4 3.2	3 8.9	5 1.3	1 0.1	7.2
Field Crew	1 1 .0	1 5 4.3	2 5 3.7	1 2 2.8	7 6.2	2 8.5	2 0.8
Computer Programmers	5 .9	4 8.9	3 9.5	6 .0	7 .0	4 .0	1 1.2
Inspectors	5 .0	1 3 6.5	1 3 .0	1 7 7.5	8 2 6.6	5 3.5	3 2.1
	8 4 3.9	2 8 5 3.8	6 4 4 0.7	1 1 7.3	1 4 8 3.5	5 0 3.3	3 5 5.1

Table C-2

Numbers of Employees in Each Occupational Category Engaged in Various Employment Duties, Responsibilities and Functions for 47 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region I.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	C						
	EMPLOYMENT DUTIES, RESPONSIBILITIES AND FUNCTIONS						
	Water Resources Planning	Preliminary Engr. (Feasibility Economic Process, etc.)	Plans and Specifications	Construction Administration	Resident Engineering	Plant Start up and Consulting	Monitoring of Systems
PROFESSIONAL STAFF	77.6	248.5	498.7	57.9	68.5	45.7	20.0
Water Resources Planners	27.5	22.0	15.0	2.0	1.0	3.0	3.0
Civil/Sanitary Engineers	13.1	94.5	232.7	29.6	28.0	14.5	3.0
Civil/Structural Engrs.	2.0	13.0	65.0	7.0	6.0	7.0	3.0
Civil/Soils Engrs.	2.0	8.0	7.0	1.0	2.0	.0	1.0
Mechanical Engineers	1.0	24.2	59.7	4.0	4.0	6.0	2.0
Electrical Engineers	.0	5.0	37.0	2.0	3.0	4.0	1.0
Chemical Engineers	1.0	6.3	4.2	.3	.0	1.3	.0
Architects	.0	5.5	17.5	.0	.0	.0	.0
Geologists	2.0	3.0	4.0	.0	.0	.0	.0
Hydrologists	3.0	3.0	3.0	.0	.0	.0	.0
Biologists	2.0	2.0	1.0	.0	.0	1.0	1.0
Municipal Engrs./Planrs.	6.0	16.0	19.0	5.0	2.0	2.0	1.0
Economists	.0	3.0	1.0	.0	.0	.0	.0
Landscape Architects	3.0	12.0	14.0	3.0	1.0	1.0	.0
Surveyors	3.0	12.0	15.5	1.0	18.5	.0	1.0
Systems Analysts	2.0	5.0	2.0	2.0	2.0	2.0	3.0
Chemists	5.0	8.0	1.0	1.0	1.0	4.0	1.0
TECHNICIANS	21.0	101.0	245.0	29.5	148.0	10.0	3.0
Draftsmen	19.0	65.0	222.0	13.0	.0	.0	.0
Instrumentmen	1.0	19.0	5.0	.0	5.0	1.0	1.0
Field Crew	.0	9.0	9.0	9.0	5.0	3.0	1.0
Computer Programmers	1.0	8.0	9.0	3.0	1.0	1.0	1.0
Inspectors	.0	.0	.0	4.5	137.0	5.0	.0
	93.6	349.5	743.7	87.4	216.5	55.7	23.0

Table C-3

Numbers of Employees in Each Occupational Category Engaged in Various Employment Duties, Responsibilities and Functions for 103 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region II.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	C						
	EMPLOYMENT DUTIES, RESPONSIBILITIES AND FUNCTIONS						
	Water Resources Planning	Preliminary Engr. (Feasibility Economic Process, etc.)	Plans and Specifications	Construction Administration	Resident Engineering	Plant Start up and Consulting	Monitoring of Systems
PROFESSIONAL STAFF	23.4	222.7	437.7	64.9	47.6	42.5	39.7
Water Resources Planners	21.5	10.5	2.0	.0	1.0	.0	.0
Civil/Sanitary Engineers	32.8	104.5	184.2	35.6	30.5	23.2	8.6
Civil/Structural Engrs.	2.0	14.7	20.2	7.0	4.3	4.0	3.0
Civil/Soils Engrs.	4.2	13.8	14.8	5.0	1.5	3.0	1.0
Mechanical Engineers	5.5	19.2	50.9	6.3	1.1	4.6	3.0
Electrical Engineers	.0	8.3	48.5	2.0	.1	1.3	1.0
Chemical Engineers	2.3	9.8	13.3	.0	.0	2.5	1.0
Architects	.0	4.0	13.0	1.0	.0	.0	.0
Geologists	2.0	5.0	1.0	.0	.0	1.0	1.0
Hydrologists	4.5	3.5	1.0	.0	.0	.0	1.0
Biologists	1.0	.0	.0	.0	.0	.0	1.0
Municipal Engrs./Planrs.	4.0	9.1	9.5	4.5	1.0	1.0	1.1
Economists	.0	3.0	.0	.0	.0	.0	.0
Landscape Architects	.0	.0	1.0	.0	.0	.0	.0
Surveyors	.0	6.6	15.1	3.5	8.1	2.0	3.0
Systems Analysts	3.5	5.5	2.0	.0	.0	.0	1.0
Chemists	.0	5.0	1.0	.0	.0	.0	14.0
TECHNICIANS	17.5	91.0	415.7	20.0	174.6	24.7	7.4
Draftsmen	14.5	63.0	383.7	6.0	4.0	5.0	2.0
Instrumentmen	.0	8.5	18.0	.5	5.0	3.1	.2
Field Crew	.0	9.5	11.0	1.5	11.0	13.1	1.1
Computer Programmers	.0	6.0	2.0	.0	.0	.0	3.0
Inspectors	3.0	4.0	1.0	12.0	154.6	3.5	1.1
	100.9	313.7	853.4	84.9	222.2	67.2	47.1

Table C-4

Numbers of Employees in Each Occupational Category Engaged in Various Employment Duties, Responsibilities and Functions for 102 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region III.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	C						
	EMPLOYMENT DUTIES, RESPONSIBILITIES AND FUNCTIONS						
	Water Resources Planning	Preliminary Engr. (Feasibility Economic Process, etc.)	Plans and Specifications	Construction Administration	Resident Engineering	Plant Start up and Consulting	Monitoring of Systems
PROFESSIONAL STAFF	51.0	257.1	401.8	65.0	19.9	46.6	28.9
Water Resources Planners	22.5	14.0	11.0	1.5	1.5	2.0	1.0
Civil/Sanitary Engineers	11.4	90.3	173.2	20.5	10.9	24.6	9.9
Civil/Structural Engrs.	.0	18.0	65.0	4.0	1.0	3.0	.0
Civil/Soils Engrs.	.0	8.0	9.0	1.0	.0	1.0	.0
Mechanical Engineers	2.0	20.0	40.5	7.5	3.0	5.0	2.0
Electrical Engineers	.0	7.5	43.5	6.0	.0	3.0	3.0
Chemical Engineers	.0	16.0	13.0	.0	1.0	1.0	2.0
Architects	2.0	5.5	13.5	.0	.0	.0	.0
Geologists	5.0	5.5	1.5	.0	.0	1.0	1.0
Hydrologists	3.0	6.0	.0	.0	.0	1.0	1.0
Biologists	3.0	2.0	1.0	.0	.0	.0	2.0
Municipal Engrs./Planrs.	1.0	14.0	8.0	1.0	.0	.0	.0
Economists	1.0	4.0	.0	.0	.0	.0	.0
Landscape Architects	1.0	3.0	9.0	.0	1.0	.0	.0
Surveyors	.0	29.5	10.5	3.5	1.5	4.0	.0
Systems Analysts	2.0	4.0	2.0	.0	.0	1.0	3.0
Chemists	1.1	5.8	1.1	.0	.0	.0	4.0
TECHNICIANS	21.5	97.0	340.5	47.5	143.0	8.0	4.0
Draftsmen	21.5	56.0	302.0	13.0	.0	4.0	1.0
Instrumentmen	.0	11.0	14.5	3.5	2.0	.0	.0
Field Crew	.0	23.0	20.0	7.0	3.0	2.0	1.0
Computer Programmers	.0	4.0	4.0	.0	.0	.0	.0
Inspectors	.0	3.0	.0	24.0	138.0	2.0	2.0
	82.5	356.1	742.3	92.5	162.9	54.6	32.9

Table C-5

Numbers of Employees in Each Occupational Category Engaged in Various Employment Duties, Responsibilities and Functions for 142 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region IV.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	C						
	EMPLOYMENT DUTIES, RESPONSIBILITIES AND FUNCTIONS						
	Water Resources Planning	Preliminary Engr. (Feasibility/Economic Process, etc.)	Plans and Specifications	Construction Administration	Resident Engineering	Plant Start up and Consulting	Monitoring of Systems
PROFESSIONAL STAFF	82.6	195.5	401.6	126.5	50.1	44.7	26.0
Water Resources Planners	23.3	15.3	8.3	7.0	5.0	3.0	3.0
Civil/Sanitary Engineers	42.2	93.6	176.4	57.5	28.3	24.8	7.7
Civil/Structural Engrs.	1.0	10.9	62.5	15.0	1.5	2.0	.0
Civil/Soils Engrs.	.0	2.0	10.0	2.0	1.0	1.0	.0
Mechanical Engineers	2.0	18.2	40.8	7.6	1.3	7.9	5.2
Electrical Engineers	.0	10.2	53.9	12.1	1.0	3.0	2.0
Chemical Engineers	.0	3.5	2.0	2.0	.0	1.0	1.5
Architects	.0	.2	4.6	3.2	.0	.0	.0
Geologists	1.0	1.5	1.5	1.0	.0	.0	.0
Hydrologists	1.0	1.0	1.0	.0	.0	.0	.0
Biologists	.0	.0	.0	.0	.0	.0	.0
Municipal Engrs./Planrs.	7.0	12.0	6.0	5.0	5.0	2.0	2.0
Economists	.0	2.0	.0	.0	.0	.0	.0
Landscape Architects	.0	4.0	6.0	.0	.0	.0	.0
Surveyors	5.0	16.0	23.0	13.0	6.0	.0	.0
Systems Analysts	.0	1.0	3.0	1.0	1.0	.0	1.0
Chemists	.0	4.0	2.5	.0	.0	.0	3.5
TECHNICIANS	5.0	74.5	363.2	58.5	94.6	15.2	5.2
Draftsmen	5.0	30.5	254.2	4.5	.1	1.0	1.0
Instrumentmen	.0	10.0	49.0	9.0	6.0	1.0	.0
Field Crew	.0	32.0	50.0	25.0	5.0	.0	3.0
Computer Programmers	.0	1.0	8.0	1.0	5.0	1.0	.0
Inspectors	.0	1.0	2.0	19.0	78.5	12.2	1.3
	87.6	270.0	764.8	185.0	144.7	59.9	31.2

Table C-6

Numbers of Employees in Each Occupational Category Engaged in Various Employment Duties, Responsibilities and Functions for 189 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region V.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	C						
	EMPLOYMENT DUTIES, RESPONSIBILITIES AND FUNCTIONS						
	Water Resources Planning	Preliminary Engr. (Feasibility Economic Process, etc.)	Plans and Specifications	Construction Administration	Resident Engineering	Plant Start up and Consulting	Monitoring of Systems
PROFESSIONAL STAFF	135.7	370.3	650.7	197.0	125.5	80.9	63.9
Water Resources Planners	44.0	21.0	16.0	2.0	1.0	1.0	2.0
Civil/Sanitary Engineers	51.7	156.3	277.5	77.4	70.1	42.1	24.1
Civil/Structural Engrs.	3.3	30.5	94.1	27.7	11.6	7.5	5.3
Civil/Soils Engrs.	1.0	23.0	20.0	6.5	9.0	1.0	1.0
Mechanical Engineers	7.1	30.5	77.8	28.4	8.5	13.9	6.4
Electrical Engineers	1.0	9.4	44.8	11.5	2.0	3.2	4.0
Chemical Engineers	1.1	16.0	10.2	1.0	.0	5.1	.1
Architects	1.0	8.0	41.0	6.0	4.0	2.0	2.0
Geologists	.0	3.0	2.0	.0	1.0	.0	1.0
Hydrologists	4.0	9.0	1.0	.0	.0	1.0	1.0
Biologists	.0	1.0	.0	.0	.0	.0	4.0
Municipal Engrs./Planrs.	6.5	23.5	30.0	7.0	6.0	1.0	1.0
Economists	1.0	5.0	.0	1.0	.0	.0	1.0
Landscape Architects	.0	2.0	3.0	.0	.0	.0	.0
Surveyors	2.0	21.0	30.2	27.5	11.2	1.0	4.0
Systems Analysts	1.0	9.0	2.0	1.0	1.0	1.0	2.0
Chemists	1.0	2.0	1.0	.0	.0	1.0	5.0
TECHNICIANS	10.5	194.6	473.1	116.0	115.2	27.0	32.0
Draftsmen	9.5	42.9	355.1	16.0	5.0	5.0	6.0
Instrumentmen	.0	14.7	23.5	10.5	10.7	2.0	2.0
Field Crew	.0	29.5	81.5	36.5	17.5	.0	.0
Computer Programmers	1.0	4.5	5.0	.0	.0	.0	5.0
Inspectors	.0	103.0	8.0	53.0	82.0	20.0	19.0
	146.2	564.9	1123.8	313.0	240.7	107.9	95.9

Table C-7

Numbers of Employees in Each Occupational Category Engaged in Various Employment Duties, Responsibilities and Functions for 89 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region VI.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	C						
	EMPLOYMENT DUTIES, RESPONSIBILITIES AND FUNCTIONS						
	Water Resources Planning	Preliminary Engr. (Feasibility Economic Process, etc.)	Plans and Specifications	Construction Administration	Resident Engineering	Plant Start up and Consulting	Monitoring of Systems
PROFESSIONAL STAFF	57.7	165.0	234.9	49.5	30.2	33.3	21.4
Water Resources Planners	18.2	11.5	8.8	1.3	.3	1.0	4.0
Civil/Sanitary Engineers	13.9	60.3	99.7	20.9	6.3	10.8	3.1
Civil/Structural Engrs.	5.5	10.7	30.5	7.2	2.0	.5	.5
Civil/Soils Engrs.	.0	3.0	5.0	2.0	1.0	.0	.0
Mechanical Engineers	3.0	15.0	27.0	7.0	7.0	15.0	5.0
Electrical Engineers	2.0	8.0	16.0	3.0	1.0	2.0	3.0
Chemical Engineers	1.0	5.0	7.0	1.0	1.0	2.5	1.5
Architects	.0	1.3	4.3	.3	2.0	.0	.0
Geologists	1.0	1.0	1.0	1.0	.0	1.0	1.0
Hydrologists	8.5	.5	1.0	.0	.0	.0	.0
Biologists	.0	.0	.0	.0	.0	.0	.0
Municipal Engrs./Planrs.	3.0	27.4	32.1	1.3	1.0	.0	.0
Economists	1.0	2.0	.0	.0	.0	.0	.0
Landscape Architects	.0	.0	.0	.0	.0	.0	.0
Surveyors	.0	10.7	11.5	4.5	6.5	.2	2.0
Systems Analysts	.0	4.0	.0	.0	2.0	.3	.3
Chemists	.5	4.5	1.0	.0	.0	.0	1.0
TECHNICIANS	10.4	66.8	272.6	51.3	68.5	3.7	9.2
Draftsmen	7.2	41.1	227.1	2.0	4.0	.0	2.0
Instrumentmen	.0	5.2	12.2	4.5	9.5	.0	.0
Field Crew	.0	12.2	31.3	10.8	15.5	.7	5.0
Computer Programmers	3.2	8.2	1.0	.0	.0	.0	1.2
Inspectors	.0	.0	1.0	34.0	39.5	3.0	1.0
	58.1	231.9	507.6	100.8	98.7	37.0	30.6

Table C-8

Numbers of Employees in Each Occupational Category Engaged in Various Employment Duties, Responsibilities and Functions for 60 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region VII.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	C						
	EMPLOYMENT DUTIES, RESPONSIBILITIES AND FUNCTIONS						
	Water Resources Planning	Preliminary Engr. (Feasibility Economic Process, etc.)	Plans and Specifications	Construction Administration	Resident Engineering	Plant Start up and Consulting	Monitoring of Systems
PROFESSIONAL STAFF	47.1	120.7	328.5	46.4	66.2	18.0	6.1
Water Resources Planners	23.0	8.0	2.0	.0	2.0	.0	.0
Civil/Sanitary Engineers	11.5	41.2	141.7	15.6	32.4	10.2	.6
Civil/Structural Engrs.	1.0	12.4	71.7	5.7	14.3	1.0	.3
Civil/Soils Engrs.	.3	6.7	7.9	2.0	1.1	1.0	.0
Mechanical Engineers	.3	7.0	29.2	3.5	3.0	3.0	1.0
Electrical Engineers	.0	2.4	19.1	1.1	.1	1.6	.0
Chemical Engineers	.0	3.0	6.0	.0	.0	1.0	1.0
Architects	.0	7.2	25.7	5.0	.1	.0	.0
Geologists	.0	2.0	1.0	.0	.0	.0	.0
Hydrologists	3.0	3.0	1.0	.0	.0	.0	.0
Biologists	.0	.0	.0	.0	.0	.0	.0
Municipal Engrs./Planrs.	3.8	8.2	13.5	4.5	3.0	.0	1.0
Economists	1.5	5.5	.0	.0	.0	.0	.0
Landscape Architects	1.0	2.0	3.0	1.0	.0	.0	.0
Surveyors	.7	9.6	4.6	8.0	10.1	.0	.0
Systems Analysts	1.0	2.0	2.0	.0	.0	.0	2.0
Chemists	.2	.4	.0	.0	.0	.2	.2
TECHNICIANS	23.0	53.7	144.7	32.5	71.9	2.9	2.2
Draftsmen	5.7	28.4	113.2	3.5	1.4	.7	2.0
Instrumentmen	3.5	7.5	10.0	4.0	2.0	.0	.0
Field Crew	11.0	14.0	19.0	15.0	.0	.0	.0
Computer Programmers	.8	2.7	2.5	.0	.0	1.0	.0
Inspectors	2.0	1.0	.0	10.0	68.5	1.3	.3
	70.1	174.4	473.2	78.9	138.1	21.0	8.3

Table C-9

Numbers of Employees in Each Occupational Category Engaged in Various Employment Duties, Responsibilities and Functions for 37 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region VIII.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	C						
	EMPLOYMENT DUTIES, RESPONSIBILITIES AND FUNCTIONS						
	Water Resources Planning	Preliminary Engr. (Feasibility Economic Process, etc.)	Plans and Specifications	Construction Administration	Resident Engineering	Plant Start up and Consulting	Monitoring of Systems
PROFESSIONAL STAFF	24.2	41.4	63.8	15.0	9.5	7.0	2.0
Water Resources Planners	13.0	2.0	1.0	.0	.0	.0	.0
Civil/Sanitary Engineers	6.3	22.9	32.3	8.5	7.5	4.5	1.0
Civil/Structural Engrs.	.0	2.0	11.0	1.0	.0	.0	.0
Civil/Soils Engrs.	1.0	.5	1.5	1.0	.0	.0	.0
Mechanical Engineers	.0	2.0	6.0	.0	.0	.0	.0
Electrical Engineers	.0	2.0	5.0	1.0	.0	1.0	.0
Chemical Engineers	1.0	1.0	.0	.0	.0	.0	.0
Architects	.0	.0	6.0	1.0	.0	.0	.0
Geologists	1.0	.0	.0	.0	.0	1.0	.0
Hydrologists	1.0	2.0	.0	.0	.0	.0	.0
Biologists	.0	.0	.0	.0	.0	.0	.0
Municipal Engrs./Planrs.	1.0	1.5	.0	1.0	.0	.5	.0
Economists	.0	2.0	.0	.0	.0	.0	.0
Landscape Architects	.0	.0	.0	.0	.0	.0	.0
Surveyors	.0	2.5	1.0	1.5	2.0	.0	.0
Systems Analysts	.0	.0	.0	.0	.0	.0	.0
Chemists	.0	1.0	.0	.0	.0	.0	1.0
TECHNICIANS	2.0	9.5	22.0	11.5	19.0	.0	2.0
Draftsmen	2.0	3.0	18.5	.0	1.0	.0	.0
Instrumentmen	.0	.5	.0	2.5	.0	.0	.0
Field Crew	.0	3.0	2.0	8.0	3.0	.0	2.0
Computer Programmers	.0	3.0	1.5	.0	1.0	.0	.0
Inspectors	.0	.0	.0	1.0	14.0	.0	.0
	26.2	50.9	85.8	26.5	28.5	7.0	4.0

Table C-10

Numbers of Employees in Each Occupational Category Engaged in Various Employment Duties, Responsibilities and Functions for 97 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region IX.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	C						
	EMPLOYMENT DUTIES, RESPONSIBILITIES AND FUNCTIONS						
	Water Resources Planning	Preliminary Engr. (Feasibility Economic Process, etc.)	Plans and Specifications	Construction Administration	Resident Engineering	Plant Start up and Consulting	Monitoring of Systems
PROFESSIONAL STAFF	70.7	218.7	267.3	44.3	33.4	27.2	28.1
Water Resources Planners	24.3	20.7	1.7	.1	.1	.0	.5
Civil/Sanitary Engineers	17.4	70.1	98.6	16.7	17.2	11.9	5.4
Civil/Structural Engrs.	4.0	23.6	52.2	7.7	4.8	.1	.1
Civil/Soils Engrs.	1.1	9.4	5.7	1.2	2.8	1.1	.5
Mechanical Engineers	4.0	10.5	39.0	2.0	1.0	1.0	.0
Electrical Engineers	.0	4.0	25.5	.0	.0	.5	2.0
Chemical Engineers	.0	4.0	1.0	.0	.0	.0	2.0
Architects	2.0	7.0	13.0	2.0	.0	1.0	.0
Geologists	2.6	9.9	4.6	.1	1.6	5.1	2.1
Hydrologists	5.0	9.5	1.0	.0	.0	1.0	.5
Biologists	.0	2.0	.0	.0	1.0	.0	.0
Municipal Engrs./Planrs.	3.2	14.3	14.8	1.1	2.1	3.0	1.5
Economists	3.0	10.0	.0	.0	.0	.0	.0
Landscape Architects	1.0	1.0	1.0	.0	.0	.0	.0
Surveyors	.0	12.5	8.0	13.3	2.7	.0	2.0
Systems Analysts	2.0	6.0	2.0	.0	.0	.0	2.0
Chemists	1.0	4.0	.0	.0	.0	2.5	9.5
TECHNICIANS							
Draftsmen	4.8	17.3	194.5	1.3	.0	1.0	.0
Instrumentmen	.0	9.0	3.0	1.4	1.1	1.0	1.0
Field Crew	.0	18.0	7.0	3.0	4.7	3.7	5.7
Computer Programmers	.0	3.5	3.0	2.0	.0	1.0	1.0
Inspectors	.0	20.5	.0	13.0	29.5	1.5	3.5
	75.5	287.0	474.8	64.9	68.7	35.4	39.3

Table C-11

Numbers of Employees in Each Occupational Category Engaged in Various Employment Duties, Responsibilities and Functions for 57 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region X.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	C						
	EMPLOYMENT DUTIES, RESPONSIBILITIES AND FUNCTIONS						
	Water Resources Planning	Preliminary Engr. (Feasibility Economic Process, etc.)	Plans and Specifications	Construction Administration	Resident Engineering	Plant Start up and Consulting	Monitoring of Systems
PROFESSIONAL STAFF	29.5	78.0	158.7	42.3	16.7	27.5	24.7
Water Resources Planners	8.0	2.2	2.2	.3	.3	.0	.0
Civil/Sanitary Engineers	4.7	32.5	34.5	21.0	5.2	16.2	12.7
Civil/Structural Engrs.	1.3	5.2	9.0	6.3	2.0	2.2	.0
Civil/Soils Engrs.	.0	.8	4.2	.8	1.3	.0	.0
Mechanical Engineers	.3	5.5	18.2	1.0	1.0	2.0	3.0
Electrical Engineers	.0	6.0	20.0	2.7	1.0	.8	.0
Chemical Engineers	.0	3.5	1.5	.0	.0	2.0	4.0
Architects	.0	.0	5.0	1.0	.0	.0	.0
Geologists	.0	.0	.0	.0	.0	.0	.0
Hydrologists	1.0	1.0	.0	.0	.0	.0	.0
Biologists	1.0	2.0	.0	.0	.0	.0	.0
Municipal Engrs./Planrs.	2.2	16.2	11.0	6.3	5.0	4.2	4.0
Economists	.0	1.0	.0	.0	.0	.0	.0
Landscape Architects	.0	1.0	1.5	.0	.0	.0	.0
Surveyors	.0	1.0	1.5	3.0	1.0	.0	.0
Systems Analysts	.0	.0	.0	.0	.0	.0	.0
Chemists	1.0	.0	.0	.0	.0	.0	1.0
TECHNICIANS	1.0	12.0	62.7	13.0	39.2	7.0	7.0
Draftsmen	1.0	3.0	56.3	1.0	1.7	.0	2.0
Instrumentmen	.0	.0	2.0	3.0	10.0	2.0	3.0
Field Crew	.0	2.0	4.0	5.0	7.5	4.0	2.0
Computer Programmers	.0	2.0	.5	.0	.0	.0	.0
Inspectors	.0	.0	.0	4.0	20.0	1.0	.0
	30.5	90.0	221.5	55.3	55.9	34.5	31.7

Table C-12

Numbers of Employees in Each Occupational Category Engaged in Various Employment Duties, Responsibilities and Functions for 18 Consulting Engineering Firms Engaged in Water Pollution Control Not Classified by EPA Region.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	C						
	EMPLOYMENT DUTIES, RESPONSIBILITIES AND FUNCTIONS						
	Water Resources Planning	Preliminary Engr. (Feasibility Economic Process, etc.)	Plans and Specifications	Construction Administration	Resident Engineering	Plant Start up and Consulting	Monitoring of Systems
PROFESSIONAL STAFF	69.5	143.2	262.7	19.0	36.5	17.0	7.0
Water Resources Planners	25.5	8.0	8.0	.0	2.0	.0	.0
Civil/Sanitary Engineers	17.0	50.5	89.0	14.0	23.0	12.0	3.0
Civil/Structural Engrs.	3.0	10.0	53.0	3.0	3.0	2.0	.0
Civil/Soils Engrs.	1.0	10.0	19.0	1.0	4.0	1.0	.0
Mechanical Engineers	2.0	11.0	35.2	.0	1.0	.0	.0
Electrical Engineers	1.0	8.0	41.2	.0	.0	.0	.0
Chemical Engineers	.0	6.0	2.0	.0	.0	.0	.0
Architects	1.0	11.0	4.0	.0	.0	.0	.0
Geologists	2.0	4.0	2.0	.0	.0	.0	.0
Hydrologists	4.0	2.0	.0	.0	.0	.0	.0
Biologists	.0	.0	.0	.0	.0	.0	.0
Municipal Engrs./Planrs.	.0	5.2	.3	.0	.0	.0	.0
Economists	1.0	5.0	.0	.0	.0	.0	.0
Landscape Architects	.0	1.0	2.0	.0	.0	.0	.0
Surveyors	1.0	4.5	5.0	1.0	3.5	.0	.0
Systems Analysts	1.0	4.0	2.0	.0	.0	1.0	.0
Chemists	.0	3.0	.0	.0	.0	1.0	4.0
TECHNICIANS	3.0	28.0	127.0	9.0	70.0	6.0	4.0
Draftsmen	3.0	15.0	158.0	4.0	1.0	.0	.0
Instrumentmen	.0	1.0	6.0	.0	.0	.0	.0
Field Crew	.0	2.0	19.0	2.0	4.0	2.0	.0
Computer Programmers	.0	6.0	3.0	.0	.0	.0	.0
Inspectors	.0	4.0	1.0	3.0	65.0	4.0	4.0
	62.5	171.2	469.7	28.0	106.5	23.0	11.0

APPENDIX D

Table D-1
 Numbers of Employees Licensed or Certified and the Number of Employees
 Holding Various Academic Degrees in Each Occupational Category for 941
 Consulting Engineering Firms Engaged in Water Pollution Control
 in the USA.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	D						
	Number of Employees Licensed or Certified			DEGREES			
	Registered	Dip. A.A.E.E.	Cert. Eng. Tech.	Assoc.	B.S.	M.S.	Ph.D.
PROFESSIONAL STAFF	6483.6	194.0	243.0	381.0	6123.5	1777.6	242.0
Water Resources Planners	353.5	26.0	5.0	14.0	264.5	165.0	21.0
Civil/Sanitary Engineers	2348.0	141.0	99.0	95.0	2225.1	795.0	79.0
Civil/Structural Engrs.	967.0	.0	25.0	29.0	935.7	268.3	25.0
Civil/Soils Engrs.	242.5	1.0	13.0	21.0	180.2	120.3	20.0
Mechanical Engineers	702.4	6.0	44.0	42.0	742.9	92.0	11.0
Electrical Engineers	477.2	4.0	19.0	28.0	575.6	53.0	4.0
Chemical Engineers	117.0	5.0	2.0	3.0	134.0	49.0	22.0
Architects	322.0	1.0	.0	28.0	309.0	32.0	1.0
Geologists	52.0	1.0	1.0	.0	89.0	22.0	9.0
Hydrologists	56.0	1.0	1.0	2.0	57.0	41.0	6.0
Biologists	8.0	.0	.0	.0	18.0	9.0	7.0
Municipal Engrs./Planrs.	236.2	3.0	6.0	12.0	256.2	66.0	3.0
Economists	9.0	1.0	.0	.0	31.0	15.0	8.0
Landscape Architects	56.0	.0	.0	8.0	67.0	11.0	.0
Surveyors	489.8	3.0	23.0	94.0	111.3	4.0	1.0
Systems Analysts	26.0	1.0	5.0	1.0	55.0	22.0	8.0
Chemists	22.0	.0	.0	4.0	72.0	13.0	17.0
	156.5	4.0	561.0	499.0	209.5	13.0	10.0
TECHNICIANS							
Draftsmen	88.0	1.0	409.0	313.0	91.0	4.0	8.0
Instrumentmen	11.0	.0	48.0	32.0	7.0	.0	.0
Field Crew	14.0	.0	24.0	63.0	5.0	.0	.0
Computer Programmers	19.5	3.0	12.0	15.0	41.5	7.0	2.0
Inspectors	34.0	.0	68.0	76.0	64.0	2.0	.0
	6650.1	198.0	804.0	880.0	6332.0	1790.6	252.0

Table D-2

Numbers of Employees Licensed or Certified and the Number of Employees Holding Various Academic Degrees in Each Occupational Category for 47 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region I.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	D						
	Number of Employees Licensed or Certified			DEGREES			
	Registered	Dip. AAEE	Cert. Eng. Tech.	Assoc.	B.S.	M.S.	Ph.D.
PROFESSIONAL STAFF	646.0	44.0	11.0	96.0	641.0	245.0	36.0
Water Resources Planners	53.0	8.0	.0	4.0	30.0	24.0	5.0
Civil/Sanitary Engineers	274.0	31.0	4.0	41.0	275.0	139.0	11.0
Civil/Structural Engrs.	63.0	.0	4.0	14.0	62.0	18.0	1.0
Civil/Soils Engrs.	16.0	.0	2.0	2.0	13.0	17.0	8.0
Mechanical Engineers	74.0	1.0	1.0	11.0	75.0	14.0	4.0
Electrical Engineers	35.0	.0	.0	8.0	52.0	3.0	.0
Chemical Engineers	14.0	1.0	.0	1.0	9.0	1.0	4.0
Architects	15.0	.0	.0	2.0	14.0	6.0	.0
Geologists	3.0	.0	.0	.0	9.0	.0	1.0
Hydrologists	8.0	1.0	.0	1.0	7.0	2.0	.0
Biologists	.0	.0	.0	.0	2.0	1.0	.0
Municipal Engrs./Planrs.	32.0	2.0	.0	2.0	34.0	10.0	.0
Economists	2.0	.0	.0	.0	3.0	.0	.0
Landscape Architects	17.0	.0	.0	.0	25.0	3.0	.0
Surveyors	34.0	.0	.0	10.0	19.0	.0	.0
Systems Analysts	6.0	.0	.0	.0	6.0	5.0	1.0
Chemists	.0	.0	.0	.0	5.0	2.0	1.0
TECHNICIANS	3.0	3.0	6.0	93.0	19.0	1.0	.0
Draftsmen	.0	.0	6.0	62.0	3.0	.0	.0
Instrumentmen	.0	.0	.0	.0	.0	.0	.0
Field Crew	.0	.0	.0	3.0	.0	.0	.0
Computer Programmers	2.0	3.0	.0	5.0	8.0	1.0	.0
Inspectors	1.0	.0	.0	23.0	8.0	.0	.0
	649.0	47.0	17.0	189.0	660.0	246.0	

Table D-3

Numbers of Employees Licensed or Certified and the Number of Employees Holding Various Academic Degrees in Each Occupational Category for 103 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region II.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	D						
	Number of Employees Licensed or Certified			DEGREES			
	Registered	Dip. AAEE	Cert. Eng. Tech.	Assoc.	B.S.	M.S.	Ph.D.
PROFESSIONAL STAFF	635.1	23.0	26.0	82.0	671.0	233.6	33.0
Water Resources Planners	25.0	2.0	1.0	2.0	16.0	18.0	1.0
Civil/Sanitary Engineers	252.5	16.0	18.0	16.0	282.5	115.0	11.0
Civil/Structural Engrs.	108.5	.0	4.0	6.0	125.2	34.3	1.0
Civil/Soils Engrs.	26.5	.0	3.0	5.0	16.2	18.3	3.0
Mechanical Engineers	58.4	.0	.0	6.0	78.4	15.0	2.0
Electrical Engineers	34.2	.0	.0	5.0	58.2	5.0	.0
Chemical Engineers	15.0	2.0	.0	.0	16.0	4.0	2.0
Architects	29.0	.0	.0	20.0	20.0	1.0	.0
Geologists	.0	.0	.0	.0	7.0	4.0	1.0
Hydrologists	2.0	.0	.0	.0	4.0	5.0	1.0
Biologists	.0	.0	.0	.0	.0	1.0	2.0
Municipal Engrs./Planrs.	17.2	.0	.0	2.0	16.2	6.0	1.0
Economists	1.0	.0	.0	.0	2.0	2.0	.0
Landscape Architects	5.0	.0	.0	7.0	1.0	.0	.0
Surveyors	57.8	3.0	.0	12.0	11.3	.0	1.0
Systems Analysts	.0	.0	.0	.0	4.0	4.0	4.0
Chemists	3.0	.0	.0	1.0	13.0	1.0	3.0
TECHNICIANS	3.0	.0	30.0	101.0	22.0	1.0	.0
Draftsmen	.0	.0	19.0	67.0	8.0	.0	.0
Instrumentmen	.0	.0	2.0	7.0	3.0	.0	.0
Field Crew	2.0	.0	3.0	3.0	.0	.0	.0
Computer Programmers	.0	.0	1.0	2.0	1.0	.0	.0
Inspectors	1.0	.0	5.0	22.0	10.0	1.0	.0
	638.1	23.0	56.0	183.0	693.0	234.6	33.0

Table D-4

Numbers of Employees Licensed or Certified and the Number of Employees Holding Various Academic Degrees in Each Occupational Category for 102 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region III.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	D						
	Number of Employees Licensed or Certified			DEGREES			
	Registered	Dip. AAEE	Cert. Eng. Tech.	Assoc.	B.S.	M.S.	Ph.D
PROFESSIONAL STAFF	701.0	24.0	39.0	24.0	702.0	164.0	25.0
Water Resources Planners	40.0	4.0	.0	.0	37.0	12.0	2.0
Civil/Sanitary Engineers	262.0	15.0	11.0	4.0	259.0	64.0	8.0
Civil/Structural Engrs.	91.0	.0	4.0	.0	78.0	32.0	.0
Civil/Soils Engrs.	26.0	.0	2.0	.0	23.0	6.0	1.0
Mechanical Engineers	101.0	2.0	15.0	5.0	98.0	15.0	1.0
Electrical Engineers	59.0	.0	3.0	3.0	54.0	5.0	.0
Chemical Engineers	13.0	.0	.0	.0	22.0	9.0	3.0
Architects	15.0	1.0	.0	.0	27.0	1.0	1.0
Geologists	8.0	.0	.0	.0	11.0	2.0	3.0
Hydrologists	5.0	.0	.0	.0	8.0	3.0	.0
Biologists	.0	.0	.0	.0	3.0	1.0	3.0
Municipal Engrs./Planrs.	15.0	.0	1.0	4.0	16.0	8.0	1.0
Economists	.0	1.0	.0	.0	6.0	1.0	2.0
Landscape Architects	11.0	.0	.0	1.0	13.0	2.0	.0
Surveyors	50.0	.0	2.0	7.0	13.0	.0	.0
Systems Analysts	4.0	1.0	1.0	.0	24.0	3.0	.0
Chemists	1.0	.0	.0	.0	10.0	.0	.0
TECHNICIANS	5.0	.0	55.0	58.0	16.0	2.0	.0
Draftsmen	.0	.0	54.0	44.0	2.0	.0	.0
Instrumentmen	.0	.0	.0	6.0	.0	.0	.0
Field Crew	.0	.0	1.0	2.0	.0	.0	.0
Computer Programmers	.0	.0	.0	1.0	4.0	2.0	.0
Inspectors	5.0	.0	.0	5.0	10.0	.0	.0
	706.0	24.0	94.0	82.0	718.0	166.0	25.0

Table D-5

Numbers of Employees Licensed or Certified and the Number of Employees Holding Various Academic Degrees in Each Occupational Category for 142 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region IV.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	D						
	Number of Employees Licensed or Certified			DEGREES			
	Registered	Dip. AAEE	Cert. Eng. Tech.	Assoc.	B.S.	M.S.	Ph.D.
PROFESSIONAL STAFF	687.0	14.0	42.0	27.0	608.0	122.0	17.0
Water Resources Planners	28.0	3.0	.0	.0	25.0	14.0	.0
Civil/Sanitary Engineers	258.0	10.0	18.0	10.0	236.1	62.0	6.0
Civil/Structural Engrs.	95.0	.0	3.0	1.0	91.0	20.0	4.0
Civil/Soils Engrs.	26.0	.0	.0	1.0	15.0	2.0	.0
Mechanical Engineers	72.0	.0	7.0	4.0	75.5	3.0	1.0
Electrical Engineers	63.0	1.0	7.0	2.0	71.4	8.0	2.0
Chemical Engineers	4.0	.0	.0	1.0	19.0	3.0	.0
Architects	53.0	.0	.0	1.0	27.0	1.0	.0
Geologists	3.0	.0	1.0	.0	3.0	.0	1.0
Hydrologists	3.0	.0	.0	.0	3.0	1.0	.0
Biologists	1.0	.0	.0	.0	1.0	1.0	1.0
Municipal Engrs./Planrs.	13.0	.0	.0	1.0	13.0	6.0	.0
Economists	.0	.0	.0	.0	1.0	1.0	1.0
Landscape Architects	5.0	.0	.0	.0	7.0	.0	.0
Surveyors	56.0	.0	2.0	6.0	9.0	.0	.0
Systems Analysts	1.0	.0	4.0	.0	1.0	.0	.0
Chemists	6.0	.0	.0	.0	9.0	.0	1.0
TECHNICIANS	3.0	1.0	64.0	35.0	10.0	1.0	.0
Draftsmen	1.0	1.0	41.0	25.0	7.0	.0	.0
Instrumentmen	.0	.0	7.0	3.0	1.0	.0	.0
Field Crew	.0	.0	6.0	4.0	.0	.0	.0
Computer Programmers	1.0	.0	.0	1.0	.0	1.0	.0
Inspectors	1.0	.0	10.0	2.0	2.0	.0	.0
	690.0	15.0	106.0	62.0	618.0	123.0	17.0

Table D-6

Numbers of Employees Licensed or Certified and the Number of Employees Holding Various Academic Degrees in Each Occupational Category for 189 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region V.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	D						
	Number of Employees Licensed or Certified			DEGREES			
	Registered	Dip. AAEE	Cert. Eng. Tech.	Assoc.	B.S.	M.S.	Ph.D
PROFESSIONAL STAFF	1207.5	26.0	26.0	40.0	1093.5	266.0	33.0
Water Resources Planners	35.0	1.0	.0	3.0	25.0	23.0	2.0
Civil/Sanitary Engineers	411.5	23.0	17.0	5.0	411.5	117.0	10.0
Civil/Structural Engrs.	200.0	.0	2.0	7.0	161.0	43.0	5.0
Civil/Soils Engrs.	40.0	.0	.0	.0	48.0	21.0	3.0
Mechanical Engineers	112.0	1.0	4.0	5.0	123.0	9.0	1.0
Electrical Engineers	72.0	.0	.0	2.0	83.0	8.0	1.0
Chemical Engineers	27.0	1.0	2.0	.0	19.0	11.0	5.0
Architects	90.0	.0	.0	2.0	94.0	9.0	.0
Geologists	3.0	.0	.0	.0	8.0	1.0	.0
Hydrologists	13.0	.0	.0	.0	10.0	6.0	1.0
Biologists	3.0	.0	.0	.0	6.0	2.0	.0
Municipal Engrs./Planrs.	61.0	.0	.0	1.0	54.0	6.0	1.0
Economists	2.0	.0	.0	.0	6.0	1.0	1.0
Landscape Architects	.0	.0	.0	.0	.0	1.0	.0
Surveyors	127.0	.0	1.0	14.0	31.0	3.0	.0
Systems Analysts	7.0	.0	.0	.0	5.0	1.0	1.0
Chemists	4.0	.0	.0	1.0	9.0	4.0	2.0
TECHNICIANS	92.5	.0	134.0	67.0	77.5	4.0	9.0
Draftsmen	48.0	.0	87.0	52.0	49.0	4.0	3.0
Instrumentmen	7.0	.0	13.0	4.0	3.0	.0	.0
Field Crew	9.0	.0	7.0	8.0	3.0	.0	.0
Computer Programmers	13.5	.0	3.0	.0	12.5	.0	1.0
Inspectors	15.0	.0	24.0	3.0	10.0	.0	.0
	1300.0	26.0	160.0	107.0	1171.0	270.0	42.0

Table D-7

Numbers of Employees Licensed or Certified and the Number of Employees Holding Various Academic Degrees in Each Occupational Category for 89 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region VI.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	D						
	Number of Employees Licensed or Certified			DEGREES			
	Registered	Dip. AAEE	Cert. Eng. Tech.	Assoc.	B.S.	M.S.	Ph.D.
PROFESSIONAL STAFF	592.0	9.0	22.0	29.0	571.0	116.0	11.0
Water Resources Planners	30.0	.0	.0	1.0	28.0	10.0	2.0
Civil/Sanitary Engineers	177.0	7.0	7.0	7.0	153.0	52.0	5.0
Civil/Structural Engrs.	87.0	.0	1.0	.0	95.0	15.0	2.0
Civil/Soils Engrs.	26.0	1.0	.0	7.0	21.0	2.0	.0
Mechanical Engineers	94.0	.0	7.0	5.0	85.0	9.0	.0
Electrical Engineers	59.0	1.0	2.0	5.0	71.0	3.0	.0
Chemical Engineers	18.0	.0	.0	1.0	22.0	5.0	.0
Architects	14.0	.0	.0	2.0	15.0	2.0	.0
Geologists	1.0	.0	.0	.0	3.0	.0	.0
Hydrologists	3.0	.0	.0	.0	8.0	5.0	.0
Biologists	1.0	.0	.0	.0	1.0	.0	.0
Municipal Engrs./Planrs.	39.0	.0	1.0	.0	47.0	10.0	.0
Economists	.0	.0	.0	.0	2.0	1.0	.0
Landscape Architects	2.0	.0	.0	.0	4.0	.0	.0
Surveyors	38.0	.0	4.0	1.0	7.0	.0	.0
Systems Analysts	2.0	.0	.0	.0	5.0	1.0	.0
Chemists	1.0	.0	.0	.0	4.0	1.0	2.0
TECHNICIANS	26.0	.0	112.0	43.0	12.0	.0	1.0
Draftsmen	24.0	.0	95.0	1.0	6.0	.0	.0
Instrumentmen	.0	.0	7.0	2.0	.0	.0	.0
Field Crew	.0	.0	1.0	40.0	.0	.0	.0
Computer Programmers	.0	.0	2.0	.0	5.0	.0	1.0
Inspectors	2.0	.0	7.0	.0	1.0	.0	.0
	618.0	9.0	134.0	72.0	583.0	116.0	12.0

Table D-8

Numbers of Employees Licensed or Certified and the Number of Employees Holding Various Academic Degrees in Each Occupational Category for 60 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region VII.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	D						
	Number of Employees Licensed or Certified			DEGREES			
	Registered	Dip. AAEE	Cert. Eng. Tech.	Assoc.	B.S.	M.S.	Ph.D
PROFESSIONAL STAFF	509.0	19.0	16.0	19.0	525.0	122.0	9.0
Water Resources Planners	28.0	.0	.0	1.0	20.0	12.0	2.0
Civil/Sanitary Engineers	189.0	13.0	7.0	1.0	182.0	61.0	3.0
Civil/Structural Engrs.	70.0	.0	1.0	.0	94.0	17.0	2.0
Civil/Soils Engrs.	12.0	.0	1.0	.0	14.0	7.0	.0
Mechanical Engineers	41.0	.0	.0	.0	53.0	2.0	.0
Electrical Engineers	42.0	.0	.0	.0	56.0	3.0	1.0
Chemical Engineers	8.0	.0	.0	.0	10.0	2.0	.0
Architects	32.0	.0	.0	.0	34.0	3.0	.0
Geologists	2.0	.0	.0	.0	6.0	.0	.0
Hydrologists	6.0	.0	1.0	.0	5.0	2.0	.0
Biologists	2.0	.0	.0	.0	2.0	.0	.0
Municipal Engrs./Planrs.	18.0	.0	.0	2.0	24.0	3.0	.0
Economists	1.0	.0	.0	.0	6.0	4.0	.0
Landscape Architects	3.0	.0	.0	.0	8.0	1.0	.0
Surveyors	44.0	.0	6.0	15.0	7.0	1.0	.0
Systems Analysts	1.0	.0	.0	.0	2.0	4.0	.0
Chemists	4.0	.0	.0	.0	2.0	.0	1.0
TECHNICIANS	12.0	.0	45.0	23.0	14.0	.0	.0
Draftsmen	4.0	.0	33.0	14.0	2.0	.0	.0
Instrumentmen	.0	.0	8.0	4.0	.0	.0	.0
Field Crew	.0	.0	2.0	2.0	.0	.0	.0
Computer Programmers	3.0	.0	.0	1.0	2.0	.0	.0
Inspectors	5.0	.0	2.0	2.0	10.0	.0	.0
	521.0	19.0	61.0	42.0	539.0	122.0	9.0

Table D-9

Numbers of Employees Licensed or Certified and the Number of Employees Holding Various Academic Degrees in Each Occupational Category for 37 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region VIII.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	D						
	Number of Employees Licensed or Certified			DEGREES			
	Registered P.E.	Dip. AAEE	Cert. Eng. Tech.	Assoc.	B.S.	M.S.	Ph.D
PROFESSIONAL STAFF	159.0	.0	9.0	5.0	162.0	58.0	10.0
Water Resources Planners	12.0	.0	.0	.0	15.0	15.0	3.0
Civil/Sanitary Engineers	67.0	.0	3.0	.0	68.0	24.0	3.0
Civil/Structural Engrs.	35.0	.0	.0	.0	41.0	9.0	1.0
Civil/Soils Engrs.	7.0	.0	.0	.0	2.0	5.0	.0
Mechanical Engineers	5.0	.0	2.0	1.0	5.0	2.0	.0
Electrical Engineers	4.0	.0	1.0	.0	8.0	.0	.0
Chemical Engineers	2.0	.0	.0	.0	1.0	.0	1.0
Architects	7.0	.0	.0	.0	9.0	.0	.0
Geologists	2.0	.0	.0	.0	2.0	1.0	1.0
Hydrologists	2.0	.0	.0	.0	4.0	1.0	1.0
Biologists	1.0	.0	.0	.0	2.0	.0	.0
Municipal Engrs./Planrs.	2.0	.0	.0	.0	.0	1.0	.0
Economists	.0	.0	.0	.0	.0	.0	.0
Landscape Architects	1.0	.0	.0	.0	.0	.0	.0
Surveyors	12.0	.0	3.0	4.0	4.0	.0	.0
Systems Analysts	.0	.0	.0	.0	.0	.0	.0
Chemists	.0	.0	.0	.0	3.0	.0	.0
TECHNICIANS	4.0	.0	4.0	5.0	7.0	.0	.0
Draftsmen	.0	.0	2.0	5.0	3.0	.0	.0
Instrumentmen	4.0	.0	.0	.0	.0	.0	.0
Field Crew	.0	.0	.0	.0	1.0	.0	.0
Computer Programmers	.0	.0	.0	.0	1.0	.0	.0
Inspectors	.0	.0	2.0	.0	2.0	.0	.0
	163.0	.0	13.0	10.0	169.0	58.0	10.0

Table D-10

Numbers of Employees Licensed or Certified and the Number of Employees Holding Various Academic Degrees in Each Occupational Category for 97 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region IX.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	D						
	Number of Employees Licensed or Certified			DEGREES			
	Registered	Dip. AAEE	Cert. Eng. Tech.	Assoc.	B.S.	M.S.	Ph.D.
PROFESSIONAL STAFF	609.0	24.0	12.0	32.0	506.0	220.0	41.0
Water Resources Planners	49.5	4.0	1.0	.0	29.5	21.0	3.0
Civil/Sanitary Engineers	179.0	14.0	4.0	2.0	156.0	63.0	15.0
Civil/Structural Engrs.	117.5	.0	.0	.0	79.5	38.0	3.0
Civil/Soils Engrs.	27.0	.0	1.0	3.0	14.0	26.0	2.0
Mechanical Engineers	58.0	2.0	2.0	5.0	65.0	11.0	1.0
Electrical Engineers	38.0	2.0	1.0	2.0	47.0	6.0	.0
Chemical Engineers	7.0	.0	.0	.0	6.0	8.0	4.0
Architects	19.0	.0	.0	.0	16.0	5.0	.0
Geologists	28.0	1.0	.0	.0	35.0	13.0	2.0
Hydrologists	11.0	.0	.0	1.0	6.0	11.0	3.0
Biologists	.0	.0	.0	.0	1.0	2.0	.0
Municipal Engrs./Planrs.	23.0	1.0	2.0	.0	24.0	6.0	.0
Economists	2.0	.0	.0	.0	4.0	3.0	2.0
Landscape Architects	7.0	.0	.0	.0	4.0	3.0	.0
Surveyors	39.0	.0	1.0	17.0	4.0	.0	.0
Systems Analysts	1.0	.0	.0	.0	4.0	2.0	1.0
Chemists	3.0	.0	.0	2.0	11.0	2.0	5.0
TECHNICIANS	2.0	.0	48.0	33.0	20.0	2.0	.0
Draftsmen	.0	.0	32.0	21.0	7.0	.0	.0
Instrumentmen	.0	.0	3.0	.0	.0	.0	.0
Field Crew	.0	.0	2.0	1.0	1.0	.0	.0
Computer Programmers	.0	.0	1.0	2.0	4.0	2.0	.0
Inspectors	2.0	.0	10.0	9.0	8.0	.0	.0
	611.0	24.0	60.0	65.0	526.0	222.0	41.0

Table D-11

Numbers of Employees Licensed or Certified and the Number of Employees Holding Various Academic Degrees in Each Occupational Category for 57 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region X.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	D						
	Number of Employees Licensed or Certified			DEGREES			
	Registered	Dip. AAEE	Cert. Eng. Tech.	Assoc.	B.S.	M.S.	Ph.D
PROFESSIONAL STAFF	351.0	.0	11.0	8.0	292.0	64.0	6.0
Water Resources Planners	18.0	.0	.0	.0	13.0	3.0	.0
Civil/Sanitary Engineers	121.0	.0	2.0	2.0	96.0	28.0	2.0
Civil/Structural Engrs.	50.0	.0	.0	.0	41.0	12.0	1.0
Civil/Soils Engrs.	12.0	.0	.0	.0	8.0	2.0	1.0
Mechanical Engineers	41.0	.0	3.0	.0	36.0	4.0	.0
Electrical Engineers	27.0	.0	1.0	.0	25.0	2.0	.0
Chemical Engineers	4.0	.0	.0	.0	3.0	1.0	1.0
Architects	31.0	.0	.0	.0	32.0	2.0	.0
Geologists	.0	.0	.0	.0	2.0	.0	.0
Hydrologists	2.0	.0	.0	.0	2.0	.0	.0
Biologists	.0	.0	.0	.0	.0	1.0	1.0
Municipal Engrs./Planrs.	15.0	.0	2.0	.0	26.0	7.0	.0
Economists	.0	.0	.0	.0	1.0	.0	.0
Landscape Architects	2.0	.0	.0	.0	2.0	1.0	.0
Surveyors	28.0	.0	3.0	6.0	2.0	.0	.0
Systems Analysts	.0	.0	.0	.0	1.0	.0	.0
Chemists	.0	.0	.0	.0	2.0	1.0	.0
TECHNICIANS	13.0	.0	24.0	10.0	2.0	1.0	.0
Draftsmen	11.0	.0	15.0	4.0	1.0	.0	.0
Instrumentmen	.0	.0	5.0	6.0	.0	.0	.0
Field Crew	.0	.0	.0	.0	.0	.0	.0
Computer Programmers	.0	.0	2.0	.0	.0	.0	.0
Inspectors	2.0	.0	2.0	.0	1.0	1.0	.0
	364.0	.0	35.0	18.0	294.0	65.0	6.0

Table D-12

Numbers of Employees Licensed or Certified and the Number of Employees Holding Various Academic Degrees in Each Occupational Category for 18 Consulting Engineering Firms Engaged in Water Pollution Control Not Classified by EPA Region.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	D						
	Number of Employees Licensed or Certified			DEGREES			
	Registered	Dip. AAEE	Cert. Eng. Tech.	Assoc.	B.S.	M.S.	Ph.D.
PROFESSIONAL STAFF	387.0	11.0	29.0	19.0	352.0	167.0	21.0
Water Resources Planners	75.0	4.0	3.0	3.0	26.0	13.0	1.0
Civil/Sanitary Engineers	157.0	6.0	8.0	7.0	108.0	70.0	5.0
Civil/Structural Engrs.	50.0	.0	6.0	1.0	68.0	30.0	5.0
Civil/Soils Engrs.	18.0	.0	4.0	3.0	5.0	14.0	2.0
Mechanical Engineers	46.0	.0	3.0	.0	48.0	8.0	1.0
Electrical Engineers	44.0	.0	4.0	1.0	50.0	10.0	.0
Chemical Engineers	5.0	1.0	.0	.0	7.0	5.0	2.0
Architects	17.0	.0	.0	1.0	20.0	2.0	.0
Geologists	2.0	.0	.0	.0	3.0	1.0	.0
Hydrologists	1.0	.0	.0	.0	.0	5.0	.0
Biologists	.0	.0	.0	.0	.0	.0	.0
Municipal Engrs./Planrs.	1.0	.0	.0	.0	2.0	3.0	.0
Economists	.0	.0	.0	.0	.0	2.0	2.0
Landscape Architects	3.0	.0	.0	.0	3.0	.0	.0
Surveyors	4.0	.0	1.0	2.0	4.0	.0	.0
Systems Analysts	4.0	.0	.0	1.0	4.0	2.0	1.0
Chemists	.0	.0	.0	.0	4.0	2.0	2.0
TECHNICIANS	3.0	.0	39.0	31.0	9.0	1.0	.0
Draftsmen	.0	.0	25.0	18.0	3.0	.0	.0
Instrumentmen	.0	.0	3.0	.0	.0	.0	.0
Field Crew	3.0	.0	2.0	.0	.0	.0	.0
Computer Programmers	.0	.0	3.0	3.0	4.0	1.0	.0
Inspectors	.0	.0	6.0	10.0	2.0	.0	.0
	390.0	11.0	68.0	50.0	361.0	168.0	21.0

APPENDIX E

Table E-1

Projected Manpower and Training Requirements for 941 Consulting Engineering Firms Engaged
in Water Pollution Control in the USA.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	E								
	What are your Firm's Projected Manpower Requirements				If Federal Monitoring of Industrial & Stream Pollution were Contracted to private firms, how many of what type employee would you require to handle weekly monitoring of:			No. of employees expected to require advanced Training During Next 5 years.	
	At Present Levels of Federal Aid		At Two Times Present Level Fed. Aid		25 Stations	50 Stations	100 Stations	Short Term w/less than 2 yrs. exp.	Long Term
	1972	1976	1972	1976					
PROFESSIONAL STAFF	8690.8	11929.5	11219.0	16708.5	1202.3	1812.1	2888.0	2248.0	1650.0
Water Resources Planners	456.5	666.1	618.6	979.7	77.5	114.5	182.0	168.5	117.0
Civil/Sanitary Engineers	3258.6	4247.8	4221.5	6161.0	385.5	588.5	947.6	925.0	678.0
Civil/Structural Engrs.	1035.6	1410.1	1276.5	1871.0	23.1	29.2	42.3	219.5	183.0
Civil/Soils Engrs.	301.6	417.1	394.0	541.0	11.0	14.0	22.0	65.0	50.0
Mechanical Engineers	777.5	1096.0	985.5	1486.0	65.2	105.4	196.5	185.0	165.0
Electrical Engineers	651.8	877.8	818.0	1172.5	39.2	60.4	96.5	139.0	117.0
Chemical Engineers	209.1	393.1	305.1	621.2	82.9	119.9	190.5	98.0	68.0
Architects	290.0	376.6	354.6	467.2	2.0	2.0	2.0	81.0	17.0
Geologists	124.0	165.1	155.1	232.2	10.0	17.0	30.0	29.0	13.0
Hydrologists	129.0	214.6	174.1	308.7	57.5	78.0	113.6	39.0	32.0
Biologists	57.0	112.1	92.1	174.2	88.3	139.1	217.0	27.0	10.0
Municipal Engrs./Planrs.	383.7	547.5	526.5	773.5	12.0	20.0	30.0	89.0	71.0
Economists	63.0	99.6	89.1	145.7	3.0	4.0	5.0	10.0	6.0
Landscape Architects	91.0	118.6	112.1	153.7	3.0	5.0	7.0	5.0	5.0
Surveyors	652.4	837.6	810.0	1139.0	24.5	33.0	46.0	63.0	49.0
Systems Analysts	99.0	158.1	133.1	227.2	40.5	54.5	78.0	38.0	26.0
Chemists	111.0	191.6	153.1	254.7	277.0	427.6	682.0	67.0	43.0
TECHNICIANS	7038.7	9772.4	9467.1	13722.7	977.8	1410.4	2381.9	1211.5	759.0
Draftsmen	3503.8	4839.3	4530.0	6649.5	103.0	159.0	229.0	577.0	364.0
Instrumentmen	665.3	930.1	873.0	1195.0	66.0	113.0	194.0	85.0	74.0
Field Crew	1077.8	1564.3	1564.5	2272.5	454.0	514.5	866.0	134.0	123.0
Computer Programmers	236.5	315.1	290.6	426.2	53.2	69.4	116.6	52.5	41.0
Inspectors	1555.3	2123.5	2209.0	3179.5	301.6	554.5	976.3	363.0	157.0
	15729.5	21701.9	20686.1	30431.2	2180.1	3222.5	5269.9	3459.5	2409.0

Table E-2

Projected Manpower and Training Requirements for 47 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region I.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	E									
	What are your Firm's Projected Manpower Requirements				If Federal Monitoring of Industrial & Stream Pollution were Contracted to private firms, how many of what type employee would you require to handle weekly monitoring of:			No. of employees expected to require advanced Training During Next 5 years.		
	At Present Levels of Federal Aid		At Two Times Present Level Fed. Aid		25 Stations	50 Stations	100 Stations	Short Term w/less than 2 yrs. exp.	Long Term	
	1972	1976	1972	1976						
PROFESSIONAL STAFF	1108.0	1338.0	1420.0	1750.5	36.5	56.0	95.0	276.0	245.0	
Water Resources Planners	76.0	108.0	90.0	132.0	2.5	3.5	5.0	37.0	37.0	
Civil/Sanitary Engineers	469.5	529.5	600.0	687.0	16.0	22.5	36.0	143.0	110.0	
Civil/Structural Engrs.	118.5	144.5	145.5	198.0	.0	.0	.0	31.0	28.0	
Civil/Soils Engrs.	33.5	41.5	47.0	61.0	.0	.0	.0	9.0	6.0	
Mechanical Engineers	107.5	129.5	134.0	162.5	.0	.0	1.0	18.0	12.0	
Electrical Engineers	43.5	53.5	62.0	74.5	.0	.0	.0	7.0	6.0	
Chemical Engineers	15.0	21.0	25.0	32.0	2.0	2.0	2.0	6.0	8.0	
Architects	27.0	31.0	34.5	40.5	.0	.0	.0	2.0	3.0	
Geologists	9.0	12.0	11.0	16.0	.0	.0	.0	4.0	1.0	
Hydrologists	12.0	20.0	16.0	24.0	1.0	1.0	2.0	5.0	5.0	
Biologists	5.0	7.0	6.0	7.0	1.0	2.0	4.0	2.0	1.0	
Municipal Engrs./Planrs.	66.0	76.0	92.0	108.0	.0	.0	.0	5.0	11.0	
Economists	8.0	10.0	11.0	12.0	.0	.0	.0	1.0	.0	
Landscape Architects	32.0	41.0	36.0	46.0	1.0	2.0	4.0	.0	1.0	
Surveyors	50.5	76.5	79.0	105.0	.0	.0	.0	1.0	1.0	
Systems Analysts	17.0	22.0	18.0	25.0	.0	.0	1.0	.0	9.0	
Chemists	8.0	15.0	13.0	20.0	13.0	23.0	40.0	5.0	6.0	
TECHNICIANS	806.0	1004.0	1100.5	1374.5	45.0	80.5	150.0	48.0	84.0	
Draftsmen	411.0	509.0	532.0	661.0	3.0	1.0	2.0	25.0	58.0	
Instrumentmen	68.5	96.5	91.0	127.0	2.0	4.0	7.0	1.0	.0	
Field Crew	69.5	95.5	93.5	130.5	17.0	30.5	53.0	7.0	10.0	
Computer Programmers	59.0	69.0	74.0	99.0	2.0	3.0	5.0	4.0	4.0	
Inspectors	198.0	234.0	310.0	357.0	21.0	42.0	83.0	11.0	12.0	
	1914.0	2342.0	2520.5	3125.0	81.5	136.5	245.0	324.0	329.0	

Table E-3

Projected Manpower and Training Requirements for 103 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region II.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	E									
	What are your Firm's Projected Manpower Requirements				If Federal Monitoring of Industrial & Stream Pollution were Contracted to private firms, how many of what type employee would you require to handle weekly monitoring of:			No. of employees expected to require advanced Training During Next 5 years.		
	At Present Levels of Federal Aid		At Two Times Present Level Fed. Aid		25 Stations	50 Stations	100 Stations	Short Term w/less than 2 yrs. exp.	Long Term	
	1972	1976	1972	1976						
PROFESSIONAL STAFF	1117.3	1425.3	1270.0	2038.5	137.8	195.1	305.4	330.0	177.0	
Water Resources Planners	40.0	64.1	42.1	95.2	13.0	18.0	29.0	20.0	9.0	
Civil/Sanitary Engineers	496.6	597.6	596.5	908.0	45.0	66.0	93.0	142.0	85.0	
Civil/Structural Engrs.	90.6	141.6	115.0	197.0	2.1	3.2	5.3	36.0	13.0	
Civil/Soils Engrs.	37.6	57.6	51.0	72.0	3.0	4.0	7.0	12.0	7.0	
Mechanical Engineers	74.5	115.0	100.0	155.0	6.2	10.4	17.5	25.0	18.0	
Electrical Engineers	64.3	96.3	86.0	127.0	4.2	7.4	14.5	27.0	17.0	
Chemical Engineers	16.1	47.1	22.1	64.2	7.2	8.4	10.5	14.0	7.0	
Architects	15.0	24.1	19.1	32.2	.0	.0	.0	4.0	.0	
Geologists	14.0	20.1	20.1	27.2	1.0	2.0	5.0	3.0	.0	
Hydrologists	15.0	26.1	19.1	34.2	6.5	7.0	12.6	8.0	2.0	
Biologists	4.0	7.1	7.1	9.2	7.3	9.6	11.0	2.0	2.0	
Municipal Engrs./Planrs.	28.2	47.3	36.5	63.5	1.0	2.0	4.0	8.0	2.0	
Economists	6.0	10.1	8.1	13.2	1.0	1.0	2.0	2.0	.0	
Landscape Architects	4.0	7.1	4.1	9.2	.0	1.0	1.0	2.0	.0	
Surveyors	69.4	99.9	87.0	141.0	8.0	11.0	16.0	7.0	7.0	
Systems Analysts	16.0	28.1	17.1	37.2	4.0	3.0	3.0	11.0	2.0	
Chemists	26.0	37.1	32.1	53.2	28.3	41.1	74.0	7.0	6.0	
TECHNICIANS	752.2	1077.9	949.1	1477.2	107.2	182.4	327.6	184.0	77.0	
Draftsmen	362.7	532.5	437.0	721.0	8.0	10.0	17.0	88.0	40.0	
Instrumentmen	68.3	97.4	81.0	124.0	10.0	15.0	25.0	9.0	4.0	
Field Crew	70.3	106.8	99.0	151.0	45.0	61.0	143.0	16.0	16.0	
Computer Programmers	17.0	25.1	19.1	31.2	4.2	4.4	6.6	6.0	4.0	
Inspectors	244.3	316.0	313.0	450.0	40.0	72.0	134.0	65.0	13.0	
	1779.5	2504.2	2219.1	3515.7	245.0	377.5	633.0	514.0	254.0	

Table E-4

Projected Manpower and Training Requirements for 102 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region III.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	E								
	What are your Firm's Projected Manpower Requirements				If Federal Monitoring of Industrial & Stream Pollution were Contracted to private firms, how many of what type employee would you require to handle weekly monitoring of:			No. of employees expected to require advanced Training During Next 5 years.	
	At Present Levels of Federal Aid		At Two Times Present Level Fed. Aid		25 Stations	50 Stations	100 Stations	Short Term w/less than 2 yrs. exp.	Long Term
	1972	1976	1972	1976					
PROFESSIONAL STAFF	907.0	1367.0	1237.0	1883.0	145.2	223.5	344.0	291.0	138.0
Water Resources Planners	43.0	72.0	77.0	138.0	12.0	15.0	23.0	20.0	4.0
Civil/Sanitary Engineers	325.0	494.0	427.0	616.0	35.5	58.0	93.0	107.0	55.0
Civil/Structural Engrs.	94.0	134.0	126.0	206.0	5.0	8.0	12.0	34.0	11.0
Civil/Soils Engrs.	24.0	48.0	35.0	62.0	.0	.0	.0	7.0	.0
Mechanical Engineers	79.0	119.0	102.0	159.0	8.0	13.0	22.0	31.0	21.0
Electrical Engineers	95.0	123.0	120.0	166.0	5.0	9.0	14.0	21.0	11.0
Chemical Engineers	29.0	49.0	49.0	82.0	10.0	14.0	24.0	23.0	13.0
Architects	23.0	33.0	28.0	39.0	.0	.0	.0	6.0	.0
Geologists	14.0	27.0	24.0	42.0	1.0	1.0	1.0	5.0	7.0
Hydrologists	14.0	29.0	22.0	47.0	11.0	15.0	20.0	5.0	7.0
Biologists	8.0	13.0	12.0	21.0	17.2	26.5	39.0	6.0	2.0
Municipal Engrs./Planrs.	31.0	50.0	41.0	63.0	1.0	2.0	3.0	7.0	1.0
Economists	5.0	9.0	8.0	21.0	.0	.0	.0	1.0	.0
Landscape Architects	19.0	23.0	27.0	29.0	.0	.0	.0	.0	3.0
Surveyors	83.0	116.0	110.0	153.0	2.0	4.0	5.0	6.0	2.0
Systems Analysts	9.0	14.0	16.0	20.0	6.0	8.0	12.0	3.0	.0
Chemists	8.0	14.0	13.0	19.0	31.5	50.0	76.0	9.0	1.0
TECHNICIANS	951.5	1307.0	1380.0	1923.0	83.0	149.0	282.0	198.0	52.0
Draftsmen	522.5	700.0	771.0	1073.0	11.0	18.0	43.0	112.0	25.0
Instrumentmen	97.5	161.0	126.0	165.0	11.0	18.0	43.0	17.0	20.0
Field Crew	138.5	193.0	185.0	279.0	32.0	52.0	84.0	35.0	2.0
Computer Programmers	22.0	25.0	26.0	33.0	3.0	7.0	10.0	8.0	.0
Inspectors	171.0	227.0	272.0	373.0	26.0	54.0	102.0	25.0	5.0
	1854.5	2674.0	2617.0	3916.0	228.2	372.5	626.0	499.0	190.0

Table E-5

Projected Manpower and Training Requirements for 142 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region IV.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	What are your Firm's Projected Manpower Requirements				If Federal Monitoring of Industrial & Stream Pollution were Contracted to private firms, how many of what type employee would you require to handle weekly monitoring of:			No. of employees expected to require advanced Training During Next 5 years.	
	At Present Levels of Federal Aid		At Two Times Present Level Fed. Aid		25 Stations	50 Stations	100 Stations	Short Term w/less than 2 yrs. exp.	Long Term
	1972	1976	1972	1976					
	1972	1976	1972	1976	25 Stations	50 Stations	100 Stations	Short Term w/less than 2 yrs. exp.	Long Term
PROFESSIONAL STAFF	953.0	1235.0	1256.5	1736.0	207.2	327.5	523.0	217.0	163.0
Water Resources Planners	42.0	59.0	62.0	88.0	2.0	2.0	4.0	13.0	14.0
Civil/Sanitary Engineers	379.0	455.0	484.0	667.0	67.2	112.5	192.0	98.0	75.0
Civil/Structural Engrs.	115.0	144.0	140.0	188.0	4.0	3.0	4.0	13.0	9.0
Civil/Soils Engrs.	18.0	26.0	28.0	37.0	.0	.0	.0	1.0	1.0
Mechanical Engineers	97.5	131.5	120.5	168.5	11.0	19.0	30.0	17.0	14.0
Electrical Engineers	98.5	130.5	126.0	168.5	7.0	13.0	20.0	19.0	11.0
Chemical Engineers	11.0	15.0	18.0	28.0	20.0	30.0	48.0	11.0	5.0
Architects	36.0	44.0	41.0	54.0	1.0	.0	.0	1.0	.0
Geologists	5.0	7.0	9.0	12.0	.0	.0	.0	1.0	1.0
Hydrologists	8.0	9.0	12.0	14.0	8.0	12.0	17.0	4.0	3.0
Biologists	3.0	7.0	9.0	14.0	16.0	27.0	42.0	4.0	2.0
Municipal Engrs./Planrs.	21.0	38.0	38.0	64.0	2.0	4.0	6.0	8.0	2.0
Economists	5.0	9.0	10.0	15.0	1.0	1.0	1.0	1.0	1.0
Landscape Architects	13.0	15.0	18.0	22.0	.0	.0	.0	1.0	.0
Surveyors	84.0	110.0	116.0	157.0	4.0	6.0	9.0	6.0	7.0
Systems Analysts	9.0	12.0	15.0	25.0	8.0	9.0	10.0	6.0	4.0
Chemists	8.0	23.0	10.0	14.0	56.0	89.0	140.0	13.0	14.0
TECHNICIANS	1027.0	1360.5	1403.0	1964.5	171.0	270.0	425.0	129.0	90.0
Draftsmen	471.0	622.0	639.0	887.0	15.0	26.0	27.0	52.0	42.0
Instrumentmen	114.0	153.5	159.0	221.5	12.0	19.0	29.0	13.0	7.0
Field Crew	208.0	265.5	280.0	375.5	59.0	83.0	136.0	19.0	11.0
Computer Programmers	29.0	47.0	33.0	53.0	13.0	11.0	17.0	6.0	5.0
Inspectors	205.0	271.5	292.0	427.5	72.0	131.0	216.0	39.0	25.0
	1980.0	2595.5	2659.5	3700.5	378.2	597.5	948.0	346.0	253.0

Table E-6

Projected Manpower and Training Requirements for 189 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region V.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	E								
	What are your Firm's Projected Manpower Requirements				If Federal Monitoring of Industrial & Stream Pollution were Contracted to private firms, how many of what type employee would you require to handle weekly monitoring of:			No. of employees expected to require advanced Training During Next 5 years.	
	At Present Levels of Federal Aid		At Two Times Present Level Fed. Aid		25 Stations	50 Stations	100 Stations	Short Term w/less than 2 yrs. exp.	Long Term
	1972	1976	1972	1976					
PROFESSIONAL STAFF	1 465.5	19 89.5	2 028.5	2927.5	195.5	295.5	466.0	334.0	306.0
Water Resources Planners	53.0	70.0	87.0	114.0	14.0	22.0	31.0	21.0	13.0
Civil/Sanitary Engineers	496.5	697.5	748.5	1126.5	70.0	105.0	158.0	116.0	87.0
Civil/Structural Engrs.	211.0	287.0	271.0	380.0	7.0	7.0	7.0	25.0	63.0
Civil/Soils Engrs.	67.0	89.0	85.0	112.0	1.0	1.0	2.0	12.0	15.0
Mechanical Engineers	165.0	227.0	215.0	315.0	14.0	28.0	64.0	31.0	37.0
Electrical Engineers	87.0	113.0	122.0	179.0	7.0	10.0	15.0	12.0	20.0
Chemical Engineers	42.0	60.0	58.0	89.0	11.5	16.0	25.0	11.0	17.0
Architects	95.0	118.0	125.0	156.0	.0	1.0	1.0	62.0	9.0
Geologists	8.0	13.0	9.0	16.0	.0	.0	.0	1.0	1.0
Hydrologists	20.0	27.0	21.0	37.0	8.0	9.0	12.0	4.0	3.0
Biologists	8.0	11.0	12.0	15.0	10.0	16.0	29.0	4.0	1.0
Municipal Engrs./Planrs.	62.0	82.0	80.0	117.0	1.0	1.0	1.0	9.0	16.0
Economists	6.0	8.0	9.0	13.0	.0	.0	.0	.0	2.0
Landscape Architects	5.0	7.0	6.0	9.0	1.0	1.0	1.0	1.0	1.0
Surveyors	122.0	149.0	152.0	205.0	3.0	5.0	9.0	12.0	14.0
Systems Analysts	10.0	14.0	14.0	22.0	7.0	10.5	15.0	3.0	5.0
Chemists	9.0	17.0	14.0	22.0	41.0	63.0	96.0	10.0	2.0
TECHNICIANS	1 197.5	16 85.5	1 645.5	23 99.5	126.0	239.0	378.0	264.5	227.0
Draftsmen	547.5	794.5	735.0	1104.0	22.0	39.0	41.0	111.0	118.0
Instrumentmen	114.5	151.5	158.0	214.0	6.0	13.0	22.0	21.0	22.0
Field Crew	228.0	313.0	304.0	427.0	44.0	83.0	135.0	26.0	36.0
Computer Programmers	31.5	42.5	41.5	58.5	6.0	11.0	21.0	2.5	7.0
Inspectors	276.0	384.0	407.0	596.0	48.0	93.0	159.0	104.0	44.0
	2 664.0	36 75.0	3 674.0	53 27.0	321.5	534.5	844.0	598.5	533.0

Table E-7

Projected Manpower and Training Requirements for 89 Consulting Engineering Firms Engaged
in Water Pollution Control in EPA Region VI.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	E								
	What are your Firm's Projected Manpower Requirements				If Federal Monitoring of Industrial & Stream Pollution were Contracted to private firms, how many of what type employee would you require to handle weekly monitoring of:			No. of employees expected to require advanced Training During Next 5 years.	
	At Present Levels of Federal Aid		At Two Times Present Level Fed. Aid		25 Stations	50 Stations	100 Stations	Short Term w/less than 2 yrs. exp.	Long Term
	1972	1976	1972	1976					
PROFESSIONAL STAFF	568.0	814.0	739.0	1170.0	140.0	210.0	357.0	189.0	179.0
Water Resources Planners	31.0	38.0	39.0	58.0	5.0	5.0	7.0	14.0	17.0
Civil/Sanitary Engineers	192.0	267.0	258.0	413.0	50.2	79.5	136.0	78.0	66.0
Civil/Structural Engrs.	55.0	77.0	79.0	111.0	.0	.0	.0	6.0	12.0
Civil/Soils Engrs.	11.0	14.0	14.0	20.0	.0	.0	.0	3.0	5.0
Mechanical Engineers	45.0	78.0	60.0	109.0	7.0	12.0	24.0	19.0	22.0
Electrical Engineers	37.0	57.0	50.0	85.0	2.0	2.0	2.0	14.0	19.0
Chemical Engineers	23.0	42.0	28.0	57.0	12.7	20.5	36.0	5.0	8.0
Architects	8.0	12.0	9.0	15.0	.0	.0	.0	.0	.0
Geologists	2.0	3.0	3.0	5.0	2.0	3.0	3.0	1.0	1.0
Hydrologists	11.0	18.0	14.0	23.0	6.0	6.0	7.0	.0	1.0
Biologists	3.0	3.0	6.0	11.0	12.0	18.0	32.0	5.0	2.0
Municipal Engrs./Planrs.	64.0	83.0	81.0	113.0	.0	.0	1.0	18.0	14.0
Economists	7.0	5.0	5.0	7.0	.0	.0	.0	1.0	.0
Landscape Architects	1.0	2.0	1.0	4.0	.0	.0	.0	.0	.0
Surveyors	68.0	87.0	75.0	107.0	1.0	1.0	1.0	12.0	2.0
Systems Analysts	6.0	10.0	8.0	14.0	5.0	7.0	12.0	3.0	4.0
Chemists	9.0	13.0	9.0	17.0	37.0	56.0	96.0	10.0	6.0
TECHNICIANS	656.0	955.0	952.0	1417.0	218.5	122.0	218.0	111.0	83.0
Draftsmen	370.0	464.0	403.0	611.0	10.0	14.0	20.0	58.0	27.0
Instrumentmen	75.0	101.0	94.0	130.0	7.0	13.0	21.0	10.0	2.0
Field Crew	111.0	248.0	305.0	457.0	176.0	48.0	90.0	13.0	31.0
Computer Programmers	21.0	24.0	25.0	36.0	5.0	5.0	6.0	7.0	6.0
Inspectors	79.0	118.0	125.0	183.0	20.5	42.0	81.0	23.0	17.0
	1224.0	1769.0	1691.0	2587.0	358.5	332.0	575.0	300.0	262.0

Table E-8

Projected Manpower and Training Requirements for 60 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region VII.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	E								
	What are your Firm's Projected Manpower Requirements				If Federal Monitoring of Industrial & Stream Pollution were Contracted to private firms, how many of what type employee would you require to handle weekly monitoring of:			No. of employees expected to require advanced Training During Next 5 years.	
	At Present Levels of Federal Aid		At Two Times Present Level Fed. Aid		25 Stations	50 Stations	100 Stations	Short Term w/less than 2 yrs. exp.	Long Term
	1972	1976	1972	1976					
PROFESSIONAL STAFF	649.5	927.0	816.0	1209.0	72.5	97.5	156.0	141.0	98.0
Water Resources Planners	37.0	46.0	41.0	58.0	4.0	9.0	13.0	8.0	3.0
Civil/Sanitary Engineers	242.0	354.0	296.0	444.0	24.0	29.0	49.0	66.0	42.0
Civil/Structural Engrs.	107.0	156.0	130.0	193.0	1.0	2.0	4.0	17.0	15.0
Civil/Soils Engrs.	11.0	15.0	17.0	23.0	1.0	.0	1.0	7.0	4.0
Mechanical Engineers	46.0	54.0	61.0	84.0	.0	.0	.0	7.0	7.0
Electrical Engineers	55.5	76.5	70.0	96.5	6.0	8.0	12.0	8.0	10.0
Chemical Engineers	16.0	30.0	21.0	34.0	5.0	6.0	9.0	2.0	3.0
Architects	37.0	49.5	40.0	45.5	.0	.0	.0	3.0	2.0
Geologists	7.0	4.0	5.0	8.0	.0	.0	.0	2.0	.0
Hydrologists	6.0	10.5	7.0	12.5	1.0	2.0	3.0	.0	.0
Biologists	.0	.0	.0	2.0	6.5	9.5	13.0	1.0	.0
Municipal Engrs./Planrs.	21.0	36.0	40.0	62.0	2.0	3.0	5.0	13.0	7.0
Economists	8.0	11.5	8.0	13.5	.0	.0	.0	.0	.0
Landscape Architects	5.0	6.5	6.0	10.5	.0	.0	.0	.0	.0
Surveyors	50.0	51.0	57.0	86.0	.0	.0	.0	7.0	5.0
Systems Analysts	6.0	11.0	9.0	17.0	2.0	3.0	6.0	.0	.0
Chemists	3.0	5.5	8.0	9.5	20.0	26.0	41.0	.0	.0
TECHNICIANS	401.0	587.0	530.0	814.0	66.0	101.0	175.0	48.0	11.0
Draftsmen	169.0	266.5	237.0	359.5	6.0	10.0	17.0	21.0	4.0
Instrumentmen	40.0	48.5	46.0	64.5	6.0	10.0	12.0	4.0	.0
Field Crew	84.0	114.5	101.0	173.5	19.0	36.0	66.0	7.0	2.0
Computer Programmers	19.0	22.5	21.0	32.5	9.0	11.0	21.0	7.0	3.0
Inspectors	89.0	135.0	123.0	184.0	26.0	34.0	59.0	9.0	2.0
	1050.5	1514.0	1346.0	2023.0	138.5	198.5	331.0	189.0	109.0

Table E-9

Projected Manpower and Training Requirements for 37 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region VIII.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	What are your Firm's Projected Manpower Requirements				If Federal Monitoring of Industrial & Stream Pollution were Contracted to private firms, how many of what type employee would you require to handle weekly monitoring of:			No. of employees expected to require advanced Training During Next 5 years.	
	At Present Levels of Federal Aid		At Two Times Present Level Fed. Aid		25 Stations	50 Stations	100 Stations	Short Term w/less than 2 yrs. exp.	Long Term
	1972	1976	1972	1976					
	1972	1976	1972	1976	25 Stations	50 Stations	100 Stations	Short Term w/less than 2 yrs. exp.	Long Term
PROFESSIONAL STAFF	184.0	230.0	217.0	302.0	38.5	48.0	67.0	31.0	48.0
Water Resources Planners	21.0	27.0	31.0	41.0	3.0	1.0	1.0	5.0	7.0
Civil/Sanitary Engineers	75.0	107.0	97.0	145.0	15.5	25.0	32.0	17.0	26.0
Civil/Structural Engrs.	20.0	23.0	21.0	25.0	.0	.0	.0	1.0	5.0
Civil/Soils Engrs.	6.0	5.0	3.0	4.0	.0	.0	.0	1.0	.0
Mechanical Engineers	5.0	5.0	5.0	6.0	1.0	.0	.0	.0	.0
Electrical Engineers	7.0	8.0	9.0	11.0	.0	.0	.0	.0	.0
Chemical Engineers	2.0	2.0	2.0	2.0	3.0	4.0	7.0	.0	.0
Architects	7.0	8.0	7.0	9.0	.0	.0	.0	.0	.0
Geologists	4.0	5.0	2.0	3.0	.0	.0	.0	.0	.0
Hydrologists	2.0	4.0	5.0	5.0	6.0	8.0	11.0	.0	2.0
Biologists	.0	.0	.0	.0	2.0	3.0	6.0	.0	.0
Municipal Engrs./Planrs.	8.0	11.0	10.0	17.0	.0	.0	.0	2.0	2.0
Economists	1.0	1.0	1.0	1.0	.0	.0	.0	.0	1.0
Landscape Architects	.0	.0	.0	.0	.0	.0	.0	.0	.0
Surveyors	22.0	21.0	21.0	30.0	2.0	.0	.0	4.0	4.0
Systems Analysts	.0	.0	.0	.0	.0	.0	.0	.0	.0
Chemists	4.0	3.0	3.0	3.0	6.0	7.0	10.0	1.0	1.0
TECHNICIANS	119.0	140.0	153.0	202.0	21.0	31.0	41.0	10.0	20.0
Draftsmen	38.0	59.0	60.0	90.0	2.0	2.0	4.0	6.0	6.0
Instrumentmen	12.0	12.0	15.0	17.0	1.0	1.0	2.0	2.0	10.0
Field Crew	26.0	23.0	27.0	33.0	11.0	16.0	16.0	1.0	.0
Computer Programmers	7.0	7.0	9.0	9.0	.0	.0	.0	.0	.0
Inspectors	36.0	39.0	42.0	53.0	7.0	12.0	19.0	1.0	4.0
	303.0	370.0	370.0	504.0	59.5	79.0	108.0	41.0	68.0

Table E-10

Projected Manpower and Training Requirements for 97 Consulting Engineering Firms Engaged in Water Pollution Control in EPA Region IX.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	E								
	What are your Firm's Projected Manpower Requirements				If Federal Monitoring of Industrial & Stream Pollution were Contracted to private firms, how many of what type employee would you require to handle weekly monitoring of:			No. of employees expected to require advanced Training During Next 5 years.	
	At Present Levels of Federal Aid		At Two Times Present Level Fed. Aid		25 Stations	50 Stations	100 Stations	Short Term w/less than 2 yrs. exp.	Long Term
	1972	1976	1972	1976					
PROFESSIONAL STAFF	957.0	1394.2	1207.0	1937.0	148.0	234.0	373.0	194.0	138.0
Water Resources Planners	56.0	82.5	68.0	104.0	18.0	32.0	58.0	19.5	5.0
Civil/Sanitary Engineers	268.0	385.2	333.0	515.0	30.0	45.0	76.0	64.0	63.0
Civil/Structural Engrs.	117.5	150.0	135.0	177.0	1.0	2.0	3.0	22.5	8.0
Civil/Soils Engrs.	50.5	65.0	75.0	84.0	3.0	4.0	5.0	8.0	2.0
Mechanical Engineers	78.0	111.0	98.0	176.0	15.0	18.0	32.0	20.0	23.0
Electrical Engineers	73.0	95.0	71.0	106.0	5.0	7.0	13.0	9.0	12.0
Chemical Engineers	33.0	73.0	54.0	164.0	7.5	12.0	21.0	11.0	3.0
Architects	23.0	32.0	26.0	41.0	1.0	1.0	1.0	2.0	1.0
Geologists	52.0	61.0	61.0	82.0	6.0	11.0	19.0	7.0	1.0
Hydrologists	28.0	49.0	42.0	83.0	8.0	14.0	23.0	8.0	8.0
Biologists	21.0	50.0	32.0	81.0	9.0	15.0	22.0	.0	.0
Municipal Engrs./Planrs.	43.5	65.2	60.0	97.0	3.0	4.0	5.0	7.0	6.0
Economists	13.0	21.0	17.0	30.0	1.0	2.0	2.0	1.0	.0
Landscape Architects	9.0	11.0	11.0	15.0	.0	.0	.0	.0	.0
Surveyors	52.5	70.2	64.0	85.0	4.0	5.0	5.0	3.0	1.0
Systems Analysts	14.0	27.0	23.0	39.0	6.5	11.0	15.0	5.0	.0
Chemists	25.0	44.0	37.0	68.0	30.0	51.0	73.0	7.0	5.0
TECHNICIANS	517.0	725.5	646.0	950.0	84.5	140.5	219.0	59.0	52.0
Draftsmen	295.5	395.7	360.0	537.0	18.0	30.0	43.0	17.0	21.0
Instrumentmen	38.5	52.7	50.0	63.0	11.0	20.0	33.0	4.0	4.0
Field Crew	59.0	100.0	84.0	110.0	32.0	52.0	84.0	7.0	7.0
Computer Programmers	16.0	25.0	24.0	39.0	4.0	5.0	6.0	5.0	6.0
Inspectors	98.0	152.0	128.0	201.0	19.5	33.5	53.0	26.0	14.0
	1484.0	2120.7	953.0	2887.0	232.5	374.5	592.0	253.0	190.0

Table E-11

Projected Manpower and Training Requirements for 57 Consulting Engineering Firms Engaged
in Water Pollution Control in EPA Region X.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	What are your Firm's Projected Manpower Requirements				If Federal Monitoring of Industrial & Stream Pollution were Contracted to private firms, how many of what type employee would you require to handle weekly monitoring of:			No. of employees expected to require advanced Training During Next 5 years.	
	At Present Levels of Federal Aid		At Two Times Present Level Fed. Aid		25 Stations	50 Stations	100 Stations	Short Term w/less than 2 yrs. exp.	Long Term
	1972	1976	1972	1976					
	1972	1976	1972	1976	25 Stations	50 Stations	100 Stations	Short Term w/less than 2 yrs. exp.	Long Term
PROFESSIONAL STAFF	368.0	515.0	444.0	700.0	52.5	75.0	124.6	86.0	111.0
Water Resources Planners	20.0	33.0	28.0	50.0	3.0	5.0	8.0	3.0	4.0
Civil/Sanitary Engineers	129.0	182.0	172.0	267.0	24.5	37.0	61.6	34.0	51.0
Civil/Structural Engrs.	45.0	58.0	45.0	79.0	2.0	2.0	4.0	11.0	13.0
Civil/Soils Engrs.	8.0	10.0	7.0	11.0	1.0	1.0	1.0	3.0	6.0
Mechanical Engineers	35.0	53.0	37.0	62.0	2.0	3.0	3.0	7.0	9.0
Electrical Engineers	40.0	55.0	47.0	61.0	2.0	2.0	3.0	5.0	8.0
Chemical Engineers	10.0	17.0	14.0	20.0	3.0	6.0	8.0	4.0	2.0
Architects	2.0	3.0	5.0	7.0	.0	.0	.0	.0	2.0
Geologists	5.0	2.0	3.0	7.0	.0	.0	2.0	4.0	1.0
Hydrologists	3.0	4.0	3.0	7.0	2.0	4.0	6.0	.0	.0
Biologists	3.0	4.0	4.0	7.0	5.2	6.5	10.0	1.0	.0
Municipal Engrs./Planrs.	32.0	44.0	37.0	58.0	1.0	2.0	2.0	7.0	9.0
Economists	1.0	2.0	3.0	3.0	.0	.0	.0	1.0	1.0
Landscape Architects	1.0	3.0	1.0	4.0	.0	.0	.0	.0	.0
Surveyors	29.0	39.0	32.0	45.0	.5	1.0	1.0	3.0	3.0
Systems Analysts	2.0	2.0	2.0	3.0	1.0	1.0	1.0	1.0	1.0
Chemists	3.0	4.0	4.0	9.0	5.2	8.5	14.0	2.0	1.0
TECHNICIANS	270.5	399.0	324.0	485.0	37.6	60.0	105.3	44.0	41.0
Draftsmen	119.0	176.0	136.0	197.0	8.0	9.0	15.0	20.0	14.0
Instrumentmen	31.0	48.0	35.0	50.0	.0	.0	.0	2.0	4.0
Field Crew	50.5	80.0	72.0	108.0	9.0	14.0	24.0	2.0	4.0
Computer Programmers	6.0	13.0	8.0	16.0	7.0	12.0	22.0	4.0	5.0
Inspectors	54.0	82.0	73.0	114.0	13.6	25.0	44.3	16.0	14.0
	638.5	914.0	768.0	1185.0	90.1	135.0	229.9	130.0	152.0

Table E-12
Projected Manpower and Training Requirements for 18 Consulting Engineering Firms Engaged
in Water Pollution Control Not Classified by EPA Region.

SCIENTIFIC, PROFESSIONAL TECHNICAL, OCCUPATIONS	E								
	What are your Firm's Projected Manpower Requirements				If Federal Monitoring of Industrial & Stream Pollution were Contracted to private firms, how many of what type employee would you require to handle weekly monitoring of:			No. of employees expected to require advanced Training During Next 5 years.	
	At Present Levels of Federal Aid		At Two Times Present Level Fed. Aid		25 Stations	50 Stations	100 Stations	Short Term w/less than 2 yrs. exp.	Long Term
	1972	1976	1972	1976					
PROFESSIONAL STAFF	506.5	693.5	584.0	1055.0	28.5	50.0	77.0	159.0	47.0
Water Resources Planners	41.5	66.5	46.5	91.5	1.0	2.0	3.0	8.0	4.0
Civil/Sanitary Engineers	186.0	178.0	209.5	372.5	7.5	13.0	21.0	60.0	18.0
Civil/Structural Engrs.	62.0	95.0	69.0	117.0	1.0	2.0	3.0	23.0	6.0
Civil/Soils Engrs.	25.0	45.0	32.0	55.0	2.0	4.0	6.0	2.0	4.0
Mechanical Engineers	45.0	63.0	53.0	89.0	1.0	2.0	3.0	10.0	2.0
Electrical Engineers	51.0	70.0	55.0	98.0	1.0	2.0	3.0	17.0	3.0
Chemical Engineers	12.0	37.0	14.0	49.0	1.0	1.0	.0	11.0	2.0
Architects	17.0	22.0	20.0	27.0	.0	.0	.0	1.0	.0
Geologists	8.0	11.0	8.0	14.0	.0	.0	.0	1.0	.0
Hydrologists	10.0	18.0	13.0	22.0	.0	.0	.0	5.0	1.0
Biologists	2.0	5.0	4.0	7.0	2.0	6.0	9.0	2.0	.0
Municipal Engrs./Planrs.	7.0	15.0	11.0	21.0	1.0	2.0	3.0	5.0	1.0
Economists	7.0	13.0	9.0	17.0	.0	.0	.0	2.0	1.0
Landscape Architects	2.0	3.0	2.0	5.0	1.0	1.0	1.0	1.0	.0
Surveyors	12.0	18.0	17.0	25.0	.0	.0	.0	2.0	3.0
Systems Analysts	10.0	18.0	11.0	25.0	1.0	2.0	3.0	6.0	1.0
Chemists	9.0	16.0	10.0	20.0	9.0	13.0	22.0	3.0	1.0
TECHNICIANS	340.0	541.0	395.0	731.0	18.0	35.0	61.0	119.0	22.0
Draftsmen	198.0	319.0	220.0	409.0	.0	.0	.0	67.0	9.0
Instrumentmen	6.0	9.0	16.0	19.0	.0	.0	.0	2.0	1.0
Field Crew	22.0	35.0	25.0	43.0	10.0	19.0	35.0	3.0	4.0
Computer Programmers	9.0	14.0	10.0	19.0	.0	.0	.0	3.0	1.0
Inspectors	105.0	165.0	124.0	241.0	8.0	16.0	26.0	44.0	7.0
	846.5	1234.5	979.0	1786.0	46.5	85.0	138.0	278.0	69.0

APPENDIX F

QUESTIONNAIRE

TECHNOLOGICAL RESOURCES SURVEY

The Environmental Protection Agency, in accord with instructions of the United States Congress, is required to submit periodic reports of the Nation's consulting engineering capabilities and technical manpower needs in the water pollution control field. This questionnaire is an attempt to develop authoritative information regarding U.S. technological and scientific resources and manpower currently available to handle existing and future water quality project studies and designs. PLEASE READ THESE INSTRUCTIONS AND THEN COMPLETE THIS QUESTIONNAIRE AS ACCURATELY AS POSSIBLE TO REFLECT YOUR FIRM'S ENGINEERING MANPOWER UTILIZATION AND EXPECTED FUTURE NEEDS. SEPARATE QUESTIONNAIRES SHOULD BE COMPLETED FOR SATELLITE OR BRANCH OFFICES OF THE FIRM LOCATED IN ANOTHER CITY. After completing the questionnaire, fold it and mail it, using the self-mailer return address on the back. Questionnaires should be returned as soon as possible but NO LATER THAN SEPTEMBER 15, 1971.

Instructions for completing questionnaire for the survey of Manpower Utilization and Future Needs of Consulting Engineering Firms Engaged in Water Pollution Control.

NOTE: The sum of the New Hires (Inexperienced and Experienced), minus the separations, should equal the number of new personnel employed during October 1970.

A. 1. Scientific, Professional, & Technical Occupations

The subtitles appearing in the occupational categories refer to the title of the most recent academic degree received. If other subdivisions of major engineering areas occur, enter all of the positions under the major area of engineering. If it becomes difficult to categorize personnel because of a combination or general degree, enter the position in a category in which there is the most activity. Technician positions should be entered according to academic or certification title. If combination degrees or certificates occur, enter the position according to the area of greatest activity. If the position is occupied by an individual without a degree of certification, classify the position according to the area of greatest activity.

2. Total Employees

(a) *1970 Part-Time and Full-Time* Enter the average number for both part-time and full-time scientific, professional, and technical workers employed during the month of October, 1970, for each of the occupational designations. Full-time workers are those who worked an average of 35 hours per week, or more, during 1970. The month of October was selected so that survey data might be comparable with data collected by the Bureau of Census on an annual basis. The total number of personnel in each Occupational designation in Section A should equal the sum of the number of personnel shown under the "Employment Duties, Responsibilities and functions" heading (Section C). For example, if 10 full-time and 2 part-time personnel are listed as "Water Resources Planners" in Section A, but their responsibilities cover both Water Resources Planning and Preliminary Engineering, they should be appropriately divided into both functions with the sum of these two columns equaling 12.

(b) *1971 Part-Time and Full-Time*. Enter the total number for both part-time and full-time scientific, professional, and technical workers expected to be employed during the month of October, 1971, for each of the occupational classifications. Follow the same procedure for totaling as specified in Paragraph A, 2 (a) above.

B. Vacancies (One month or more)

Enter for each occupational designation the number of both part-time and full-time openings unfilled for one month or more which were available for filling on June 30, 1971, by workers outside your establishment and for which your firm was actively seeking such employees. Include only permanent vacancies. Follow the same procedure for summing as specified above.

1. Turnovers (Last 12 Months)

(a) New Hires

Three Years or Less of Experience: Enter for each job classification the number of permanent additions to your firm's employment roll, during the 1970 calendar year, who had three years, or less, of work experience in the area of employment.

Experienced: Enter for each job classification the number of permanent additions to your firm's employment roll during the 1970 calendar year who had over three years of work experience in the area of employment.

(b) *Separations:* Enter for each occupation classification the number of terminations of employment for each of the three reasons that occurred during the 1970 calendar year.

C. Functions

Enter the number of employees in each occupational designation that devote time to each of the functions. Please distribute the total part-time and full-time employees in each area according to the percent effort that they devote to each function. The sum of the number of personnel engaged in each function should equal the sum of both the part-time and full-time employees as set forth in A, 2, (a) above.

D. Licensed or Certified

1. Registered

Enter the number of engineers, architects, geologists, surveyors, etc. in your firm who are licensed to practice in accord with state laws in your state.

2. *Diplomate, American Academy of Environmental Engineers*
Enter the number of engineers certified as a Diplomate by the American Academy of Environmental Engineers.

3. Certified Engineering or other Technician

Enter the number of technicians holding a certificate from the Institute for Certification of Engineering Technicians (ICET) attesting to their competency in their area of specialty.

4. Degree

Enter the number of employees holding each of the four degrees. Count each employee only once and SHOW ONLY THE HIGHEST DEGREE EARNED.

E. Projected Manpower Requirements

1. *At Present Level of expenditure for construction* (Approximately \$4 billion annually for Government and \$1 billion annually for Industry.) Enter for each year (1972 and 1976) a projection of the average total number of workers in each of the occupational areas that will be employed by your firm during October, 1971. Assume that qualified workers will be available to fill openings as they occur. Base the estimated manpower needs on the expected increase in the company workload if the present trends in expenditures for water pollution control facilities (Municipal and industrial) continue until 1972 and through 1976.

2. *At Two Times Present Level of government and industrial expenditures* (Approximately \$4 billion annually for Government and \$2 billion annually for industry.) Enter for each year (1972 and 1976) provide a projection of the average total number of workers in each of the occupational classifications which will be employed by your firm during October, 1971. Assume that qualified workers will be available to fill openings as they occur.

3. Monitoring Programs

Enter, for each occupational classification, the number of permanent additions to your firm's employment roll that would be required to provide complete services if Federal monitoring of the industrial contribution to stream pollution were contracted to consulting engineering firms.

4. Training Needs

Enter, for each occupational classification, the number of present employees that will require either short-term (two-weeks) or more extended training within the next year to remain current in present practices in water pollution control.

